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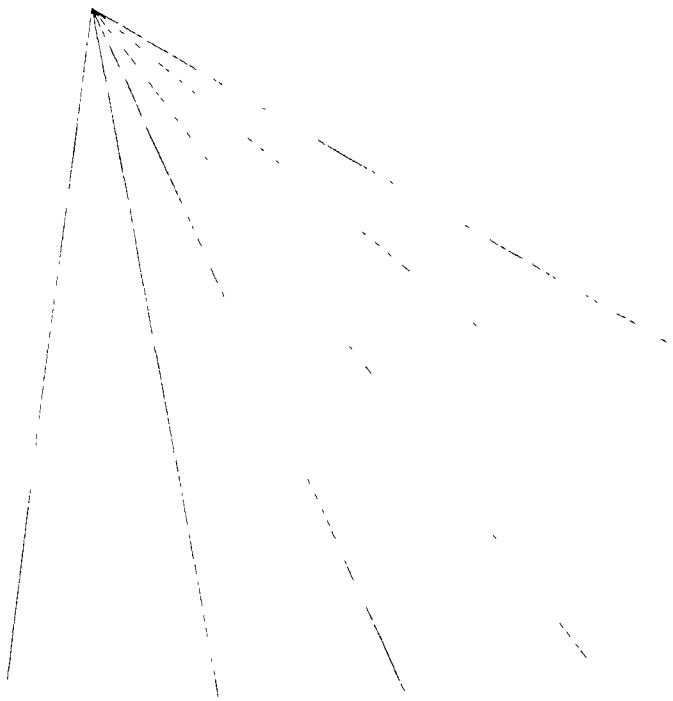
ABSTRACT

Using current national data, this report describes emerging labor force and employment trends among industries and occupations expected to experience the fastest rates of growth or decline by the year 2000. In addition, the report analyzes the challenges and opportunities for higher education arising from a developing technological base accompanied by an increasing demand for a better educated and more highly skilled workforce. Section I discusses the impact of technological change and international competition on the labor force, the global economy, organizational structures, and the worksite. The discussion indicates that technological changes in the work place can either increase or downgrade the skill levels required of workers, depending upon the occupation. As a result, a dichotomy is emerging between a growing number of new jobs requiring increasing levels of education and skills, and a large group of low-paying jobs requiring minimal skills. Section II reviews national and, when available, statewide demographic and literacy trends and patterns as they relate to the workforce. The section describes a slow growing and aging workforce; the entry of an increasing number of women, minorities, and immigrants into the labor force; and the adverse influence of illiteracy on the labor market and economy. Highlighted problems include a workforce that is shrinking and less willing to change, a shortage of teachers, increasing needs for day care, and the need to ensure basic literacy among all Americans and immigrants. Section III addresses the changes which must be made at state and institutional levels so that higher education in Missouri can meet job retraining and skill upgrading requirements. The report includes appendixes which list industrial and occupational classifications, an analysis of manpower demand by type of industry, employment trends by occupation and their relationship to educational levels, and 32 references. (VVC)

Manpower Trends and Issues:

a National Perspective
a Missouri Context



Missouri Coordinating Board for Higher Education

August 1989

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Manpower Trends and Issues:

a National Perspective
a Missouri Context

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FOREWORD

Judy Vickrey
Interim Commissioner

Manpower Trends and Issues. A National Perspective, A Missouri Context describes current and emerging manpower trends among the industries and occupations the Nation and states depend on to remain economically competitive with other nations and states. The effect of these trends on the workforce is to require not only that many workers learn and relearn specific skills throughout their working careers, but also that they develop new skills as well. This demand for lifelong educational opportunities is creating both new opportunities and new challenges for American and Missouri higher education.

The impact of technological progress, the changing demography of the Nation and in Missouri, and the issue of illiteracy, present challenges to state-level higher education policy planning and development and to higher education institutions. As part of a series of reports to the Coordinating Board for Higher Education, Manpower Trends and Issues: A National Perspective, A Missouri Context, provides an overview of issues and background on a topical subject of interest and concern to the Board. Other reports in this series include Challenges and Opportunities: Minorities in Missouri Higher Education, as well as the Invisible Campus: Off-campus and Out-of-district Instruction in Missouri and Report on Student Financial Aid in Missouri. In addition, reports related to the regional needs assessments in Missouri and issues and background reports on higher education and economic development, undergraduate education and telecommunications policy, planning, and coordination are forthcoming.

Individually these reports present information and background on the policy and planning issues associated with the Board's public policy goals of providing financial access, improving the quality of undergraduate education and ensuring the efficient and effective use of state resources. Collectively, the reports provide an overall context within which the Board plans, coordinates and establishes policy for creating an environment which enables Missouri's colleges and universities to continually improve their instruction, research and public services and to better serve Missouri's needs for a well-educated citizenry and well prepared and productive labor force.

Jefferson City
August 1989

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EXECUTIVE SUMMARY

The 1983 report, Missouri Manpower Trends, emphasized that national and state employment was shifting from traditional manufacturing to trade and service industries. This shift, stimulated by a developing high technological base, meant an increasing demand for a better educated and more highly skilled workforce. This report, Manpower Trends and Issues: A National Perspective, A Missouri Context, demonstrates that the changes noted in 1983 will continue and, perhaps, accelerate through the year 2000. The changes will continue to have profound impact, not only on the labor force, but on the organization of the worksite itself.

While higher education is the focal point for the report, in the context of these changes, the current discussion among educators regarding existing and proposed linkages between the noncollegiate providers of adult postsecondary education and the higher education community is also reviewed. This review is necessary as manpower trends and issues are also human resource development issues associated with themes of lifelong learning. The human resource development and lifelong learning discussions are rapidly changing concepts of what, when, where and how education and training opportunities are provided for adults preparing to enter or are already a part of the national labor force. A consequence of this changing concept has focused the discussion on education and training opportunities available throughout the entire system of postsecondary education.

Institutional mission must guide each institution as it addresses manpower issues

It is important, therefore, to distinguish at the outset of this report between postsecondary education and higher education. Postsecondary education, which is the more general category, encompasses not only the traditional collegiate sector represented by the various types of colleges and universities, but also includes for-profit private educational institutions, many of the activities of the public and private vocational/technical education system, and the business/industry-based education programs. Higher education means those colleges and universities and other institutions which are usually accredited by a recognized regional accrediting association and grant degrees in what are considered the more traditional academic disciplines and professions.

The distinction is especially important when considering opportunities for lifelong learning. Not every institution can be responsible for doing everything discussed, or respond in total to the manpower trends and issues contained in this report. An institutional mission must provide the appropriate role for each institution in addressing manpower issues. In turn, institutional responses to these issues must be coordinated throughout the state system of public and private postsecondary education.

A Summary of Trends and Issues

Technology, a catalyst for many changes in the composition of the labor force, helps to mold and shape the labor force by contributing to (1) a redistribution in the number of jobs in goods-producing activities relative to service-producing activities, (2) an increase in the importance of higher skill occupations relative to other occupations, and (3) a broadening of skill requirements within occupations. These changes, which are accelerated by the increasingly competitive demands of the global economy, are not only requiring increasing skill levels for many workers, but also are generating fundamental changes in the nature of the employer organizations themselves. Many organizations are finding that competitive pressures are making it necessary to move from a segmentalized, or hierarchical, style to an integrative style of operation. Unlike the segmentalized style, the integrative approach encourages problem solving by involving the entire workforce in decision making. This, however, requires a more sophisticated workforce at all levels of the organization.

As production techniques become more technologically oriented, they are also undergoing profound changes. Computer based applications allow more sophisticated and individualized modes of production than does the assembly line. In doing so they are not only requiring more sophisticated tools and machinery, but also are leading to a major change in the ways production is organized and in the ways workers relate to the production process and to each other.

Changes in organizational structure and in the modes of production are also calling for the development or enhancement of new and different skills for many workers. These include knowing how to learn, the ability to self-direct, teamwork abilities, conflict resolution skills, the ability to communicate complex ideas, to analyze and solve complex problems, and to think and reason abstractly. This requirement for new skills, coupled with the need for skill upgrading and retraining, is leading many adult workers to demand greater opportunities for skills development education and training.

While increasing skill levels are the norm for many occupations, a number of those occupations projected to generate many of the new

jobs do not easily adapt to technological innovation. In others, the application of technology has led to a decrease rather than an increase in the required skill levels. These occupations tend to be low skill, part-time, and low paying, offering little chance for advancement, and few, if any benefits.

This developing dichotomy between large numbers of both high and low skill jobs is true for occupations related to the service industries and for many of those goods-producing industries where "deindustrialization" has displaced many workers previously working in manufacturing production. In almost all cases, those displaced workers that had developed or upgraded their skill levels were more likely to obtain a higher skill and better paying job than were those that had not done so.

Several key demographic trends are having, and are projected to continue having, a major impact on the composition of the labor force. A slow growing and aging workforce is already creating moderate to severe labor shortages at all skill levels. The increasing entry of women into the workforce, while somewhat offsetting this labor shortage, is anticipated to require greater subsidization, institutionalization, and regulation of day care and pre-school education. The increasing proportion of undereducated minorities and immigrants in the population is associated in part with the high rate of illiteracy within the labor force. This, in turn, reduces the ability of national and state industries to compete in the global economy.

Illiteracy is widespread among much of America's population. The rate of illiteracy in the United States has been estimated to be twenty times that of Japan. In general, American students rank far below those of other industrial powers in achievement test results. There is concern among employers that even many high school graduates are ill-prepared for the job market of today, lacking skills for even the most basic jobs. Illiteracy and lack of basic skills development have the potential to make the developing labor shortage even worse.

Opportunities and Challenges for Higher Education

The demand for skills upgrading and retraining among the adult workforce has the potential to change many aspects of higher education. The numbers and proportions of older and nontraditional students have increased significantly since 1981, and this increase is expected to accelerate through the year 2000. While colleges and universities have responded to this constituency by developing new options to accommodate their needs, higher education is being criticized by businessmen and others that it is still not responsive enough to the changing needs of the workforce.

In response to this criticism, a number of educational theorists have proposed that the educational system be broadened to more adequately include and recognize noncollegiate providers of adult postsecondary education and training, including public and private vocational/technical schools, corporations, and labor unions. Such a process, they suggest, would (1) allow for a greater integration of all the educational and training resources available to the Nation, (2) deal more directly with the issues of illiteracy and basic skills development, and (3) streamline the process of skills upgrading and retraining.

Another challenge to higher education is the growing teacher shortage in key academic areas, including business, mathematics, engineering, the computer sciences, the health sciences, and the life and physical sciences. Proposed solutions to this issue include making salaries in these disciplines more competitive with private industry, recruiting graduate students, improving faculty development programs, increasing graduate assistant stipends, and faculty "mortgaging." As a substitute for more teachers, others advocate that the utilization of new approaches to traditional classroom techniques could enhance the productivity of the teaching profession.

In summary, manpower related issues are both diverse and complex. They can however, be considered under several basic themes that may lend themselves to further exploration. These include the:

1. Determination of the appropriate allocation of higher education resources to help redress basic skills developmental problems that occurred elsewhere on the educational path;

2. Development of the best means for the coordination of higher education policy, planning, and coordination activities with those of other state agencies to better address issues of basic skills development, illiteracy, and related issues;

3. Consideration of the appropriate extent to which the education and training provided at the worksite and other noncollegiate settings should be incorporated into policy, planning, and coordination activities of higher education;

4. Development of effective and efficient alternative modes of course delivery to adult workers and the funding mechanisms available to encourage such alternatives; and

5. Consideration of policies, funding, and incentives designed to help alleviate the shortage of persons educated in selected, key academic disciplines such as business, mathematics, engineering, the computer sciences, the health sciences, and the life and physical sciences.

MANPOWER TRENDS AND ISSUES: A NATIONAL PERSPECTIVE, A MISSOURI CONTEXT

Introduction

In June 1983, the Missouri Coordinating Board for Higher Education report, Missouri Manpower Trends (1983), was prepared as part of the Master Plan III Assessment Project. The report emphasized that national and state employment was shifting from traditional manufacturing to trade and service industries. It pointed out that this shift, stimulated by a developing high technological base, had led to an increasing demand for a better educated and more highly skilled workforce. The report strongly suggested that the higher education curricula be reviewed to ensure that it reflected this demand.

As the economy grows more complex and more dependent on human capital, the standards set by the American education system must be raised

Since 1983, these changes in manpower requirements have accelerated, making the need for innovative and flexible responses by public higher education even more imperative. Such conclusions have since been emphasized nationally. The Hudson Institute report, Workforce 2000, states that many new jobs will demand much higher skill levels than the jobs of today. It further suggests that "As the economy grows more complex and more depend on human capital, the standards set by the American education s m must be raised" (p. xiv).

At the state level, the Missouri Opportunity 2000 Commission Report (1987) concludes that "all of our best guesses about the future of Missouri speak to the fact that our economy will be even more dependent on knowledge than it is today" (p. 5). The recently released Interim Report of the Governor's Advisory Council on Literacy points out that the movement toward a more complex, service-oriented economy results in a change in the relative mix of unskilled jobs and jobs that require greater skill levels.

This report, Manpower Trends and Issues: A National Perspective, A Missouri Context, uses current national information to review and update the findings of 1983. The findings are further developed within the context of issues that have become central to the discussion of manpower trends and issues. Such issues include (1) the relationship of technological change and the global economy to manpower needs, (2) the growing skill requirements of the workforce, (3) the changing structural organization of the worksites, (4) the impact of a slow growing and aging workforce, (5) the entry of women, minorities, and immigrants into the workforce, and (6) the problems of illiteracy. While higher education

is the focal point for the discussion of these issues, many educators are examining existing and proposed linkages between the noncollegiate providers of adult postsecondary education and the higher education community A review of this discussion is included in the report.

This report uses national information to provide a framework with which to discuss the issues because state employment projections are not available. National information, however, appears to be substantively applicable to Missouri. When available, Missouri information has been included.

Section I describes the impact technology has on the labor market, particularly on the goods-to-service production employment mix, and on the educational and skill requirements of the workforce. The acceleration of technological change brought about by the globalization of the economy and by various state and national demographic trends is also discussed. The impact on the labor force of those occupations that do not readily lend themselves to technological upgrading, or have experienced skill downgrading due to technology, is also reviewed. The observations made in this section are supported by analyses performed on industrial and occupational trend data presented in Appendices B and C.

Section II reviews national and, when available, statewide demographic trends and patterns as they relate to the labor force. Described in this section are the impact of a slow growing and aging workforce, the increasing entry of women, minorities, and immigrants into the workforce, and the increasing adverse influence of illiteracy upon the labor market and the economy.

Section III suggests implications the report findings have for public higher education in Missouri, both for the institutions and for statewide coordination. Included is a review of a number of proposals and activities discussed in the manpower related literature designed to further integrate the education and training opportunities delivered by the various providers of adult education other than higher education, including public and private vocational/technical schools, corporations, and labor unions.

The report includes three appendices. For reference purposes, Appendix A lists the industrial and occupational classifications used throughout the report. It also briefly discusses the relationship between service industries and occupations and the service-producing industries.

Appendix B presents an analysis of national data by type of industry. The analysis focuses on the twenty industries expected to experience the fastest rate of employment growth and decline and on the twenty industries expected to generate the most new jobs through the year

2000. In particular, the analysis shows the redistribution of national employment from goods-producing to services-producing activities.

Appendix C includes an analysis similar to that in Appendix B, except it is by type of occupation. This analysis also demonstrates the employment shift from goods-producing to services-producing activities. Using educational level as a proxy for skill level, further analysis shows a dichotomy between a growing number of new jobs requiring increasing skill levels and a large number requiring only minimal skill levels.

I. Technology and Global Competition: A Catalyst for Change

Economists and social observers agree that technology has historically been a catalyst for significant changes in the labor market and upon the operating structures of business and other organizations. With the advent of global competition, such changes are continuing and even accelerating, and are resulting in the following developments.

- Technology contributes to changes in the labor market through the redistribution of employment. It does so by encouraging an increase in the relative importance of higher skill occupations and by broadening skill requirements within occupations.
- Global competition accelerates the impact technology has on the labor force.
- Technology and global competition accelerate changes in the organization of the worksite itself.
- In spite of the general trend toward greater skill requirements, many jobs either do not readily lend themselves to technological upgrading or have their skill requirements downgraded by technology; such jobs are often low paying and require minimal skill levels.

Changes in the Labor Force

Services-producing industries now employ 80 percent of all Americans

Competition and the demand for cost efficiencies spur technological change. This change, in turn, helps to mold and shape the labor force by contributing to (1) a redistribution in the number of jobs in goods-producing activities relative to services-producing activities, (2) an increase in the importance of selected higher skill occupations relative to other occupations, and (3) a broadening of skill requirements within occupations (Vaughan and Berryman, 1989, p. C-18).

In recent years technology contributed to the reduction of the number of jobs in goods-producing activities relative to services. In 1950, for example, goods-producing industries (durable and nondurable goods manufacturing, mining, construction, and agriculture) employed 40 percent of all Americans. Today, they employ only 20 percent. Conversely, the services-producing industries (transportation and public utilities, wholesale and retail trade, finance, insurance and real estate, services, and government) now employ 80 percent of all Americans. (For a more detailed listing of industrial and occupational classifications, see Appendix A.)

Employment in the durable goods manufacturing industries increased only slightly between 1972 and 1987, while employment in the non-durable goods manufacturing industries actually decreased by over 250,000 jobs during this time. On the other hand, between 1972 and 1987, national employment increased in every services-producing industry.

Table 1.
Comparison of National Non-Agricultural Employment, 1972 - 1987

Industry	1972	1987	Difference 1972-1987	% Difference
GOODS-PRODUCING:				
Manufacturing:				
Durable Goods	11,050,000	11,220,000	170,000	1 5%
Nondurable Goods	8,100,000	7,850,000	(250,000)	-3.1%
Mining	630,000	720,000	90,000	14 3%
Construction	3,890,000	5,000,000	1,110,000	28.5%
Total Goods Producing:	23,670,000	24,790,000	1,120,000	4 7%
SERVICES-PRODUCING:				
Transportation & Public Utilities	4,540,000	5,390,000	850,000	18.7%
Wholesale and Retail Trade	1,600,000	2,440,000	840,000	52.5%
Finance, Insurance, and Real Estate	3,910,000	6,550,000	2,640,000	67.5%
Services	12.280,000	24,200,000	11,920,000	97.1%
Government:				
Federal Government	2,680,000	2,940,000	260,000	9.7%
State and Local Government	10,650,000	14,070,000	3,420,000	32 1%
Total Services-Producing:	35,660,000	55,590,000	19,930,000	55 9%
TOTAL NONAGRICULTURAL EMPLOYMENT:	59,330,000	80,380,000	21,050,000	35.5%

Source: U.S. Department of Labor, Bureau of Labor Statistics, LABSTAT Data Base

Within the services-producing industries, the services and retail trade Industries are expected to provide 75 percent of new job growth through the year 2000. The number of new jobs in the services industries alone is expected to be over eight million, and the wholesale and retail trade industries are expected to generate over five and a half million new jobs. Health and business services are expected to account for over half of the service industry employment growth (U.S. Department of Labor, March 1988, p. 28, 30, 41).

The observation that technology contributes to the reduction in the number of goods-producing jobs is also supported by the analyses in Appendices A and B. The analysis of employment data by type of industry in Appendix A shows that 18 of the 20 industries anticipated to

experience the fastest percentage rate of growth through the year 2000 are services industries, while 17 of the 20 industries expected to experience the fastest percentage rate of decline are manufacturing industries. The analysis also shows that all of the 20 industries projected to generate the most new wage and salary jobs are service or retail trade industries, while none are manufacturing industries.

The analysis of employment data by type of occupation in Appendix C shows that the occupations directly related to the services-producing and, specifically, the service industries are not only expected to be the fastest growing of all major occupational groups, but are expected to generate the most new jobs as well. The analysis also shows that, when considering individual occupations, most of the 20 occupations expected to experience the fastest rates of employment growth are directly related to the services-producing industries. A majority of the 20 occupations expected to experience the greatest loss of jobs, on the other hand, are directly related to the goods-producing industries.

Finally, the analysis in Appendix C shows that the majority of those occupations expected to have the greatest numbers of new jobs through the year 2000 are directly related to the services-producing industries and the others listed, including managers and administrators and computer programmers, are heavily employed by these industries. None are directly related to the goods-producing industries. In contrast, half of the occupations expected to experience the greatest loss of jobs are directly related to goods-producing industries.

Manufacturing Output Will Remain Constant

Even with the national employment decline in the manufacturing industries, the percentage of total gross national product (GNP) by the manufacturing industries, however, has remained at or near 20 percent over the last several decades (Leach and Chakiris, 1988, p. 48). Total manufacturing product output through the year 2000 is expected to keep pace with total growth in the GNP, averaging over two percent per year.

This trend strongly suggests that new technologies have been utilized to increase the level of output per worker in these industries. In doing so, however, it has rendered many types of jobs obsolete while creating a demand for others. Employment of material moving equipment operators, for example, is expected to decline due to greater use of automated material handling equipment in factories and warehouses. Also, computer-assisted design and manufacturing has doubled the number of technical jobs while cutting the number of production jobs in half. In contrast, the number of professional, technical, and managerial positions in the manufacturing industries is actually expected to increase (U.S. Department of Labor, April 1988, p. 10,12).

Technological progress also contributes to the increasing importance of certain higher skill occupations relative to other occupations. In 1900, about ten percent of the experienced labor force were classified as managers, professionals, or technicians while about 30 percent were farm or nonfarm laborers. By 1980 these percentages had roughly reversed, with about six percent working as laborers and over 25 percent as professionals, technicians, or managers.

Table 2.
Ratio of Employment by Occupation to Total Experienced Labor Force: 1900 and 1980

Occupation	Ratio 1900	Percentage 1900	Ratio 1980	Percentage 1980
Professional/Technical	1:23	4.3%	1:7	14.3%
Managerial/Proprietors	1:17	5.9%	1:9	11.1%
Clerical & Related	1:33	3.0%	1:5	20.0%
Salesworkers	1:22	4.5%	1:16	6.3%
Craftworkers/Supervisors	1:10	10.0%	1:8	12.5%
Operatives	1:8	12.5%	1:7	14.3%
Non-Farm Laborers	1:8	12.5%	1:20	5.0%
Service	1:11	9.1%	1:7	14.3%
Farmers/Farm Managers	1:5	20.0%	1:71	1.4%
Farm Laborers	1:6	16.7%	1:77	1.3%

Source: Vaughn and Berryman, "Employer-Sponsored Training. Current Status, Future Possibilities," 1988, p. 19

Most new jobs created through the year 2000 will require education beyond high school

This trend is expected to continue as more efficient production techniques, including computer-aided manufacturing and industrial robotics, are utilized, thereby eliminating jobs for production workers. Anticipated technological advances in information storage and retrieval, communications, materials development, biotechnologies, and superconductivity are anticipated to hasten the need for higher skilled workers. In fact, of all the new jobs that will be created through the year 2000, more than half are expected to require some education beyond high school, and almost a third will be filled by persons with four years of college or more (Hudson Institute, Inc., 1987, p. 97-98). The analysis of Appendix C supports this observation when the occupations with the fastest rates of employment growth and decline are considered. Most of the 20 occupations expected to experience the fastest rate of employment growth require some higher education, while almost none of the 20 occupations anticipated to experience the fastest rate of employment decline do so.

The analysis also shows that only one of the 20 occupations expected to experience the greatest decreases in the number of jobs requires postsecondary education. When considering those occupations ex-

pected to generate the most new jobs, however, the relationship between job growth and educational level is less pronounced. The ramifications of this latter finding are discussed in pages 11 through 13 of this report.

Technology also contributes to the broadening of skill requirements within occupations. A secretary today must be able to operate complex communications and data processing equipment not even invented a decade ago. Also, the use of desktop computers has, in the insurance industry, led to the combining of five jobs - messenger, file clerk, customer assistance clerk, claims adjuster, and policy writer - into the one job of claims adjuster (Vaughan and Berryman, p. C-18).

Technology will introduce change and turbulence into every industry

By 1995 data management and control are expected to be major responsibilities of 80 percent of all managers. By the year 2000, about half of all service workers are expected to be involved in collecting, analyzing, synthesizing, structuring, storing, or retrieving information (Cetron et. al., 1988, p. 30). The typical large business is becoming information based, composed of specialists utilizing information provided by colleagues, customers, and headquarters. In short, technology "will introduce change and turbulence into every industry" (Hudson Institute, Inc., 1987, p. 37) and into many jobs.

Not only will the skill requirements within occupations increase, but people entering the work force are likely to "switch jobs, if not occupations and industries, several times in the course of their working lives" (Feuer, 1987, p. 35), either by choice or through mandatory changes brought about by rapidly shifting markets. In order to maintain employability, many workers are already having to continually learn and adapt to new situations. They are, in turn, demanding from their employers greater opportunities to upgrade their educational and skill levels.

The Global Economy

Such trends are accelerated by the increasing globalization of the economy. International trade has increased significantly in the last decade with further growth projected through the year 2000. Factors contributing to this growth include the integration of global markets, excess production capacity, and the rapidly growing world labor force. This growth has resulted in an increasingly competitive environment for individual firms, states, and the nation as a whole. The necessity to gain a competitive edge will encourage individual firms, industries, and nations to decrease the time lag between the development of an idea for product or product improvement and its entry into the marketplace. It will also lead to a "relentless pressure to change and adapt to new markets and technologies" (Hudson Institute, Inc., 1987, p. 48).

The advent of the global economy also means that workers are no longer competing only with their fellow countrymen for employment, but are competing directly or indirectly with an international workforce that is "growing, young, cheap, motivated," and increasingly well-educated. In other words, the "international economy pits the productivity of the nation's workforce against that of all other nations" (Miller, 1989, p. B-6).

Changes in Organizational Structure

Technology and global competition are also contributing to changes in the nature of the employer organizations themselves; this is true for both the goods and services-producing industries. Kanter (1983) suggests that this transforming economic and social environment is demanding movement from segmentalized to integrative organizational styles and structures.

Segmentalized organizations are characterized by very hierarchical management and very clearly defined departments and levels, all standing somewhat independently of each other, and with minimal cooperation except at the top levels. These organizations usually see problem solving as isolated to one segment or area of the organization. Such organizations find it difficult to innovate or handle change, which discourages flexible problem solving skills within their workforce.

Integrative organizations, on the other hand, see problems as "wholes," requiring a team-oriented approach. The integrative approach "reduces rancorous conflict and isolation between organizational units; creates mechanisms for the exchange of information and new ideas across organizational boundaries; ensures that multiple perspectives will be taken into account in decisions; and provides coherence and direction to the whole organization" (p. 28). This approach also changes the tasks for management at all levels and encourages the involvement of the entire workforce in problem solving. Organizations that effectively employ the integrative approach find it relatively easy to stimulate innovation, productivity and change, and are, thus, more able to compete in the global economy.

Vaughan and Berryman (1989) view technological change as creating movement from production-oriented to product-oriented and customer-oriented modes of organization. The objective of the production-oriented mode was to use the assembly line approach to replace teams of skilled workers. An outcome of this mode of production was the specialization of labor and the routinization of jobs.

As the production techniques become more technologically-based, and particularly, more computer based, they become more adaptable in that "retooling simply requires reprogramming, thus allowing shorter production runs and more varied or customized production" (p. C-20).

This customer-oriented mode of production requires the application of more sophisticated general purpose tools and machines. These, in turn, require more sophisticated levels of worker and managerial skills and generally lead to a reorganization of the worksite itself. In other words, the increased use of computer based and related technologies "does not just result in new machines that must be mastered, but in a much deeper change in the way production is organized and the ways workers relate to the production process and to each other" (p. C-23).

New Skills are Required

Required skills highlight the increasing value of the liberal arts and sciences

Such changes in the workplace are not only demanding increased levels of basic skills, but are requiring the development or enhancement of new and different skills. These include knowing how to learn, the ability to self-direct, teamwork abilities, and conflict resolution skills (Berryman, p. C-24). Such skills also include the "ability to communicate complex ideas, to analyze and solve complex problems, to identify order and find direction in an ambiguous and uncertain environment, and to think and reason abstractly" (Cohen, 1989, p. 1). The growing need for these skills, which are closely tied to the concept of liberal learning, highlights the increasing value of the liberal arts and sciences for all areas of both business and education.

Because many workers in the future will experience rapid changes in both the technologies and the jobs themselves, they will also need to be able to learn new skills and tasks quickly. While such skills have in the past been emphasized in management or supervisory positions, as more responsibilities are demanded at every job level, they are now seen as becoming important in even what are considered the lower skill jobs.

The Other Side of the Issue

The discussion to this point makes it obvious that technology and the global economy are not only having a profound impact upon the skill and educational levels of many workers in the labor force, but upon the organization of the worksite itself. Whenever technology can be utilized to increase the productivity and efficiency of a worksite or industry, increasingly greater skill levels are required.

Not all occupations, however, are easily adaptable to technology, and will likely remain low skill and low paying occupations. Such occupations, including waiters, cashiers, maids, refuse collectors, etc., comprise a large proportion of the fast growing retail trade and service industries. This is one reason why over the past 15 years there has been a sluggish growth of productivity in the service industries, leading many to "doubt that these dispersed, low-technology industries can ever

become highly automated or productive" (Hudson Institute, Inc., 1987, p. 42).

There are also many occupations where the application of technology leads to a decrease rather than an increase in the required skill levels of workers. These are occupations where the "new technologies will enable robots and other sophisticated machines to perform a greater number of functions and more complex as well as physical tasks, while making the operation of these machines easier" (Feuer, 1987, p. 32).

Many skilled crafts occupations have already fallen victim to such skills downgrading. For instance, the proliferation of instant printing shops has eliminated the need for skilled workers such as lithograph artists and etchers, while generating "an abundance of relatively low-skilled machine operator jobs." Advances such as automated banking and computerized underwriting for insurance agents has already reduced skill levels for some occupations within the banking and insurance industries. The same is true for many service and retail trade occupations, where many of the jobs are labor intensive. McDonald's, for example, has introduced a grill that cooks hamburgers without their having to be manually flipped, and PepsiCo will soon have a computerized beverage dispenser to fill cups with their product.

The low skill occupations tend to be part-time, "paying wages at half the level of manufacturing jobs" (Cetron et. al., 1988, p. 34). They also offer little chance for advancement, offer few, if any, benefits, and are often the first to be eliminated in economic downturns. On the other hand, job growth within such technology-intensive industries as health care, finance, and transportation is demanding ever increasing skill levels. Such industries require extensive knowledge and training, and pay premium wages.

A dichotomy is emerging between a growing number of new jobs requiring increasing levels of education and skills, and a large group requiring minimal skill levels

In short, there appears to be a dichotomy being created between a growing number of new jobs requiring increasing levels of education and skills and a large group requiring minimal skill levels (see Appendices B and C). In support of this conclusion, researchers such as Bluestone and Harrison (1988) found that the proportion of low skill/low wage employment "has grown substantially, particularly since the late 1970s" (p. 124). They also found that, at least among year-round full-time workers, the high skill occupations typically paid high wages, while the low skill occupations paid low wages.

This wage polarization is particularly true within the service industries, which "tend to have more high and low earners, and fewer in the middle," and within the goods-producing industries in the Midwest, where "deindustrialization" has displaced many workers that were previously working in manufacturing production. In almost all cases of the latter, those workers that had the most education and had developed or upgraded

their skill levels were less susceptible to worker displacement than were those who had not.

The analysis in Appendix C supports this observation. Using level of postsecondary education as a proxy for skill level, it was found that 11 of the 20 occupations expected to experience the greatest numerical increases in new jobs require no postsecondary education. In four others, postsecondary education is not considered mandatory for employment. Yet there is expected to be over nine million new jobs created in these 15 occupations through the year 2000.

Table 3.
Projected Number of New Jobs and Educational Levels Typically Associated With Occupations Projected to Gain the Most New Jobs Through the Year 2000*

Occupation	Projected New Jobs	Postsecondary Educational Level
Sales & Related Workers	2,455,000	None
Nursing & Psychiatric Aides, Orderlies, & Attendants	872,000	None to Certificate
Waiters & Waitresses	752,000	None
Janitors & Cleaners, Including Maid/Housekeeping	604,000	None
Cashiers	575,000	None
Truck Drivers, Light & Heavy	525,000	None
General Office Clerks	463,000	None
Food Counter, Fountain, & Related Workers	449,000	None
Secretaries	424,000	None to Associate Degree
Guards	383,000	None
Cooks, Except Short Order	355,000	None
Computer Programmers	334,000	None to Advanced Degree
Food Preparation Workers	324,000	None
Receptionists & Information Clerks	282,000	None
All Other Management Support Workers	280,000	None to Bachelor's Degree
Total Projected New Jobs	9,077,000	

*Only occupations with projected 2000 employment of 10,000 or more are included.

Source: Occupational Employment Data: U.S. Department of Labor, Bureau of Labor Statistics, Occupational Projections and Training Data, 1988 Edition, Bulletin 2301, Table A-1

With the exception of computer programmers, most of these 15 occupations are labor intensive and not readily amenable to technological upgrading. Perhaps with the exception of truck drivers, they are typically low paying and low skill jobs.

Level of education and training is, thus, a critical factor in the ability to enter or reenter higher level and better paying jobs. This important issue is further addressed in the discussion in Section II of demographic and literacy trends and projections.

II. Demographic and Literacy Trends and Patterns

The slow rate of population growth, the relative aging of the population, the increasing proportion of minorities and immigrants in the population, and the increasing entry of women into the workforce are having profound effects upon the size, makeup, and literacy rate of the workforce. These issues and their current and potential impact upon the labor market include the following trends.

- The population and workforce will experience slower growth than at any time since the 1930s; the average age of the population and the workforce will increase, while the pool of young workers entering the labor market will decrease.

- A developing shortage of college and university instructors in a number of disciplines may have a major impact upon the ability of this nation to compete in the global economy.

- More women will enter the workforce; almost two-thirds of the new entrants into the workforce between now and the year 2000 will be women; 60 percent of all women of working age are expected to have jobs by the year 2000.

- Minorities and immigrants will constitute a larger share of the national workforce than they do today; substantial increases in the number of blacks, Hispanics, and Asians are anticipated, reflecting high birth rates in these population groups as well as a continued flow of immigrants into the United States.

- Growing illiteracy among the existing and future workforce may make it more difficult for national industries to compete in the global economy.

- The problem of illiteracy, combined with a slow-growing workforce, is creating a labor shortage in many occupations.

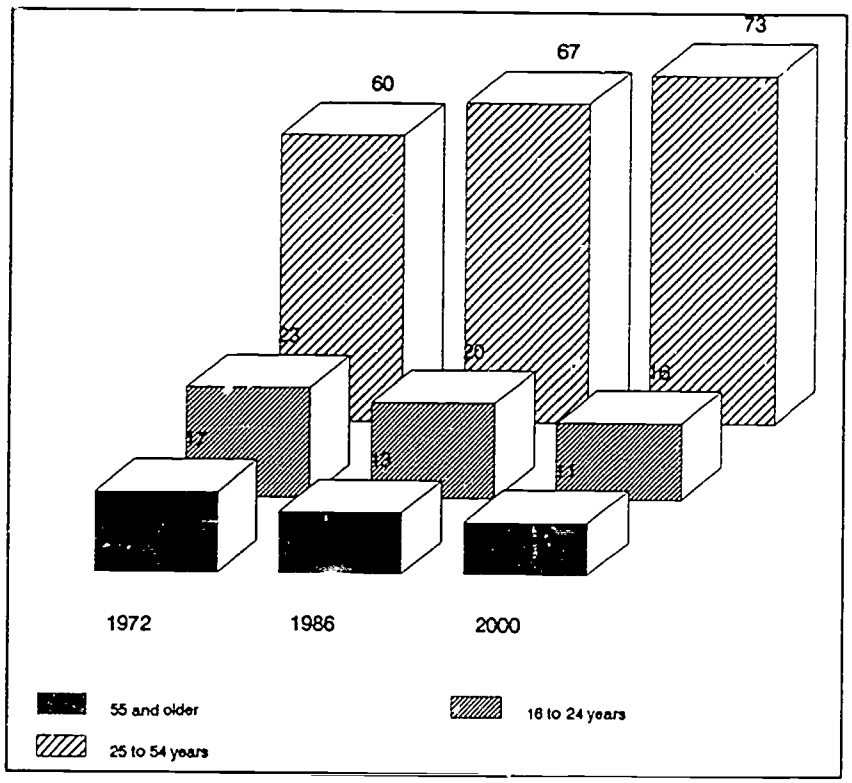
A Slow-growing and Aging Workforce

A combination of a declining birth rate and a large number of births during the "baby boom" years (1946-1964) have led to a situation where, by the year 2000, almost three out of four workers will be between 25 and 54 years of age. Nationally, the average age of the typical worker will climb from 36 in 1986 to 39 years of age, and the number of young workers age 16-24 will drop by almost two million. The proportion of persons aged 55 and older will increase through the year 2000. As their

rate of participation in the labor force is anticipated to decline, however, the number of workers in this age group is expected to be only slightly higher in 2000 than in 1986.

Figure 1.
Share of the National Labor Force by Age: 1972, 1986, and Projected 2000

Share of the labor force by age (percent)



Source: U.S. Dept. of Labor, Bureau of Labor Statistics, Occupational Outlook Quarterly, Fall 1987, Vol. 31. No. 3, 8

In Missouri, 72 percent of the labor force will be between the ages of 25-54 by the year 2000 (Missouri Opportunity 2000 Commission, 1987, p. 30). In contrast, the number of workers in the under-thirty-five age group will actually shrink by eight percent. While the population of persons over 54 will increase, declining participation in the labor market will actually lead to fewer workers of this age group.

These demographic trends could have both positive and negative influences on the workforce. While the older workforce will be more experienced, stable, and reliable, it may also be less adaptable. Generally, the older workers may be less willing to move, change occupations, or undertake retraining than will younger workers. Many

companies with older workforces may find that their aging, higher paid workers make them less competitive. The dearth of young workers, on the other hand, may hamper the ability of companies to expand, and many of those that depend upon young people for market growth may even have to retrench.

A Shortage of College Teachers

Related to the general labor shortage is a growing shortage of college teachers in some academic disciplines, including business, mathematics, engineering, the computer sciences, the health sciences, and the life and physical sciences.

A major contributing factor to this shortage is that many of the professors in the disciplines where shortages exist were hired in the 1950s and 1960s, a time when enrollment in these disciplines was rapidly growing. The faculty members hired during those years are now reaching retirement age and will need to be replaced. At the same time, colleges and universities must compete with lucrative salaries offered by private industry for graduates, particularly those with advanced degrees in the natural sciences and in engineering. Yet this is occurring at a time when the demand for persons with advanced degrees in these occupations is expected to increase, while the "supply of PhDs will not show any upward trend" (Leon, 1988, p. 34).

This impending shortage will also make it harder to find and hire minority faculty members. In fact, because of "the difficulty of attracting to academic careers talented minorities who have significantly more lucrative career options," the proportion of minorities on faculties may even decline in the near future. Already the number and proportion of black faculty with tenure has decreased in the public colleges and universities in Missouri. "In 1981, 64 black faculty were tenured, representing 1.8 percent of all tenured faculty. In 1987, the comparable figures were 51 and 1.5 percent" (Missouri Coordinating Board for Higher Education, November 1988, p. 16).

Obviously, this potential teacher shortage in selected academic disciplines could have a major impact upon the future well-being of the national economy. Without an adequate supply of college and university teachers to train the workforce in those disciplines essential to a technologically based economy, the ability to compete with nations that find solutions to such problems will be severely diminished.

While the U.S. Department of Labor projects increasing demands for faculty in selected disciplines, its projected demand for college and university professors in all disciplines by the year 2000 is expected to decrease by about 32,000 (see Table 7A). The report is based on projected enrollment declines and projected stabilization in estimated

college going rates. This projection showing a decrease in demand for college and university faculty may be in error, however, as it is inconsistent with recent assessments of the faculty shortage issue.

For example, in Missouri, nearly a fourth (23.8 percent) of the full-time tenured and eligible for tenure faculty in public two- and four-year institutions are age 55 and over; 9.7 percent are age 60 and over. This means that, owing to retirement, 1,238 of the 5,199 Missouri public two- and four-year institution full-time tenured and tenure track faculty will need to be replaced in the next ten years (Missouri Coordinating Board for Higher Education, June 1989a). The proportion of Missouri faculty retiring in the next ten years is not too different from many other states. An August 1989 report of 24 states shows almost 21 percent of the 114,000 faculty employed by state supported institutions in those states to be age 55 or over (Dorsey and Lavery). This report alone would suggest that, because of retirements, these 24 states will need to replace 23,940 public higher education faculty members sometime during the next ten years.

Assuming a conservative 20 percent as the estimated replacement rate for college and university faculty by the year 2000, some 150,800 of the 754,000 faculty reported by the U.S. Department of Labor in 1986 will retire by the year 2000. A more dramatic report of the need for faculty during the 1990s is that within the next fifteen years, 340,000, or 74 percent of an estimated 460,000 faculty members, will be needed to fill vacancies created by faculty retirements (Schuster, 1989).

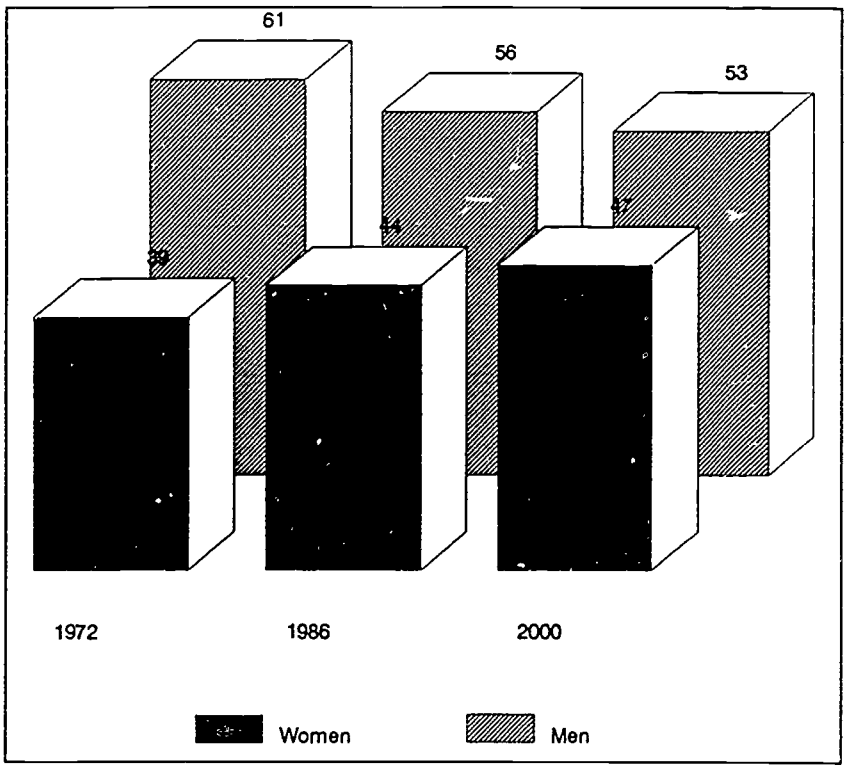
Because of declining numbers of PhD recipients, replacing existing faculty poses some challenges for higher education. But it also provides higher education with the opportunity to replace many of these retiring faculty, depending on availability, with minorities and women.

Female Labor Force Participation

The increased entry of women into the workforce somewhat offsets the slowing of the growth of the labor market. In 1972, women constituted only 39 percent of the national workforce; by 1986, this percentage increased to 44 percent; it is expected to increase to 47 percent by the year 2000, from 52 million in 1986 to 66 million

Figure 2.
Share of the National Labor Force by Sex: 1972, 1986, and Projected 2000

Share of the labor force by sex (percent)



Source: U.S. Dept. of Labor, Bureau of Labor Statistics, Occupational Outlook Quarterly, Fall 1987, Vol. 31, No. 3, 9

Not only are more women entering the labor force, but they now work more hours per week and more weeks per year than they did ten years ago. Their rapid entry into higher paying professional and technical fields has decreased the average salary difference between men and women. The salaries of women averaged only 61 percent of their counterparts in 1960, but by 1986 their salaries had increased to 70 percent of those earned by men.

In addition to alleviating some of the problems created by a slow growth in other segments of the workforce, the entry of women into the workforce is affecting, and will continue to affect, the workplace in other ways. For example, the increasing number of working women may lead to greater subsidization, institutionalization, and regulation for day care and pre-school education. Benefit policies are also likely to be restructured to reflect the desires of two-earner families and single workers. As

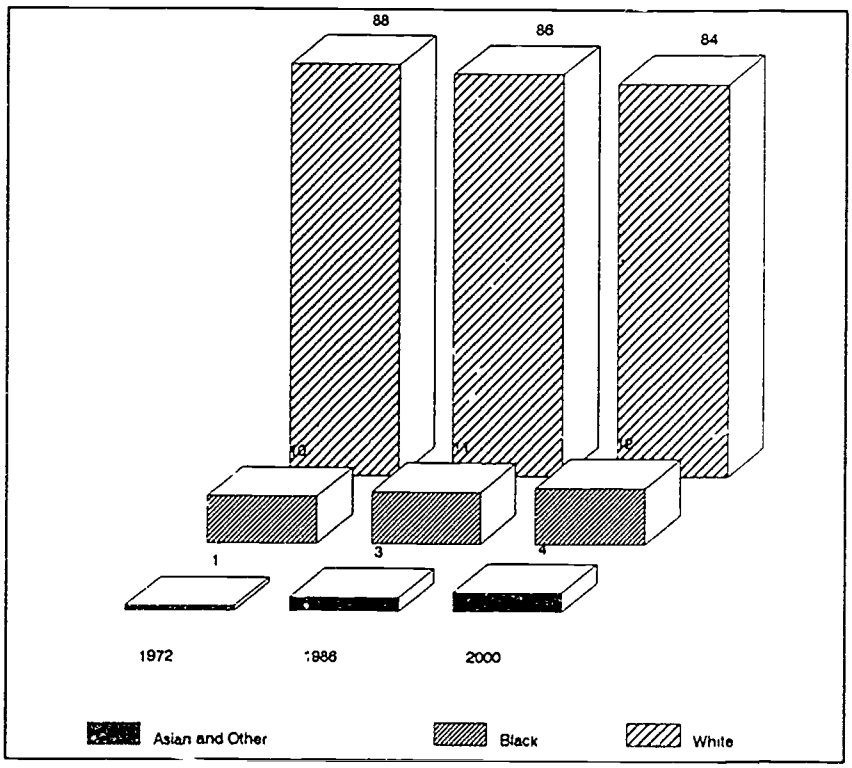
two-career families are generally less willing to move, the workforce may also become less flexible (Hudson Institute, Inc., 1987, p. 87-88).

Minorities and Immigrants in the Workforce

In 1982, the proportion of blacks in the national workforce was 10 percent. By 1986 it had increased to 11 percent and, by the year 2000 it is expected to increase to 12 percent. The proportion of Asian and other minorities was one percent in 1972 and is expected to increase to four percent by 2000.

Figure 3.
Share of the National Labor Force by Race: 1972, 1986, and Projected 2000

Share of the labor force by race (percent)



Source: U.S. Dept. of Labor, Bureau of Labor Statistics, Occupational Outlook Quarterly, Fall 1987, Vol. 31, No. 3, 10

The proportion of Hispanics is expected to increase from eight million, or seven percent of the national workforce in 1986, to 14 million, or 10 percent in 2000 (U.S. Department of Labor, March 1988, p. 10-11). Also, approximately 600,000 immigrants are expected to enter the United

States annually through the year 2000. This represents the largest influx of immigrants since World War I.

In 1986 the black population in Missouri was 534,000, representing 10.6 percent of the total state population; other nonwhite population was less than 60,000, or less than one percent of the total state population (U.S. Department of Commerce, 1988). Projections indicate only modest levels of net immigration projected for the state for the remainder of the century (Missouri Opportunity 2000 Commission, 1987, p. 26). Thus, while no state specific data are available, it is assumed that, of the minority and immigrant groups in Missouri, only the black population will have a major impact upon the labor force.

Illiteracy Issues and Manpower Needs

Inadequate basic education among minorities will adversely impact the labor market

Counties in Missouri with high rates of illiteracy include St. Louis City and those in the Bootheel region. While the rate of illiteracy in Jackson County is not as high as in St. Louis and the Bootheel region, the illiteracy rate for Kansas City is higher than for the entire county. The vast majority of the minority population in Missouri is centered in the Kansas City, St. Louis, and Bootheel areas. In each area, as in many similar areas across the nation, to the extent that they grow up in a disadvantaged environment, the minority population is more likely to be functionally illiterate, drop out of school, become pregnant as teenagers, or abuse drugs and alcohol. Those that do graduate from high school often have limited reading and writing skills, which can translate to limited career opportunities. As minorities will comprise an increasingly higher proportion of a slow growing labor force, a lack of adequate basic education among this group will adversely impact the labor market, by both aggravating the problem of labor shortages and requiring extensive preparatory training for even low skill jobs.

The illiteracy problem is, however, not restricted to minorities. Twenty-seven million Americans over the age of 17 are functionally illiterate, and another 45 million are marginally literate (Plawin, 1988, p. 107). The illiteracy rate in this country has been estimated to be as much as 20 times that of Japan. American students generally rank far below those of other industrial powers in achievement test results, especially in math and science, but also in verbal areas (Power, 1988, p. 14). The 1984 National Assessment of Education Progress (NAEP) also showed that over 60 percent of 17-year-old students lack the ability to find, understand, summarize, and explain relatively complicated information (Cohen, p. 1). The same assessment showed that the overwhelming majority of eleventh-graders could not write a brief passage well enough to accomplish their writing objective.

Nationally, and in Missouri, the current high school dropout rate is about 25 percent (Missouri Coordinating Board for Higher Education, Novem-

Business leaders say many high school graduates are virtually unemployable

ber 1988, p. 11), with little sign of improvement. Among the high school graduates, however, there is concern by employers in both large and small businesses about their low reading, writing, and math skills, as well as their attitudes toward work and lack of knowledge of appropriate behavior on the job. Many have also not learned how to learn, solve problems, make decisions, or set priorities. Many high school graduates are considered virtually unemployable, even at today's minimum wage (Committee for Economic Development, 1981, p. 20). Yet, as previously discussed, this is occurring at a time when the labor force is growing at a slow rate and technological change and global competition are demanding that the education and skill levels required for many jobs increase. Many businesses are already experiencing shortages of persons that have the requisite skills and training to meet their employment needs, yet there are "thousands of adults who are losing their jobs as production methods change and who lack the literacy, the basic education or the skills to adapt to new jobs" (Power, p. 14).

III. Issues for Higher Education Institutions and Policy Implications for Statewide Coordination

Issues for Higher Education Institutions

Job Retraining and Skill Upgrading

Technological progress, accelerated by global competition, is drastically changing the nature of the workforce and the organization of the worksite. The movement from a goods-producing to a services-producing economy is increasing the demand for professionals, technicians, and managers, while reducing the number of production-related jobs. The effect of these changes is to demand, not only that many workers learn and relearn specific skills throughout their working careers, but that they develop new skills as well. This demand for lifelong educational opportunities is rapidly changing many aspects of postsecondary education in general and higher education in particular.

Within this context, it is important to distinguish between postsecondary education and higher education. Postsecondary education, which is the more general category, encompasses not only the traditional post-high school education sector represented by the various types of colleges and universities, but also includes for-profit private educational institutions, many of the activities of the vocational/technical education system, and the business/industry based education programs. Higher education, on the other hand, refers only to those institutions, generally accredited by a recognized regional accrediting association, that grant postsecondary degrees in what are considered the more traditional academic disciplines and professions. This distinction, which is often blurred in much of the related literature, must be kept in focus when considering the many issues related to lifelong learning.

With this distinction in mind, it is apparent that the issues of lifelong adult learning are directly affecting the student mix within the state public higher education system. Since 1981, for example, the percentage of part-time undergraduate students attending Missouri public four-year institutions has increased from 20 to 24 percent. The public two-year institutions have shown a similar increase from 65 percent to 68 percent over this time period. These nontraditional students are generally older than the traditional (18-24 year old) student, and are often employed. In Missouri, over 8,400 students 25 years of age or older were enrolled in Missouri public institutions in Fall 1988 as full-time undergraduate students (Missouri Coordinating Board for Higher Education, June 1989a, p. 38). Nationally, almost 75 percent of the male students, and more than 50 percent of the female students, both full- and part-time, were employed while attending classes (Johnston, 1989, p. A-10).

Seventy-five percent of the male students, and more than 50 percent of the female students are employed while attending classes

This shift to an older student population is encouraging the development of new options to accommodate their needs. Generally, admissions requirements and formal entry qualifications are being reevaluated. For example, nationally, 92 percent of all institutions permit students to matriculate with a General Educational Development (GED) certificate. In addition, many institutions are scheduling classes at times and places more convenient to working adults (p. A-11).

There are many workers, however, who find it difficult to travel to a campus in order to upgrade their skills. Many institutions are responding to this by offering independent study and delivering courses at sites more convenient to students (Missouri Coordinating Board for Higher Education, June 1989b). Through consortial arrangements colleges and universities are joining with other institutions and schools offering vocational/technical programs to deliver courses off-campus. These consortial arrangements not only bring the courses closer to potential students, but institutions can offer a wider range of courses to meet their demands. The Bootheel Educational Consortium, consisting of Southeast Missouri State University, Three Rivers Community College, University of Missouri Extension, and area vocational/technical schools, is an example of such a consortial arrangement in Missouri.

Many institutions, including several in Missouri, are also utilizing telecommunications technologies to deliver course materials to the worksite itself. This is typically done through contracts with the businesses for either entire programs or specific courses. Telecommunication technologies are also being utilized by institutions in a number of states to deliver course materials to remote communities.

Yet, even with these activities, some observers argue that, "while education has changed through the years, change has not kept pace with the needs of the workplace" (Miller, 1989, p. B-8). Some also suggest that higher education institutions, particularly the four-year institutions, are still too focused upon standard degree programs and upon the traditional student.

Concern is also being expressed within the business community, where employer sponsored training programs now account for about two-fifths of total dollars spent on training. Business leaders often contend that higher education and other postsecondary institutions are still not responsive enough to the training needs of business, particularly in their ability to meet the rapidly changing educational demands of the economy in a timely and flexible manner. This lack of flexibility, they argue, requires businesses to assume a rapidly increasing role in the training of their employees.

This training, however, whether delivered by the employers, or contracted to higher education institutions or other outside agencies, is often delivered primarily to their best educated employees. Vaughan

and Berryman (1989), for example, found that "only 45 percent of those who failed to complete high school but 71 percent of high school completers and 79 percent of college graduates receive training from their employers" (p. C-6). This uneven distribution of training among employees tends to intensify the dichotomy of low and high skill workers.

A Seamless Interface

Perceptions that each level of schooling is separate and distinct from all other levels must be abandoned

A number of educational theorists contend that neither the problem of upgrading and retraining the labor force nor the high rate of illiteracy will be solved until education is viewed as a lifelong process. In his report, All One System, Hodgkinson (1985) states that the traditional perception that each level of schooling is separate and distinct from all other levels must be abandoned. He argues that learners passing through the various levels of education perceive them to be one system, and developments at any one level affect all other levels. Colleges, for example, must be concerned about what elementary school students are learning - and not learning - today, because "a majority of today's elementary school students will be enrolling in colleges in 6 to 12 years" (p. 1).

Spille (1989) takes this argument one step further. He is concerned that the educational system has no capability to formally recognize the learning that persons have acquired through life experiences. He also suggests that, as the modern economy is demanding continual retraining on the part of the workforce, Hodgkinson's model of "All One System" of schooling should be expanded. Spille writes:

> This . . . system would be characterized by formal working, cooperative relationships among the various providers of postsecondary-level education and training . . . Members of this system will include major noncollegiate providers or sponsors of postsecondary education and training (such as corporations, labor unions, the military, government agencies, and professional and voluntary associations); some vocational schools, technical institutes, colleges, and universities; and organizations that need the services of the system. The system's clients will be adult learners. The link among the providers will be the commitment to 'formally' recognize the learning their 'students' have acquired. Thus, the system will not necessarily provide more education and training than is currently provided, but it will identify more effectively the education and training needs of the workforce and coordinate or target the efforts of providers who can meet those needs. Costly duplication of planning and offerings will be avoided (p. D-13).

Such a system, he argues, would provide a comprehensive adjustment and training strategy to prepare workers for a lifetime of change. It would provide the "ways and means to provide remedial education and pre-entry training for disadvantaged and impaired workers, entry-level training for more than a million new workers coming into the labor force each year, continuing training and education for the vast majority of workers who will need a lifetime of skills improvement, and retraining and adjustment assistance for the two million people who are displaced from their jobs each year" (Choate and Linger, 1987, p. 13).

In other words, Spille perceives such a system as not only dealing with the training needs of the higher skill occupations, but also helping the economy come to terms with the problem of an increasing wage and skill polarization. Specifically, it could assist those persons whose low skill levels give them little hope of escaping the low skill/low paying jobs at the bottom of the job ladder. In doing so, it would also mitigate at least some of the labor shortage problem.

While most agree that steps need to be taken to deal with these issues, not all concur that such a radical revamping of the educational system is required. Even if accepted, the resources, coordination efforts, and time required to create such a system would be enormous. Also, those in the educational community that advocate such dramatic changes typically emphasize that any such system must not lead to the dilution of the quality of the certificates and degrees offered and must maintain or enhance the basic mission and goals of higher education. Even Spille advocates that higher education institutions, "through their faculty, administrators, and governing boards, will retain sole responsibility for awarding educational credentials" (Spille, 1989, p. D-22).

Other options, while smaller in sccpe than the Spille proposal, have been implemented with some success. For instance, in order to give formal credit for noncollegiate based learning experiences, most institutions have policies that "permit the acceptance of credit for learning acquired in noncollegiate settings" (Johnston, 1989, p. A-11). Such policies include granting credit for courses offered by, or occupational proficiencies attained in, the armed forces and for courses conducted by business and industry. Most colleges also give credit for knowledge demonstrated through standardized examinations such as College Level Examination Program (CLEP) of The College Board. Some institutions have also developed assessment techniques for student portfolios, occupational licenses, or other formal certification (Hester and Anderson, 1986). It remains a lively issue among higher education institutions, however, the extent to which such "nontraditional" credit may be appropriately substituted for more conventional learning.

To facilitate labor retraining and skill upgrading, a number of institutions are actively participating in state or employer subsidized training programs. For example, a number of community colleges and other

higher education institutions are heavily involved with a training program known as "PATHWAYS to the Future." This program, a result of collective bargaining between US West Communications and the Communications Workers of America, provides financial assistance, counseling, and other support to more than 28,000 active management and nonmanagement employees in eight states (Arizona, Colorado, Idaho, Montana, New Mexico, Utah, Wyoming, and a portion of Oregon). In support of this effort, the participating higher education institutions have modified their class schedules to include more evening and weekend hours and have expanded assessment and independent study opportunities.

Although Missouri is not part of "PATHWAYS to the Future," several Missouri institutions are involved with similar programs. Through these programs schools provide pre-employment assessment, career assessment and planning, and basic skills or workplace literacy assessment. Companies involved with these programs include McDonnell-Douglas, Westinghouse, and AT&T in the St. Louis area. The programs provide participants the opportunity to develop skills necessary to manage career change and are designed to enhance the self-esteem of the participants through "realistic assessment and reinforcement of skills, abilities, and interests" (St. Louis Community College, 1989, p. 3).

Similar efforts, whether through collective bargaining agreements or resulting from college and business contracts, are being undertaken across the country. Early indications are that many employees are taking advantage of this option when it is available. If proven successful, it is likely that a "sizable proportion of the workforce in the United States will begin to have access to these kinds of retraining activities in the future" (Johnston, 1989, p. A-26).

Basic Skills Development

Most colleges and universities have developed remedial programs to help deal with the basic skills issues. In Missouri the effectiveness of such programs has been enhanced through a major statewide assessment and outcomes evaluation initiative being undertaken in all state public colleges and universities. By screening students at the beginning of their college experience, these programs provide an appraisal of any skill deficiencies that a student may possess. If needed by the students, they are typically encouraged to complete a developmental education program to remedy any deficiencies. While each institution has its own assessment methodology, "certain features are common to most programs, including the use of nationally normed tests and surveys to help develop a better understanding of the degree to which institutions are meeting student and societal needs" (Missouri Coordinating Board for Higher Education, February 1989, p. 2).

Eighty percent of Missouri's college freshmen indicate the need for remedial coursework or counseling

A potential demand for developmental programs has been verified by the Missouri Student Achievement Study. Over 80 percent of Missouri's fall 1986 first-time freshmen in the study indicated that they would require some form of remedial coursework or counseling (Missouri Coordinating Board for Higher Education, September 1988, p. 3). As these data and other indicators point to a growing demand for basic skills development programs, the number of such programs, and the accompanying costs, are likely to increase in the future.

The Teacher Shortage

Even if the issues of illiteracy and general skills development are effectively dealt with, the economy, and especially higher education, must come to terms with a growing shortage of college and university teachers in a number of disciplines including business, mathematics, engineering, the computer science the health sciences, and the life and physical sciences. It must also deal with the general difficulty of recruiting and retaining qualified minority faculty. Perhaps the most compelling incentive would be higher salaries. The average annual salary increase for college and university faculty members was less than five percent from academic years 1986-87 to 1987-88, the lowest rate in four years (Leon, 1988, p. 34). Adjusted for inflation, average salaries rose nationally by 0.9 percent between fiscal years 1987 and 1988, the slowest increase in six years, with the percentage being even lower at the entry level. In Missouri, the average annual salary increase for public four-year college and university faculty was 4.3 percent between fiscal years 1987 and 1988, from $33,224 to $34,653.

Increasing salaries will not, by itself, solve the problem. Other proposed solutions include "identifying and cultivating first-rate candidates while they are still in graduate school, improving faculty development programs, and increasing graduate assistant stipends to encourage more students to stay in academe" (Leon, 1988, p. 35). Another approach is "mortgaging," which is a technique of stockpiling talent in advance. A department with no immediate vacancies is allowed to hire an especially competent instructor now, with the understanding that a future departmental vacancy will not be filled.

Some suggest that, even if such programs are widely implemented, it is doubtful adjustments can be made in time to fill the vacancies with able young people. Partly for this reason, reports such as Workforce 2000 (Hudson Institute Inc., 1987), advocate immediate reevaluation of traditional classroom techniques. The authors point out that "productivity of the world's education systems has remained fundamentally unchanged since the days of Socrates" (p. 67). They further state that teachers still stand in front of classes and deliver lectures to assembled groups of students, meaning that "learning per class hour or per teacher hour has shown little change." They argue that, if fully applied, the technology of

today, particularly computer technology, could dramatically alter the educational process.

Any widespread use of such technology in higher education, however, may take time. In the first place, the cost effectiveness and appropriateness of such technology for general use in the classroom is still being debated. Also, "faculty members in most disciplines have little experience with technology, and their institutions frequently do not provide incentives for them to use it or assist those who do become involved" (McNeil, 1989). College and university administrators are, thus, often given the task of weighing the costs and benefits of the technology in relation to other priorities.

Other manpower related issues with which colleges and universities must contend include increasing minority, immigrant and adult female enrollment and preparing a workforce requiring new job skills. Each of these issues poses unique opportunities and unique problems. For instance, to what extent should an institution provide day care for women students with children? What steps are the institutions taking to deal with the unique acculturation and adaptation problems often encountered by minorities and immigrants on the campuses? In what ways are cognitive development, communication, and social skills incorporated into the curriculum? In some cases current approaches will only require upgrading. In general, however, new and creative approaches must be taken by the colleges and universities to deal with these and other pressing manpower issues.

Policy Implications for Statewide Coordination

Many manpower related issues transcend the traditional boundaries among the various levels of educational delivery. For instance, while many suggest that basic skills should be cultivated long before a student reaches an institution of higher education, the reality is that many students are beginning college with severe deficiencies in these skills. At some point, state coordinating boards may be asked to determine the level of resources states are willing to allocate to help redress problems that occurred elsewhere on the educational path. They may also want to consider what advocacy and educational roles they have in addressing the illiteracy problem. Such issues may lead to new and expanded dialogues regarding the efficacy of greater coordination among state agencies.

Worker retraining and skill upgrading issues present similar challenges to state coordinating boards. For instance, as more workers find it advantageous to upgrade their job skills, it is becoming apparent that some of the perceived boundaries between higher education, on-the-job, vocational training, and learning through life experiences are becoming blurred. Yet the current practices of higher education

institutions frequently discourage the recognition of learning that occurs outside the classroom. As the economy focuses more upon lifelong learning, there will, no doubt, be increasing need to review such practices and to ensure that appropriate procedures exist for the integration of learning that occurs in the classroom and at nontraditional sites.

The emphasis on lifelong learning, retraining, and skill upgrading is placing new demands on higher education institutions to make courses and programs more accessible to the workforce. Certainly, there exist areas in the state where potential students live and work too far from campuses to readily take advantage of their offerings. Yet, given scarce funding resources, it is not feasible to create a new campus within or near most communities. Planning and cost considerations require determining the location of these areas within the state as well as assessing the types of programs needed. The Missouri Coordinating Board has responded to such a need in the Bootheel area by encouraging a consortial agreement between institutions that will deliver needed courses and programs to the area. A series of regional needs assessments are also underway to determine if such needs exist in other areas of the state.

As the demand for worksite training grows, coordination may also be confronted with increasingly difficult decisions regarding the degree of latitude given to public institutions in delivering such programs. To the extent that telecommunications technology is making traditional institutional service areas less of a barrier, this problem is becoming even more acute. With the recent completion of its off-campus and out-of-district study and the convening of a telecommunications task force, the Missouri Coordinating Board is moving in the direction of finding a suitable policy framework for state public higher education.

Missouri's ability to compete in interstate and international competition for economic development is dependent on finding instructors for selected disciplines

A growing college teacher shortage in key academic disciplines also poses policy challenges for statewide coordination. A shortage of instructors in crucial areas including business, mathematics, engineering, the computer sciences, the health sciences, and the life and physical sciences not only has implications on the ability of the public institutions to deliver quality training, but also has a direct bearing on the ability of the state to compete in the interstate and international competition for economic development. The difficulty of recruiting qualified minority faculty often makes it more difficult to attract the best minority students. Should state coordinating boards seek statewide incentives or targeted investments to help bolster salaries? And, if so, will this limit adequate funding for other needed programs? Do alternatives exist that could be explored, such as an increase in the "borrowing" of talent from the private sector to teach these areas on an adjunct basis? If so, how might this affect existing structures? Are targeted incentives needed to help recruit and maintain qualifed minority faculty? Whatever the solution or solutions, shortages in many of these disciplines already exist, and are projected to grow through the year 2000.

To summarize, while these manpower related issues are both diverse and complex, they can be considered under several basic themes that may lend themselves to further exploration. These themes include the following:

1. Determination of the appropriate allocation of higher education resources to help redress problems that occurred elsewhere on the educational path;

2. Development of the best means for the coordination of higher education policy, planning and coordination activities with those of other state agencies to better address issues of basic skills development, illiteracy, and related issues;

3. Consideration of the appropriate extent to which the education and training provided at the worksite and in other noncollegiate settings should be incorporated into the policy, planning, and coordination activities of higher education;

4. Development of effective and efficient alternative modes of course delivery to adult workers and the funding mechanisms available to encourage such alternatives; and

5. Consideration of policies, funding and incentives designed to help alleviate the shortage of persons educated in selected key academic disciplines such as business, mathematics, engineering, the computer sciences, the health sciences, and the life and physical sciences.

In conclusion, the changes to the labor force brought about by demographic trends, technology, and the globalization of the economy are directly affecting higher education. The changes are demanding creative solutions that may require dialogue, cooperation and coordination among the various agents of educational delivery. In the short run, the most effective solutions may appear costly and difficult to carry out. Yet most would agree that the long-term benefit of a better educated and more productive labor force is well worth the investment.

APPENDIX A

Industrial and Occupational Classifications

INDUSTRIAL AND OCCUPATIONAL CLASSIFICATIONS

Industrial Classifications

The following industrial classification codes provided for reference are the Standard Industrial Classification (SIC) codes defined and used by the U.S. Department of Labor, Bureau of Labor Statistics. The service industries (including health services, business services, social services, educational services, etc.) are classified under "Services" within the services-producing industries.

Goods-Producing Industries

Durable Goods Manufacturing Industries:
- Lumber and Wood Products
- Furniture and Fixtures
- Stone, Clay and Glass Products
- Primary Metal Industries
- Fabricated Metal Products
- Machinery, Except Electrical
- Electrical and Electrical Equipment
- Transportation Equipment
- Instruments and Related Products
- Miscellaneous Manufacturing

Nondurable Goods Manufacturing Industries:
- Food and Kindred Products
- Tobacco Manufactures
- Textile Mill Products
- Apparel and Other Textile Products
- Paper and Allied Products
- Printing and Publishing
- Chemicals and Allied Products
- Petroleum and Coal Products
- Rubber and Miscellaneous Plastics Products
- Leather and Leather Products

Mining:
- Metal Mining
- Coal Mining
- Oil and Gas Extraction
- Nonmetallic Minerals, Except Fuels

Construction:
- General Building Contractors
- Heavy Construction Contractors
- Special Trade Contractors

Services-Producing Industries

Transportation, Communication and Public Utilities:
- Transportation -
  - Railroad Transportation
  - Local and Interurban Passenger Transit
  - Trucking and Warehousing
  - Water Transportation
  - Air Transportation
  - Pipe Lines, Except Natural Gas
  - Transportation Services
  - Communication
  - Electric, Gas and Sanitary Services

Wholesale Trade:
- Durable Goods -
  - Motor Vehicles and Automotive Equipment
  - Furniture and Home Furnishings
  - Lumber and Construction Materials
  - Sporting Goods, Toys, and Hobby Goods
  - Metals and Minerals, except Petroleum
  - Electrical Goods
  - Hardware, Plumbing and Heating Equipment
  - Machinery, Equipment and Supplies
  - Miscellaneous Durable Goods
- Nondurable Goods -
  - Paper and Paper Products
  - Drugs, Proprietaries and Sundries
  - Apparel, Piece Goods, and Notions
  - Groceries and Related Products
  - Chemicals and Allied Products
  - Petroleum and Petroleum Products
  - Beer, Wine, and Distilled Beverages
  - Miscellaneous Nondurable Goods

Retail Trade:
- Building Materials and Garden Supplies
- General Merchandise Stores
- Food Stores
- Automotive Dealers and Service Stations
- Apparel and Accessory Stores
- Furniture and Home Furnishings Stores
- Eating and Drinking Places
- Miscellaneous Retail

Finance, Insurance and Real Estate:
- Banking
- Credit Agencies Other than Banks
- Security, Commodity Brokers and Services
- Insurance Carriers
- Insurance Agents, Brokers and Services
- Real Estate

Services:
- Hotels and Other Lodging Places
- Personal Services
- Business Services
- Auto Repair, Services, and Garages
- Miscellaneous Repair Services
- Motion Pictures

Services (Continued):
- Amusement and Recreation Services
- Health Services
- Legal Services
- Educational Services
- Social Services
- Museums, Botanical and Zoological Gardens
- Membership Organizations
- Miscellaneous Services

Government:
- Federal Government
- State Government
- Local Government

Occupational Classifications

The occupational classifications used in the report are derived from the National Industry-Occupation Matrix, developed by the Bureau of Labor Statistics. While there is an occupational grouping entitled "service," many of the occupations within the other major groupings are frequently employed within the services-producing industries. The major occupational groupings are:

- Managerial and Management Related Occupations
- Professional Specialty Occupations
- Technician Occupations
- Marketing and Sales Occupations
- Administrative Support Occupations
- Service Occupations
- Farming, Forestry, Fishing and Related Occupations
- Precision Production, Craft and Repair Occupations
- Operator, Fabricator and Laborer Occupations

APPENDIX B

AN ANALYSIS OF MANPOWER DEMAND BY TYPE OF INDUSTRY

AN ANALYSIS OF MANPOWER DEMAND BY TYPE OF INDUSTRY

In Section I it was reported that technology has impacted the economy and labor market through the redistribution of employment from goods-producing to the services-producing activities. This is confirmed through a review and analysis of (1) the 20 industries anticipated to experience the fastest rates of employment growth, (2) the 20 industries expected to experience the fastest rates of employment decline, (3) the 20 industries expected to generate the most new jobs, and (4) the 20 industries expected to have the greatest decline in the number of new jobs.

When observing these data, refer to the industrial classifications in Appendix A. This review will show that manufacturing industries comprise a subcategory of the goods-producing industries and that service industries comprise a subcategory of the services-producing industries. Also, the analysis focuses upon the more general category of postsecondary education. While such postsecondary training may refer to that received in a higher education institution, it may also in many cases refer to that received in public and private vocational/technical or other providers of adult postsecondary training. Regarding the industries expected nationally to experience the most and least employment growth:

- All but two of the industries expected to experience the most rapid rate of employment growth through the year 2000 are service industries; all of the industries expected to experience the most rapid rate of employment decline are goods-producing, and specifically, manufacturing industries.

- None of the industries projected to generate the largest numbers of new jobs are manufacturing industries.

Eighteen of the 20 industries anticipated to experience the fastest percentage rate of growth through the year 2000 (Table 1A) are services-producing and, specifically, service industries. Only one is a manufacturing industry.

Table 1A.
Industries Projected to Experience the Most Rapid Rates of Employment Growth Through the Year 2000, by Type of Industry, 1986 and Projected 2000 Employment, Projected Job Growth, and Projected Percentage Job Growth*

Industry	Industry Type	1986 Employment	Projected 2000 Employment	Projected Job Growth	Projected Percentage Growth 1986-2000
Computer and data processing services	service	591,000	1,203,000	612,000	103.6%
Outpatient facilities and health services	service	591,000	1,103,000	512,000	86.6%
Personnel supply services	service	1,017,000	1,851,000	834,000	82.0%
Offices of health practitioners	service	1,672,000	3,061,000	1,389,000	83.1%
Credit reporting and business services, other	service	677,000	1,184,000	507,000	74.9%
Legal services	service	748,000	1,267,000	519,000	69.4%
Nursing and personal care facilities	service	1,250,000	2,097,000	847,000	67.8%
Research, management, and consulting services	business services	788,000	1,301,000	513,000	65.1%
Residential care	social service	319,000	519,000	200,000	62.7%
Miscellaneous publishing	nondur. manufac.	72,000	115,000	43,000	59.7%
Equipment rental and leasing	business services	208,000	330,000	122,000	58.7%
Accounting, auditing, and services	business services	458,000	711,000	253,000	55.2%
Personal services	personal services	267,000	411,000	144,000	53.9%
Detective and protective services	business services	445,000	687,000	242,000	54.4%
Credit agencies and investment offices	business services	1,023,000	1,518,000	495,000	48.4%
Advertising	business services	202,000	302,000	100,000	49.5%
Services to dwellings and other buildings	business services	681,000	1,020,000	339,000	49.8%
Individual and miscellaneous social services	social services	528,000	790,000	262,000	49.6%
Miscellaneous shopping goods stores	retail trade	748,000	1,085,000	339,000	45.4%
Automotive rentals, without drivers	auto services	161,000	233,000	72,000	44.7%

* Only occupations with projected 2000 employment of 10,000 or more are included.

Sources: Industrial Employment Growth Data: U.S. Department of Labor, Bureau of Labor Statistics, Projections 2000 March 1988, Bulletin 2302, Table 6
Industrial Categorical Data: Missouri Occupational Information Coordinating Committee Micro Occupational/Industrial Data Base, 1989

Seventeen of the 20 industries (Table 2A) expected to experience the fastest percentage rate of decline are manufacturing industries.

Table 2A.
Industries Projected to Experience the Most Rapid Rates of Employment Decline Through the Year 2000, by Type of Industry, 1986 and Projected 2000 Employment, Projected Job Decline, and Projected Percentage Decline*

Industry	Industry Type	1986 Employment	Projected 2000 Employment	Projected Job Decline	Projected Percentage Decline 1986-2000
Railroad transportation	trans. & pub util.	331,000	190,000	(141,000)	-42.6%
Footwear except rubber and plastic	nondur. manu.	96,000	58,000	(38,000)	-39 6%
Railroad equipment	dur. manu.	28,000	17,000	(11,000)	-39 3%
Metal mining	mining	41,000	27,000	(14,000)	-34.1%
Miscellaneous primary and secondary metals	dur. manu	42,000	30,000	(12,000)	-28.6%
Luggage, handbags, and leather products	nondur. manu.	56,000	40,000	(16,000)	-28 6%
Blast furnaces and basic steel products	dur. manu.	275,000	202,000	(73,000)	-26 5%
Iron and steel foundries	dur. manu.	131,000	97,000	(34,000)	-26 0%
Electronic home entertainment equipment	dur. manu.	82,000	61,000	(21,000)	-25 6%
Agricultural chemicals	nondur manu	55,000	42,000	(13,000)	-23.6%
Dairy products	nondur. manu.	163,000	125,000	(38,000)	-23 3%
Petroleum refining	nondur. manu.	131,000	100,000	(31,000)	-23.7%
Grain mill products and fats and oils	nondur. manu.	156,000	122,000	(34,000)	-21.8%
Tobacco manufactures	nondur. manu	59,000	46,000	(13,000)	-22.0%
Tires and inner tubes	nondur. manu.	88,000	69,000	(19,000)	-21 6%
Plastics materials and synthetics	nondur. manu.	167,000	132,000	(35,000)	-21.0%
Coal mining	mining	176,000	141,000	(35,000)	-19 9%
Ship and boat building and repairing	dur. manu	185,000	147,000	(38,000)	-20.5%
Sugar and confectionery products	nondur. manu.	97,000	78,000	(19,000)	-19.6%
Aircraft	dur. manu	339,000	274,000	(65,000)	-19 2%

*Only occupations with projected 2000 employment of 10,000 or more are included.

Sources: Industrial Employment Growth Data: U.S. Department of Labor, Bureau of Labor Statistics, Projections 2000 March 1988, Bulletin 2302, Table 6
Industrial Categorical Data: Missouri Occupational Information Coordinating Committee Micro Occupational/Industrial Data Base, 1989

All of the 20 industries projected to generate nationally the most new wage and salary jobs are service or retail trade industries: none are manufacturing industries (Table 3A).

Table 3A.
Industries Projected to Generate Nationally the Largest Number of New Wage and Salary Jobs Through the Year 2000

Industry	Projected New Jobs
Eating and drinking places	2,486,000
Offices of health practitioners	1,389,000
New and repair construction	890,000
Nursing and personal care facilities	847,000
Personnel supply services	834,000
State and local government education	784,000
Machinery and equipment wholesalers	614,000
Computer and data processing services	612,000
Grocery stores	598,000
Hotels and other lodging places	570,000
State and local general government, n.e.c.	537,000
Legal services	519,000
Outpatient facilities and health services, n.e.c.	513,000
Research, management, and consulting services	513,000
Credit reporting and business services, n.e.c.	507,000
Credit agencies and investment offices	495,000
Hospitals, private	475,000
Department stores	386,000
Real estate	348,000
Services to dwellings and other buildings	339,000

n.e.c. - not elsewhere classified

Source: U.S. Department of Labor, Bureau of Labor Statistics, March 1988, Bulletin 2302, Table 5, p. 34

APPENDIX C

EMPLOYMENT TRENDS BY TYPE OF OCCUPATION AND THEIR RELATIONSHIP TO EDUCATIONAL LEVELS

EMPLOYMENT TRENDS BY TYPE OF OCCUPATION AND THEIR RELATIONSHIP TO EDUCATIONAL LEVELS

This appendix provides an analysis similar to that of Appendix B, except it is by occupational type rather than by industry. Emphasis is placed on those occupations expected to experience the highest and lowest percentage and numerical growth. This analysis again confirms a redistribution in employment from goods-producing to services-producing activities. By comparing the typical level of postsecondary education required for these occupations, the analysis confirms a developing dichotomy occurring within the labor force between new low and high skill jobs. While educational and skill levels do not correlate precisely, an unpublished analysis provided by the Missouri Occupational Information Coordinating Committee (MOICC) shows that the correlation between skill and educational level is strong enough to allow inferences to be made. This is particularly true with the high skill occupations. Also, please note that, as in Appendix B, the analysis focuses upon the more general designation of postsecondary education and training, rather than referring only to higher education. The analysis shows that:

- Most of the 20 fastest growing occupations are directly related to the services-producing industries; none are exclusively related to the goods-producing industries.

  Fourteen of the 20 occupations experiencing the fastest rates of decline are directly related to the goods-producing industries.

- Thirteen of the 20 occupations anticipated to have the most new employment are directly related to the services-producing industries; none are directly related to the goods-producing industries.

- Half of the 20 occupations anticipated to experience the greatest numerical employment declines are directly related to the goods-producing industries.

Most of the occupations expected to have the fastest rates of growth are directly related to the services-producing industries (Table 4A). Many are in the health, legal, and business professions, and several are generally distributed across many industries. While a few could be employed in either the goods- or services-producing industries, none are exclusively related to the goods-producing industries.

Table 4A.
Occupations Projected to Experience the Fastest Rates of National Employment Growth Through the Year 2000, by Related Type of Industry*

Occupation	Related Type of Industry	1988 Employment	Projected 2000 Employment	Projected Percentage Growth 1988-2000
Medical assistants	Services-producing	132,000	251,000	90.2%
Physical therapists	Services-producing	61,000	115,000	88.5%
Data processing equipment repairers	Services-producing	69,000	125,000	81.2%
Physical and corrective therapy assistants & aides	Services-producing	36,000	65,000	80.6%
Home health aides	Services-producing	138,000	249,000	80.4%
Podiatrists	Services-producing	13,000	[illegible],000	76.9%
Computer systems analysts, data processing	Either	331,000	582,000	75.8%
Medical records technicians	Services-producing	40,000	70,000	75.0%
Emp. interviewers, private or public emp. service	Either	75,000	129,000	72.0%
Computer programmers	Either	479,000	813,000	69.7%
Paralegal personnel	Services-producing	401,000	669,000	66.8%
Radiologic technologists and technicians	Services-producing	115,000	190,000	65.2%
Dental hygienists	Services-producing	87,000	141,000	62.1%
Nuclear med. & radiologic technologists & technicians	Services-producing	125,000	202,000	61.6%
Physician assistants	Services-producing	26,000	41,000	57.7%
Dental assistants	Services-producing	155,000	244,000	57.4%
Actuaries	Services-producing	9,000	14,000	55.6%
Operations & systems researchers	Either	38,000	59,000	55.3%
Occupational therapists	Services-producing	29,000	45,000	55.2%
All other health professionals and paraprofessionals	Services-Producing	283,000	435,000	53.7%

* Only occupations with projected 2000 employment of 10,000 or more are included.

Sources: Occupational Employment Data: U.S. Department of Labor, Bureau of Labor Statistics Occupational Projections and Training Data: 1988 Edition, Bulletin 2301, Table A-1
Industrial/Occupational Categorical Data: Missouri Occupational Information Coordinating Committee Micro Occupational/Industrial Data Base, 1989

Table 5A shows fourteen of the occupations expected to have the fastest rates of decline are directly related to the goods-producing industries. Two of the three industries that are related to the services-producing industries, rail workers and industrial and truck and tractor operators, are transportation industries that directly support the goods-producing industries.

Table 5A.
Occupations Projected to Experience the Fastest Rates of National Employment Decline Through the Year 2000, by Related Type of Industry, 1986 and Projected 2000 Employment, Projected Job Loss, and Projected Percentage Job Growth*

Occupation	Related Type of Industry	1986 Employment	Projected 2000 Employment	Projected Job Loss	Percentage Change
Electrical assemblers & processors	Goods-Producing	756,000	479,000	(277,000)	-36 6%
Gas & petroleum plant & system occupations	Goods-Producing	31,000	20,000	(11,000)	-35 5%
Rail workers	Services-Producing	176,000	114,000	(62,000)	-35.2%
Shoe sewing machine operators & tenders	Goods-Producing	27,000	18,000	(9,000)	-33 3%
Industrial & logging truck & tractor operators	Services-Producing	881,000	594,000	(287,000)	-32 6%
Station installers & repairers, telephone	Services-Producing	58,000	40,000	(18,000)	-31.0%
Chemical plant & system operators	Goods-Producing	33,000	23,000	(10,000)	-30 3%
Chemical equip. controllers, oper. & tenders	Goods-Producing	73,000	52,000	(21,000)	-28.8%
Stenographers	Either	178,000	128,000	(50,000)	-28 1%
Statistical clerks	Either	71,000	52,000	(19,000)	-26 8%
Textile draw-out & winding mach. oper. & tenders	Goods-Producing	219,000	164,000	(55,000)	-25 1%
Farmers & farm workers	Goods-Producing	2,122,000	1,590,000	(532,000)	-25.1%
Furnace operators & tenders	Goods-Producing	20,000	15,000	(5,000)	-25 0%
Dairy processing equip. oper., including setters	Goods-Producing	16,000	12,000	(4,000)	-25 0%
Shipfitters	Goods-Producing	13,000	10,000	(3,000)	-23 1%
Frame wirers, central office	Goods-Producing	13,000	10,000	(3,000)	-23.1%
Central office & PBX installers & repairers	Goods-Producing	74,000	57,000	(17,000)	-23 0%
Aircraft assemblers, precision	Goods-Producing	24,000	19,000	(5,000)	-20 8%
Central office operators	Either	42,000	34,000	(8,000)	-19 0%
Portable machine cutters	Goods-Producing	17,000	14,000	(3,000)	-17 6%

* Only occupations with 2000 employment of 10,000 or more are included.

Sources: Occupational Employment Data: U.S. Department of Labor, Bureau of Labor Statistics Occupational Projections and Training Data: 1988 Edition Bulletin 2301, Table A-1
Industrial/Occupational Categorical Data: Missouri Occupational Information Coordinating Committee Micro Occupational/Industrial Data Base, 1989

This movement of employment from the goods-producing to the services-producing industries is also obvious when considering the 20 occupations expected to have the most new employment. This is demonstrated through the data presented on Table 6A.

Table 6A.
Occupations Projected Nationally to Gain the Most New Wage and Salary Jobs Through the Year 2000, by Type of Related Industry, 1986 and Projected 2000 Employment, and Projected Number of Jobs Lost Through the Year 2000*

Occupation	Related Type of Industry	1988 Employment	Projected 2000 Employment	Projected New Jobs	Projected Percentage Growth 1986-2000
Sales & related workers	Services-producing	7,998,000	10,453,000	2,455,000	30.7%
All other managers & administrators	Either	2,627,000	3,532,000	905,000	34 4%
Nursing & psychiatric aides, orderlies, & attendants	Services-producing	2,536,000	3,408,000	872,000	34 4%
Waiters & waitresses	Services-producing	1,702,000	2,454,000	752,000	44 2%
Registered nurses	Services-producing	1,406,000	2,018,000	612,000	43 5%
Janitors & cleaners, including maid/housekeeping	Services-producing	2,676,000	3,280,000	604,000	22 6%
General managers & top executives	Either	2,383,000	2,965,000	582,000	24.4%
Cashiers	Services-producing	2,165,000	2,740,000	575,000	26 6%
Truck drivers, light & heavy	Services-producing	2,211,000	2,736,000	525,000	23 7%
General office clerks	Either	2,381,000	2,824,000	463,000	19 6%
Food counter, fountain, & related workers	Services-producing	1,500,000	1,949,000	449,000	29.9%
Secretaries	Either	3,234,000	3,658,000	424,000	13.1%
Guards	Either	794,000	1,177,000	383,000	48.2%
Accountants & auditors	Services-producing	945,000	1,322,000	377,000	39 9%
Teachers, preschool, kindergarten, & elementary	Services-producing	1,702,000	2,068,000	364,000	21.4%
Cooks, except short order	Services-producing	1,023,000	1,378,000	355,000	34 7%
Computer programmers	Either	479,000	813,000	334,000	69 7%
Food preparation workers	Services-producing	949,000	1,273,000	324,000	34.1%
Teachers, kindergarten & elementary	Services-producing	682,000	964,000	282,000	41 3%
Receptionists & information clerks	Either	837,000	1,117,000	280,000	33 5%

* Only occupations with projected 2000 employment of 10,000 or more are included.

Sources: Occupational Employment Data: U.S. Department of Labor, Bureau of Labor Statistics Occupational Projections and Training Data: 1988 Edition, Bulletin 2301, Table A-1
Industrial/Occupational Categorical Data: Missouri Occupational Information Coordinating Committee Micro Occupational/Industrial Data Base, 1989

Thirteen of these occupations are directly related to the services-producing industries and the others, such as managers and administrators and computer programmers, are heavily employed by these industries. Again, none are directly related to the goods-producing industries.

While the trend is not as obvious when considering the 20 occupations expected to lose the greatest number of jobs (Table 7A), it is, nevertheless, present.

Table 7A.
Occupations Projected Nationally to Lose the Most Wage and Salary Jobs Through the Year 2000, by Type of Related Industry, 1986 and Projected 2000 Employment, and Projected Number of Jobs Lost Through the Year 2000*

Occupation	Related Type of Industry	1986 Employment	Projected 2000 Employment	Projected New Jobs	Projected Percentage Growth 1986-2000
Farmers & farm workers	Goods-producing	2,122,000	1,590,000	(532,000)	-25.1%
Sewing machine operators, including garment*	Goods-producing	1,400,000	1,015,000	(385,000)	-27.5%
Industrial & logging truck & tractor operators	Services-producing	881,000	594,000	(287,000)	-32.6%
Typists & word processors	Either	1,002,000	862,000	(140,000)	-14.0%
Electronic & electronic assemblers	Goods-producing	249,000	116,000	(133,000)	-53.4%
Electrical, electronic, & electromech. equipment assemb.	Goods-producing	478,000	349,000	(129,000)	-27.0%
Data entry keyers, including composing	Either	829,000	712,000	(117,000)	-14.1%
Mach. tool cut. & form. set., oper. & tenders, metal & plas.	Goods-producing	822,000	737,000	(85,000)	-10.3%
Textile draw-out & winding mach. oper. & tenders	Goods-producing	219,000	164,000	(55,000)	-25.1%
Stenographers	Either	178,000	128,000	(50,000)	-28.1%
Child care workers, private household	Services-producing	400,000	362,000	(38,000)	-9.5%
College & university faculty	Services-producing	754,000	722,000	(32,000)	-4.2%
Payroll & timekeeping clerks	Either	204,000	180,000	(24,000)	-11.8%
Stock clerks, stockroom, warehouse, or yard	Either	726,000	703,000	(23,000)	-3.2%
All other machine tool cutting & forming workers	Goods-producing	177,000	155,000	(22,000)	-12.4%
Chemical equip. controllers, operators, & tenders	Goods-producing	73,000	52,000	(21,000)	-28.8%
Driver/sales workers	Services-producing	252,000	232,000	(20,000)	-7.9%
Statistical clerks	Either	71,000	52,000	(19,000)	-26.8%
Freight, stock, & material movers, hand	Goods-producing	831,000	812,000	(19,000)	-2.3%
Machine tool cutting operators & tenders, metal & plastic	Goods-producing	167,000	148,000	(19,000)	-11.4%

* Only occupations with projected 2000 employment of 10,000 or more are included.

Sources: Occupational Employment Data: U.S. Department of Labor, Bureau of Labor Statistics Occupational Projections and Training Data: 1988 Edition, Bulletin 2301, Table A-1
Industrial/Occupational Categorical Data: Missouri Occupational Information Coordinating Committee Micro Occupational/Industrial Data Base, 1989

While ten of these occupations are directly related to the goods-producing industries, the following three -- child care workers, college and university faculty, and drivers/sales workers, are considered services-producing related occupations. The fourth occupation, industrial and logging truck and tractor operators, generally supports the goods-producing industries. The others could be employed by either type of industry. Thus, the observation that employment in the national economy is moving from goods-producing to services-producing activities is strongly supported by national data regarding occupational growth.

Relationship of Manpower Needs to Educational Attainment

This analysis addresses the extent to which technology promotes changes in the labor market by increasing the relative importance of higher skill-level occupations relative to other occupations. The analysis relates the typical postsecondary educational level to the occupations discussed above, i.e., those that are anticipated to experience the greatest rates or numerical changes in employment levels. It shows that through the year 2000:

- Most occupations expected to experience the fastest rates of employment growth require some postsecondary education.
- Almost none of the occupations anticipated to experience the fastest rates of employment decline require postsecondary education.
- Only one occupation of the 20 expected to experience the greatest numerical employment decline requires postsecondary education; when considering those occupations expected to experience the greatest numerical growth, however, the relationship between job growth and educational level is less pronounced.

Nineteen of the 20 occupations expected to experience the fastest rates of employment growth often require at least some postsecondary training (Table 8A). In a number of the occupations, a graduate degree is preferred by most employers; in two occupations, a first professional degree is a requirement. In only one occupation, home health aides, is postsecondary education not considered necessary, or, at least, preferred for employment at an entry level.

Table 8A.
Occupations Projected Nationally to Experience the Fastest Rates of Employment Growth Through the Year 2000, by Postsecondary Educational Level Typically Associated with Each Occupation*

Occupation	Postsecondary Educational Level
Medical assistants	None to Associate Degree
Physical therapists	Certificate to Advanced Degree
Data processing equipment repairers	None to Associate Degree
Physical and corrective therapy assistants & aides	None to Associate Degree
Home health aides	None
Podiatrists	First Professional
Computer systems analysts, data processing	Bachelor's to Advanced Degree
Medical records technicians	Associate to Bachelor's Degree
Emp. interviewers, private or public emp. service	None to Bachelor's Degree
Paralegal personnel	None to Bachelor's Degree
Computer programmers	None to Advanced Degree
Radiologic technologists and technicians	Certificate to Bachelor's Degree
Dental hygienists	Associate to Advanced Degree
Nuclear med. & radiologic technologists & technicians	Certificate to Advanced Degree
Physician assistants	Associate to Advanced Degree
Dental assistants	None to Certificate
Actuaries	Bachelor's to Advanced Degree
Operations & systems researchers	Advanced Degree
Occupational therapists	Bachelor's to Advanced Degree
All other health professionals and paraprofessionals	Bachelor's to First Professional Degree

* Only occupations with projected 2000 employment of 10,000 or more are included.

Sources: Occupational Employment Data: U.S. Department of Labor, Bureau of Labor Statistics Occupational Projections and Training Data: 1988 Edition Bulletin 2301, Table A-1
Related Educational Level: U.S. Department of Labor, Bureau of Labor Statistics Occupational Outlook Handbook, April 1988: Bulletin 2300

On the other hand, data presented in Table 9A show that none of 20 occupations expected to experience the fastest rates of employment decline require postsecondary training. In only two occupations, stenographers and central office, and PBX installers and repairers, is a postsecondary education certificate considered preferable for employment.

Table 9A.
Occupations Projected Nationally to Experience the Fastest Rates of Employment Decline Through the Year 2000, by Postsecondary Educational Level Typically Associated with Each Occupation*

Occupation	Postsecondary Educational Level
Electrical assemblers & processors	None
Gas & petroleum plant & system occupations	None
Rail workers	None
Shoe sewing machine operators & tender	None
Industrial & logging truck & tractor operators	None
Station installers & repairers, telephone	None
Chemical plant & system operators	None
Chemical equip. controllers, oper. & tenders	None
Stenographers	None to Certificate
Statistical clerks	None
Textile draw-out & winding mach. oper. & tenders	None
Farmers & farm workers	None
Furnace operators & tenders	None
Dairy processing equip. oper., including setters	None
Shipfitters	None
Frame wirers, central office	None
Central office & PBX installers & repairers	None to Certificate
Aircraft assemblers, precision	None
Central office operators	None
Portable machine cutters	None

* Only occupations with projected 2000 employment of 10,000 or more are included.

Sources: Occupational Employment Data: U.S. Department of Labor, Bureau of Labor Statistics Occupational Projections and Training Data: 1988 Edition Bulletin 2301, Table A-1
Related Educational Level: U.S. Department of Labor, Bureau of Labor Statistics Occupational Outlook Handbook, April 1988: Bulletin 2300

The same trend is true when considering the 20 occupations expected to experience the greatest numerical declines shown in Table 10A. In only one occupation, college and university faculty, is postsecondary education considered mandatory. In only two other occupations, typists and word processors, and stenographers, is an associate degree or postsecondary certificate, respectively, considered preferable.

Table 10A.
Occupations Projected Nationally to Experience the Largest Decline in New Wage and Salary Jobs Through the Year 2000, by Postsecondary Educational Level Typically Associated with Each Occupation*

Occupation	Postsecondary Educational Level
Farmers & farm workers	None
Sewing machine operators, including garment	None
Industrial & logging truck & tractor operators	None
Typists & word processors	None to Associate Degree
Electronic & electronic assemblers	None
Electrical, electronic, & electromech. equipment assemb.	None
Data entry keyers, including composing	None
Mach. tool cut. & form. set., oper. & tenders, metal & plas.	None
Textile draw-out & winding mach. oper. & tenders	None
Stenographers	None to Certificate
Child care workers, private household	None
College & university faculty	Advanced Degree
Payroll & timekeeping clerks	None
Stock clerks, stockroom, warehouse, or yard	None
All other machine tool cutting & forming workers	None
Chemical equip. controllers, operators, & tenders	None
Driver/sales workers	None
Statistical clerks	None
Freight, stock, & material movers, hand	None
Machine tool cutting operators & tenders, metal & plastic	None

* Only occupations with projected 2000 employment of 10,000 or more are included.

Sources: Occupational Employment Data: U.S Department of Labor, Bureau of Labor Statistics Occupational Projections and Training Data: 1988 Edition Bulletin 2301, Table A-1
Related Educational Level: U.S. Department of Labor, Bureau of Labor Statistics Occupational Outlook Handbook, April 1988: Bulletin 2300

This direct relationship between employment growth and educational level becomes less clear, however, when looking at the 20 occupations, shown in Table 11A, expected to experience the greatest numerical increase in employment.

Table 11A.
Occupations Projected Nationally to Gain the Most New Wage and Salary Jobs Through the Year 2000, by Projected Number of New Jobs and Postsecondary Educational Level Typically Associated with Each Occupation*

Occupation	Projected Number of New Jobs	Postsecondary Educational Level
Sales & related workers	2,455,000	None
All other managers & administrators	905,000	Bachelor's to Advanced Degree
Nursing & psychiatric aides, orderlies, & attendants	872,000	None to Certificate
Waiters & waitresses	752,000	None
Registered nurses	612,000	Certificate to Advanced Degree
Janitors & cleaners, including maid/housekeeping	604,000	None
General managers & top executives	582,000	Bachelor's to Advanced Degree
Cashiers	575,000	None
Truck drivers, light & heavy	525,000	None
General office clerks	463,000	None
Food counter, fountain, & related workers	449,000	None
Secretaries	424,000	None to Associate Degree
Guards	383,000	None
Accountants & auditors	377,000	Bachelor's to Advanced Degree
Teachers, preschool, kindergarten, & elementary	364,000	Bachelor's to Advanced Degree
Cooks, except short order	355,000	None
Computer programmers	334,000	None to Advanced Degree
Food preparation workers	324,000	None
Receptionists & information clerks	282,000	None
All other management support workers	280,000	None to Bachelor's Degree
Total New Jobs Projected for These Occupations:	11,917,000	
Total New Jobs Projected for Occupations Where Postsecondary Education is not Considered Mandatory:	9,077,000	

* Only occupations with projected 2000 employment of 10,000 or more are included.

Sources: Occupational Employment Data. U.S. Department of Labor, Bureau of Labor Statistics Occupational Projections and Training Data. 1988 Edition Bulletin 2301, Table A-1
Related Educational Level: U.S. Department of Labor, Bureau of Labor Statistics Occupational Outlook Handbook, April 1988: Bulletin 2300

Eleven require no postsecondary education, and in four others, postsecondary education is not considered mandatory for employment. Yet, there is expected to be over nine million new jobs in these 15 occupations through the year 2000.

With the exception of computer programmers, and, perhaps management support workers, most of these occupations are labor intensive and not readily amenable to technological upgrading. Perhaps with the exception of truck drivers, most are low-paying and low skill jobs. When combined with the information regarding the occupations with the fastest rate of growth, these data strongly support the earlier observation that a dichotomy is being created between a growing number of new jobs requiring increasing levels of education and skills and a large group requiring minimal skill levels.

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