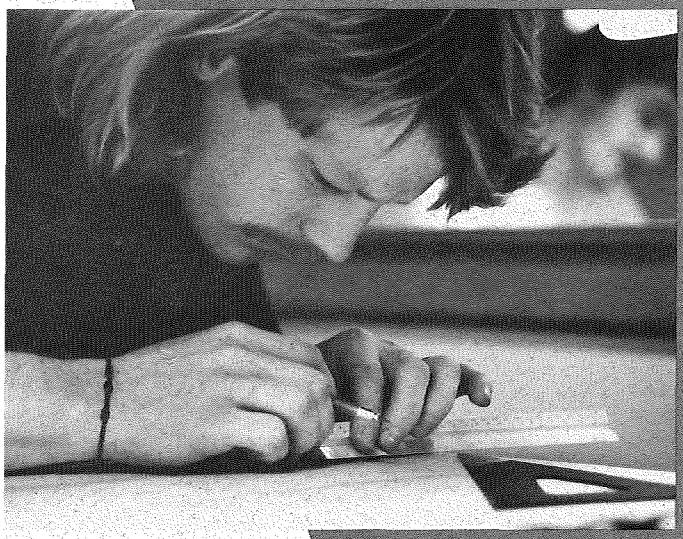
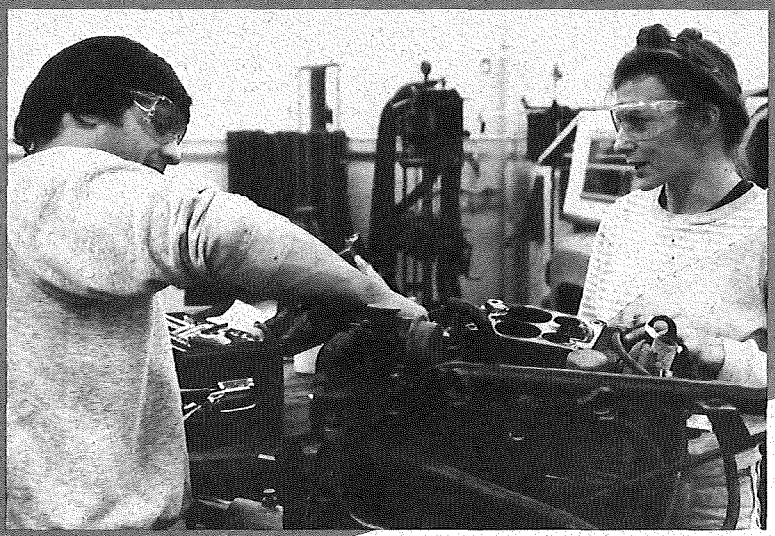
INVESTING IN MAINE'S WORKFORCE



A REPORT
BY THE COMMISSION
TO REVIEW THE
CAPACITY OF
THE MAINE TECHNICAL
COLLEGE SYSTEM



MAY 1991

INVESTING IN MAINE'S WORKFORCE

A Report by the Commission to Review the Capacity of the Maine Technical College System

Joe C. Collier, Jr., Chair
President, Central Maine Power Company

Dale Parnell, Honorary Chair
President, American Association of Community & Junior Colleges

G. Melvin Hovey, Vice Chair
President, Maine Public Service Company

Jane Amero
Chair, State Board of Education

Michael W. Aube
Chair, MTCS Board of Trustees

Kenneth Burrill
Vice President, Sargent Group

Jane Chee
President, Global Seafoods

Edward F. Gorham
Secretary/Treasurer, Maine AFL/CIO

Ronell F. Harris
President, Harris Oil Company

A. William Kany
President, Saco-Biddeford Savings Institution

David M. MacMahon
President, Gates Formed-Fibre, Inc.

Sister Mary Norberta
President, St. Joseph Hospital

Ann Sossong
Executive Director, Maine State Nurses Association

Gary Willey
Vice President, Jasper Wyman & Sons

May 1991

PREFACE

Traditionally our state and the nation have focused on preparing students for 4-year college degrees. But that's not enough anymore. With most jobs now requiring technical skills, it's time we took a serious look at how well we're preparing the backbone of our workforce—the technicians who work in our offices, our hospitals, our shipyards, our airports, our paper companies—the people who keep Maine running.

Governor John R. McKernan, Jr.

The Commission To Review the Capacity of the Maine Technical College System was formed by Governor McKernan in September, 1990, to analyze the capacity of the Maine Technical College System (MTCS) to meet the demand for technically-skilled workers in Maine. The study was motivated by concern that the demand for post-secondary technical education in today's rapidly advancing technological world may be outstripping the state's current capacity to prepare students.

The Commission's charge was to assess the demand over the next ten years for post-secondary technical education—from Maine employers seeking skilled workers and from Maine citizens seeking one- and two-year degrees in technical fields—and to develop recommendations for how Maine can meet that demand. The Commission was not charged with the responsibility for analyzing demands for specific MTCS programs, assessing regional demands, nor analyzing the capacities of individual campuses within the Technical College System.

The Commission was made up of fourteen leaders from the business community, membership organizations, education, and labor throughout Maine, as well as the Chair of the MTCS Board of Trustees.

THE MAINE TECHNICAL COLLEGE SYSTEM

The enabling legislation that created the Maine Technical College System defined its mission clearly:

The basic mission of the Maine Technical College System is to provide associate degree, diploma, and certificate programs directed at the educational, occupational and technical needs of the State's citizens and the workforce needs of the State's employers. The primary goals of the post-secondary vocational-technical education and the MTCS are to create an educated,

skilled, and adaptable labor force which is responsive to the changing needs of the economy of the state and to promote local, regional and statewide economic development. (Title 20A: SS12703).

Today, the System includes six technical colleges: Central Maine Technical College in Auburn; Eastern Maine Technical College in Bangor; Kennebec Valley Technical College in Fairfield; Northern Maine Technical College in Presque Isle; Southern Maine Technical College in South Portland; and Washington County Technical College in Calais.

The six campuses offer 106 associate degree, certificate and diploma programs in business, automotive, construction, electrical and electronics, health fields, the hospitality industry, trade and technical fields, marine and natural resources, public and occupational safety, and graphic arts and printing. In addition, each college offers a wide variety of seminars, workshops, and credit and noncredit courses through the Continuing Education Divisions, some of which are specifically tailored for a particular business or industry. In 1989/1990, the MTCS enrolled 3,699 full and part-time students and graduated 1,287 students with degrees, certificates and diplomas. Over 11,000 adults participated in Continuing Education programs.

Total revenues for the System in fiscal year 1990 were $24 million, of which 58.2 percent was from state appropriations, 13.6 percent from tuition and fees, 14.9 percent from government grants, and the remainder from other sources that include gifts and auxiliary enterprises. The budget was spent in the following ways: 42.4 percent for instruction; 10.3 percent for plant operation and maintenance; 12.7 percent for student services and scholarships; 13.2 percent for institutional support; and the remainder for auxiliary enterprises and public service.

HOW THE COMMISSION UNDERTOOK ITS MISSION

From the outset, Commission Chairman, Joe Collier directed members to focus on the long-term needs for technical education despite the current state budget crisis. The Commission's responsibility was to assess real, long-term needs rather than to develop expedient, short-term recommendations.

The Commission retained a nationally-recognized economist specializing in technical education, Dr. Roger Vaughan, to prepare the demand analysis and draft the final report. The demand analysis compared estimates of Maine's growing demand for technically-educated people with comparable information from national sources. Maine's demand analysis relied principally on three sources: 1) the economic forecast model used by the Maine State Planning Office; 2) occupational projections prepared by the Maine Department of Labor; and 3) estimates made by the Maine Occupational Information Coordinating Committee (MOICC).

The Commission gathered information from many organizations involved with technical education in Maine. To augment the existing data, the Commission solicited input from 122 business, education, and labor organizations. This information was correlated with the demand analysis developed by the MOICC and by Dr. Vaughan.

The Commission conducted six public meetings throughout the study process. One meeting, a day-long public hearing, was conducted simultaneously in Bangor and Auburn to be as accessible as possible to participants throughout the state. Verbal and written testimony was received from MTCS administrators, faculty, and students, community and business leaders, vocational education providers, union leaders, and members of the general public.

WHAT THE COMMISSION LEARNED

While Commission members were familiar with the growing need for technically-educated employees, they did not anticipate either the magnitude or the urgency of the needs they uncovered. The Commission concluded that it could not overstate the importance of a flexible and modern technical education system to the economic future of Maine.

The Commission found that the present capacity of the MTCS is far below workforce needs. Without additional state commitment and greater involvement by private employers, healthy economic development in the state will be jeopardized. Time and time again, the Commission was told that, despite the current recession, the major barrier confronting employers is a growing shortage of technically-educated employees. Like the national economy, Maine's economy has been plunged into a global marketplace in which economic success depends on the education and skills of its workforce.

In addition, the Commission found that opportunities are quickly disappearing for people currently in the workforce who lack the skills that employers demand. Unless Maine's Technical Colleges can offer existing workers the chance to retrain or to upgrade their skills, many of them will not be able to find well-paid work, or any work at all. With a majority of the workforce of the year 2000 already working, the Commission concludes that it is critical that upgrading and retraining opportunities must be expanded for the economic future of Maine citizens and the success of business and industry in Maine.

The Commission concluded that unless the Technical Colleges can serve more people, Maine faces an ever-widening gap between the skills possessed by workers and the skills demanded by employers. If not addressed, this gap will discourage companies from moving into the state, will slow the creation and expansion of businesses, and, most important, will weaken the competitive position of all sectors of our economy.

The Commission believes that by the end of the century Maine's technical education system must have the capacity to serve a much greater segment of our population. An expanded technical education system will enable more Mainers to acquire skills needed for well-paid work, to strengthen those skills as the demands of the workplace increase, and to learn new skills as the old ones become obsolete.

The Commission also believes that, to meet this critical need for technical skills in Maine, the Maine Technical College System must be an equal player in Maine's educational arena.

Like the nation as a whole, Maine has responded to the growing demands for educated people by expanding enrollment in four-year university programs. In 1986, the Visiting Committee of the University of Maine System recommended, and the Legislature approved, a $15 million increase in state funds toward the University System's expansion. That investment has been of great benefit to Maine and Maine citizens. The Commission believes that, with the unprecedented changes that have taken place in our economy and at our worksites, it is time for a similar investment in the Technical College System.

During the course of its study, the Commission continually encountered strong support for the Technical Colleges. The Commission heard repeatedly from community and business leaders, legislators, educators, labor groups, as well as Maine citizens, of the need for a stronger and larger Technical College System. This support has been reflected by the passage of bond issues, including the $20,210,600 Bond approved by Maine voters in November 1989. The Commission feels that this level of public support will ensure that the additional state investment that the Commission urgently recommends will be spent wisely and effectively.

The Commission also heard repeatedly, from employees, students, and from business and industry groups, of the extreme need for updated training equipment for MTCS programs. The Commission feels it is vital to train Technical College students on equipment embodying up-to-date technology. It strongly supports the recommendation of the Maine Legislature's Joint Standing Committee on Audit and Program Review to authorize a general obligation bond issue for $10,045,000 to update technical training equipment for the MTCS.

The Commission wishes to share the enthusiasm and excitement we gained through our study. The deep and broad support we heard for the Technical College System and for technical education in general, combined with the urgency of the needs we uncovered, left each of us deeply committed to a strong and vital Technical College System for the State of Maine.

The Commission would like to thank all of the people of Maine who took the time to provide valuable information and insight into the technical education needs of the state.

CONTENTS

Preface

I. Maine is Running Out of Skilled Workers 6

II. Why Is Maine's Demand for Technical Education Growing? 8

III. How Maine Will Meet The Growing Demand for Technical Education 17

IV. Commission Findings and Recommendations 20

Acknowledgements 27

Appendix A: Forecasting the Annual Demand for Technical Education 31

Appendix B: How Reliable Are Occupational Forecasts? 39

Appendix C: Projecting the Costs of Expanding the Capacity of the Maine Technical College System 40

Appendix D: Why Employers Cannot Train Their Own Employees 44

Appendix E: How Other States Are Adapting to the Growing Need for Technical Education 48

I. MAINE IS RUNNING OUT OF SKILLED WORKERS

Our machines and parts are more sophisticated than ever before. A lot of our metal cutting equipment is computer numerically controlled. We are working in dimensions never heard of before. We need competent technically-trained people or we cannot be competitive.

Robert King, President, Maine Metal Products Association

Recently it took almost a year to fill a position for a sonographer in cardiology at the Maine Medical Center. The search included bringing candidates from as far away as Colorado.

Costas T. Lambrew, Director of Cardiology, Maine Medical Center

In Washington County there is a demand for trained manufacturing employees. Specific skills are not so much the issue as is having a basic knowledge of mechanical and computerized equipment procedures. Logging tractor operators, fallers, buckers, fishermen, log-graders and scalers, paper goods machine setters and set-up operators are all on the list of the fastest declining occupations in Maine. People employed in these positions will need to be equipped with new skills to remain in the workforce.

Edward Collins, Director, QUODDY Region Job Opportunity Zone

The demand for our employees to become computer competent is on the upswing. Almost all of our employees must, at some time or another, be involved in operating computers. Other important areas generating demand among all our employees are general business and statistical process control skills.

James Evers, S.D. Warren Company

At Eastern Maine Medical Center in Bangor we have been actively recruiting for Nuclear Medical Technologists for over three years. In the entire state of Maine, there are no training sites for Nuclear Medicine or Ultrasonography, occupations in which, by conservative estimate, I believe there to be at least 200 people employed in Maine.

Paul Kelley, VP, Diagnostic and Support Services, Eastern Maine Medical Center

Although Maine entered the 1990s with an economic recession and concomitant fiscal problems, its economic problems are very different from those it has faced in prior recessions. Despite rising unemployment, Maine is running out of people with the skills that employers need to work with new technologies. Without a workforce with stronger technical skills, Maine will not emerge from the recession to repeat its growth performance of the mid 1980s. And unless they acquire the technical skills needed by employers today, many Mainers will not find work. Although our workforce is becoming better educated, it is less well prepared for work.

We are familiar with some aspects of the skill shortage—the chronic need for nurses and electronics technicians, for example. But the need for better skilled workers is not limited to high-growth service industries or high-tech manufacturing industries. It is endemic to all economic activities. Technology and increasingly intense competition has transformed and will continue to transform all workplaces—in all parts of the state and in all types of economic activity. Few of us will be protected from the need to learn new skills or to deepen our existing skills in the coming decade.

Maine's problems are no different from those of the nation as a whole. BusinessWeek recently warned: "The nation's ability to compete is threatened by our inadequate investment in our most important resource: people. Put simply, too many workers lack the skills to perform more demanding jobs."

The national scope of the problem makes Maine's problem even more serious. In the past, Maine has been able to meet the needs for skilled workers by "importing" them from other states—relying on its quality of life to draw people to the Northeast. But as shortages worsen in other regions, our employers will not be able to afford the escalating wages that will be needed to draw employees to Maine. As those running the QUODDY Job Opportunity Zone told this commission: "A productive workforce cannot be found. It must be created."

The task is urgent. Many major corporations have complained to this commission that they cannot find technically-trained employees. This lack of skilled people explains why our wages still lag behind the national average—Maine's workforce ranks 41st with respect to annual average pay despite ranking 13th in long-term employment growth.

Today's recession is shielding us temporarily from the increasing scarcity of skilled labor. But that does not mean that the problem has disappeared. If anything, it exacerbates the skill problem. Communities with better educated and better trained workforces bounce back more quickly from recessions because they are able to exploit new opportunities faster than communities with less skilled people. And people with up-to-date and marketable skills are more able to weather recessions by finding alternative jobs or even by creating their own businesses.

If we are to survive in an increasingly competitive national and world economy, Maine cannot afford to face the next economic recovery without greater capacity to train and retrain its workers.

II. TECHNICAL EDUCATION IS VITAL TO MAINE'S ECONOMIC FUTURE

The changing structure of industrial employment and changing technologies is resulting in demands from employers for workers with higher levels of skills and education. Ninety percent of Maine's workforce for the year 2000 is already working, yet 50 percent of the existing jobs will be phased out or greatly changed by then. Combined with the fact that three out of four new jobs will require some sort of postsecondary education or training, the critical need to enhance the state's education and job training system is not just important—it has become a necessity.

Third Annual Maine Human Resource Development Plan, 1990

Why are many employers in Maine facing a shortage of technically-skilled employees? What has gone wrong? Is the state's technical education and training system that helped many into rewarding and fulfilling careers no longer working?

In fact, our technical education system is still working. But it is not reaching enough people to meet the State's rapidly escalating needs. We need more graduates from our technical programs and we need people with stronger basic and technical skills. We do not need better-trained people only for emerging "high-tech" industries. We need people who can adapt to new technologies and new working environments in all industries and in all occupations within those industries.

For many decades, Maine's high schools, technical colleges, universities, and on-the-job training programs have prepared employees who are among the best educated, the best trained, and, consequently, the most productive in the world. But that world is changing quickly. We can no longer take our leadership for granted. Unless we create a system that prepares people for work more effectively and provides many more people with advanced skills, we will surrender our leadership and leave our children a legacy of shrinking economic opportunity.

The workplace—in traditional manufacturing industries and in new growth industries, in commercial banks and in our medical centers, and even in state and local public agencies—is changing faster and further than anyone expected. We have not adapted the education and training that we provide people entering the workforce as quickly. Students' views of their abilities and career opportunities are no longer based in reality. Educators and parents have overlooked the value of non-baccalaureate degrees. And better and more widespread technical education has not been recognized as the core to successful economic development.

One national study estimates that three-quarters of those entering the nation's workforce during the next decade will be qualified only for what the U.S. Department of Labor classifies as first and second level jobs—those paying low wages and requiring limited verbal and writing skills. These jobs will account for only two out of five new openings. But only 25 percent of new entrants will be qualified for the

three out of five new jobs that demand greater skills and pay higher wages. Industry will therefore suffer persistent shortages of skilled workers—a fatal handicap in the competitive world economy.

In 1987, the National Assessment of Educational Progress concluded that "more than one half of the nation's 17-year-olds appear to be inadequately prepared either to perform competently jobs that require technical skills or to benefit substantially from specialized on-the-job training." Many will be unemployed and too many will be unemployable—posing growing fiscal and social burdens. As the Washington-based Brookings Institution recently concluded: "America's children are not learning enough, they are not learning the right things, and they are not learning how to learn."

NEW TECHNOLOGY IS UPGRADING THE SKILLS MAINE'S EMPLOYERS DEMAND

> *The Maine Technical College System can be most useful in the revitalization of Maine's economy by being an active contributor in the areas of retraining and upgrading the skills of Maine workers.*
>
> Charles J. O'Leary, President, Maine AFL-CIO

New technologies are greatly increasing the productivity of our workforce. Although Maine still lags the nation in the value of product produced by each employee, productivity is growing faster in Maine than in the nation as a whole—particularly in the non-electrical machinery and electronics sectors. The latter industries recorded annual productivity growth in Maine of 14.1 percent and 7.2 percent respectively.

While not all new jobs in Maine demand high skill levels, the share of new jobs demanding high skills is rising. As it does, it is driving up the earnings of qualified people and driving down the earnings of those without skills. This gap is widening quickly: we are replacing low-skilled with higher-skilled jobs at a faster and faster rate. High-technology industries—electronics, composite materials, and communications, for example—employ scientists and technicians designing new products, improving production techniques, and monitoring production. Each new job needs, on average, only two-thirds as much investment in physical capital (plant and equipment) as do traditional jobs. But each needs much higher investments in human capital.

For example, Central Maine Power's engineering assistants now need computer-assisted design skills, its electrical testers need electronics skills, and its automotive mechanics need to be familiar with computerized diagnostic equipment. CMP now has 277 employees with two-year technical degrees, 95 percent of whom were trained in Maine institutions.

To reap the benefits of new technology, all employees need higher levels of technical competence, greater flexibility, and stronger "people skills". The days when manufacturing work meant dirty, repetitive work are fast disappearing. Today, most employees work in teams and perform complex and varied tasks. Jobs in financial corporations, communications companies, and health industries are also becoming more complex.

Even jobs we have traditionally viewed as unskilled such as janitor or messenger are starting to demand employees with "the ability to connect practice and theory, identify problems, and then analyze, test, and troubleshoot, and adapt to new technology."

Employers cannot provide their employees on the job the basic skills they failed to learn—or were not taught—before they were hired. A statewide survey of

the Maine metals industry found that companies face problems training their employees on the job because they lack basic mathematical skills and firms cannot provide remedial education to entry level employees. Employers train employees in skills specific to the firm or the industry. But they need stronger basic skills. Employers who invest in training their workers in basic skills may lose their investment if the trainees leave to work elsewhere. Few employers can afford to engage in what Xerox chairman David Kearns has called "product recall work for the public school system." Nationwide, employers train only 45 percent of the high school drop-outs they hire but train 70 percent of high school completers and 80 percent of those with some post-secondary education or training.

Recognizing the need to broaden technical education, the Panel on Engineering and Technology Education convened by the Board of Trustees of the University of Maine System in 1988 recommended:

> *The University of Maine System, the Maine Maritime Academy and the Vocational Technical Institute System join in a continuing coordinated effort to determine the needs and provide instruction on engineering and technical subjects in the most appropriate and economical form wherever it is needed in the state. This effort should be in partnership with business and should make use of instructional expertise and facilities from industry as well as educational institutions.*

New technology eliminates some jobs while it is transforming other jobs. Roger Hare, a Maine machinist, reminded the Commission that "technology is neither benign nor neutral with respect to jobs and job opportunities, with respect to job skills and the organization of work, with respect to the distribution of wealth and income." As technological change accelerates, more and more members of Maine's workforce are threatened with falling wages or long-term unemployment unless they can strengthen their basic and technical skills. Nationwide, while the highest earning 30 percent of the workforce increased its share of national income during the 1980s, the other 70 percent has suffered a loss of share—reflecting their lack of marketable skills. For this commission's report, Mr. Hare warned, "it is not enough to explore future technology...we have to consider the people currently technologically unemployed."

THE GLOBAL ECONOMY IS DRIVING THE U.S. TO SPECIALIZE IN ECONOMIC ACTIVITY DEMANDING SKILLED PEOPLE

> *The global economy is becoming increasingly linked and more fiercely competitive...We must begin building a world-class work force if we are going to survive in the Year 2000.*
>
> William Brock, former Secretary of Labor, 1991

International trade is transforming every aspect of our economy—no matter how far we are located from seaports nor how secure our traditional industries may appear. We see this transformation in the closing of old manufacturing plants and in the growth of foreign investment. We also see it in the annual deficits in the U.S. current account (the difference between the value of U.S. goods and services sold to foreign buyers and the value of goods and services purchased by U.S. buyers from abroad).

Maine has suffered the consequences of rising imports because of its concentration in "trade vulnerable" labor intensive industries such as textiles, shoes, food processing and primary wood products. Since 1983, 15,000 work-

ers have been affected by manufacturing plants closing down in Maine. "Many of these workers," warns the 1990 Human Resource Development Plan, "will never find work in the same industries again." International competition will continue to penetrate deeper and deeper into our economy.

Plant closings and loss of world market share are not always signs that Maine businesses cannot compete. Sometimes they reflect the growing specialization that trade inevitably leads to. Nationwide, most jobs lost as imports have climbed over the past two decades have been semi-skilled and unskilled manufacturing jobs, and most of the jobs gained through the growth of exports require relatively high levels of human capital. Congress's Office of Technology Assessment found that job losses were concentrated in low-wage and medium-wage manufacturing while gains were in high-wage manufacturing, transportation, and transactional activities such as finance.

Trade is growing because what Maine and U.S. workers are relatively good at producing is different from what our trading partners are relatively good at. As we expand the level of trade, each country and community necessarily produces more of those goods and services in which they enjoy a comparative advantage and less of those goods and services in which their partners enjoy comparative advantages. Contrary to conventional wisdom, American workers are still far more productive than workers anywhere else in the world. During a year the average American worker produces goods and services worth 20 percent more than those in Germany, and 40 percent more than those in Britain or in Japan. The U.S., therefore, enjoys a strong comparative advantage in those industries that depend on productive and educated workers. The challenge for the nation's technical education system is to prepare people with the needed skills.

Two years ago, researchers in Maine concluded: "The world economy is based less and less on manual labor and more and more on computers, electronics, machines and automation. Maine can no longer count on a reliable, available, inexpensive labor force to attract and keep industry. Workers increasingly need to be knowledgeable and skilled."

MAINE'S NEW JOBS DEMAND ENTREPRENEURIAL AS WELL AS TECHNICAL SKILLS

For many years, its attractive environment, strong work ethic, and quality of life have drawn firms to Maine. But this should not tempt Maine to create a technical education and training strategy that prepares people only for jobs in companies moving into or already thriving in the state. Technical education must create jobs, not simply fill jobs. All members of the workforce, whether starting their own businesses or working for others, need to know how businesses work and how to work with others. They will be more productive and flexible if they understand why changes are occurring and what is expected of them. When managers of the QUODDY Job Opportunity Zone surveyed local skill needs in downeast Maine they found they needed programs "aimed at people managing people and people managing businesses."

Nationwide, each year, the number of people working grows by about two million, 600,000 new incorporations occur, about one million new businesses are created, and the number of self-employed people grows by half a million. Nearly one-sixth of the workforce heads a business (many in addition to regular work). There are 18 million businesses in the U.S. today, and the U.S. Small Business Administration predicts that, by the year 2000, there will be 25 million. At the same time, the share of the workforce that is self-employed grew from 5.4 percent in 1975 to 7.9 percent today and will continue to expand during the 1990s.

Three-quarters of the people entering the U.S. labor force today find their first job in a company hiring less than 100 people. They will be called upon to perform a variety of tasks—someone who would serve only as a secretary in a large corporation, would, when working for a small business, also deal directly with customers, purchase supplies, control inventory, and keep accounts. But new businesses are less able than large corporations to train their employees in house.

The rate of new business formation in Maine is above average: the Corporation for Enterprise Development's 1989 Report Card ranked the state 27th with respect to the number of new businesses per 10,000 workers (at 10.5 businesses), but 14th with respect to the percent of companies classified as fast growing. In Maine, 18 percent of all jobs at the end of 1987 were in businesses that had been created since 1981, a period when total employment had grown by less than 14 percent.

This rapid increase in business formation rates is an indirect consequence of technological change that is allowing the decentralization of economic activity. New businesses can enter markets more easily and large corporations are able to contract out for more specialized products and services.

Entrepreneurship is an increasingly vital skill. Many graduates of technical education and training programs will become self-employed or will create their own businesses at some time in their working lives. They will be more successful if they have acquired business skills as well as technical skills.

PROJECTING THE DEMAND FOR ONE- AND TWO-YEAR TECHNICAL COLLEGE EDUCATION

Because there is no data that identifies exactly how many people will need MTCS-level technical education, we have used two different, independent, methods that reach similar projections. For the purposes of this demand analysis, the terms "MTCS-level training" or "MTCS-level education" are used to mean the technical education required to earn a certificate, diploma, or associate degree from the Maine Technical College System. The term does not include continuing education or employer-sponsored training.

Method I: MOICC Projections of Growth of Job Openings in Selected Occupations: 1984-1995

The first projection was prepared by the Maine Occupational Information Coordinating Committee (MOICC) in September 1990. It is based on employment projections prepared by the Department of Labor and the State Planning Office. MOICC projected employment growth in Maine between 1984 and 1995 in 36 occupations which require skills that can be acquired through MTCS programs. MOICC concluded that, in the decade between 1984 and 1995, there would be an annual average of 8,711 jobs requiring MTCS-level education.

Method II: Projections of Demand for Non-Baccalaureate Technical Degrees from National Data: 1989-2000

The estimates reported below were made using similar types of projections of employment growth and replacement job openings in Maine used by MOICC. But this report uses estimates from national data of the share of these employees who will need technical education at less than the level offered by four or more years of university education. This data indicates that at the beginning of the decade 4,400 people annually will need non-baccalaureate technical education to be hired

or to upgrade their skills on their current job. By the end of the decade, this number is projected to rise to 5,700-7,125 persons per year.

Why is the MOICC number higher than the estimates presented below? The MOICC number is a projection of the number of jobs in selected occupational clusters that use skills like those taught through MTCS programs. This is not the same as a projection of the number of people needing non-baccalaureate degrees. The difference may be the people who have already acquired the skills (perhaps obtained in technical institutions in other states or from on-the-job experience) or people who "over-qualify" by graduating from four-year baccalaureate degree programs. The estimates in this study use national data to project how many people will need non-baccalaureate technical degrees (and not from baccalaureate degree-level courses). Therefore we should expect the MOICC projections to be larger than these estimates.

To summarize the findings of the numbers of people each year seeking MTCS-level technical education:

	Low Demand Estimate	High Demand Estimate
1989	4,400	5,500
1995	5158	6447
2000	5,700	7,125

There are three sources of demand for technical education:

Industrial Expansion: Several industries are anticipated to employ more people in the year 2000 than they did in 1989 (the last year for which annual data are available). Many of these additional employees will need technical education. Overall, the Maine State Planning Office anticipates that employment in 29 growing sectors will add 78,568 jobs between 1989 and 2000 (listed in Table A:1).

Replacement Hiring: The largest source of demand for worker education will be to replace employees who retire, temporarily leave the workforce, leave the state, or move into another occupational classification. Projections by the Maine State Planning Office indicate that the 29 growing sectors will need to hire 232,637 replacements and the 17 declining sectors (listed in Table A:2) will need to hire 35,056 replacements. These estimates of replacement needs are based on the size of the existing workforce in each industry and their average age—the older the workforce, the higher the fraction retiring. In general, those retiring will be less well-educated than those hired to replace them—but they are, obviously, more experienced.

Upgrading the Existing Workforce: As new technologies are adopted, new products developed, and workplaces reorganized, some existing workers will need to acquire new skills. There are 722,060 now in Maine's workforce, including those working, those unemployed and those self-employed. Of these, 267,693 will have left the workforce by the year 2000, leaving 454,367 members of the existing workforce of whom many will need retraining or technical education for the first time.

In Appendix A, these anticipated overall hiring and retiring patterns in the Maine economy are converted into aggregate annual demands for post-secondary technical education. No estimate of the numbers of people needing different types of skills can be exact. Some of the factors that make precise estimates impossible include:

* *Some employers can adapt the organization of the workplace to economize on skills that are in short supply.* As the expected salaries and the cost of searching for new staff have risen, some hospitals, for example, have reorganized patient care to reduce the need for trained nurses.
* *Skills can be acquired in many different ways—on the job, out of state, from proprietary institutions, from universities—as well as from the MTCS.* The choice of means will depend on relative costs, the credential demands of employers, and access.
* *New technologies can influence skills demanded in the workplace in unpredictable ways.* The introduction of new equipment can change the types of skills needed to perform jobs. During the 1970s, for example, the best nationwide estimates projected that the number of people needing secretarial skills would grow from 3 million in 1970 to 4 million in 1980. The advent of the wordprocessor actually led to a fall in the number to 2.7 million—while the number of people working with computer skills was double the original prediction.
* *The level of technical preparation needed by those filling the new and replacement job slots depends on their work experience and education attainment.* Over the next ten years, the slowing number of new entrants will create two countervailing forces. On one hand, employers will have to employ people who have previously been at the margin of the workforce: high school drop-outs, part-time employees, etc. These will need more preparation than the average. On the other hand, the labor shortage will lead to the retention of many workers who would otherwise have retired. Because of their many years of experience, employees working past retirement may need less technical education. The relative weight of these two forces for an industry will depend on the age of its workforce and the importance of experience and formal technical education needed to fill its job slots.
* *The estimates of growth and replacement needs are, themselves, approximations.* Even with the most sophisticated computer models and data sources, peering into the future is inexact. An evaluation of the quality of employment and occupational forecasts is given in Appendix B below.

Despite these problems, the conservative estimates of the demands for MTCS-level technical education made in this chapter support the arguments recently made by Robert Reich in The Atlantic Monthly:

> *Increasingly, educated brainpower—along with roads, airports, computers, and fiber-optic cables connecting it up—determines a nation's standard of living ... Whether the industry is old or new, mature or high-tech, specialized knowledge is accounting for a larger and larger portion of its revenues. The hottest sector of the tool-and-die-casting industry, for example, produces precision castings out of aluminum and zinc for computer parts. The leading textile businesses depend on the knowledge needed to produce specially coated and finished fabrics for automobiles, office furniture, rain gear and wall-coverings. The fastest growing semi-conductor firms make micro-processors and customized chips tailored to the particular needs of buyers. The fastest growing telecommunications services involve specialized knowledge: voice, video, and information processing; the development of "smart buildings" to connect office telephones, computers and facsimile machines; and running specialized communications networks that link employees in different locations.*

MAINE'S CHANGING ECONOMY WILL NEED MANY MORE TECHNICALLY EDUCATED PEOPLE

> *Productivity has always been the foundation of a competitive business, but the transformation of the economic environment has intensified its importance. Increasingly sophisticated competition from abroad, rapid technological advance and irreversible labor force dynamics are permanently altering the rules of economic engagement in Maine and around the world. Now more than ever the vitality of Maine's economy will rest on the ability to respond to the "productivity imperative." How? By blending smart workers with smart machines.*
>
> State Economist Stephen Adams

In sum, faster technological progress, greater international competition, and the growing importance of entrepreneurship demand employees with much stronger technical education. It is a process that has been underway at least since the beginning of the century. The result is to increase the ratios of workers with technical training. In 1900, only one employee in 23 was classified within the "professional/technical" category. By 1980, that ratio had risen to one in six. Those classified as farm laborers fell from one in six to one in 77 in the same period.

Since 1900, technological progress has increased the ratio of the workforce working in occupations for which technical education is needed:

Occupation	*Ratio 1900*	*Ratio 1980*
Professional/Technical	1:23	1:6
Managerial/Proprietors	1:17	1:9
Clerical/Kindred	1:33	1:5
Salesworkers	1:22	1:16
Craftsmen/Foremen	1:10	1:8
Machine operatives	1:8	1:7
Non-Farm Laborers	1:8	1:22
Service (including Domestic)	1:11	1:8
Farmers/Farm managers	1:5	1:56
Farm laborers	1:6	1:77

Source: U.S. Historical Abstracts, various years.

In Maine today, 189,500 jobs, about 27 percent of the total, embody skills taught through MTCS programs—although not all the people holding those jobs acquired their skills from MTCS programs. But this data does not mean that the issue facing Maine is simply to increase the numbers of people graduating with the traditional vocational skills needed by growth sector employers. As we have seen, students in all occupational areas will need deeper and broader skills, and academic students—no matter how many baccalaureate degrees they earn—will need practical, applied skills to supplement their "book learning".

Waiting Lists

Systemwide, there were more applicants on waiting lists for student slots in the MTCS system—2,984—than there were freshmen students enrolled—2,467. Many of the longest waiting lists were in skill areas that experience and forecasts suggest are facing the greatest shortages:

Program	*Annual New Jobs*	*Annual MTCS Graduates*	*Annual Shortfall**	*Numbers Waiting*
Auto Tech	311	34	277	124
Business management	1,692	111	878	187
Electronics	448	95	353	95
Assoc Nursing degree	568	69	171	66
Practical nursing	183	143	40	657
Office management	630	13	617	234
Hotel Management	203	12	191	41

* Estimates of the shortfall take into account the numbers of people graduating from non-MTCS technical education programs

This lack of capacity has resulted from underinvestment in post-secondary technical education in Maine. Although state appropriations per post-secondary student have exceeded national averages since 1986, most of this has been concentrated in the University of Maine System. The state appropriation per student for non-four-year post-secondary programs is far short of the national average and below the totals for New Hampshire and Vermont.

III. THE MAINE TECHNICAL COLLEGE SYSTEM NEEDS GREATER CAPACITY TO MEET THE GROWING DEMAND FOR TECHNICALLY EDUCATED EMPLOYEES

> *Americans are unwittingly making a choice. It is a choice that most of us would probably not make were we aware of its consequences. It is a choice that undermines the American dream of economic opportunity for all. It is a choice that will lead to an America where 30 percent of our people do well—at least for a while—but the other 70 percent will see their dreams slip away.*
>
> Commission on the Skills of the American Workforce, 1990

Maine's current technical education system cannot meet the growing demands placed upon it. There are four reasons why Maine lacks technical education capacity. First, fewer people are entering Maine's workforce—a reflection of the nationwide "baby-bust". Second, technical education has always been a separate and unequal part of the state's education system. Third, we have underinvested in equipment needed to keep technical education programs current. And fourth, many people—including high school counsellors and parents—are unaware of the career opportunities that technical education opens to participants. These problems are discussed in the following four sections followed by a detailed analysis of MTCS's capacity shortfall.

BARRIER 1: FEWER PEOPLE ARE ENTERING MAINE'S WORKFORCE

Is there a skills shortage?
Yes, if we want high living standards.
Yes, if we want to increase productivity.
Yes, if we need workers who can learn and be flexible.

Commission on Skills of the American Workforce, 1990

"Despite the recent economic slowdown," Maine's 1990 Human Resource Development Plan concluded, "the expansion and competitiveness of Maine employers continue to be threatened by a lack of skilled workers, and this situation is expected to last through the 1990s. The demographics are clear. The entry level labor pool is shrinking and will continue to do so through the year 2000." At a time when better educated employees are needed, the demographically-induced decline in new entrants creates special problems. Traditionally, new entrants are more educated than the current workforce. Therefore upgrading the skills of the existing workforce will be doubly important.

Maine's labor force will continue to grow, but more slowly than in the past mostly as a result of falling population growth rates. Between 1970 and 1980 Maine's population grew by 8.8 percent. During the last decade this fell to 8.4 percent and is

predicted to shrink to only 7.5 percent between 1990 and 2000. During the 1980s, the labor force grew from 507,000 to 629,000—a 24 percent increase. During the 1990s, the State Bureau of Employment Security predicts, the labor force will climb to 702,000—a 12 percent increase. While the number of 15-24 year olds (the age group from which new entrants to the workforce are drawn) will shrink from 194,400 in 1990 to 183,000 in 1998, the share of this age group that is working will shrink even more quickly.

These demographic forces mean that people who have not, traditionally, been regarded as part of the mainstream workforce must become technical education students. For example, women will provide six out of ten of the new workers during the 1990s as female labor force participation grows from 58 percent to 63 percent.

BARRIER 2: TECHNICAL EDUCATION HAS NOT BEEN VALUED AS AN EQUAL PARTNER IN MAINE'S EDUCATION SYSTEM

A man at work in his trade is the equal of the most learned doctor.
Russian Proverb

Technical—or vocational—education was introduced as a national program in 1917 to counter the threat posed to U.S. industry by Europe's apprenticeship programs. Despite the increasing need for technically-educated employees throughout the century, the nation's investments in technical education have not kept pace with investments in Germany and Japan. Rather than focus on technical excellence, vocational programs have been used, increasingly, as programs for students who perform poorly in academic track education courses. As a result, those entering the workforce from high school have received little preparation for acquiring skills they will need during their careers—familiarity with computers and telecommunications systems, the ability to solve problems, to work in groups and to communicate effectively. Additionally, growing numbers of MTCS students—25 percent in 1990—had followed the traditional path of enrolling in college, and have transferred to a Technical College to acquire the qualifications they will need to obtain employment.

In post-secondary education, the U.S. has invested most of its resources in baccalaureate degree programs. Yet the number of jobs demanding non-baccalaureate technical degrees is growing rapidly. National data show that in the Year 2000 the skills demanded in three out of four jobs can be learned through MTCS-level technical education and only one out of four need post secondary education lasting four or more years (Table D.1). Because the capacity of community and technical colleges has not kept pace with demand, the expected earnings from completing many non-baccalaureate degrees has grown faster than the salaries that baccalaureate degree students can expect.

Post-secondary technical education is no longer simply occupation training. It has come of age. Technical education today provides an applied way of learning much of the same material taught in academic science and math courses.

The National Academy of Sciences concluded in 1986 that: "training requirements remain skills-oriented, but the skills are defined more broadly to include the ability to think about the process, as well as interpersonal and team skills." These skills have been the concern of vocational students, but, in the future, they will be needed by everyone entering the labor market.

BARRIER 3: TECHNICAL EDUCATION PROGRAMS HAVE NOT BEEN ABLE TO AFFORD UP-TO-DATE EQUIPMENT

> *"There is an ongoing need at the Technical Colleges for capital equipment, to ensure that programs are keeping pace with current technology. While we have been fortunate to receive donations from industries, private sector contributions do not, and could not, keep the Technical Colleges adequately equipped. Given the high cost of equipment and ever-changing technologies, this is always a significant problem."*
>
> John Fitzsimmons, President, Maine Technical College System

Companies are introducing new technologies into the workplace at a faster pace today than at any other time in our history. These new technologies include not only numerically controlled equipment in the factory, but new software in offices and new diagnostic equipment in hospitals. These innovations are not simply updated versions of well-established equipment, but whole new approaches to performing tasks. For example, the auto mechanic, today, must be able to use sophisticated computer-controlled diagnostic equipment. Unless MTCS graduates learn their skills on today's equipment they will be ill-prepared for work. Because we have invested too little in educational equipment, too many students must learn in classrooms that look much as they did when their parents learned.

Investing in state-of-the-art equipment is necessary if MTCS graduates are to learn the technical skills that employers stress today. The MTCS must be a leader in using equipment embodying new technologies. The increasing demands for technical education will require more dramatic changes in programs than will be needed in academically-oriented education programs.

BARRIER 4: THE PUBLIC IS UNAWARE OF THE BENEFITS OF TECHNICAL EDUCATION AND ITS CAREER OPPORTUNITIES

Although technical education is changing quickly, the public's perception of it and of the prospects that non-baccalaureate degrees offer is not changing as quickly. People making educational and career choices frequently rely on informal information sources—usually friends and family. Yet these informal advisors are not well-informed about technical education. Their advice reflects job conditions when they first entered the labor market, not opportunities today.

Recent education reforms in Maine and in most other states have demanded additional academic credits in order to graduate from high school. Many families emphasize academic not technical education endeavors. And state and federal governments offer heavier subsidies for students continuing in baccalaureate degree programs than to those enrolling in technical courses. Yet, nationwide, about one-half the vocational/technical courses are taken by students graduating in the top one-half of their classes. And job prospects associated with technical education have changed dramatically in the past decade relative to the prospects for many of the more "prestigious" professions that require post-graduate degrees.

IV: RECOMMENDATIONS FOR A STATE STRATEGY TO EXPAND THE CAPACITY OF THE MAINE TECHNICAL COLLEGE SYSTEM

> *Businesses must clearly tell schools what skills they need. They should view the education community as their most important supplier—providing the essential human capital they need to survive and thrive. Through these relationships, schools can better prepare to adapt to changing needs and new technologies. Colleges have good track records of working with businesses. But we must build more partnerships between businesses and community colleges. Many medium and small firms, with little ability to support human resource programs, could easily go to local community colleges for the training their workers need.*
>
> William Brock, former Secretary of Labor, 1991

In a world of growing economic complexity and international competitiveness, Maine needs a world class technical education system. This is our challenge. To meet it, the Commission is making six recommendations.

RECOMMENDATION 1

Findings

The Commission's study revealed a significant gap between the technical skills currently possessed by Maine workers and the skill needs of Maine employers. The Commission also found, from analyses conducted at the state level and reinforced by national data, that the demand for technical skills will continue to increase throughout the 1990s. The Commission projects that Maine will need a minimum of 60,000 additional technicians to meet projected employment growth during the 1990s.

The Commission notes that the programs presently offered by the Technical Colleges cover 36 occupational areas, which represent one third of all Maine jobs. Furthermore, the Technical Colleges are the sole providers of post/secondary education for 29 of those 36 occupational areas. Because the Technical Colleges are the primary deliverers of post-secondary technical education in the state, the Commission concludes that, if the Technical Colleges remain at their current capacity graduating only 1,300 students each year, the state's workforce will be short at least 47,000 technicians in the 1990s. The Commission fears that the skills shortage will lead employers either to look outside the state for skilled workers—slowing their growth—or, worse, to move to a state with a larger skilled labor force.

The Commission also found that the demand by students for technical programs far exceeds the capacity of the Technical Colleges. During the Fall of 1990, 3,000 more students applied than could be served at the Technical Colleges.

The Commission expects this demand to increase during the 1990s as a result of greater understanding of the career opportunities and higher earning potential associated with technical training. The Commission also believes that interest in one- and two-year technical programs will increase as a result of the attention and resources currently directed toward raising the aspirations of noncollege bound students. The Commission notes that the slowing economy is also placing greater demands on the Technical Colleges, demonstrated by the 50 percent increase in applications since the Fall of 1990. The Commission believes that the ability of laid-off workers to enroll in Technical College programs and prepare for new careers will be vital to the State's economic recovery.

RECOMMENDATION 1: The Commission recommends that the State of Maine invest in an eight-year Growth Plan for the Maine Technical College System, beginning in fiscal year 1993. This Growth Plan would increase enrollment from its current enrollment of 4,100 to 10,000 students by the year 2000. It would cost the State, on average, an additional $3.7 million each year for the next eight years, for a total increase of $29,363,000.

The Growth Plan is projected to increase the number of Technical College graduates entering the marketplace from 1,300 in 1990 to 3,300 by the year 2000, representing a 250 percent increase over the System's current capacity. This investment, which would double the System's state-financed budget by the year 2000, would result in approximately 127 new or expanded programs being added to the System's current offerings of 106 programs. While the Commission recognizes that this investment will not meet the entire demand for technicians in Maine, it expects the System's current market penetration to double, from 27 to 54 percent, by the year 2000.

The Growth Plan reflects the Maine Technical College System's assessment of the level of growth that can be accomplished over the eight-year period without compromising educational quality. Based on a comprehensive budget, it includes the addition of new and expanded programs; expansion of student services, such as library, laboratory, and counseling services; and the necessary upgrading of technical training equipment.

The investment plan is intended to build on the facility improvements provided for in the $20.2 million bond issue approved by Maine voters in November 1989. While the Commission recognizes the impossibility of predicting specific training demands, and hence facility needs, in the late 1990s, it appears based on current demand analyses that additional facilities are unnecessary. The Commission recommends that the investment plan be implemented through:

a. increased utilization of existing facilities, particularly during off-peak times, such as evenings and summers; and
b. development of cooperative agreements with the regional secondary vocational centers as satellite facilities.

Construction of new facilities should be considered only as a last resort if other options are insufficient to meet the needs of new program development. The Growth Plan does not include any funding for new facilities.

The Growth Plan also does not provide for campus residential facilities, which, if needed, will be developed on an enterprise funding basis with the facilities being self-supporting through room and board fees.

RECOMMENDATION 2

Findings

The American Society for Training and Development recently reported that 42 percent of the nation's workforce will need additional training over the next decade. In Maine, that translates into approximately 243,600 workers. The Technical Colleges have been experiencing a steady increase in the number of nontraditional students returning to school either to upgrade their skills or to prepare for a new career. This demand is expected to increase throughout the decade. The Commission is concerned that if current programming cannot meet the needs of these nontraditional students, many will not be able to obtain the education they desire or may need to continue as productive members of the workforce.

The Commission has also found that the current recession has in fact heightened the demand by nontraditional students for retraining. Since January of 1990, 72 Maine plants have closed or had mass layoffs, leaving 8,300 Maine people out of work. Many of these people will never find work in the same occupation and will have to become retrained for a new career.

The demand for nontraditional programming is equally vital to Maine employers. The Commission heard testimony from business and industry organizations throughout Maine on the critical demand for their current workers to be upgraded in order to keep pace with technological changes. With 90 percent of Maine businesses employing 25 or fewer employees, it is vital that our businesses have access to customized training programs for their employees, such as those provided by the Technical Colleges.

RECOMMENDATION 2: As part of the Maine Technical College System Growth Plan, the Commission recommends an expansion of the Technical Colleges' Continuing Education Divisions from the current enrollment of 11,000 students to 20,000 by the year 2000. The cost of CED expansion has been incorporated into the $29,363,000 Growth Plan.

In addition to providing credit courses for part-time students that lead to degrees, Continuing Education provides short-term customized training programs for business and industry. The CED component offers specialized workshops, courses and seminars that are flexible and responsive to employer and employee needs. While the Commission acknowledges that the Technical Colleges are not the sole providers of continuing education and customized training, it does believe the Technical Colleges offer a vital service that, if expanded, could help meet the increasing need for retraining and upgrading, and the demand from business and industry for customized training.

RECOMMENDATION 3

Findings

An expansion plan of the magnitude proposed by the Commission requires careful planning that ensures that quality of educational services is maintained throughout the expansion process. The Commission, therefore, believes it is essential that a comprehensive implementation strategy be developed, to ensure that growth is implemented responsibly. The Commission recognizes that the MTCS Board of Trustees has governing authority over the Technical College System and as such is the most appropriate body to plan and oversee implementation of the Growth Plan.

During the course of its study, the Commission identified broad industries which are expected to experience high growth throughout the decade, and industries which are experiencing rapid technological change. The Commission did not assess regional demands, specific program needs, or the capacity needs of each campus. The broad industry and occupational analyses are intended to serve as a guide to the MTCS in their program planning and implementation of the Growth Plan.

RECOMMENDATION 3: The Commission recommends that the MTCS Board of Trustees develop an implementation strategy by April 1992 to achieve the goals of the Growth Plan. This strategy should include the process for selection of new and expanded programs. The Commission further recommends that the Board of Trustees allow for annual reviews of the implementation strategy, to ensure that the System remains flexible to changing economic conditions and changing student needs.

The Commission recommends that special emphasis be placed on:

a. Responding to sectors of the Maine economy with documented shortages of technically-skilled employees, such as the health care industry.
b. Supporting Maine businesses and industry where rapid technological advances will continue to raise skill demands; and
c. Fulfulling the training needs for technical occupations with substantial public benefit served exclusively by the MTCS, such as the technical education program for waste water treatment operators.

RECOMMENDATION 4

Findings

The Commission believes strongly that education must be viewed as a lifetime commitment—continuing throughout our working lives—for personal fulfillment and out of economic necessity. With people changing jobs and even careers many more times than in the past, and technological changes accelerating, it is vital that we are able to move in and out of the education system with as few barriers as possible.

The Commission found that students could greatly benefit from a smoother transition from secondary schools to the Technical Colleges without the need to repeat courses once enrolled in the College. The Commission supports the concepts of Two + Two or Tech Prep programs as a means of facilitating the transition from secondary school to a Technical College, and encourages the MTCS to develop such programs wherever possible.

The Commission found that the MTCS and the University of Maine System have recently developed articulation agreements that have greatly benefitted students wishing to enroll in bachelors degree programs after obtaining an associate degree from a Technical College program, or vice versa. The Commission commends these actions and encourages the MTCS and the University of Maine System to continue these efforts, as a means of encouraging students to continue their education as efficiently as possible.

Recommendation 4: The Commission recommends that the Maine Technical College System continue to work closely with the secondary schools and the University of Maine System with the primary goal of increasing the number of articulation agreements so that students will be better able to transfer credits into and out of the MTCS.

The Commission anticipates that the efforts to provide a smoother transition among educational systems will result in cost savings, as well as eliminate unnecessary duplication.

RECOMMENDATION 5

Findings

The Commission is concerned about the apparent lack of understanding by parents and students of the excellent career opportunities and earning potential that technical positions offer. Despite the many changes that have taken place in the nature of technical occupations, the public retains outdated impressions of what technicians do. Too often, Technical Colleges are erroneously seen as a less desirable alternative, instead of colleges of choice, for students not pursuing a four-year baccalaureate degree. As a result of these outmoded perceptions, the Commission believes that a large segment of Maine students is missing out on excellent educational and career opportunities.

The Commission believes that the MTCS has a responsibility to communicate to the public its role and status among the state's education providers. While the change in name from the Vocational-Technical Institutes to Technical Colleges reflects their status and mission more accurately, the MTCS needs to be more proactive in communicating the career opportunities and earning potential associated with technical education to the public and, in particular, to high school guidance counsellors and to parent-teacher organizations. While the Commission is aware of the many excellent recruitment and public awareness efforts undertaken by College professionals, changes in technical education fields have occurred so quickly that an aggressive, focused campaign is needed. In addition, the MTCS needs to communicate more clearly to middle and high-school students the educational requirements needed for matriculation to Technical Colleges so that they can better prepare for their post-secondary technical education.

Recommendation 5: The Commission recommends that the Maine Technical College System strengthen its alliances with secondary school guidance departments and parent/teacher organizations with the goal of increasing awareness of the excellent career opportunities and higher earning potential associated with technical jobs.

RECOMMENDATION 6

Findings

During its analysis, the Commission learned much about the technical education needs of the Maine workforce and about the capacity of the Maine Technical College System to meet those needs. In addition, the Commission gained insights into many issues that go beyond the scope of its charge. Because of the importance of these issues the Commission has included recommendations in these areas in the hope that they will prove useful to the MTCS Board of Trustees as they carry out the Growth Plan, and in their continuing efforts to meet the needs for technical education among Maine's citizens and businesses.

RECOMMENDATION 6: The Commission recommends that the MTCS Board of Trustees, in implementing the Growth Plan, consider a number of issues that the Commission believes are essential to the System's mission, which include (1) the changing role of technical education in the lives of Maine workers; (2) the role of technical education in Maine's economic development strategy; and (3) issues relating to the internal operations of the System.

THE CHANGING ROLE OF TECHNICAL EDUCATION IN THE LIVES OF MAINE WORKERS

1. The people of Maine must rethink the role that post-secondary technical education plays in their lives. They must elevate technical education to the level demanded by the rapidly evolving marketplace in which technical competence and innovation are our foundations of economic prosperity.

2. The people of Maine must become aware that education is a lifelong endeavor and that their careers depend on their ability to continuously update their knowledge and skills.

3. Core educational and specific technical skills are only part of the skills package required in today's workplace. People must be able to work in teams, be familiar with statistical process control, be flexible as production techniques change, be able to assume a greater variety of responsibilities, be more involved in decision-making, and be more entrepreneurial.

4. To ensure that the Technical Colleges remain an affordable and accessible option for Maine's citizens, the MTCS must continue to seek additional sources of financial aid and scholarships for its students.

TECHNICAL EDUCATION MUST PLAY A GROWING ROLE IN MAINE'S ECONOMIC DEVELOPMENT STRATEGY

5. Education of today's and tomorrow's employees is one of the most pressing problems that employers face. Workforce preparation—finding people for the growing number of skilled jobs—must be the core of the state's economic development strategy, in attracting businesses to the state, in helping current businesses retain their competitiveness, and in fostering the birth and expansion of businesses.

6. Traditionally, Technical Colleges have served the market rather than led the market in new skills programs. The Commission believes that the MTCS can support the growth of expanding industries by taking the lead in helping businesses incorporate the latest skills innovations in their operations.

7. The MTCS could expand its role in economic development by creating "programs of excellence" in technical specialty areas important to Maine industry with large employment bases and excellent growth potential. Potential targets include allied health, machining/metal-working, wood products manufacturing, and electronics. These programs could generate new jobs, or could save jobs by increasing the competitiveness of businesses.

8. The Commission found that many MTCS graduates at some time in their careers start and own businesses. Many programs would benefit from the inclusion of business management courses to complement the technical training.

9. Applied research and development is an important component of Technical College programs in other states. Maine industries could benefit greatly through partnerships with the Technical Colleges, enabling them to innovate fast enough to remain competitive internationally.

IMPORTANT ISSUES AFFECTING THE INTERNAL OPERATIONS OF THE MTCS

10. The MTCS must continue to provide general education and basic skills courses as they provide an essential base from which their graduates can continuously update their technical skills throughout their working lives.

11. Recognizing the growing demands for technical competence, MTCS must continue to expand its investment in faculty development. Faculty must maintain high standards in their respective disciplines.

12. Various state agencies, including the Maine Department of Labor, Division of Economic Analysis and Research, the Maine Occupational Information Coordinating Committee, and the State Planning Office, manage important economic and occupational data. However, this information is not available in a form that is compatible with the planning needs of the MTCS. The MTCS needs to work with these agencies to develop a means of forecasting and reporting that can be used for regular planning and evaluation.

13. The MTCS should develop a standardized method of tracking the placement and earnings of its program graduates to identify current demands in different skills and to be able to demonstrate the value of career prospects through technical education.

ACKNOWLEDGEMENTS

The Commission wishes to thank several organizations and individuals for their contributions to this study. Our special thanks go to Dr. Roger J. Vaughan, the principal author of the report, for his insights into Maine, his ranging national perspective on technical education, and his ability to describe the needs in Maine in relationship to the national and world economies.

We also thank the Maine Development Foundation for its organization, administrative, and research support which was so vital to accomplishing our task in a timely manner. Both Laurie Winsor and Gore Flynn, special consultants to the project, were especially helpful in providing the background information required, scheduling meetings and hearings, and drafting findings and recommendations.

We also thank Steve Adams, State Economist; Dana Evans, Department of Labor Economist; and Denis Fortier, Analyst for the Maine Occupational Information Coordinating Committee, for their valuable research and analyses. We also thank the Maine Technical College System for its cooperation and support. John Fitzsimmons, MTCS President, and staff members Alice Kirkpatrick, Lynn Olson, and Marcia Schools provided the Commission with information in a timely manner and were very supportive in helping the Commission understand the Maine Technical College System. We wish to offer the Board of Trustees our thanks in advance for accepting the responsibility of implementing this Growth Plan.

People from many parts of the Maine economy made valuable contributions during the course of the Commission's review process.

From the Legislature:

Senator Stephen Estes, Chair, Joint Standing Committee on Education
Representative Nathaniel J. Crowley, Sr., Chair, Joint Standing Committee on Education
Lock Kiermaier, Legislative Analyst, Office of Fiscal and Program Review, on behalf of the Joint Standing Committee on Audit and Program Review

the Presidents from the MTCS:

Nathaniel Crowley, Jr., Acting President, Eastern Maine Technical College
William Hierstein, President, Central Maine Technical College
Durward Huffman, President, Northern Maine Technical College
Ronald Renaud, President, Washington County Technical College
Wayne Ross, President, Southern Maine Technical College
Barbara Woodlee, President, Kennebec Valley Technical College

from the business community:

Marilyn Ardito-Stafford, Director of Training, Georgia Pacific Corporation
Roy Daigle, Manager, Bangor Mall Offices
James Evers, Safety and Security Manager, S.D. Warren Company
Margaret Hodgkins, President, Knowlton-McLeary Company
Thomas Howard, Assistant Executive Director, Associated General Contractors of Maine
Paul Kelley, Vice President of Diagnostic and Support Services, Eastern Maine Medical Center
Robert King, President, Maine Metal Products Association
Costas Lambrew, M.D., Director, Division of Cardiology, Maine Medical Center
Joseph Moran, Vice President, Quality Assurance & Planning, Central Maine Power Company
Douglass Nason, Director of Facility Engineering, Sprague Electric
William Nugent, President, Greater Portland Regional Chamber of Commerce
David Peterson, Chief Executive Officer, Aroostook Medical Center;
Gordon Platt, President, Curry Printing & Graphics
James Saunders, Executive Director, Lewiston/Auburn Chamber of Commerce
Bob Wallace, Manager, Federal Marine Terminals, Inc.

from organized labor:

Andrew Clark, Representative, Brewer Millwrights Union
Laura Fortin, President, Maine State Nurses' Association, Local Unit 1
Roger Hare, Retired Regional & Local Representative, Machinist Union/UAW
D. Bruce King, President, Carpenter, Millinocket Local 621
Ed King, Training Coordinator, United Brotherhood of Carpenters & Jointers, Local 320
Gerry Langlais, Member, Plumbers and Pipefitters, Local 783
Charles O'Leary, President, Maine AFL-CIO

from economic development organizations:

Ed Collins, Director, Quoddy Job Opportunity Zone
William Spolyar, Chairman, Mid-State Economic Development Corporation

from the education and training community:

Daniel Bridgham, Chair, NMTC General Advisory Council
Peter Burns, Director of Admissions, Eastern Maine Technical College
Tina Carter, Student Senate Representative, Washington County Technical College
Alan Campbell, General Manager, Cole Training Institute
Richard Fifield, Employment & Training Specialist, Bureau of Employment and Training Programs

Ronald Fitzgerald, Department Chair, Northern Maine Technical College
Don Hansen, Faculty Association President, Eastern Maine Technical College
Karl Kelley, Student Senate President, Eastern Maine Technical College
Gerald Libby, Jr., Student Senate Vice President, Central Maine Technical College
Karen Marston, Student Senate Representative, Southern Maine Technical College
James McKinney, Jr., Director, Oxford Hills Technical School
Lori McPherson, Student Representative, Northern Maine Technical College
Richard Mooers, Student Senate President, Kennebec Valley Technical College
Patrick O'Neill, Director, Southern Penobscot Vocational School-Region 4
Suzanne Raeside, Director, Adult Education, MSAD #35-Marshwood
James Rowe, Faculty Association President, Kennebec Valley Technical College
Reginald Roy, Faculty, Welding Technology, Eastern Maine Technical College
Kevin Sweeney, Faculty Association President, Southern Maine Technical College
Gregory Swett, Dean of Students, Eastern Maine Technical College
James Ugone, Principal, Caribou High School
Marilyn Vail, Nursing Faculty, Eastern Maine Technical College
John Wilson, Faculty Association President, Central Maine Technical College

APPENDIX A:
FORECASTING THE ANNUAL DEMAND FOR TECHNICAL EDUCATION

There are no data—either at the national or the state level—that show the share of employees who need non-baccalaureate degree technical education. However, it is possible to use data from surveys to develop approximate ratios (how these ratios are calculated is described below).

Estimates prepared for the Commission from national data indicate that, during the 1980s, about nine percent of those entering the workforce—to fill the new jobs in growth industries or as replacements—needed MTCS level technical education. At the same time, about 5 percent of the existing workforce needed MTCS level technical education to upgrade their skills.

These ratios allow us to calculate a "lower bound" of the total number of people needing technical education during the 1990s. The estimate is a lower bound because there is widespread agreement that the percent of jobs demanding technical education will increase each year and these ratios were based on data from the 1980s. Therefore, the analysis is performed in two stages:

PART I: These lower bound estimates are used to measure the numbers of people needing technical education each year at the beginning of the 1990s;

PART II: For the year 2000, these ratios are expanded to incorporate estimates of the growth of the share of the workforce that will need technical education;

PART I: ANNUAL DEMAND FOR TECHNICAL EDUCATION DURING THE EARLY 1990s

This is a conservative estimate necessitated by the lack of up-to-date survey data. The second part of the calculation, below, attempts to compensate for the rising need for technically-educated employees.

Total Needing, Non-Baccalaureate Degree Technical Education Among New Entrants

About 310,457 people will enter the Maine work force between 1989 and the year 2000. Some of these will be entering for the first time; some will be re-entering the workforce (perhaps after a raising children, a period of discouragement with job prospects, or some other reason for temporarily leaving the workforce); and some will be moving into the state from elsewhere. Some will already have earned technical education credentials. Most will not.

If nine percent—the 1980s ratio—seek technical education through the MTCS, that will place aggregate demand through the decade at 27,900. This would mean an average throughout the decade of 2,790.

But this number will grow during the decade from about 2,400 during the early 1990s to over 3,200 at the end of the decade.

Total Needing Non-Baccalaureate-Degree Technical Education Among Existing Employees

About 454,367 of the 698,968 people working in Maine in 1989 will still be in the State's labor force by the year 2000. The remaining 244,601 people will have either retired, died, temporarily left the labor force, or moved out of state. Over the course of the decade, we project from national data that 5 percent of the existing workforce—or 22,718 people—will need technical education to upgrade their skills or to learn new ones and will seek that education through programs that are less than full university degrees. This corresponds to an average of 2,272 annually, or about 2,000 early in the decade and 2,500 by the end of the decade.

The cumulative total of Maine people—new entrants and existing workforce—needing formal technical education between 1989 and 2000 is 50,618 at a level below four or more years of university education.

In the early 1990s, the annual total needing one or two years of MTCS-level technical education will be about 4,400. At the end of the decade, this will have risen to 5,700.

These estimates are our lower bound. Because the percentages of people within each occupation needing MTCS-level education to get a job or to upgrade their skills, a second set of estimates were made adjusting for these changes. These are reported in Part II below.

PART II: ANNUAL DEMAND FOR TECHNICAL EDUCATION BY THE YEAR 2000

The percentages used in PART I to estimate the share of those entering the workforce seeking technical education and the share of the existing workforce seeking to upgrade their skills (9 percent and 5 percent respectively) are growing. One projection, by Dennis Swyt of the U.S. Bureau of Standards suggests that the share of technically-based professions in the total workforce will grow by about 25 percent between 1980 and 2000. Therefore these percentages will grow to 11.25 percent of entrants to the workforce seeking MTCS-qualifications and 6.25 percent of the existing workforce seeking MTCS qualifications to upgrade.

If we assume that the share of new entrants and existing employees needing MTCS-level technical education in the year 2000 has grown by 25 percent between 1990 and 2000, then by the turn of the century, 7,125 Mainers will need MTCS-level technical education each year.

CALCULATING PERCENTAGES OF NEW ENTRANTS AND EXISTING WORKFORCES NEEDING TECHNICAL EDUCATION AND TRAINING

A rough measure of the need to train the 310,457 new entrants to the workforce between 1989 and the year 2000—those hired to fill growing slots and those hired for replacement jobs—can be made using the data presented in Tables A:1 and in D:1, below.

For new entrants, this is done by, for each occupation, multiplying its share of the workforce (calculated from the last column in Table A:1) by the fraction requiring non-company formal education or training to get a job (first column in Table D:1) by the share receiving training in non-university courses (first column in Table A:1). The resulting numbers for each occupation are summed for all occupations.

For example, professional and technical occupations constitute 15 percent of the national workforce of 113 million in 1984 (12.8+3.6/1.13). Of these, 75 percent (76 percent of men and 74 percent of women) required formal education to fill jobs (Table D:1). Of these, about one third will fill those requirements in non-university technical education and training programs (this is the sum of the shares of professional specialty (78 percent of Professional/Technical) and technicians (22 percent of Prof/Tech) x 0.25 and 0.71 respectively (from column 1 of Table A.1). Thus, the demand for technical qualifications by professional/technical occupations is:

0.15x0.75x0.34=0.04, or 4 percent.

If this is repeated for each of the occupational classifications, the total is nine percent.

For existing workforces, the second term is replaced by the fraction requiring school education and training to upgrade their skills (fourth column in Table D:1).

In the mid 1980s, about 9 percent of those hired would receive formal education and training in non-university courses in order to get their jobs. These would be mainly those in five occupational areas Admin/managerial; Professional Specialty, Technicians; Craft; and Operatives. If this ratio were to remain unchanged in the 1990s, this would mean that about 27,900 of the 310,457 new hires during the decade would need formal technical education or training.

About 5 percent of existing employees (mostly in the same professions) would receive technical education and training in non-university courses to upgrade their skills. If this ratio remained unchanged during the 1990s, this would mean that 22,718 people of the 454,367 Maine people working today who will still be working in the year 2000 will need formal technical education at some time during the decade.

Table A:1
In 1984, Most Employees in Most Occupations Did Not Need Baccalaureate Degrees

Occupation	Percent Non-Bacc.-Degree	Median Weekly Wage	Total Number of Jobs
Executive, Administrative	55.0%	$483	11.3million
Professional Specialty	25.5	$455	12.8
Technicians	71.4	379	3.6
Clerical/Sales	79.0	319	11.2
Private Household Services	98.4	134	35.4
Craft	94.6	384	12.5
Machine Operatives	97.2	277	8.2
Transportation	96.9	344	4.7
Handlers, Laborers	97.4	251	4.2
Farm, Fishing, Forestry	92.1	203	3.6
Average	77.9	326	106.8

Source: Office of Technology Assessment, Technology and the American Economic Transition, Washington D.C., Table 10.3.

INDUSTRY PROFILES IN TECHNICAL EDUCATION AND TRAINING NEEDS

An alternative is to examine industry-specific technical education needs. The following profiles of the seventeen sectors demanding the largest numbers of new hires or replacement jobs accounted for two out of three total jobs in Maine in 1989. Tables A:1-A:2 list the 28 growing sectors and 14 declining sectors. (Estimates of 4 other sectors with very small net jobs are not listed but are reflected in the total.)

The profiles summarize employment data in each industry showing annual average employment in 1989, projected annual average employment in the year 2000, and estimated job growth from the beginning of the period to the end of the period. (The latter is not the difference between the first two numbers because of differences in the months for which estimates are presented).

Profiles also show: estimates of replacement job openings between 1989 and 2000; a qualitative judgment of the pace at which the skills required in the industry will grow (high; medium; or low). Finally the profile includes descriptions of changes in the sector—drawn from testimony presented to this Commission, or national or local reports—of new technologies and skill needs.

1. Health Care

Total Employment in 1989:	*51,623*
Total Employment in 2000:	*66,717*
Growth in Employment, Jan 1989-Dec 2000:	*15,945*
Replacement Jobs, 1989-2000:	*9,567*
Growth in Skills Needs:	*High*

The health care industry includes the staffs of hospitals, medical laboratories, nursing homes, hospices, and a wide range of related activities. It has a workforce with one of the highest fraction of technically-trained employees.

The Commission was told that health care faces chronic shortages of many occupations—perennially in nursing, but also in occupations using new technologies. Costas T. Lambrew, Director of Cardiology, Maine Medical Center said: "Recently it took almost a year to fill a position for a sonographer in cardiology at the Maine Medical Center. The search included bringing candidates from as far away as Colorado." Paul Kelly, VP Diagnostic and Support Services, Eastern Maine Medical Center told the Commission: "At Eastern Maine Medical Center in Bangor we have been actively recruiting for Nuclear Medical Technologists for over three years. In the entire state of Maine, there are no training sites for Nuclear Medicine or Ultrasonography, occupations in which, by conservative estimate, I believe there to be at least 200 people employed in Maine."

2. Miscellaneous Business Services

Total Employment in 1989:	*25,884*
Total Employment in 2000:	*38,291*
Growth in Employment, Jan 1989-Dec 2000:	*14,709*
Replacement Jobs, 1989-2000:	*27,947*
Growth in Skills Needs:	*High*

The rapid growth of computer applications, new telecommunications, and other new technologies coupled with the increasing practice by businesses of "contracting out" for services are likely to make business services Maine's fastest growing industry. The industry includes advertising, credit reporting, mailing and reproduction, services to buildings, news syndicates, computer services, data processing, research and development, detective and protective agencies, equipment leasing and rentals, photofinishing, and commercial testing labs. It will need technically sophisticated employees, and a growing supply of entrepreneurs. Even jobs that have heretofore required little or no skills—such as janitorial services—will require more intensive training to familiarize employees with the different chemicals used and to manage increasingly sophisticated equipment.

3. Rest of Retail

Total Employment in 1989:	*90,983*
Total Employment in 2000:	*101,240*
Growth in Employment, Jan 1989-Dec 2000:	*10,464*
Replacement Jobs, 1989-2000:	*34,047*
Growth in Skills Needs:	*Low*

These activities are difficult to characterize. Some branches of retail—particularly telemarketing (via telephone and television)—will require employees with greater familiarity with telecommunications equipment. Other areas will continue to employ low-skilled workers.

4. Eating and Drinking Establishments

Total Employment in 1989:	*38,683*
Total Employment in 2000:	*45,535*
Growth in Employment, Jan 1989-Dec 2000:	*7,114*
Replacement Jobs, 1989-2000:	*9,960*
Growth in Skills Needs:	*Low/moderate*

Employment in eating and drinking establishments will continue to grow quickly, demanding staff with catering skills—some of which will be trained in the MTCS.

5. Hotels and Related Activities

Total Employment in 1989:	*12,850*
Total Employment in 2000:	*16,769*
Growth in Employment, Jan 1989-Dec 2000:	*5,618*
Replacement Jobs, 1989-2000:	*16,234*
Growth in Skills Needs:	*Medium*

Tourism will continue to be a growing part of the Maine economy. However, many of the jobs are seasonal and the industry is dominated by many small businesses. Therefore, graduates from MTCS hospitality-related programs will, increasingly, need to be familiar with business administration skills.

6. Miscellaneous Professional Services

Total Employment in 1989:	*16,535*
Total Employment in 2000:	*21,375*
Growth in Employment, 1989-2000:	*4,983*
Replacement Jobs, 1989-2000:	*10,963*
Growth in Skills Needs:	*High*

This sector includes lawyers, accountants, consulting, and other services. See comments on business services above.

7. Non-Profit Organizations

Total Employment in 1989:	*17,725*
Total Employment in 2000:	*21,397*
Growth in Employment, Jan 1989-Dec 2000:	*3,495*
Replacement Jobs, 1989-2000:	*7,689*
Growth in Skills Needs:	*Medium*

This sector is difficult to categorize. It includes chambers of commerce, the United Way, and religious organizations. Many employees will need basic business skills, and familiarity with business administration.

8. Wholesale

Total Employment in 1989:	*28,895*
Total Employment in 2000:	*30,120*
Growth in Employment, Jan 1989-Dec 2000:	*2,176*
Replacement Jobs, 1989-2000:	*5,591*
Growth in Skills Needs:	*Low*

9. Auto Repair/Services

Total Employment in 1989:	*7,548*
Total Employment in 2000:	*8,732*
Growth in Employment, 1989-2000:	*2,040*
Replacement Jobs, 1989-2000:	*7,568*
Growth in Skills Needs:	*High*

10. Amusement/Recreation

Total Employment in 1989:	*7,430*
Total Employment in 2000:	*8,847*
Growth in Employment, 1989-2000:	*1,388*
Replacement Jobs, 1989-2000:	*3,214*
Growth in Skills Needs:	*Medium*

See comments under Hotel Industry above.

11. Printing and Publishing

Total Employment in 1989:	*6,326*
Total Employment in 2000:	*7,369*
Growth in Employment, 1989-2000:	*1,170*
Replacement Jobs, 1989-2000:	*3,978*
Growth in Skills Needs:	*High*

A recent report by the National Association of Printers and Lithographers concluded: "As an industry we are replacing craft—which can be learned on the job over a period of years—with technology that requires equally skilled workers but workers who can use tools such as statistical quality control and system programming. The only practical way of managing this is to raise the ante of the skills required to begin learning a system. To begin learning new systems, operators need to know more about math, reading, problem solving, critical thinking. The present workforce lacks important workplace skills needed to get up to speed in state of the art systems and equipment." Four out of five printers surveyed replied that their employees needed greater work-related basic skills.

12. Finance (Credit and Banking)

Total Employment in 1989:	*12,259*
Total Employment in 2000:	*13,175*
Growth in Employment, Jan 1989-Dec 2000:	*1,068*
Replacement Jobs, 1989-2000:	*1,569*
Growth in Skills Needs:	*High*

Commercial banks in Japan, Germany, France and the U.S. sharply upgraded the educational attainment of their new hires between 1976-7 and 1985-6—the German bank for example, shifted from 85 percent of its new employees with less than twelve years schooling to 85 percent with 12 or more years. The financial

industry in New England, reports Maine's Department of Labor, was transformed in the 1980s in response to two major legislative initiatives which changed the structure of the industry to an unprecedented degree: the first was national deregulation in 1980; and the second was the passage of interstate compacts. These initiatives increased competition and led to large scale consolidation. Consolidation efforts have been enhanced by the advent of new processes in automation—making computer and telecommunications applications a necessity for survival.

13. Insurance

Total Employment in 1989:	*12,144*
Total Employment in 2000:	*13,069*
Growth in Employment, Jan 1989-Dec 2000:	*1,032*
Replacement Jobs, 1989-2000:	*826*
Growth in Skills Needs:	*High*

Thomas Bailey, a researcher who completed a study of the insurance industry described the rapid skill upgrading in one company typical of the industry as a whole: "An insurance company took advantage of the capabilities of desk-top computers to restructure—creating many small teams that work directly with field agents and each carries out all 167 tasks that used to be performed by three separate departments. Clients' requests can be handled much faster and new products are developed faster."

14. Personal Services

Total Employment in 1989:	*17,487*
Total Employment in 2000:	*18,255*
Growth in Employment, 1989-2000:	*916*
Replacement Jobs, 1989-2000:	*1,127*
Growth in Skills Needs:	*Varied*

This sector is not easily characterized. The industry includes domestic servants, health clubs, and other activities.

15. Non Electrical Machinery

Total Employment in 1989:	*5,501*
Total Employment in 2000:	*6,611*
Growth in Employment, 1989-2000:	*885*
Replacement Jobs, 1989-2000:	*2,655*
Growth in Skills Needs:	*High*

Between 1981 and 1988 in Maine, productivity of employees in the non-electrical machinery industry grew by 14.2 percent—faster than in any other industry. This has slowed the growth in the number of employees needed in the industry but is raising the skills they need.

16. Electrical/Electronic Equipment

Total Employment in 1989:	*8,894*
Total Employment in 2000:	*9,723*
Growth in Employment, Jan 1989-Dec 2000:	*846*
Replacement Jobs, 1989-2000:	*2,115*
Growth in Skills Needs:	*High*

This industry experienced the second fastest productivity growth in Maine, although productivity per worker still trails the national average.

17. Pulp and Paper

Total Employment in 1989:	*17,699*
Total Employment in 2000:	*16,767*
Growth in Employment, Jan 1989-Dec 2000:	*-654*
Replacement Jobs, 1989-2000:	*2,040*
Growth in Skills Needs:	*High*

James Evers, from the S.D. Warren Company, told the Commission: "The demand for our employees to become computer competent is on the upswing. Almost all of our employees must, at some time or another, be involved in operating computers. Other important areas generating demand among all our employees are general business and statistical process control skills."

Table A:2
Hiring for Job Growth and Replacement in the 28 Industries Anticipated to Increase Employment between 1989-2000

Industry	*Net New Jobs* *Total*	*Replacement Jobs* *Total*	*Total Jobs* *Total*	*Annual*
Health	15,945	9,567	25,512	2,551
Business Services	14,709	27,947	42,656	4,266
Other Retail	10,464	34,047	44,511	4,451
Eating & Drinking	7,114	9,960	17,074	1,707
Hotels	5,618	16,234	21,852	2,185
Profess Services	4,983	10,963	15,946	1,595
Non-Profit Org	3,495	7,689	11,184	1,118
Wholesale	2,176	5,591	7,767	777
Auto Repair	2,040	7,568	9,608	961
Recreation	1,388	3,214	4,602	460
Printing	1,170	3,978	5,148	542
Insurance	1,032	826	1,858	186
Personal Services	916	1,127	2,043	204
Education	907	1,361	2,268	227
Non-Elec Machinery	885	2,655	3,540	354
Trucking	852	1,557	2,409	241
Elec Machinery	846	2,115	2,961	296
Other Trans Equip	784	2,666	3,450	345
Public Utilities	613	490	1,103	110
Communications	596	477	1,073	107
Credit and Finance	592	474	1,066	107
Banking	476	1,095	1,571	157
Air transport	305	244	549	55
Instruments	282	302	584	58
Private Household	156	1,217	1,373	137
Motion Pictures	109	252	361	36
Local Transport	71	355	426	43
Motor Vehicle	26	65	91	9
TOTAL	**78,568**	**154,069**	**232,637**	**23,264**

Table A:3
Hiring for Job Growth and Replacement in the 14 Industries Anticipated to Reduce Total Employment between 1989-2000

Industry	10 Year Job Reduction	Replacement Jobs Total	Net Openings* Total	Annual
Construction	9,929	14,002	4,073	407
Other Trans Equip	4,579	1,826	2,753	275
Leather	3,667	2,448	(1,219)	(122)
Real Estate	1,588	2,660	(1,072)	(107)
Textiles	816	1,650	834	83
Lumber	720	3,660	2,940	294
Food	654	2,040	1,386	139
Paper	654	2,520	1,866	187
Apparel	441	780	339	34
Fabricated Metal	413	520	107	11
Misc Manufacturing	116	240	124	12
Primary Metals	106	100	6	1
Furniture	31	480	449	45
Rubber	19	1,350	1,331	133
TOTAL	**23,830**	**35,056**	**11,226**	**1,123**

Source: Maine State Planning Office estimates

APPENDIX B:
HOW RELIABLE ARE OCCUPATIONAL FORECASTS?

As the rate of growth of Maine's labor force slows, the importance of assuring a supply of trained labor is growing. At the same time, education policymakers are subjecting vocational programs in high schools and in technical colleges to increasing scrutiny. Are they providing people the skills that industry needs? Are they giving sufficiently rigorous grounding in those skills? Occupational investments are long-lived. It takes many years to acquire some skills. A mistake in deciding what career to pursue may reduce peoples' lifetime earnings.

Is training used on the job? Many evaluations of occupational education and training programs attempt to assess whether graduates are hired in the fields in which they were trained. This matching is difficult and may be of only secondary importance. For example, a major New York City bank recently announced that it was seeking people with communications skills for computer programming slots, arguing that it could teach computing skills on the job much more easily than it could teach the ability to communicate. Trained programmers, it had found, were rarely able to communicate with non-programmers. Should a communications program that places its graduates in these slots be penalized because its graduates were being hired as computer programmers?

The earnings of graduates may be a more important measure of how much private employers value the skills—broadly defined—of the people they are hiring. The more rapidly new technologies are adopted, the more rapidly occupational and skill classifications are rendered obsolete and therefore the greater the difficulty of determining whether a job does or does not use the skills acquired in training.

Are people trained in areas of predicted labor shortage? A second approach to the monitoring of technical education programs has been to try to identify skill areas that will be in short supply and to judge institutions according to the number of graduates in these critical areas.

Predicting what skills we will need in the future would be a valuable activity if it were possible. Experience to date with Bureau of Labor Statistics (BLS) occupational projections is not encouraging. The BLS recently funded an evaluation of the accuracy of state projections made between 1977 and 1979 of employment by industry and occupation in 1982. The findings demonstrate the limits of forecasts.

* All states used either linear regression or shift-share models to develop their projections, but all adjusted their models' projections with analysts' judgments. Regression models yielded higher errors than shift-share analyses.
* The mean projection error for all 3-digit SIC industries was 22.6 percent (the more specific projections were less accurate). Even the direction of the employment shift—increase or decrease—was predicted correctly only two-thirds of the time.
* The errors were greatest in those industries that had experienced the largest increases or decreases in employment.
* Substate projections were less accurate than statewide ones, and Bureau of Labor Statistics national projections were more accurate than state ones.
* Overall, linear regression models specified separately for each industrial sector were no more accurate than standard regression models of state industry employment regressed against national employment and time.
* Projections for occupations were of similar accuracy to industry projections. They were better for occupations whose employment changed moderately. Manufacturing occupations were projected more accurately than non-manufacturing ones.

Therefore, projections for regions within Maine and for non-manufacturing occupations are unlikely to be accurate enough for people to "bet" the time and money that it costs to complete their course.

APPENDIX C:
PROJECTING THE COSTS OF EXPANDING THE MAINE TECHNICAL COLLEGE SYSTEM

To project the costs of serving additional students as the system grows, the Maine Technical College System developed a computer "model" of the System's operations. The basic building block of the model is the number of new students that will be added to the system in each year. The number of new students was estimated to increase at rates that the System could comfortably absorb on an annual basis without detracting from the quality of existing or new programs or seriously disrupting support systems.

The growth model is based on the assumption that the ratio of organizational resources required to support each additional student will remain approximately the same as it is today as the System grows. The costs of providing these new organizational resources are then projected into the future as students are added to the System.

The model provides for growth of the two types of students the System serves. Most system resources are directed toward matriculated students who are full or part time students who are working toward a certificate, diploma or associate's degree. The remainder are Continuing Education Division students in special classes established to serve a specific market such as a business or trade association.

This model projects costs of adding net new students to the System and of developing new programs to accommodate their needs. It does not include the ongoing costs of redesigning or developing replacement programs within the system to accommodate technological change. These costs are already included in the System's regular budget.

The model does not provide for new residential facilities because such facilities would be developed on an enterprise basis with the costs intended to be fully recovered from residential fees. The model also does not include provisions for any new classroom, administrative, or support buildings to accommodate the growth. As is indicated elsewhere in the study, the growth plan recommends attempting to make more efficient use of existing System building resources and to work with the regional vocational centers for space sharing before resorting to new construction for the Maine Technical College System.

Assumptions

The basic assumptions for the model are listed at the top of the chart and are described in detail below:

Student/Faculty Ratio - The System currently provides, on the average, one faculty member for each 12.33 students. Although some programs currently require one faculty member for as few as eight students, there are other general education programs that only require one faculty member for 30-40 students. The model assumes that the "average" will be maintained.

Students Per Program Ratio: The average number of students in each of the System's programs of study is currently 37. The model assumes that the average will be maintained.

Faculty Per Program Ratio: There is an average of three faculty members for each of the System's programs, including the academic core faculty in such areas as English, Math, and Science. The model assumes that this average will be maintained.

Students/Student Service Support Ratio: The System provides for an average of one student service support worker for every 75 students. "Student Service Support" personnel include the admissions, registrar, financial aid, counseling, developmental studies, and health services functions. The model assumes that this ratio will be maintained.

Students/Institutional Support Ratio - Currently, the System provides for an average of one institutional support worker for every 150 students. "Institutional Support" personnel include the business office, administration, personnel, development, public relations, security, and maintenance functions. The model assumes that this ratio will be maintained.

Faculty/General Staff Support Ratio - The System currently employs one general staff support person for every 10 faculty members. "General staff support" personnel include general clerical support for the faculty and programs. The model assumes that this ratio will be maintained.

Faculty/Academic Support Ratio: The System currently requires one academic support staff member for every 12 faculty members. "Academic support" includes department chairs, library and audiovisual staff, etc. The model assumes that this ratio will be maintained.

CED Students/Support Staff Ratio: The System currently employs one additional support person, above the number required to support the matriculated student programs, for every 600 continuing education division students. Because Continuing Education Division courses are, by and large, supported by revenues and federal grants, this model includes only projections for nominal support staff costs to the system. All other costs will be covered directly by program revenues.

Program Costs/All Other: Each new MTCS program requires approximately $7,800 per year in start-up expenses for general operating supplies and other expenses. The model assumes that this cost will increase only as a result of overall inflation (which is provided for elsewhere in the model).

Program Costs/Capital: Each new program requires an average of $26,000 in capital costs for equipment. The model assumes that this cost will remain the same except for general inflation except for the special technical equipment fund (described below).

Technical Equipment Pool: Technological change requires the System to acquire new equipment for training its students for tomorrow's jobs. To account for the increased equipment needs, which are not adequately reflected in the above "average" costs, the model provides for funds at the System level for new technical equipment that would be drawn on by individual campuses on an as-needed basis. This technical equipment pool is funded at $600,000 per year through the plan horizon.

Personal Services/Faculty Median: The model uses the current median faculty base salary of $33,200 plus 25% for fringe benefits for an average cost of $41,500, adjusted each year for a 4.5% annual increase for general inflation.

Personal Services/Administrative/Professional Median: The model uses the current median base salary cost of administrative/professional staff of $27,000 plus 25% for fringe benefits for an average cost of $33,750, adjusted each year for a 4.5% annual increase for general inflation.

Personal Services/Support Staff Median: The model uses the current median base salary cost of support staff of $15,000 plus 25% for fringe benefits for an average cost of $18,750, adjusted each year for a 4.5% annual increase for general inflation.

Personal Services/Administrative/Academic Median: The model uses the current median base salary cost of administrative/academic staff of $33,500 plus 25% for fringe benefits for an average cost of $44,375, adjusted each year for a 4.5% annual increase for general inflation.

Incremental Revenues: The middle column on the chart includes an "Incremental Revenue" entry. This is tuition and fee income that will be generated by additional students. This estimated incremental revenue is subtracted from the total yearly growth costs to arrive at the net cost needed from the State of Maine General Fund. The model assumes that tuition and fee income grows at the general inflation rate of 4.5%.

Design of the Model

The model's projections are shown in Table C.1, with years shown vertically (the years, enumerated in the left margin track eight years of the growth program from 1993-2000), and projections of numbers of new students and the costs of serving them shown horizontally. The "target students" column includes the total number of full and part-time students projected for the System in that year. In the same column as the year, the projected number of graduates in that year is also reported. The next column to the right includes the break down of the number of new students by full and part-time status. The next two columns to the right (3rd and 4th columns) report the number of programs and faculty required to support the new full and part-time students. The next four columns to the right (5th through 8th columns) report the number of support staff required for all new students. The bottom row in each year uses the cost assumptions to convert the growth in students into costs for each item.

The middle column (Column 9) labeled "subtotal" provides the total gross cost of the annual matriculated student increase, an adjustment to the cost to reflect tuition income, and a final adjustment to reflect as net cost after inflation of 4.5%. This is the place where the model makes general adjustment of all costs of 4.5%.

The next four columns (Columns 10-13) include the projections for the increased costs of supporting the Continuing Education Division. These numbers have been adjusted for inflation at a rate of 4.5%.

The right hand column includes the total annual adjusted cost of the supporting the growth program from sources other than tuition and fees. The model is based on the assumption that the cost of growth in each year is included in the System's regular operating budget in subsequent years and does not show the cumulative costs of the program over time. The number in the lower right hand corner is the total cost of the growth program through the year 2000. The summary chart at the bottom of the page shows the total growth to the System in terms of number of students, faculty, and support personnel through the year 2000.

Table C-1
Maine Technical College System
Growth Plan Prepared for the Commission to Review the Capacity of the Maine Technical College System

Assumptions:

Student:Faculty	12.33
Students per program	37
Faculty per program	3
Students: Student Serv Support	75
Students: Institutional Support	150
Faculty: General Staff Support	10
Faculty: Academic Support	12
CED Students: Support Staff	600

Program Costs:

Averages from FY 92-93 biennium request			
All Other	7,800		
Capital	26,000		
Plus $600,000/yr technical equipment pool			
Personal Services Costs:			
Faculty Median Base	33,200	Including	41,500
Admin/Prof Median	27,000	Benefits	33,750
Support Staff Median	15,000	at	18,750
Admin/Acad Median	35,500	25%	44,375

4,171 FT/PT Matriculated Students, Fall 1990 (FT 72%, PT 28%, for 12 Hrs)
11,000 Continuing Education Students, Fall 1990
4.5% Yearly Inflation Factor for Costs at Base Year FY91

	Target Students		Increase	Programs	Faculty	Student Services	Institutional Support	General Support	Academic Support		Subtotal	CED Target Students	Increase	Institutional Support	Subtotal	Total
FY93	5,100	FT	529	14	43											
		PT	400	5	16											
			929	19	59	12	6	6	5	88 Additional Staff		11,800	800	1		
Grads	1,683															
			Cost	1,242,200	2,448,500	405,000	112,500	112,500	221,875	4,542,575 Incremental Cost 927,514 Incremental Rev				18,750		
										Net Cost after Inflation	3,777,739				19,594	3,797,333
FY94	6,000	FT	500	14	41											
		PT	400	5	16											
			900	19	57	12	6	6	5	86 Additional Staff		13,000	1,200	2		
Grads	1,980															
			Cost	1,242,200	2,365,500	405,000	112,500	112,500	221,875	4,459,575 Incremental Cost 898,560 Incremental Rev				37,500		
										Net Cost after Inflation	3,881,506				40,951	3,922,457
FY95	6,900	FT	500	14	41											
		PT	400	5	16											
			900	19	57	12	6	6	5	86 Additional Staff		14,400	1,400	2		
Grads	2,277															
			Cost	1,242,200	2,365,500	405,000	112,500	112,500	221,875	4,459,575 Incremental Cost 898,560 Incremental Rev				37,500		
										Net Cost After Inflation	4,023,947				42,375	4,066,322
FY96	7,520	FT	400	11	32											
		PT	220	3	9											
			620	14	41	8	4	4	3	60 Additional Staff		15,800	1,400	2		
Grads	2,482															
			Cost	1,073,200	1,701,500	270,000	75,000	75,000	133,125	3,327,825 Incremental Cost 619,008 Incremental Rev				37,500		
										Net Cost after Inflation	3,196,404				44,250	3,240,654
FY97	8,140	FT	400	11	32											
		PT	220	3	9											
			620	14	41	8	4	4	3	60 Additional Staff		17,000	1,200	2		
Grads	2,686															
			Cost	1,073,200	1,701,500	270,000	75,000	75,000	133,125	3,327,825 Incremental Cost 619,008 Incremental Rev				37,500		
										Net Cost after Inflation	3,331,845				46,125	3,377,970
FY98	8,760	FT	400	11	32											
		PT	220	3	9											
			620	14	41	8	4	4	3	60 Additional Staff		18,000	1,000	2		
Grads	2,891															
			Cost	1,073,200	1,701,500	270,000	75,000	75,000	133,125	3,327,825 Incremental Cost 619,008 Incremental Rev				37,500		
										Net Cost after Inflation	3,467,286				48,000	3,515,286
FY99	9,360	FT	400	11	32											
		PT	220	3	9											
			620	14	41	8	4	4	3	60 Additional Staff		19,000	1,000	2		
Grads	3,095															
			Cost	1,073,200	1,701,500	270,000	75,000	75,000	133,125	3,327,825 Incremental Cost 619,008 Incremental Rev				37,500		
										Net Cost after Inflation	3,602,727				49,875	3,652,602
FY00	10,080	FT	400	11	32											
		PT	220	3	9											
			620	14	41	8	4	4	3	60 Additional Staff		20,000	1,000	2		
Grads	3,300															
			Cost	1,073,200	1,701,500	270,000	75,000	75,000	133,125	3,327,825 Incremental Cost 619,008 Incremental Rev				37,500		
										Net Cost after Inflation	3,738,167				51,750	3,789,917
										Net Present Value	Subtotal			NPV	Subtotal	TOTAL
										24,281,176	29,019,621			281,250	342,920	29,362,541

Total Students	Increase	New/Expanded Programs	New Faculty	Student Services	Institutional Support	General Support	Academic Support	CED Institutional Support	Total New Employees
10,000	5,829	127	378	76	38	38	30	15	575
65% 6,500 FT	3,529 61%		66%	13%	7%	7%	5%	3%	
35% 3,500 PT	2,300 39%								

Sample Reading of the Model Report for 1993

To help understand how these assumptions and averages were applied to the growth plan, the following is a sample reading of the projections for 1993. From the current 4,171 full- and part-time students, a target of 5100 students in FY93 would mean an increase of 929 students. The 529 full-time students translates into 14 new/expanded programs and 43 new faculty. The 400 part-time students are assumed to be enrolled half-time to equal 200 full-time-equivalent students, resulting in the addition of 5 programs and 16 faculty across the six campuses. Nineteen programs multiplied by $7,800 in "all other" costs and $26,000 in "capital" costs equals $642,000, plus the yearly pool of $600,000 for technical capital equipment, provides a total fiscal year new/expanded program cost of $1,242,000. The 59 new faculty at the median salary of $41,500 costs a total of $2,448,500. Twelve new student service administrative professionals at $33,750 each costs a total of $405,000. Six institutional and 6 general support staff at a median cost of $18,750 each costs a total of $112,500 for each category. The total cost for five new academic administrators at $44,375 each is $221,875. The total incremental cost of faculty, support staff, and capital expenses in FY 91 dollars is $4,542,275. The incremental tuition revenue for the 929 students of $927,514 is subtracted from those costs. The total net cost figure is then multiplied by a yearly incremental inflation factor of 4.5% to provide an adjusted cost of $3,777,739. To this figure must be added the cost of hiring one institutional support person for the 800 additional CED students, which, adjusted for inflation at 4.5%, is $19,594. The grand total cost of the growth for FY1993 is $3,797,333.

The same analysis was prepared for each fiscal year to determine the costs to serve a target population of 10,000 students in the year 2000. This is an increase of 5,829 students creating 127 new or expanded programs. The aggregated new, first-year costs for this growth is $29,362,541 (with a net present value of $24,562,426).

HOW EXPANDED CAPACITY WOULD HELP MEET MAINE'S TECHNICAL EDUCATION NEEDS

Comparing the increases in capacity that form the basis of the model we have just outlined with the estimates of demand from the preceding chapter, we can estimate the increased share of demand that the Technical College System will be able to meet. Using the lower demand estimates, increased capacity will allow the system to increase the share of people seeking technical education that it will be able to serve from 34.1 percent in 1993 to 57.9 percent in the year 2000. If we use the higher estimates of demand (those based on a growing share of the workforce needing technical education), then MTCS "market penetration" will increase from 27.3 percent in 1993 to 46.3 percent in the year 2000.

APPENDIX D:
WHY EMPLOYERS CANNOT EDUCATE AND TRAIN THEIR EMPLOYEES

As we survey Maine's needs for a growing number of technically-educated people, the obvious question arises: Why can't employers meet the increased demand with in-house education and training? This Appendix summarizes the results of a large number of nationwide studies of employer training. The basic finding is simple. Employers invest in those employees who have already attained the basic technical skills before they are hired. They cannot afford to invest in employees who have not proved that they can "grasp the basics."

Employers Already Spend Heavily on Educating and Training Employees

Annual investments in employer-sponsored education and training account for about 40 percent of our annual human capital investments, totalling about $150 billion (or about 4 percent of GNP) in 1985. These investments were about one-half as large as investments in plant and equipment. Public investments in primary and secondary education in 1985 were about $170 billion and in post-secondary education and training about $100 billion. Each year, these investments extend the skills and education of the workforce and add more to national product than our investments in capital equipment. Costs are shared between employees—who receive lower-wages as trainees and may pay some direct costs—and employers—who pay direct costs and wages to trainees in excess of their productivity.

Most People Receive Some Education or Training From Their Employers

Most people receive some company-sponsored training relevant to their work—55 percent of men and women in 1983 (see Table D:1). Respondents to one survey reported receiving an average of 150 hours education or training on their current job. In 1983, about two-thirds of the workforce report training during the previous 15 years—half of these in company sponsored programs. Two out of five men and one out of three women report that they needed company-sponsored training (formal or on-the-job) to qualify for their present jobs and 26.7 percent of men and 28.2 women needed training to improve skills.

Company-Sponsored Training is Complementary to, Not a Substitute for, Investments in Basic Skills

Employers train their best educated employees: 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 (Table D:2). Employees who are trained in one job are also more likely than other new employees to be trained in subsequent jobs. Differences are even more striking for managerial and technical training: only 7 percent of employees who did not graduate from high school received this type of training, compared with 27 percent of high school graduates, 45 percent of those with some post-secondary technical education, and 55 percent of employees who were university graduates.

Table D:1
Percent Employees Needing Education and Training to Get or Upgrade Job
(by 1-Digit Occupation)

Occupation	*Training to get Job*		*Training to Upgrade Skills*	
	School	*Company*	*School*	Company
MEN				
Admin/Managerial	44.7	14.1	17.9	19.4
Prof/Tech	76.0	11.5	30.5	17.3
Sales	16.7	15.0	8.8	19.4
Clerical	14.4	10.6	7.1	13.8
Services	8.3	10.7	8.0	10.9
Craft	11.0	17.0	8.1	16.2
Machine Operatives	6.7	8.4	5.2	5.4
Transportation	1.3	6.2	1.6	5.3
WOMEN				
Admin/Managerial	36.7	10.6	17.6	17.9
Prof/Tech	74.3	9.3	35.4	16.3
Sales	7.2	8.6	4.9	10.4
Clerical	32.2	6.0	10.8	9.5
Services	7.3	7.7	5.1	5.9
Craft	7.3	9.8	5.6	8.4
Machine Operatives	1.3	.1	.4	2.5
Transportation	0.9	17.9	5.1	18.2

Source: Hong Tan, Op.Cit, Table 2.3, from CPS data for 1983.

Table D:2
Percent of Employees Receiving Company Training By Education (1967-1980)

	Some Training	3 or more Programs
High school Drop-Out	45.4	11.0
High School Graduate	71.0	31.8
Post Secondary training	80.5	39.8
University Graduate	79.1	39.7

Source: Hong Tan, "Private Sector Training in the United States: Who Gets it and Why," Paper prepared for National Center for Education and the Economy, Conference on Employer Sponsored Training, Alexandria, VA, December 1-2, 1988, Table 2.8

Employer training, therefore, accentuates differences in basic educational attainment and achievement among employees—the differences that account for most of the differences in income among workers.

Low-Income Employees Are Poorly Educated and Receive Little Training from Employers

Lack of education and training is the single most distinguishing characteristic of the poor. Among economically disadvantaged people, only 10.9 percent of men and 12.0 percent of women report receiving any post-secondary training relevant to their work. Lacking preparation for the workplace, they are unlikely to be trained by their employers: only 2.6 percent of disadvantaged men and 2.3 percent of disadvantaged women report receiving training from their employers. People entering the workforce without basic skills will find it difficult to remedy their deficiencies on the job.

Employers Concentrate Training on Craft, Sales, Managerial and Technical Skills

The occupations requiring the greatest amount of training are administrative and managerial professions and most of the training occurs in classrooms rather than on the job. Training concentrates on managerial occupations because these jobs require skills that are specific to particular jobs and are not easily transferred to other employers (Table A:5 above).

As expected, training in schools is most important for professional and technical occupations—both to get jobs and to move ahead in a career. For craft occupations, employees are also much more likely to receive company training—both as a means of getting a job and also as a way to upgrade skills.

Employers Invest in Younger but Experienced Workers

Employers invest less in employees during their first five years in the labor market because they are more likely to change jobs as they try to match career opportunities with their individual abilities and aspirations when employers would lose any training investment (see Table D:3). Employers invest less in older workers because they can recapture less of their investment during the employee's shorter remaining work life. Training of all sorts increases with experience on the current job—although at a decreasing rate—as workers demonstrate their aptitude and commitment to a career or to an employer. In-house training is more likely to occur later in employees' careers than training in external institutions.

Table D:3
Cumulative Probability of Receiving Training (Young Men, 1967-1980)

	Years From Leaving High School:			
Type of Training	1	3	9	13
Any Training	14%	40%	56%	67%
Company Training	3	15	28	37
Business/Technical	12	11	16	20
Training in Management	1	6	10	20
Semi-Skilled/Manual	15	11	21	26

Source: Hong Tan, Op.Cit., Table 2.6.

Within three years of leaving high school, over one-half of those employees who received formal business or technical training in outside institutions between 1967 and 1980 had already received it. Less than 40 percent of employees who received company training between 1967 and 1980 had received it within their first three years in the workforce. Managerial training is likely to be received later than company training in craft or sales skills—presumably, management trainees must have chosen among career paths and demonstrated their suitability to employers.

Women are More Likely to Enroll in Training Programs without the Benefit of Employer Sponsorship and Less Likely to Receive Training from Employers

In all occupations (except transportation) women are less likely to receive company training than men to get jobs and to upgrade their skills (see Table A:5 above). Differences by sex are more pronounced for initial than for upgrading training. Women are more likely than men to receive training from schools and colleges rather than from their employers (27.9 percent compared to 22.2 percent). Even well-educated female employees are less likely to be trained by employers than comparably-educated male employees: female college graduates are only 137 percent more likely than high school graduates to get additional training on the job, but male college graduates were 148 percent more likely.

Industries with Growing Employment Hire Better-Educated Employees

Financial services, public administration, and professional services—three rapidly growing sectors—employ better educated workers than agriculture, and mining—sectors whose share of national employment has been falling (see Table D:4). This reflects—at least in part—the patterns imposed by growing international trade and the impacts of new technologies.

Table D:4
Percent Male Employees Trained (Educated) by Employer, By Sector

	Percent Employees Needing Training (Education)				Percent Increase Sector Employment:1983-86
	To Get Job		To Upgrade		
Construction	12	(10)	6	(8)	5.8
F.I.R.E.	24	(35)	27	(17)	4.4
Transport & P.U.	17	(13)	21	(6)	3.1
Retail	8	(8)	10	(4)	3.0
Public Administration	21	(35)	32	(23)	2.7
Services (professional)	8	(61)	11	(30)	2.3
Manufacturing					
(durables)	11	(21)	14	(10)	1.7
(non durable)	9	(19)	12	(8)	
Wholesale	12	(17)	17	(8)	0.8
Services (non-professional)	11	(20)	8	(7)	-0.3
Mining	11	(16)	19	(6)	-1.5
Agriculture, Forestry, Fisheries	1	(9)	2	(9)	-2.2

Source: Hong Tan, Op.Cit., Table 2.4, and OTA, Op.Cit., Table 10-13.

The overall shift of employment from goods production into services has increased the level of employer training and education because—with the exception of non-professional services and retail—most growing sectors require more of one or the other of these forms of human capital than declining sectors. In-house training by companies is less prevalent in areas with cyclically-sensitive economies. Although, large companies will tend to increase training on managerial employees during slack periods—training increases when the opportunity cost of employees' time is low—employee training is not typical countercyclical policy.

Small Firms Invest Less in Training than Large Firms

Most studies report that small firms spend less on training than large firms. This may reflect the fact that they are less likely to have a separate personnel department and formal company training procedures, and therefore have no easy way of counting. Because employees in small firms must often learn a wider variety of skills, and because small firms usually report hiring slightly less educated employees than large firms, small firms would appear to have a greater need for training. In view of the importance of new firms as creators of new jobs, policymakers need to know more about the training patterns in new firms.

Summary

In sum, employer-sponsored training accounts for about two-fifths of the nation's annual investments in workforce education and skills. These investments, in turn, account for more than one-half of the annual growth in national output. Employer-sponsored training is widespread. Most employers train some of their employees and over one-half of all employees receive training from their employers necessary for acquiring jobs and advancing careers. But only employees with sound basic skills are trained by their employers. Those without basic skills are not.

APPENDIX E:
HOW OTHER STATES ARE ADAPTING TO THE GROWING NEED FOR TECHNICAL EDUCATION

In the conditions of modern life the rule is absolute—the nation which does not value trained intelligence is doomed.

Alfred Lord Whitehead, 1954

No aspect of education is changing as rapidly as technical education. It is slowly absorbing what used to be termed "vocational" or "occupational" education. The change is far more than cosmetic: it reflects the recasting of both the goals and the content of the workforce preparation programs from the ground up. In part the speed of change nationwide owes much to the traditionally-close ties between technical education programs and employers. The changing needs of the workplace have been more apparent to technical colleges than in strictly academic education.

This chapter reviews the changes in workforce preparation programs in other states. Although the commission is studying the capacity of the post-secondary technical education system in Maine, changes in the post-secondary system in other states have often been matched by changes in the technical education in the K-12 systems.

USING NEW EDUCATIONAL TECHNOLOGIES

In many schools and colleges, classrooms look much as they did when our parents and even their parents were studying. The Congressional Office of Technology Assessment estimated that education has the lowest level of capital investment—an important way in which new technology is introduced—of any industry in the U.S. Each education employee works with about $1,000 of plant and equipment. The average for all sectors is about $50,000. This translates into about $100 per student. Research and Development spending in the education sector is equal to only 0.025 percent of annual education revenues—about 1/100th of the share of gross sales spent on R and D by the average business. Education R and D spending per employee is also behind—$50 per employee compared with an industry average of $5,000.

New computer and communications technologies offer opportunities for restructuring education that allows students to learn at their own pace, and will allow teachers to focus their skills on dealing with individual problems. It will provide a massive increase in the learning resources at the command of teachers and students and should reduce the cost of education as well as raise its quality.

Texas has developed a comprehensive technology plan which plots a twelve-year course for meeting the state's educational needs through technology. The plan focuses on four priorities: classroom instruction, instructional management, distance learning, and communications. Washington is creating a unique clearinghouse to promote the use of new educational technologies by helping school districts harness the technical expertise of private sector specialists by creating partnerships with private employers.

UPGRADING VOCATIONAL COURSES IN HIGH SCHOOL

During the 1980s, educational reforms have emphasized academic preparation. More stringent graduation requirements have added academic hours and have given little credit for vocational courses. Many vocational graduates have had to study for more hours than their academic counterparts.

In response to complaints from employers, states and school districts are increasing the "applied content" in high school curricula: to provide high school students with greater familiarity with technology and to provide students for a concrete context for learning science, mathematics and other disciplines. In 1987, the International Education Association counted 40 states with some kind of technology education courses—many revitalized versions of industrial arts courses.

To be successful, this requires radical change in K-12 curriculum. New York passed sweeping 1984 education reforms that replace all the industrial arts terminology in its vocational programs with technology language. It also redesigned courses to embed keyboarding into elementary language arts, and established tests for computer literacy at third and sixth grade. In high school, it established core courses in communications, production, transportation, electronics, energy, and drawing. Sandy Union High School, Oregon, has developed a model environmental science course using a multi-use trail on 40 acres of woodland owned by the school. Students are team taught everything from zoology and physics to forestry and photography by both vocational and science teachers.

Technology education—taught as a fusion of science with occupational skills—can blend vocational and academic streams in high school. The International Technology Education Association has counted 1,200 schools in 47 states offering Principles of Technology courses as part of their vocational education curricula. The course teaches basic physics concepts such as force and energy through hands-on experiments. One of the developers of the course, Dan Hull explains: "Only 12 percent of high school students study physics. Yet physics is the foundation of most new technologies. So we said: 'Let's take physics and put it in work clothes.'" Students improve their understanding of physics more extensively through the Principles course than through regular academic physics courses.

States' occupational education programs are preparing students to work in the new technological environments even in rural areas. For example, the University of North Dakota Industrial Technology Department developed five independent, self-contained, transportable laboratories with supporting curriculum materials on Laser/Fiber Optics, Photovoltaics, Computer Assisted Drafting and Machining, and Robotics. Teachers from 12 local schools and 726 students were taught during 1988.

Technological preparation is not a substitute for reading, writing and the ability to reason. But it can teach abstract subjects such as physics, chemistry, and biology through a "hands on" learning environment. Education that combines technology with basic skills raises productivity and employability more effectively than education that only provides basic skills. Our experience shows, not surprisingly, that: "occupational skills have a larger direct impact on productivity than basic skills," but that "basic skills and occupational skills are both essential."

CREATING WORKFORCE PREPARATION PROGRAMS

The U.S. has a much less comprehensive system for preparing non-college bound students for the labor market than most other developed countries. Partly as a result of the heavy college subsidy, nearly one-third of all high school graduates enroll in some form of post secondary education—yet less than one-half of those enrolled in four year degrees and one-fifth of those enrolled in two-year degrees graduate. For those that do not, college is an expensive way to remediate skills not acquired in high-school, to strengthen general skills, or to experiment with career options.

After reviewing workforce preparation programs in the U.S. and in other developed nations, the General Accounting Office recently concluded that:

> *The U.S. provides extensive opportunities for a large portion of its youth. Our colleges and universities are the envy of the world. Yet with workforce becoming the key element in U.S. competitiveness, the education and training of non-college youth becomes increasingly critical...A skill-deficient young workforce hampers the nation's economic growth, productivity, and ability to compete with foreign countries. Some foreign competitors may excel in part because they more effectively prepare their workforce, paying close attention to the education and training of non-college youth.*

In response, many states are introducing special workforce preparation programs based in technical education systems. These include 2+2 and 2+3 programs that offer rigorous training programs in high school that are continued in the workplace or in technical colleges (based in the German apprenticeship system), flexible accreditation programs in which students can acquire credentials through a flexible system of courses taken at work, in technical colleges and in universities, and other easily transferable systems.

Using Technical Education Systems to Create Lifelong Learning Systems

In response to the growing need for continual training and retraining, several states are reorganizing post-secondary education programs to present adults with lifelong learning opportunities.

* The Francis Tuttle Center in Oklahoma City, Oklahoma, enrolls students who range in age from 16 to 60, in classes that run from 7:30 am to 10 pm, 6 days a week, with almost daily entry and exit points for students that are based on aptitude tests.
* Oregon has developed a new approach to occupational education that recognizes that, although only about 25 percent of new jobs require a university degree, the skills required by the other "non-university" careers are growing. They have created a "vocational education" continuum, serving part-time employees and mature students, and that provides multiple entry and exit points.
* Minnesota has extended the concept of a free high school education to adults. Adults who lack a high school diploma can study at a designated learning center located in a high school that has won local board approval or they can attend universities or colleges and receive a high school credit.

Technical education systems are dealing with growing numbers of non-traditional students. Many states recognize the importance of lifelong learning and serve people at times in their careers when they must learn new skills. Many displaced workers, for example, must acquire new skills. But a true lifelong learning system also offers education in non-traditional areas that are important to career development. For example, business skills—from entrepreneurship to international trade—are important to a growing share of the workforce.

Some states are trying to make technical education programs more responsive by requiring institutions to guarantee the proficiencies they provide students. Georgia offers a warranty that, today, covers 25 of 65 technical programs offered by state post-secondary technical institutions and will cover all programs by 1992. Graduates can retrain at any institution and the institution conducting the retraining can recover costs from the original trainer. Miami College in Florida even offers to reimburse graduates for tuition fees if they cannot find work in selected fields after graduation.

Using Technical Education to Retrain Displaced Workers

Technical education programs can retool workforces and preserve local businesses:

* In Lewiston, Idaho, the Potlatch Corporation closed an antiquated logging mill laying off 400 people. State Voc-Ed funds, supplemented from the Corporation, the union, and Lewis-Clark State College were used to upgrade the workers' skills enabling the plant to renovate and reopen.
* In Nebraska last year, a biotechnology training program in a community technical college retrained 59 displaced farmers.
* Michigan has combined the resources of its JTPA system with those of its post-secondary Voc-Ed system to create the Quik Start program. Employers who need to upgrade or retrain their workforces can use customized training programs offered through local community colleges and technical education schools.
* California created the Employment Training Panel in 1982, funded by a state surcharge on the unemployment insurance tax. A panel of business representatives uses the $50 million annual proceeds to fund training contracts for the company workforces that need retraining. Local vocational programs have been heavily used.

Nationwide, only about 15 percent of all displaced workers enroll in technical education programs and only a small fraction of these find jobs that use their new skills. While most displaced workers find alternative employment, the U.S. Department of Labor estimates that the one out of three displaced workers lack marketable skills or recent occupational education and they cannot easily find other work. Many of the steel workers left jobless in midwestern cities during the past decade were highly-skilled—but their skills were not easily transferred to other occupations. Many of these displaced workers were enrolled in programs originally designed for the economically-disadvantaged, yet few needed coaching in basic work habits. They needed credentials that employers respect. Mainstream technical education programs can "recycle" workers far more effectively.

Preparing Employees for the Global Marketplace

> *Knowledge, learning, research, information, and skilled intelligence are the raw materials of commerce in a global society.*
>
> George Sinner, Governor North Dakota.

Many states are injecting a global perspective into basic education programs. In 1988, **New York** required all ninth and tenth grade students (in both public and private schools) to take a course in global studies from a curriculum recommended by the state. Successful completion of the course is required for graduation. Ninety one public schools in Dade County, Florida have entered into a partnership with Florida International University to infuse their curriculum with an international perspective.

Penetrating international markets is by no means an easy task—it requires businesses to master the intricacies of contracts, tariffs, finance, and marketing to societies with different tastes. Education and training programs can help employees learn the necessary skills (starting in high schools). Waukesha County Technical College in Wisconsin received the Governor's Export Achievement Award in 1987 for a program offering businesses dozens of technical export seminars on video-tape. The seminars cover topics from the "do's and taboos of gift giving and gestures when dealing with overseas customers" to "how to ship ocean freight."

Using Technical Education to Impart Entrepreneurial Skills

> *The key to sustained economic progress is the development of new business enterprise...the state cannot itself create this entrepreneurial spirit but it can help create the conditions that allow it to flourish.*
>
> Governor Hugh Carey, NY, 1981

The discovery of the entrepreneur has led to a dramatic change in the development policies of many states. Programs to provide venture capital—usually through privately managed investment companies—have been initiated in 26 states, hundreds of publicly-funded business incubators have been created. Education programs—in high school and in technical colleges—are being widely used to teach and promote entrepreneurship.

> *In the high school, the teaching of economics is being changed to emphasize the understanding of the real economic environment rather than how to interpret abstract graphs.*
> *In post-secondary institutions, curricula are being extended to teach practical business skills in addition to more traditional occupational education.*

A growing number of post-secondary institutions are offering courses in entrepreneurship and growing numbers of students are enrolling. Some of these provide general background—financing, marketing, management, production, etc. Others provide specific coaching to potential entrepreneurs.

There are many anecdotes of graduating students creating successful businesses, but few reliable data. Wichita State University surveyed 1,800 of the 2000 graduates of its Center for Entrepreneurship over five summers and found that ten percent had started new businesses and 75 percent reported that the course had a large influence on their decision.

In addition, 45 states now have Small Business Assistance Centers funded by the U.S. Small Business Administration and usually located within their technical or community colleges or universities. Some of these draw upon the expertise of faculty but are independent entities intended to assist small and new businesses within the community. For example, the Northern Economic Initiatives Center at Northern Michigan University in three years has drawn upon 129 university faculty, students and staff to commit 12,000 hours to projects ranging from engineering consulting and help with advertising to auditing and running conferences.

No amount of formal technical education can guarantee an entrepreneur success. But most businesses fail, it appears, not because the basic idea was unsound but because of the entrepreneurs' "incompetence, lack of managerial experience, and unbalanced experience." Most loan applications are rejected because applicants cannot demonstrate that: 1) they have viable projects; and 2) they have the skills needed to manage them. Education can help people evaluate risks and master the mechanics of setting up and managing a business. It can also teach some people that they are not cut out to be entrepreneurs.

There are a growing number of successful models:

The **Women's Economic Development Corporation** (WEDCO) is a Minneapolis-based not for profit corporation that helps women—mostly low-income women—develop business plans and secure financing for new businesses. Founded by four women entrepreneurs, WEDCO is supported partly by a local bank so that clients have access to private credit and partly by foundations and fees. Since its inception, WEDCO has helped launch 600 new businesses and expand 300 existing ones, generating over 1000 jobs. The average capitalization required for these ventures was only $4,300. One-third of those helped were living in poverty—although there were no income qualifications for participants.

The Hawaii Entrepreneurship Training and Development Institute (HETADI) proves that a pedagogical approach easily adapted to occupational education programs can assist entrepreneurs effectively. HETADI was set up in 1977 with U.S. Department of Labor funds to train low-income people to set up businesses. It has assisted over 3000 people in the U.S., Africa, and Asia. During the first class, participants describe their proposed ventures. About 50 percent drop out because their ideas are impractical or because they lack the commitment. Those remaining meet weekly for three months preparing business plans for their enterprises. One-half of those completing the course set themselves up in business and have enjoyed a higher survival rate than comparable very small businesses set up by the population at large.