

The Productivity Imperative and the New Maine Economy

MAINE STATE PLANNING OFFICE
EXECUTIVE DEPARTMENT

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The Productivity Imperative and the New Maine Economy

MAINE STATE PLANNING OFFICE
ECONOMICS DIVISION

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APRIL 1990

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*Special thanks to Dana Evans, Division of
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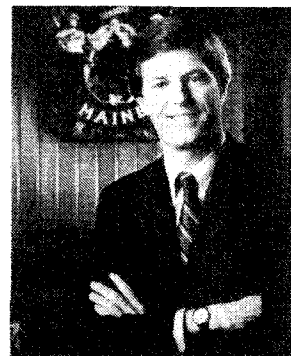


STATE OF MAINE
OFFICE OF THE GOVERNOR
AUGUSTA, MAINE
04333

JOHN R. McKERNAN, JR.
GOVERNOR

Dear Citizen,

We have entered the 1990's, the threshold to the 21st Century. We face, as citizens, workers and enterprises, new challenges and new opportunities. With the dramatic changes occurring in laboratories, on shop floors and capitals across the globe, it is certain that the coming decade will be like no other in this century.



Looking back over the past decade, it is clear that Maine left the 1980's a qualitatively different place than when we entered them. In ten short years our State has been transformed from a sluggish frontier economy to a diverse, dynamic and developed one, one that has raised us out of the ranks of the poorest U.S. states. At the same time, we have become more dependent on the world marketplace and more vulnerable to decisions and dynamics originating far from our borders.

This report describes many of the forces likely to shape Maine's economic future and offers a formula for responding to and harnessing those forces to our best advantage. While there remain many uncertainties about the coming decade and the coming century, we do know that enhancing our current prosperity will require much ingenuity, energy and determination. The productivity imperative, depicted here in economic terms, involves engaging the productive resources of Maine businesses and the creative talents of Maine people to bolster our competitive position in an increasingly aggressive international economy.

I commend this report to Maine workers, businesses, government decision makers and general citizenry in the hope that it may offer something of value to the debates, discussions and decisions about how to best forge a strong future for Maine.

Sincerely,

A handwritten signature of John R. McKernan, Jr. in dark ink.

John R. McKernan, Jr.
Governor

EXECUTIVE SUMMARY

The decade of the 1980's was a time of exceptional dynamism, virtually transforming Maine's social fabric. In a remarkably short time, Maine has gone from a languid, maturing, low-income economy to a more diversified, vigorous one, rising out of the ranks of "poor" states. At the same time, the rules of economic engagement have been dramatically altered by rapid technological advance, the mobility of technology and capital, slowing of labor force growth and increasingly sophisticated competitors. Maine's economic renaissance offers its citizens new opportunities in the national and international economy. But at the same time, Maine is more vulnerable to national and international economic forces.

MAINE'S NEW ECONOMY

Maine's new economy can be defined in both quantitative and qualitative terms. Since the start of this decade it has doubled in size. Gross State Product, the total value of the output of Maine industries, has swelled to \$19 billion, 100% above the \$9.4 billion of 1979. At the same time, the State's industries have progressed substantially—from a position as low-wage producers of commodities to a more diversified and modernized economy, as enmeshed with the U.S. and international economies as with that of the New England region.

The transformation in Maine's economy has occurred within the context of similarly dramatic changes in the larger economic environment. Maine employers now face an increasingly competitive labor market that is forcing firms to make their workplace more attractive to workers and to become more efficient with the labor at hand. The rapid proliferation of production technology

has created a growing pool of competitors with Maine businesses. Maine industries have been forced to shift away from growth strategies based on low-cost labor and toward more sophisticated and more capital-intensive production.

Several demographic and cultural shifts occurring in both Maine and the nation have contributed to higher levels of economic activity experienced in recent years. These include changes in migration patterns, in the demographic make-up of the Maine population and household composition, and in the participation of women in the workforce. These forces are not only a barometer of improved economic opportunity in Maine, but have fueled further activity as well.

The economy that is carrying Maine into the 1990's is the culmination of a fundamental restructuring of the State's industrial base. This transformation has been characterized by the formation of new manufacturing industries, the revitalization of some of Maine's traditional industries, and the decline of others. At the same time, the State's service sectors have become increasingly important to Maine's vitality, growing in both size and diversity.

Maine's economy has also become increasingly internationalized. This heightened interdependence is seen in the importation of materials by Maine firms, a broader Maine presence in international markets, foreign competition in manufacturing and in services and direct foreign investment in Maine.

The long-term outlook suggests that the current level of activity represents a relative plateau for the Maine economy. While we will not maintain the breakneck

pace of growth witnessed over the last decade, neither will Maine's economy regress to pre-1980's levels. Instead, Maine will experience a more moderate pattern of growth.

THE PRODUCTIVITY IMPERATIVE

More than ever before, the vitality of the State's economy will rest on the ability of Maine's businesses to address the productivity imperative: the need to produce goods and services ever more efficiently and of continuously increasing quality. Intensifying trade pressures, technological advance and irreversible labor force dynamics are changing the context of competition. The degree to which Maine industries respond will govern their levels of employment, the earnings of their workers, the profits of their owners and the position of the Maine economy in national and international markets; in short, the health of the economy itself.

PRODUCTIVITY, PROSPERITY AND THE NEW MAINE ECONOMY

Sustained productivity growth has always been important to improving the standard of living in Maine by supporting growth in the wages of workers and the income and investment capacity of business owners; by holding down the prices paid by Maine consumers for products and services; and by bolstering the position of Maine industries in regional, national and international markets. But in the evolving context of the new Maine economy, productivity is of greater consequence than ever before. It is the rapid evolution of the economic milieu that drives the productivity imperative.

Maine's growing vulnerability to international competition is sharpening the importance of achieving high levels of productivity growth. A growing number of countries have developed the capacity to compete very effectively with American firms both in the U.S. and third-country markets. Even absent external competition, the slowdown in Maine's labor force growth has already manifest itself in accelerating wage rates across the spectrum of service industries, from retail trade to health services, as firms vie for increasingly scarce workers. The cost pressures of Maine's more competitive labor market are also placing an added burden on the "tradable" components of Maine's industrial base (those sectors operating in the international market place). Sustained productivity, thus, becomes doubly important to Maine firms facing both intensifying competition and the cost effects of a shrinking pool of labor.

MAINE'S PRODUCTIVITY PERFORMANCE

Maine's productivity performance, when compared to the national economy, shows signs of improvement from the slowdown of the mid-seventies. While the *level* of productivity—output per worker—remains well below the U.S. average, *growth* in productivity in Maine has remained markedly higher throughout the period. In fact, the Maine economy has achieved productivity rates equal to or higher than most major developed nations except Japan during the 1981-1988 period.

Productivity of Maine Manufacturing Industries

The productivity record of Maine and the larger U.S. economy varies among sectors. Maine manufacturing productivity strength has come largely from the durable goods producers, in particular the non-electrical machinery and electronic equipment industries which recorded average real annual productivity gains of 14.2% and 7.1% respectively between 1981 and 1988. The nondurables sector in both Maine and the U.S. have begun to regain the pace of productivity growth witnessed in the early 1970's.

Nonetheless, some disturbing signs remain regarding the long-term "productive edge" of Maine's manufacturing sector. Some of Maine's recent gains are the result of one-time actions like the closing of uncompetitive plants with concomitant work force reductions. Sustaining further gains will be more arduous as opportunities for further consolidation diminish. Perhaps most troubling, Maine manufacturing industries have invested in new plant and equipment at rates below the national average. Much of the technological progress driving productivity growth results directly from the use of new capital equipment. Thus, the pace of capital investment is a critical determinant of an industry's rate of productivity growth. Maine's lower investment rates call into question the ability of Maine manufacturers to sustain competitive productivity gains into the future.

Productivity of Maine Service-Producing Industries

The productivity of the service sectors has remained weak. The more capital-intensive service industries have achieved significant productivity gains, but on the whole, the productivity of the service sector has been very poor, registering low or declining rates since the late 1970's. Of particular concern, Maine's production-related services have largely followed the national trend of weak or even declining productivity since the mid-1970's. These **transactional activities**, including communications, finance,

business, professional and legal services, have all exhibited a long-term steady decline in value-added per employee in Maine and the U.S.

The productivity imperative is just as urgent for Maine service industries as it is for manufacturing. The apparent poor record to date of most industries in this sector suggests that many service industries face a much greater challenge in improving their productive performance. However, the fate of the people they employ, the productivity of the businesses they serve and the cost of living in Maine will all be affected by the success of Maine's service sector in meeting the challenge.

MEETING THE PRODUCTIVITY IMPERATIVE

A new work regime is emerging that will set the standard for business operations in the global economy well into the 21st Century. This new production mode is imposing demands upon workers and managers that are qualitatively different from those made by the former work regime. Indeed, it is dictating an elemental change in the philosophy of the production of goods and services in America, and the transformation of public institutions designed to serve a now outdated paradigm. To meet the productivity imperative today, Maine's private and public sectors must recognize and adapt to the fundamental changes occurring in the work regime.

PRODUCTIVITY IN THE NEW WORK REGIME

The emerging work regime is based on a recognition that sustaining growth in productivity depends not only upon smarter equipment, but also upon smarter workers and new relationships between workers, managers and their machines. The efficiencies gained from computer-controlled and integrated equipment, for example, are being magnified by operators capable of reprogramming the equipment to make new or modified products. Advanced telecommunication networks between retailers and producers are keeping the shop floor in constant contact with markets and consumers. And participation by knowledgeable workers in searching out and implementing cost savings has spawned innovative and effective alternatives to plant relocations to low-wage regions.

Investment in Physical Capital

To date, successes among Maine and U.S. industry to capture the gains offered by melding new technologies and broader worker skills are more the exception than

the rule, however. While capital investment by the U.S. manufacturing sector has seen steady growth during the 1980's, Maine manufacturing firms present a more mixed record in investment trends. While per-worker equipment expenditures by Maine's goods-producing sector have roughly followed the U.S. growth trend they have remained at levels below the national rate.

Some Maine industries, notably pulp and paper, electrical and electronic equipment and textiles have equalled or bettered the per-worker investment record of their national counterparts during the 1980's. But most others, in particular Maine's food processing, fabricated metals, and leather products industries have displayed flat or declining per-worker investments since the mid-1970's.

Public works spending in Maine, as in rest of the U.S., has also failed to keep pace with the expanding economy. State and local government capital spending in Maine has fallen from 3% of Gross State Product in 1970 to only 1.7% in 1985, although it has rebounded to 2.4% by 1988. At this pace, investment in Maine's public infrastructure will be inadequate to maintain the quality of the existing capital stock, let alone adequately service expanding needs.

Investment in Human Capital

Efforts to increase the productive potential of human capital have also accelerated in the U.S. Changes in part-time adult education in the U.S. over the past two decades, with its emphasis upon cognitive skills and the need to continually upgrade work skills and knowledge, indicate some effort by both workers and employers to adapt to the changing work regime.

Investment in Maine's primary and secondary education system has increased dramatically during the 1980's, rising from \$434 million in 1982 to \$844 million by 1989. While steady through the early part of the decade, State government's share of primary and secondary education expenditures grew from 55% in 1986 to 57% in 1989. Maine's citizens have likewise supported substantial growth in investment in public higher education. In fact, since 1978 Maine has led the nation in growth in investments in its public higher education systems. Between 1978 and 1989 per-student appropriations to higher education in Maine grew by 229%. This compares with just 108% across the United States. Over the same period, Maine has raised its allocation of State revenues to public higher education to 8.2% of State appropriations, just above the U.S. average of 8.1%.

MEETING THE PRODUCTIVITY IMPERATIVE: RECOMMENDATIONS FOR MAINE INDUSTRY AND LABOR

Flexibility, quality and collaboration are the essence of the new production regime. Responding to the productivity imperative within this emerging milieu calls for flexibility in the type and design of goods and services, in production processes, in work tasks and responsibilities. For Maine industries it means melding enhanced knowledge and skills of their employees with new production and communication technologies. Moreover, it calls for a new commitment from workers, managers and owners to work cooperatively toward constant improvement in quality and efficiency.

Flexibility

Flexibility, the capacity to shift **rapidly** from one product, design or input to another using the same equipment, is increasingly defining an industry's competitive position. It is this ability that allows a firm to respond to shifting consumer tastes or business needs at lowest cost and with a minimum of delay. Maine firms face a particularly difficult road in adopting new flexible technologies. As the vast majority of Maine businesses are small or medium-sized firms, simply evaluating new technologies and changing markets is an arduous undertaking for much of Maine industry.

Collective action may be the only way that many of Maine's small firms can adopt new technologies. While individual firms may lack the time or expertise to evaluate complex and rapidly advancing technologies, they may be able to support such efforts through a trade association. Shared production and information capacity is another way that small firms, acting in concert, can finance costly technology.

Quality

As opportunities to hold down costs through lower-priced inputs and low wages diminish, quality is becoming an increasingly important component of an industry productivity strategy. A productivity strategy based on quality will require a transformation of business culture of many Maine firms. Rather than being relegated to one segment of a multidimensional organization, quality control must be an integral part of every aspect of operations, and it must begin at the highest levels of decision-making.

Seeking quality improvements by enhancing workers' roles is especially important for much of the service sector, which is often unable to substitute capital for

labor. The merchandise of these firms is often the product of the synthesis and communication of information and of direct contact between service provider and customer. In these cases, a firm's product quality depends entirely on the knowledge, skills and effort of its employees.

Collaboration

Continuous improvements in efficiency and quality using the flexible technology needed to achieve them dictate a more collaborative work environment in Maine industry. In stark contrast to the tradition of discrete tasks, workers must now have an understanding of how their tasks relate to those of others in the process.

In this setting, workers clearly need to have more decision-making authority over their tasks, and managers need to disavow the traditional notion that technology is used to limit worker discretion. Employee collaboration is a matter of persuading the workers who make the products and deliver the services to participate in quality improvement. In return for a greater responsibility for output, workers must be more intimately involved in plant reorganizations, new technology investments, job restructuring and the like.

MEETING THE PRODUCTIVITY IMPERATIVE: RECOMMENDATIONS FOR MAINE STATE GOVERNMENT

The vitality of Maine's productive potential depends principally upon the collective actions of private sector decision-makers, be they owners, managers, workers, or investors. Nevertheless, State government can play an important role in supporting and facilitating private-sector decisions that enhance the long-term productive edge of Maine's economy.

Primary & Secondary Education— "The Next Wave"

The provision of quality education is the single most important area of government influence on the productive performance of its industry. In Maine, as in states around America, State and local governments have implemented significant reforms of the primary and secondary education system. However, Maine has just begun the process of educational reform and these first steps, alone, are unlikely to achieve sustained improvements.

Just as a new work environment is emerging, so too must the educational paradigm evolve to take advantage of new technologies. But, to date, the learning environ-

ment has not adapted to new technologies. Teachers have not been adequately trained to use the technologies and administrators do not know how to organize instruction to take advantage of their capabilities.

As in private industry, teachers and administrators must work more cooperatively to improve the quality of their efforts. And as new standards of educational achievement are developed we will need better indicators that we are fulfilling our responsibility to students to provide them with the power to succeed. Toward this end, Maine should work to assure that students leave the educational environment with the requisite knowledge to function in the economic one.

Educating Maine Adults— the Workforce of the 21st Century

While crucial to our long-term development, the current focus on primary and secondary education will not address the immediate problem of improving the skills and knowledge of Maine's current workforce. To meet the productivity imperative Maine must address the crisis of education among its current workforce, which will make up over 80% of Maine's workforce in the 21st Century.

Maine's most powerful tool for providing working adults the broader knowledge and skills needed to tackle new problem-solving responsibilities and the ability to rapidly adjust to new processes and technologies is the State's higher education complex—the University of Maine System (UMS) and the Maine Technical College System (MTCS). The challenge for these institutions is to more rapidly adopt changes in focus and structure that will allow them to serve the emerging needs of both Maine's traditional and nontraditional students. Like Maine industry, these institutions must depart from traditional approaches to providing higher education services and find new ways to meet the rapidly evolving needs of Maine citizens.

Public Infrastructure— Preserving Maine's Economic Lifelines

Government needs a straightforward way to assure that it is providing sound stewardship of costly public facilities. Failure to adequately assess and provide for infrastructure needs will result in higher maintenance and replacement costs in the future and a less efficient infrastructure today. Capital plans and budgets help do this. Accordingly, the State of Maine should accelerate ef-

forts to institute capital budgeting for the State's transportation, environmental and governmental facilities.

As production technologies change so will the infrastructure needs of the private sector. It is, therefore, imperative that new infrastructure investment decisions be accompanied by an appreciation for the changing needs of an evolving economy. And just as the need for improved infrastructure becomes more urgent, the competition among public priorities for financial resources is intensifying. In this environment, the rigorous application of cost/benefit analysis of a wide variety of options will help assure that public works investments are adequately focused on approaches that offer the greatest return.

CONCLUSIONS

Maine has witnessed a great deal of change over the last decade. It must now affect a great deal more within its public and private institutions, organizations and relationships to maintain its economic vitality. Meeting the productivity imperative may be especially demanding for Maine, with its many small firms, its traditional industries and occupations and a history of lower investment in physical and human capital. But Maine also enjoys a new economic reality, a stronger position from which to acquire the tools and the know-how that will enhance its productive edge.

Many of the forces that carried Maine to its current station have begun to wane. The resurgence of the Northeastern economy that fueled the diversification of Maine's industrial base seems to have largely run its course. Sustaining and further enhancing Maine's present condition—even supporting the moderate growth anticipated for the decade ahead—must derive from sources within Maine.

Maine, like the rest of the U.S. economy, has reached a critical juncture in its development. The relentless acceleration of technological advance and growing world competitiveness are reducing the time available to make crucial decisions. The way of life enjoyed by Maine citizens in the year 2000 will largely depend upon the decisions made today. The level of income and quality of employment available to Maine households and the competitive position of Maine industries will be shaped largely by the way Maine citizens—as businesses, workers, and government—respond to the productivity imperative.

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Chapter 1

INTRODUCTION

*Distant hands in foreign lands are turning hidden wheels,
Causing things to come about which no one seems to feel.
All invisible from where we stand the connections come to pass,
And though too strange to comprehend they affect us nonetheless.*

James Taylor

It is 1990 and suddenly the "economy of the future" has arrived. A work place where smart workers operate smart machines, and where constant improvements in productivity are crucial to survival, is rapidly replacing the low-skill, low-cost assembly line. Traditional barriers to distant markets are dissolving before advances in telecommunications and transportation technologies. How well Maine citizens fare as we enter the 21st Century will depend on whether Maine industries are appropriately organized and Maine workers have the tools, skills and knowledge to compete in the new economy.

The decade of the 1980's was a time of exceptional dynamism, virtually transforming Maine's social fabric. Among the most dramatic signs of this change is the recasting of the State's economy. In a remarkably short time, Maine has gone from a languid, maturing, low-income economy to a more diversified, vigorous one, rising out of the ranks of "poor" states. Quantitative and qualitative changes in the elements of the State economy have combined to create a new economy in Maine.

But just as the Maine economy has been transformed so has the larger economic environment in which it functions. The rules of economic engagement have been dramatically altered by rapid technological advance, the mobility of technology and capital, slowing of labor force growth and increasingly sophisticated competitors. Maine's economic renaissance offers its citizens new opportunities in the national and international

economy. At the same time, Maine has become more vulnerable to national and international economic forces.

Meeting these challenges and participating in the new opportunities will require steady improvements in the productive performance of Maine's industries. Productivity will be central to sustaining the national and international competitiveness of these industries and to improving the standard of living of Maine citizens. In fact, the productivity of the State's industries will largely determine the character of the Maine economy into the 21st Century.

In turn, improving the productivity of Maine firms will depend largely on private sector decision makers such as managers, workers, and investors. However, State and local government have important roles as well. The public sector, for example, must insure that private sector efforts to improve efficiency are not diminished by inadequate transportation, communication and environmental infrastructures. More importantly, the public education infrastructure must be capable of providing Maine citizens with the ability to function in a modern and constantly evolving economy.

Productivity will be the single most important determinant of Maine's economic health into the 21st Century, a scant ten years away. This study describes the dynamics shaping the Maine economy, assesses its current productivity performance and recommends both public and private sector actions that will enhance the

competitive position of Maine firms and support an improving standard of living for Maine citizens.

Chapter Two describes the transformation of Maine's economic makeup that have occurred over this decade. This new reality manifests itself in a higher level of economic activity and greater industrial vitality. The State's industrial base has progressed from one dominated by aging, low-technology, low-wage industries to a more diverse blend of streamlined and revitalized manufacturers and modern producers of new goods and services. It is at once less dependent on the economic vigor of Southern New England and, at the same time, more dependent on national and international economies. And it is supported by a workforce gaining in maturity and experience but whose numbers are growing at a significantly slower pace.

The productivity imperative, the need for continual improvements in efficiency and quality, is the subject of Chapter Three. Internationalization of commerce and technology and a more competitive labor market are presenting new challenges to the economic welfare of Maine firms. Meeting these challenges will require improvements in the "production recipe" employed by Maine industries to produce sustained productivity improvement. This chapter considers the role of productivity in economic prosperity and the record of Maine industries in comparison with their national counterparts.

Chapter Four describes the new work regime emerging in this, the final decade of the Twentieth Century.

Changes in technologies and consumer tastes are fostering a shift from traditional mass production techniques to new flexible systems. Operating competitively in this new work regime demands of Maine firms a substantial restructuring of their production recipes. This chapter describes the type of changes required and recommends actions to facilitate them. All of these actions revolve around enhancing the flexibility, attention to quality and cooperation that will be necessary of Maine private and public sector actors to strengthen Maine's productive edge.

Productivity, despite its precise demeanor, is a concept of nebulous dimensions. It has been wielded by managers to coerce concessions from laborers. It has been used to excuse community-wrenching plant-closings. Labor leaders have stigmatized it in a bid to uphold the status quo and avoid the anxiety and uncertainty of modernizing archaic work practices. Economists and engineers have dissected each element of productive processes in their search for its essence.

But, in its authentic form, productivity encompasses all that is noble in human economic endeavor. Its source is the ingenuity, tenacity, and dedication to excellence possible of men and women. Its promise is an improved standard of living, safer and more rewarding work, and the protection and enhancement of the quality of life enjoyed by all Maine citizens.

Chapter 2

MAINE'S NEW ECONOMY

The brightness of the dream is exceeded only by its complexity.

E.B. White

INTRODUCTION

The final decades of the Twentieth Century have ushered in a new economic era for Maine. During the 1980's the Maine economy has essentially redefined itself from one dominated by maturing, low-wage and often seasonal industries to a more diversified, more vigorous economy which elevated Maine from the ranks of "poor" states. This economic renaissance was born of a confluence of forces reaching their apex during the 1980's including the resurgence of the New England economy, shifting demographic patterns, and a sometimes painful restructuring of the State's industrial base.

Maine's new economy can be defined in both quantitative and qualitative terms. Since the start of this decade it has doubled in size. Gross State Product, the total value of the output of Maine industries, has swelled to \$19 billion in 1989, 100% above the \$9.4 billion of 1979. At the same time, the State's industries have progressed substantially from a position as low-wage producers of commodities to a more diversified and modernized economy, as enmeshed with the U.S. and international economies as with that of the New England region.

The transformation in Maine's economy has occurred within the context of similarly dramatic changes in the larger economic environment. Maine employers now face an increasingly competitive labor market that is forcing firms to make their workplace more attractive to workers and to become more efficient with the labor at

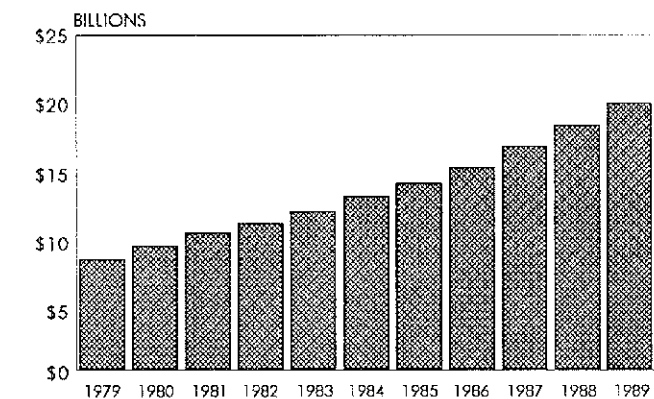
hand. The rapid international diffusion of production technology has created a growing pool of competitors with Maine businesses. Consequently, Maine industries have been forced to shift away from growth strategies based on low-cost labor and toward more sophisticated and more capital-intensive production.

A NEW LEVEL OF ECONOMIC GROWTH

It is a simple matter to document the dramatic expansion of Maine's economy during the eighties. Total personal income has climbed 141% since 1979, ballooning to \$20 billion in 1989, from its 1979 level of \$8.3 billion. This rate of increase was 40% faster than that experienced by the U.S. as a whole. Maine's economic growth index, a composite measure of general economic performance, registered an annual growth rate of 3.6% during the 1980's, well above the 2.2% annual rate achieved by the U.S.¹ One result was a lowering of Maine's unemployment rate to 4.1% in 1989, down from the 1983 recession peak of 9.0%. Figures 1 through 3 illustrate Maine's economic performance relative to the nation during the 1980's.

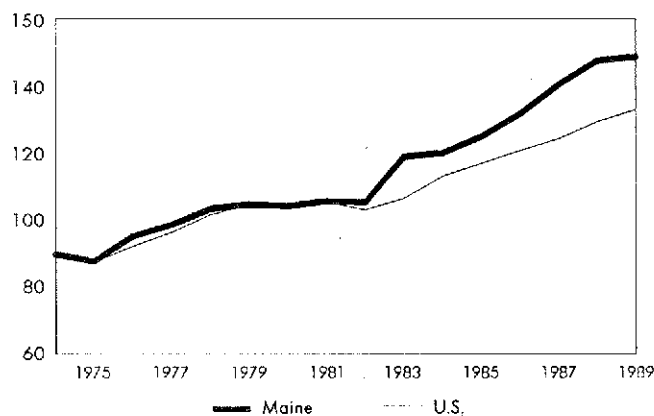
In other signs of Maine's greater vitality, new business creation sustained an annual growth of over 1200 net new firms per year by the end of the decade, as shown in Figure 4. By 1989, construction employment had topped 50,000, 70% above that in 1979, and investment in industrial, commercial and residential development

Figure 1
TOTAL PERSONAL INCOME IN MAINE
1979-1989



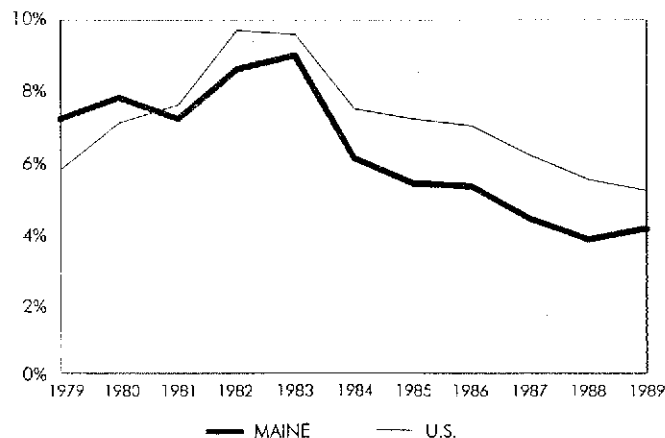
Source: U.S. Bureau of Economic Analysis

Figure 2
ECONOMIC GROWTH INDEX
MAINE & U.S. (1980=100)



Source: State Planning Office

Figure 3
UNEMPLOYMENT RATE
MAINE & U.S.

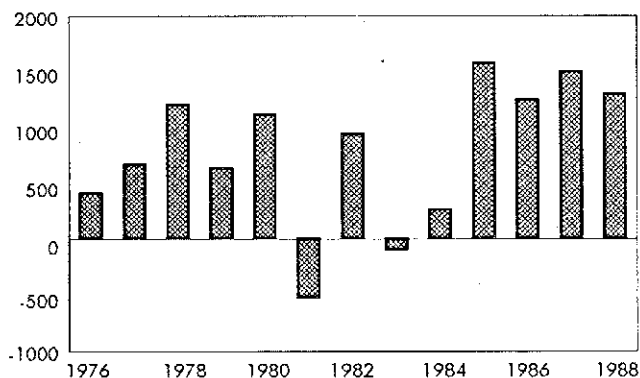


Source: Maine Dept. of Labor

reached an annual \$961 million, double 1979 levels, as shown in Figure 5.

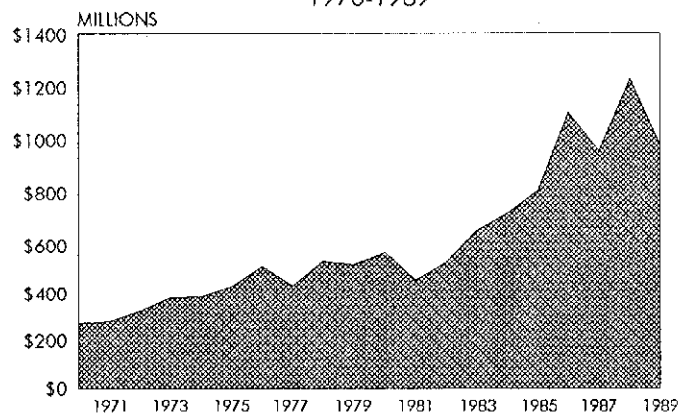
Rapid economic growth in Maine has been accompanied by a dramatic rise in per capita incomes during the 1980's, even as national income growth slowed. The rate of income growth in Maine was among the ten strongest in the nation in 1986, 1987 and 1988. This accelerated income growth has allowed Maine to move from a "poor" State, with per capita income in 1979 at only 84% of the national average, to a state of more typical means, with per capita income at 91% of the national average. By 1989 Maine had moved to 25th among the 50 states in per capita income from its place at 44th in 1979, as illustrated in Figure 6.

Figure 4
NET NEW MAINE BUSINESSES
1976-1988



Source: Maine Dept. of Labor

Figure 5
MAINE CONSTRUCTION CONTRACTS
1970-1989

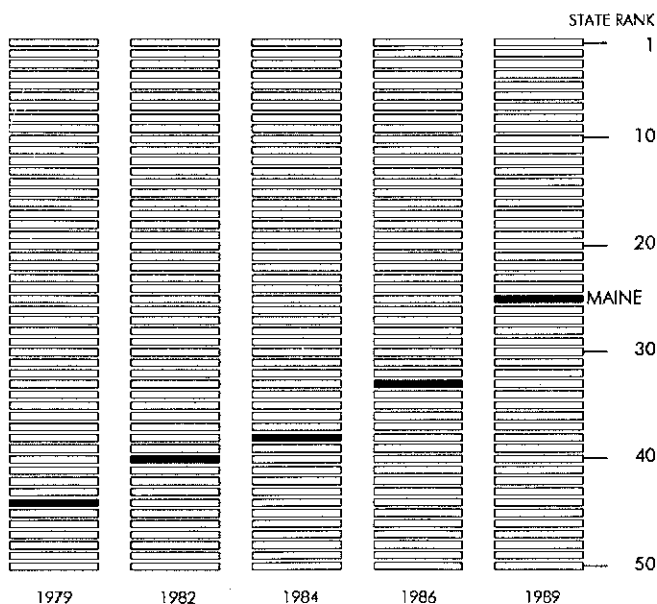


Source: Maine Advancement Program

In a more qualitative improvement, the dependence of Maine workers on seasonal employment opportunities has diminished considerably since 1979. Between 1979 and 1987 the percentage of the population working full-time rose from 50% to 59%. This was accompanied by a decline in the percentage reporting "occasional work" from 15% to 13%. Even among those working part-time in Maine, the percent of persons who reported working in seasonal jobs in Maine declined from 28% in 1979 to just 19% in 1987.²

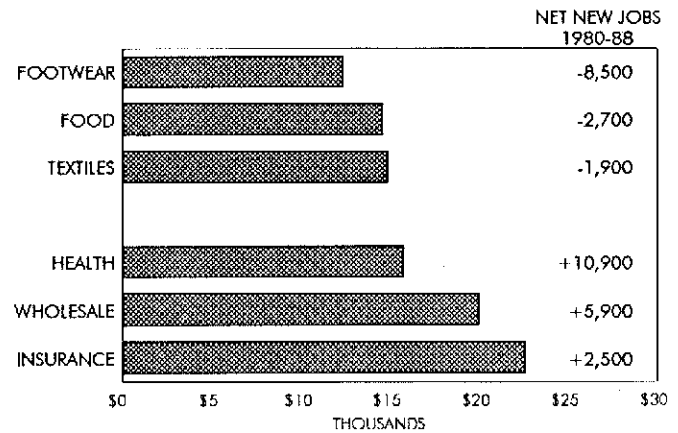
The new Maine economy appears to offer a new measure of stability and more opportunities for fulfilling employment than ever before. A 6.5% increase in real wages between 1979 and 1988, compared to the U.S. average growth of only 2.6%, and the recent reversal of the out-migration of working age adults (ages 18 to 44) attests to the greater opportunity offered by the new Maine economy. Moreover, much of the manufacturing employment lost during the 1980's offered wages below those of many of the service sector jobs that have replaced them, as shown in Figure 7.

Figure 6
MAINE'S PER CAPITA INCOME
NATIONAL RANK



Source: U.S. Bureau of Economic Analysis

Figure 7
REAL AVERAGE WAGE (1982\$)
SELECTED MAINE INDUSTRIES



Source: U.S. Bureau of Economic Analysis

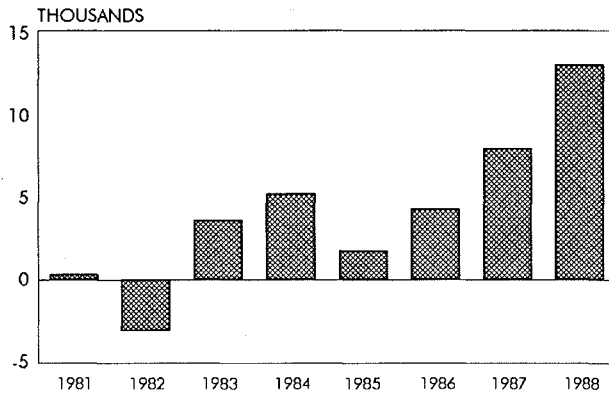
SHAPING MAINE'S NEW ECONOMY: DEMOGRAPHIC AND CULTURAL CHANGE

Several demographic and cultural shifts occurring in both Maine and the nation have contributed to higher levels of economic activity experienced in recent years. These include changes in migration patterns, in the demographic make-up of the Maine population and household composition, and in the participation of women in the workforce. These forces are not only a barometer of improved economic opportunity in Maine, but have fueled further activity as well.

Migration

Migration into Maine has seen an upturn since 1985. The U.S. Census Bureau estimates that annual net migration into Maine (the number of persons moving in minus those moving out) averaged about 2,000 persons per year between 1980 and 1986. From 1986 to 1987, net migration jumped to 8,000 persons and again jumped to 13,000 persons between 1987 and 1988, as seen in Figure 8. This influx raised average annual migration during the 1980's to 10,500 persons per year.³ Of special note is the apparent reversal of the net out-migration of persons between 18 and 44. This historical movement away from Maine of the working-age population began to slow during the mid-1970's. By 1988, the trend had reversed entirely with a net gain of 5800 people. While the make-up of this shift in population flow is uncertain, it is likely that the net in-migration of working age adults to Maine is made up, in part, of a slowing of the outflow of Maine residents as well as new arrivals to Maine.

Figure 8
MAINE NET MIGRATION
1981-1988



Source: U.S. Census

Demographics

Demographic changes affecting the rate of household formation have provided an even stronger impetus to economic activity in Maine than population growth. As in the U.S. as a whole, the average age of Maine's population is rising. As illustrated in Figure 9, the composition of Maine's population has shifted from a dominance of younger persons and small number of

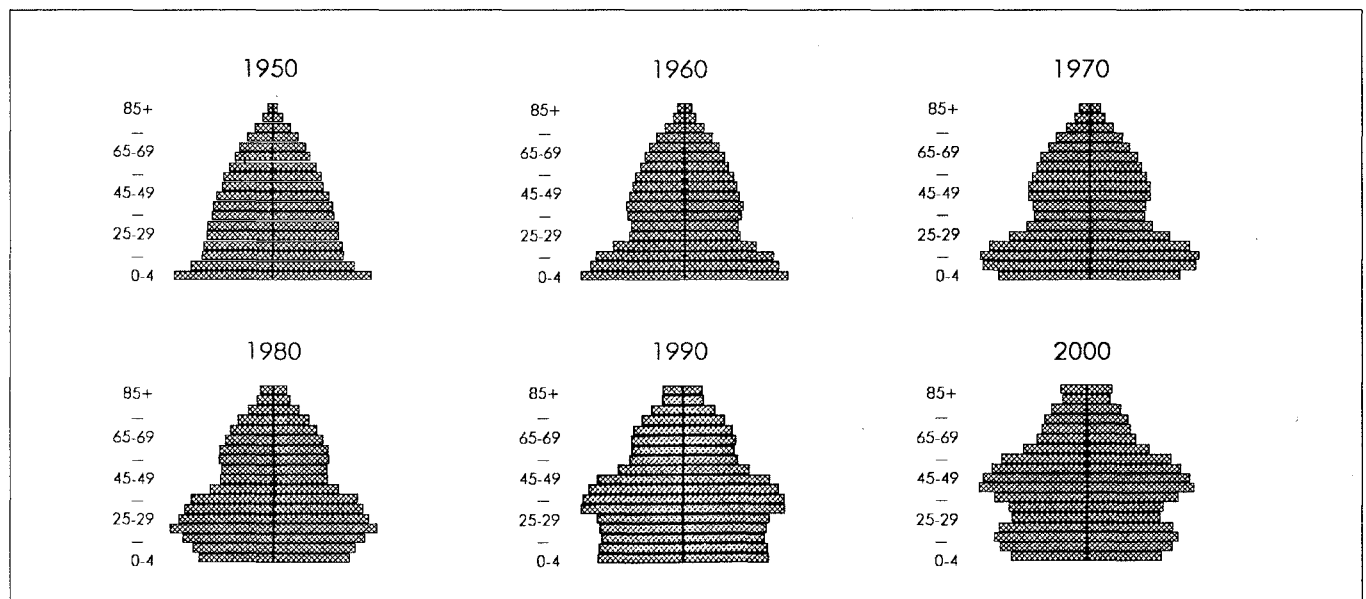
older people to a more even distribution of age cohorts. One consequence of this maturation is a shrinking household size as children leave their parents' homes to form their own households, and the number of single elderly households grows.

This pattern of demographic change, illustrated in Figure 10, accentuated the demand for new housing already fueled by moderately growing population size. In fact, from 1980 to 1988 the number of occupied year-round homes in Maine increased by 65,000 units or 81 new homes for every additional 100 residents.⁴ State Planning Office analysis of demographic and household change between 1980 and 1987 suggests that the maturation of the 1980 population accounted for slightly more than 60% of the new homes built in Maine. The same analysis suggests that movement within the State between 1980 and 1987 accounted for approximately 18% of the new homes built, while movement into Maine from elsewhere accounted for only about 6%.

Women in the Labor Force

The increasing participation of women in the labor force has also supported an expanded level of economic activity in Maine. According to U.S. Census estimates, the percentage of women in the Maine labor force grew from

Figure 9
MAINE POPULATION BY AGE COHORT 1950-2000



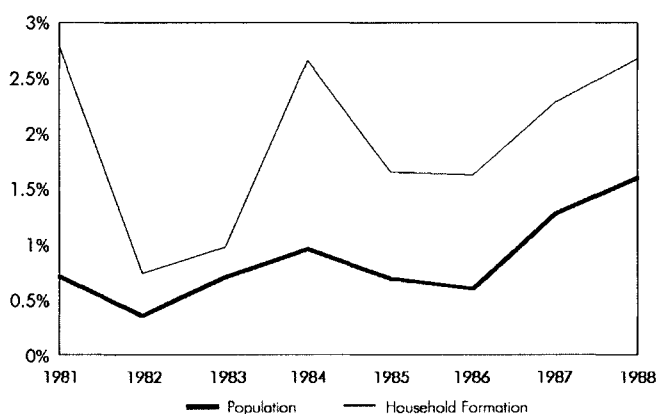
Reading this Histogram: Each horizontal bar represents the number of persons in a given age cohort. The series of figures illustrates the aging of the large baby-boom cohorts, and the growing number of Maine citizens over the age of 65.

Source: U.S. Census & State Planning Office

50% in 1979 to 57% by 1988.⁵ (See Figure 11.) The percentage of men age 16 and over with labor force earnings remained constant at about 77% during this period. Women's earnings, as a consequence, grew from 27% to 30% of the total earnings generated by the Maine economy. This increased share of just over 3% added more than \$480 million to personal income in Maine or about \$400 per resident.

Figure 10

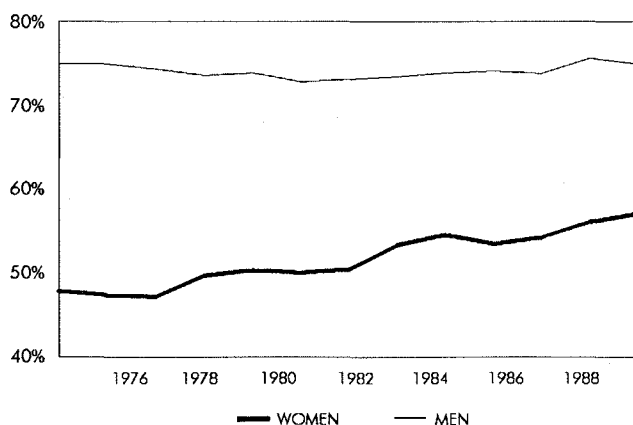
POPULATION AND HOUSEHOLD GROWTH
PERCENT CHANGE 1981-1988



Source: U.S. Census

Figure 11

LABOR FORCE PARTICIPATION IN MAINE
1976-1988



Source: Maine Dept. of Labor

SHAPING MAINE'S NEW ECONOMY: INDUSTRIAL RESTRUCTURING

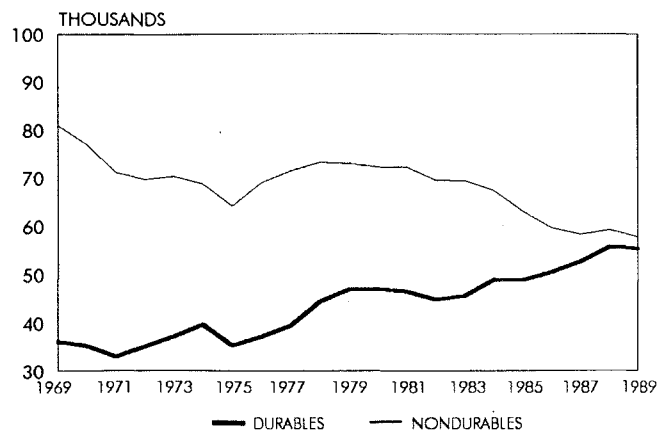
The economy that is carrying Maine into the 1990's is the culmination of a fundamental restructuring of the State's industrial base. This transformation has been characterized by the formation of new manufacturing industries, the revitalization of some of Maine's traditional industries, and the decline of others. At the same time, the State's service sectors have become increasingly important to Maine's vitality, growing in both size and diversity.

The resurgence of the New England economy, led by the high technology explosion, helped fuel the expansion of new manufacturing industries in Maine at a time when traditional sources of manufacturing strength were shrinking or maturing. Between 1979 and 1988, the metals, machinery and electronics industries added 8,500 jobs to the State employment base. At the same time Maine's natural resource and clothing industries, battered by a proliferation of low-cost foreign producers, slow-growing markets and several years of unfavorable exchange rates, lost 16,700 jobs. As shown in Figure 12, the result has been a convergence of employment in the durable and nondurable manufacturing sectors.

Just as the inter-industry mix of Maine's manufacturing sector was changing so, too, was the structure within industries. The competitive disadvantage created by high dollar values in world currency markets hastened a move by American businesses to eliminate uncompetitive operations. Maine firms across all sectors responded

Figure 12

MAINE MANUFACTURING EMPLOYMENT

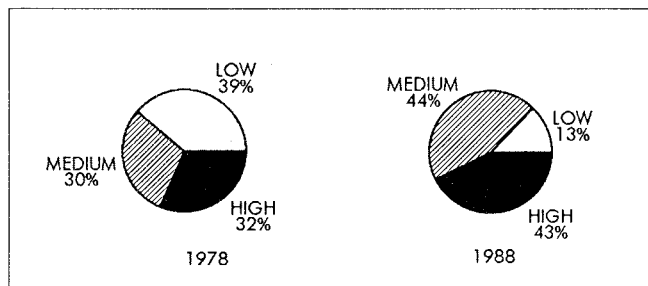


Source: U.S. Bureau of Economic Analysis

by moving away from low-value commodities and mature product markets and into newer product lines that offered stronger growth potential. In this process, industries shifted away from relatively simple processes toward more sophisticated production, adding more value to inputs and competing more on the basis of specialization and quality than on low labor and material costs. Many Maine firms unable or unwilling to shift their products and processes fell to the dual recessions of 1980/1982 and the prolonged dollar appreciation that followed. The most dramatic losses were in the footwear and food processing industries.

Figure 13

VALUE-ADDED LEVEL OF
MAINE MANUFACTURING INDUSTRIES

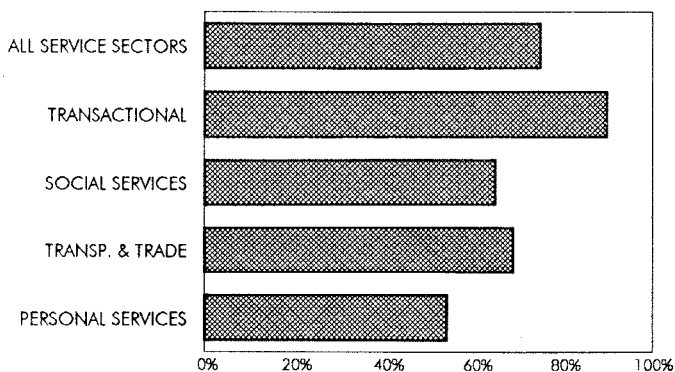


Low = <80% of U.S.
Medium = 80% to 100% of U.S.
High = >100% of U.S.

Source: U.S. Bureau of Economic Analysis & State Planning Office

Figure 14

MAINE SERVICE SECTORS
GROWTH IN REAL OUTPUT
1976-1988



Source: U.S. Bureau of Economic Analysis & State Planning Office

These combined dynamics resulted in a dramatic restructuring of Maine's manufacturing base. By 1988, the State's goods-producing sector, long dominated by mature natural resource and clothing-related industries, had shifted to a more balanced one including producers of electrical equipment and a diverse mix of non-electrical machinery firms. Product shifts within mature industries and the loss of the weakest segments of Maine's traditional industries created a more vibrant and competitive manufacturing sector, as witnessed by the dominance of higher levels of value-added per employee, a rough gauge of production sophistication, achieved by the late-1980's. (See Figure 13.)

Maine's nonmanufacturing industries have witnessed a similar, if less dramatic transformation. Maine's population, household and income growth drove significant expansion of the State's trade and service industries over the decade. At the same time, a gradual restructuring was underway that would move Maine's service-producing sector from a supplier of the basic essentials to an array of activities servicing businesses and consumers in Maine and beyond. In fact, Maine's most dynamic gains have been in industries providing services to business. As demonstrated in Figure 14, *transactional activities*, industries that deliver financial and information services to businesses, experienced a 90% increase in real net output between 1976 and 1988, the strongest performance of all service sector industries. In contrast, net output of the transportation and trade sector grew by only 69%, similar to the growth in private social service sector (health, education and social services), reflecting the growth in the general economy. As a result, the transactional activities sector increased its share of total service sector output from 35% in 1976 to 39% in 1988.

Some of the strength in this sector is attributable to the real estate industry which made up 43% of the value of transactional activities in 1986. Excluding the real estate industry, the transactional activities sector still saw a 61% growth in net output. Moreover, although 36% of the jobs in Maine's business and professional services industry is accounted for by relatively low-wage maintenance and security services and temporary personnel services, the more sophisticated management, advertising, computer and professional services now comprise 44% of the jobs in this industry, up from 38% in 1976.

FEATURES OF MAINE'S NEW ECONOMY: MORE INTERDEPENDENT

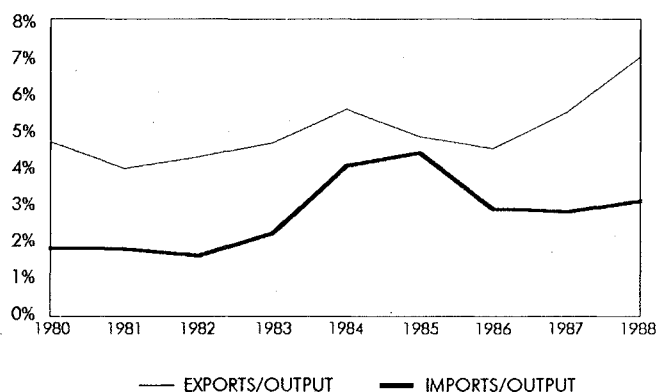
With its growth in size and diversity, Maine's economy has also become increasingly internationalized. This heightened interdependence is seen in the importation of materials by Maine firms, a broader Maine presence in international markets, foreign competition in manufacturing and in services and direct foreign investment in Maine.

Export activity by Maine industries grew gradually through much of the 1980's, interrupted during 1985 and 1986 by a prolonged period of unfavorable exchange rates. But by 1988, improving exchange rates and economic growth pushed the value of Maine exports more than 50% above 1980 levels, with leather products, electronic equipment, forest products, and nonelectric machinery representing the largest exporters. As a result, exports as a share of total output of Maine Manufacturers rose to 7% in 1988 from 5% in 1980, as shown in Figure 15.⁶

At the same time, the value of imported materials used by Maine producers increased by 145% during the 1980's, doubling the value of imports from 1.5% of output in 1983 to over 3% by 1988, as seen in Figure 15. While virtually all Maine goods-producing industries have increased the value of imported materials, the largest importers are food processing, leather products, electronic equipment, nonelectrical machinery and textiles. Consequently, the competitive position of these Maine industries is now more susceptible to changes in exchange rates.

Figure 15

FOREIGN TRADE PER DOLLAR OF OUTPUT
BY MAINE MANUFACTURING FIRMS



Source: Maine Bureau of Labor Standards

Just as Maine producers have moved into more overseas markets, so too have they become more vulnerable to competition from abroad. The loss of 8,700 Maine footwear jobs between 1982 and 1986 can be attributed largely to import penetration. Maine's textile and apparel industries have lost significant portions of their markets to overseas producers with access to increasingly sophisticated technology and very low-wage labor. In addition, American firms, themselves responding to stiffer international competition, are becoming stronger competitors with Maine industry. As a result, firms in Maine are confronted with both intensifying domestic competition as well as a growing number of aggressive foreign producers.

Although foreign trade in services is substantial in the U.S. (service exports were valued at \$53 billion in 1984 compared to \$55 billion in imports), trade is much less important to the services sector than the goods sector. Exports plus imports of services in 1984 equaled only 6% of final sales of U.S. service firms, while representing 30% of manufacturing sales (12% in exports, 18% in imports) in 1984. However, national trends do indicate an increasing trade in construction, business services, consulting and information services. In Maine this is evidenced by the presence of Japanese and French ownership of local construction firms. Similarly, Maine advertising and consulting firms have tapped European markets, not to mention the success of Maine catalog retailing overseas.

Foreign investment in Maine has grown as well during the decade. While an accurate accounting of the value of foreign investment in Maine is not available, there are indications that traditional Canadian and British investors in Maine have been joined by those from Japan, West Germany, France and the Netherlands. These investors are involved in a broadening array of Maine activities including bottling, paper production, retail trade, real estate, printing and publishing and metal working.

FEATURES OF MAINE'S NEW ECONOMY: MORE COMPETITIVE LABOR MARKET

Demographic changes are having a dramatic effect on the character of the labor force in Maine and across the United States. The result is a labor market that is strikingly different from that of the last 20 years. While the 1970's and 1980's were marked by an abundance of workers, with baby boomers and women swelling the ranks of the workforce, Maine employers are now begin-

ning to face a slower growing, more competitive labor market. This competition is being fueled by both supply and demand factors inherent in the make-up of Maine's new economy. Figure 16 displays some of the components of labor force change that are likely to occur over the next decade.

First, the number of new entrants into the labor force has slowed and will continue to grow more slowly than in the past. The baby boom generation, the source of much of the labor glut of the 1970's, has matured and has been followed by a generation of fewer numbers. As a result, the growth in the number of young working age population (ages 16 to 25) in Maine and across the United States has slowed appreciably in recent years and is expected to continue at a slowed pace. This slowdown in labor force growth is exacerbated by a slowing in the rate at which women are entering the work force. Women will continue to enter the labor force in greater numbers, but the enormous growth in their participation rate witnessed during the 1970's and 1980's (from 48% in 1976, to 57% in 1988) is expected to moderate considerably.

Second, the structure of a large segment of employment in Maine was shaped by the large labor surplus of the 1970's. Much of the unprecedented economic growth in Maine over the past decade occurred in an environment of readily available, low-wage labor. While low-

wage growth strategies in the manufacturing sector were tempered by foreign competition, the service sectors faced no such pressures. Rather than adopt labor saving efficiencies, many firms expanded production by simply adding employees and holding down labor costs by reducing benefits and weekly hours. The result was that 79% of the 171,000 new jobs created in Maine between 1979 and 1988 were in nonmanufacturing industries.

The combination of strong labor demand of a burgeoning economy and slowing supply is already creating a new labor market environment in Maine. Wage rates in Maine are beginning to be bid up. While still below the national average, wages in both manufacturing and non-manufacturing in Maine have risen by 5% and 6% per year, respectively, between 1984 and 1988. This is above the national rates of 4% for manufacturing and 5% for nonmanufacturing.

The tightening labor situation is somewhat less striking in Maine than other New England states, however. The labor force trends described above are tempered by a strengthening net in-migration of working adults. Moreover, while female participation rates have risen dramatically in Maine they remain below the New England average, indicating more opportunity for growth than neighboring states. Nonetheless, these factors provide merely a temporary buffer to allow Maine firms to respond to the inevitable shift to an ever more competitive labor market.

Figure 16

COMPONENTS OF ANNUAL
LABOR FORCE GROWTH
MAINE 1980-2000



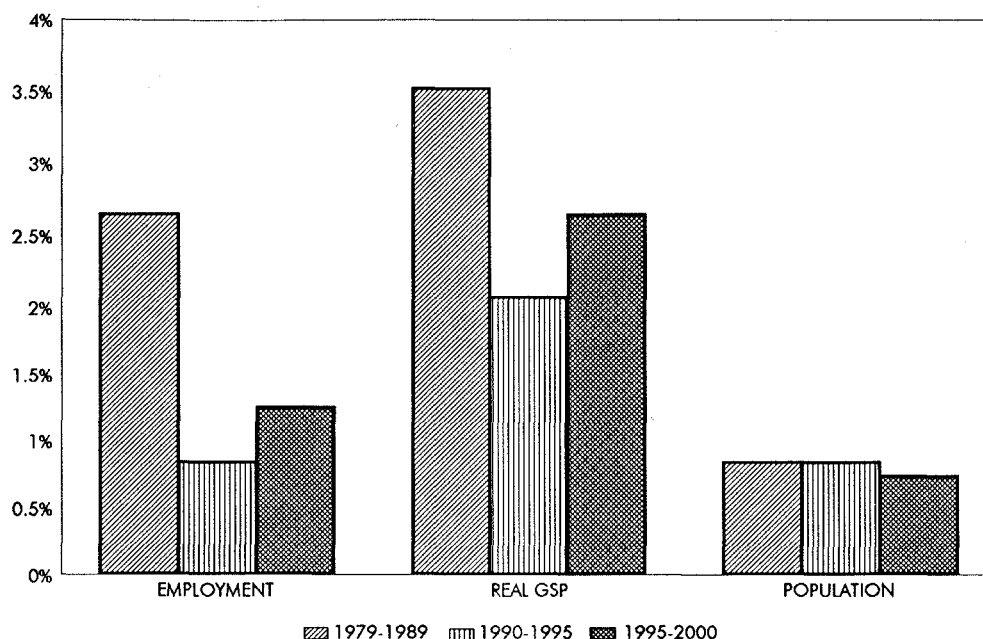
Source: Maine Dept. of Labor & State Planning Office

SUSTAINING MAINE'S NEW ECONOMY: THE LONG-TERM OUTLOOK

Overview

The long-term outlook suggests that the current level of activity represents a relative plateau for the Maine economy. While not maintaining the breakneck pace of growth witnessed over the last decade, neither will Maine's economy regress to pre-1980's levels. Instead, Maine will experience a more moderate pattern of growth, as illustrated in Figure 17. Over the next decade and into the year 2000, job growth is expected to slow to an average just over 1% per year between 1990 and 2000, down from the 2.6% annual growth experienced since 1979. During the same period, real gross state product (GSP, the value of all goods and services produced in Maine, corrected for inflation) is expected to increase by 2.4% per year, reflecting productivity gains anticipated for both manufacturing and services sectors.

Figure 17
MAINE ECONOMIC GROWTH 1990-2000
AVERAGE ANNUAL CHANGE



Source: State Planning Office

Maine's employment structure is expected to continue its shift toward the service-producing industries. These sectors are expected to make up fully 76% of all jobs in Maine by the year 2000. While significant, this represents a slowing from the trend toward nonmanufacturing witnessed during the 1980's when these sectors grew from 67% of employment in 1980 to 73% by 1989.

Maine's manufacturing base will provide a relatively stable level of employment and growing output. This apparent stability, however, belies a sector in constant flux. Workers and communities will continue to feel the effects of the inevitable rise and fall of firms and industries in response to competitive pressures, changing consumer tastes and technological advances. At the same time, Maine's manufacturing industries will continue to support income growth and provide a source of growing demand for Maine's developing service industries.

Total population in Maine is projected to reach 1.33 million people by the year 2000, a modest 9% increase over 1989's level. But it will be a significantly older population, with more people over 40 than under, and the number of Maine households will continue to increase at a faster rate than the population.

Manufacturing

Maine manufacturing employment is expected to be only 7% lower in the year 2000 than in 1989, an improvement over the trend of the last 10 years when manufacturing jobs declined by over 9%. This change is largely the result of a shift in Maine's industrial base from one dominated by mature commodity-type industries to a more diverse mix of modernized industries, as discussed above.

The bulk of Maine's new manufacturing employment will come from the nonelectrical machinery, electronic equipment and printing and publishing industries. Together these three industries are projected to add 2,900 jobs to the State economy, as shown in Figure 18. Stable employment in other major industries, notably in the forest products sectors, and a slowing in the decline of other non-durables producers will be of equal importance in steadying Maine's manufacturing base. But, continued restructuring in footwear, apparel and food products should result in reductions of 4,800 jobs in these sectors. Leather products (principally footwear) will account for 77% of these losses (See Figure 19). Despite a net loss of jobs, Maine's manufacturing output

will continue to add significantly to Gross State Product. In the year 2000, output of Maine's goods-producers will maintain the 31% share of private non-farm Gross State Product they enjoyed in 1988.

Maine manufacturing will also be affected by the inevitable realignment of U.S. national security priorities prompted by reductions in superpower tensions. The transportation equipment industry, dominated by Bath Iron Works, added 7,000 jobs to Maine's manufacturing base during the 1980's. Much of this increase was the result of the Reagan Administration naval build-up. At this writing it is unknown how reductions in Defense spending will affect the shipbuilding program at BIW. However, this forecast assumes that employment in Maine's transportation equipment industry will drop from over 14,000 recorded in 1989 to just over 9,000 by the year 2000.

Service-Producing Sectors

Maine's service-producing sectors will produce the vast majority of new jobs in Maine between 1990 and 2000, as they have over the last 30 years. Growing at nearly 1.5% per year, these sectors, including construction, trade, services and government, are expected to employ over 580,000 people in Maine by the year 2000. Wholesale and retail trade will add the greatest number of jobs at 19,700. Rapid growth in business, professional and health services will add close to 36,000 jobs to the Maine economy by 2000, 38% above 1989 levels.

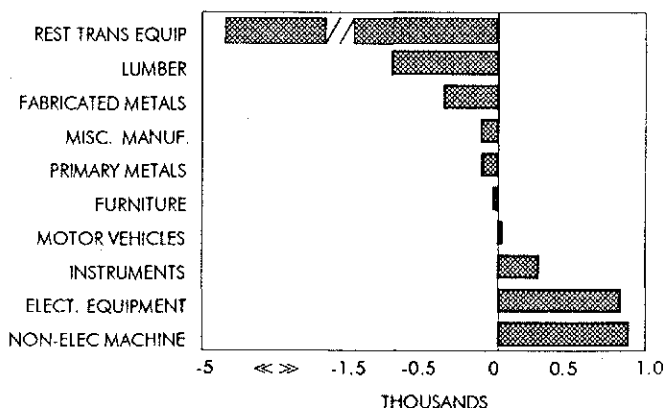
The employment performance projected for service-producing industries in Maine represents a considerable slowing of past growth trends in these sectors. Job growth in service-producing industries is expected to slow to a rate of 1.5% per year, to the year 2000—less than half of the 3.6% seen between 1980 and 1989. Even the strong performance forecasted for business and professional service employment represents a slowing in annual growth to 4% from the 8.2% enjoyed since 1980. Figures 20a to 20d display the job growth anticipated for Maine's service-producing industries.

Change is the dominant feature of any economy and Maine has gone through many stages of development in this Century. It is perhaps the sheer pace of the changes wrought over the last decade that has made them especially portentous.

The economy that carries Maine into the 21st Century will be less remarkable for dramatic growth than for sustaining a higher level of economic activity. But even this forecast of moderate growth assumes that Maine's citizens and industry are able to respond adequately to the many factors shaping the emerging economic environment. It rests on the assumption that a labor force with appropriate skills will be available to fill the jobs created over the next 10 years. It depends greatly upon the adept stewarding of the State's public infrastructure, and upon the ability of Maine industry to take the steps necessary to prosper in the evolving world marketplace.

Figure 18

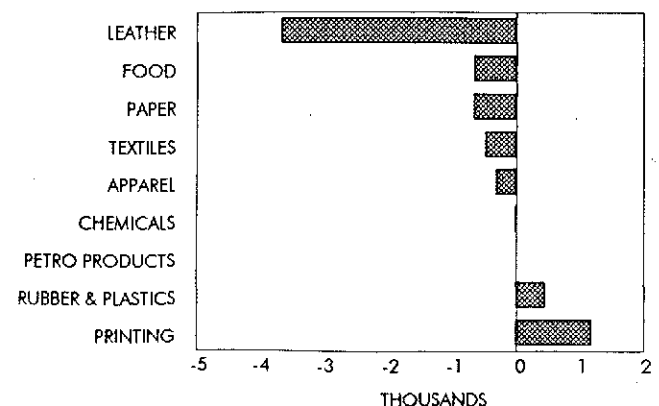
PROJECTED NET JOB CHANGE 1990-2000
DURABLE GOODS



Source: State Planning Office

Figure 19

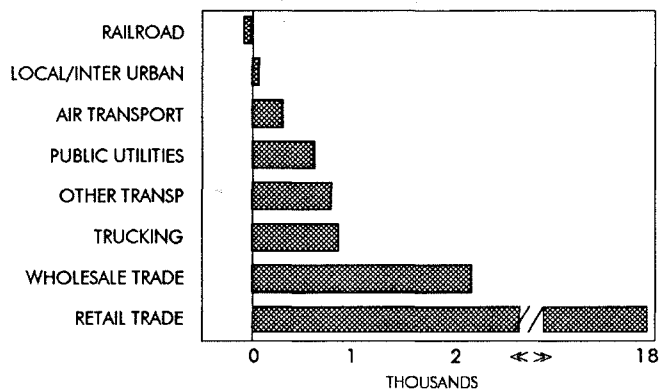
PROJECTED NET JOB CHANGE 1990-2000
NONDURABLE GOODS



Source: State Planning Office

Figure 20a

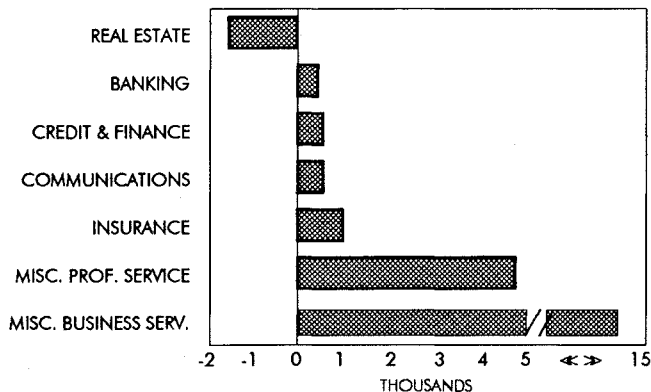
PROJECTED NET JOB CHANGE 1990-2000
TRANSPORT & TRADE



Source: State Planning Office

Figure 20b

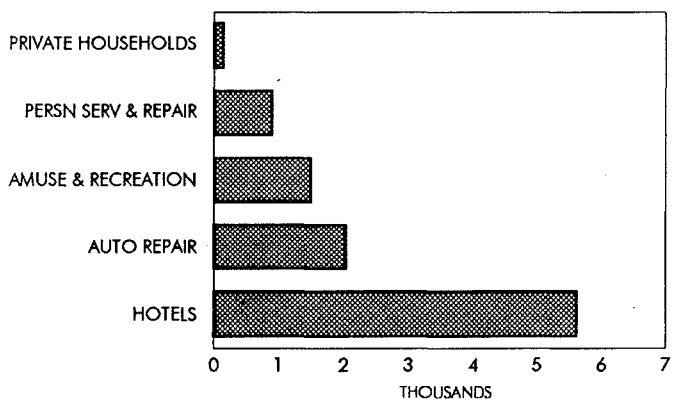
PROJECTED NET JOB CHANGE 1990-2000
TRANSACTIONAL ACTIVITIES



Source: State Planning Office

Figure 20c

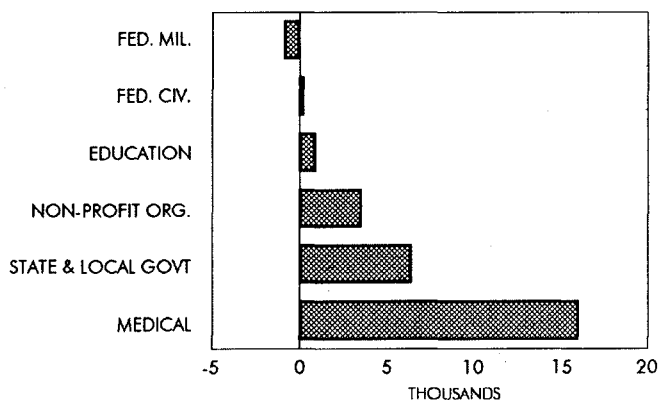
PROJECTED NET JOB CHANGE 1990-2000
PERSONAL SERVICES



Source: State Planning Office

Figure 20d

PROJECTED NET JOB CHANGE 1990-2000
SOCIAL SERVICES



Source: State Planning Office

Chapter 3

THE PRODUCTIVITY IMPERATIVE

The productivity level achieved in a particular industry or in the economy as a whole depends on the skill, health, and motivation of its work force; on the quality of the materials they have to work with; on the speed, precision, and capacity of capital equipment with which they work; and on the technological level of the production process itself.

MIT Commission on Industrial Productivity

The extraordinary economic growth enjoyed by Maine and the U.S. over the last decade owed much to the rapid expansion of demand for goods and services. In fact, the 1980's have witnessed a classic demand-driven expansion. A surge of spending by consumers and government has fueled a swelling of production and employment across the United States. The added earnings generated by more employed people fed further spending. Businesses in the U.S. and abroad, struggling to keep pace with rising consumer and government demand, invested in new plant and equipment fueling yet further growth. Wages per worker barely kept pace with inflation through much the decade, but with more people working and a rise in the number of multi-income families, both total and household incomes rose sharply.

Maine has reached a new level of economic vitality on the force of surging socio-economic tides. But the tides that carried Maine to its new economic status have largely crested. The demographic surge that fueled rapid household formation, consumer spending and rapid job growth in the last decade will moderate over the next. Labor force availability will further limit employment growth. Federal government spending is already being moderated by an unsustainable budget deficit and an easing of world tensions, and U.S. economic growth in

general is expected to moderate over the next ten years.⁷ Sustaining Maine's present level of prosperity will clearly require a new source of vigor. Productivity, the level of effort expended to yield a given amount of product, will be the engine of growth in the nineties.

More than ever before, the vitality of the State's economy will rest on the ability of Maine's businesses to address the productivity imperative: the need to produce goods and services ever more efficiently and of continuously increasing quality. Intensifying trade pressures, technological advance and irreversible labor force dynamics are changing the context of competition. The degree to which Maine industries respond will govern their levels of employment, the earnings of their workers, the profits of their owners and the position of the Maine economy in national and international markets; in short, the health of the economy itself.

PRODUCTIVITY, PROSPERITY AND THE NEW MAINE ECONOMY

Economic growth occurs through essentially two dynamics—increasing demand, as occurred during the eighties, and improving productivity. Demand-driven expansion comes from outside the production system. It originates in the desire of consumers for more goods and

services. The symbiotic effect of rising demand and production produces increasing earnings and investment income which can fuel yet more demand and more production. It can also be accompanied by rising household and business debt, a lower rate of savings, and an increasing dependence on foreign capital, as has occurred during the eighties.

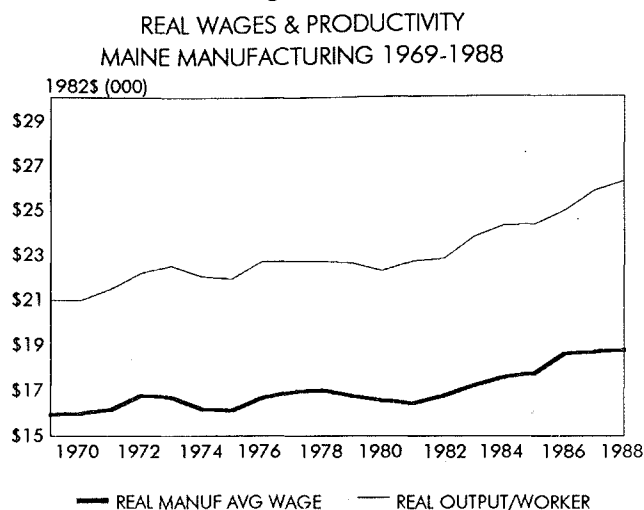
Productivity-derived growth, on the other hand, comes from within the production system. It is the result of changes in processes and products, discarding old ways and adopting new ones. Raising productivity, through changes in methods, products, organizational structure and technologies, allows a firm to raise the value of its output without adding to labor or material costs, and thereby to improve its competitive position. Once portrayed as a process of "creative destruction", innovation in products and processes is the "fundamental impulse that sets and keeps the capitalist engine in motion."⁸

Improvements in productivity, measured here as the value of output per worker, offer firms great flexibility in their response to changing market conditions. They allow firms to produce more product, generating added revenues while holding constant the cost of production. These revenues can then be shared among increasing owners' incomes, investing in new equipment, and raising the wages of workers, this last point illustrated quite clearly in Figure 21. Productivity gains also allow firms the option of holding production levels steady and reducing costs. Through this cost reduction effect, productivity growth allows firms to maintain competitive prices that generate demand for their products and fuel further growth.

The benefits of each single improvement in productivity are transient, however. While high levels of output per worker reflect an efficient and productive economy, sustaining long-term economic growth requires *constant improvements in productivity*. Liquidating inefficient factories and laying off workers, for example, create higher levels of output per worker, but only temporarily. The benefits of such one-time gains are gradually undermined by intensifying competition and inevitable increases in labor and other production costs. Long-term economic growth, in the face of rising costs and intensifying competition, demands that productivity must not only be high but it must be steadily increasing.

Sustained productivity growth, then, has always been important to improving the standard of living in Maine by supporting growth in the wages of workers and the income and investment capacity of business owners; by

Figure 21



Source: U.S. Bureau of Economic Analysis

holding down the prices paid by Maine consumers for products and services; and by bolstering the position of Maine industries in regional, national and international markets. In the evolving context of the new Maine economy, productivity is of greater consequence than ever before. It is the rapid evolution of the economic milieu that drives the productivity imperative.

INTERNATIONALIZATION OF COMMERCE AND TECHNOLOGY

Maine's growing vulnerability to international competition is sharpening the importance of achieving high levels of productivity growth. A growing number of countries have developed the capacity to compete very effectively with American firms both in the U.S. and third-country markets. The International Trade Administration estimates that about 70% of U.S. manufacturing output now faces direct foreign competition.⁹

In Maine, this competition has been felt most intensely at the commodity level of product markets in lumber, paper, footwear, apparel and textiles.¹⁰ Less-developed countries have taken advantage of increasingly mobile technology and exceptionally low wage rates to displace Maine-made products in less sophisticated markets. The adoption of new production technology is now facilitating the entrance of foreign firms into "higher-end" markets such as industrial textiles, production machinery, and higher quality footwear and apparel, while allowing them to maintain labor and other cost advantages.

Moreover, Maine industries, traditionally insulated from external competition, will see protective barriers dissolve. *The Maine Economy: A Forecast to 1995* noted that advances in communications, transportation and production technologies are eroding geographic barriers historically faced by Maine producers of goods and services.¹¹ But just as technology opens new markets to Maine firms, so too will it open Maine markets, and markets traditionally the purview of Maine firms, to competitors. Maine industries such as food processing, printing and publishing, wholesale trade and transportation, business and professional services, already face a growing level of competition from firms across New England. Advances in information and transportation technology will increasingly place their consumer and business markets within reach of competitors from throughout the United States and across the globe.

MAINE'S MORE COMPETITIVE LABOR MARKET

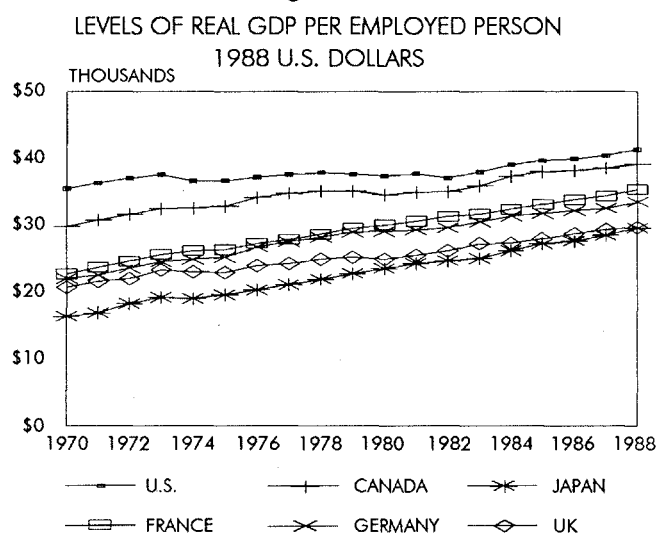
Even absent external competition, the slowdown in Maine's labor force growth is rendering the labor-intensive practices of many service sector industries obsolete. The increasingly competitive labor market facing Maine businesses has already manifest itself in accelerating wage rates across the spectrum of service industries, from retail trade to health services, as firms vie for increasingly scarce workers. Average wages in Maine nonmanufacturing industries saw an increase of 2.8% a year in real terms between 1986 and 1988, compared to an annual average of only 1.2% in the preceding three years. In contrast, U.S. nonmanufacturing wages grew by only 2% per year between 1986 and 1988. Without sustained productivity growth, these firms will have to raise the prices of their products in order to attract workers.

The cost pressures of Maine's more competitive labor market are placing an added burden on the "tradable" components of Maine's industrial base (those sectors operating in the international market place). Wage rate increases attributable to more intense labor competition are being magnified by the accelerating cost of traditional employee benefits and the rising cost of business-related services. The dramatic rise in health care costs, for example, is attributable, in part, to labor costs driven upward by the scarcity of trained health care workers. Sustained productivity, thus, becomes doubly important to Maine firms facing both intensifying competition and the cost effects of a shrinking pool of labor.

MAINE'S PRODUCTIVE PERFORMANCE

The U.S. continues to lead the world in productivity, producing more per worker than any other nation, as evidenced in Figure 22. But, as shown in Figure 23, the rate of growth in U.S. productivity still trails most other industrial countries, despite recent improvements. This has contributed to a declining standard of living, relative to other industrial countries, and a weakened competitive position of many U.S. industries in international markets.

Figure 22



Source: U.S. Bureau of Labor Statistics

Figure 23



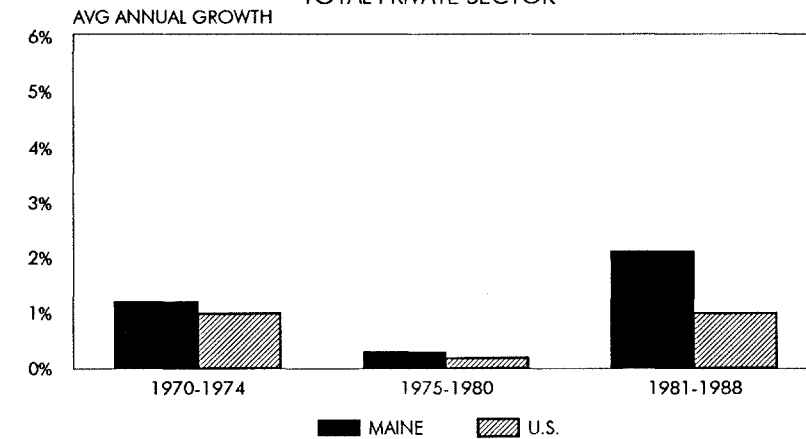
Source: U.S. Bureau of Labor Statistics

Numerous analyses of America's competitiveness have identified a disturbing slowdown in the pace of U.S. productivity growth that began in the mid-1970's. The cause of this slowdown remains a source of debate today. Among the suspects are the oil shocks of the 1970's, U.S. adoption of stringent environmental regulations and the surge of young and inexperienced workers into the labor force. While the 1980's have witnessed a resurgence in the productive performance of American industry, productivity levels have not yet returned to pre-1970 levels.

Maine's productive performance, when compared to the national economy, shows signs of improvement from the slowdown of the mid-seventies.¹² While the level of

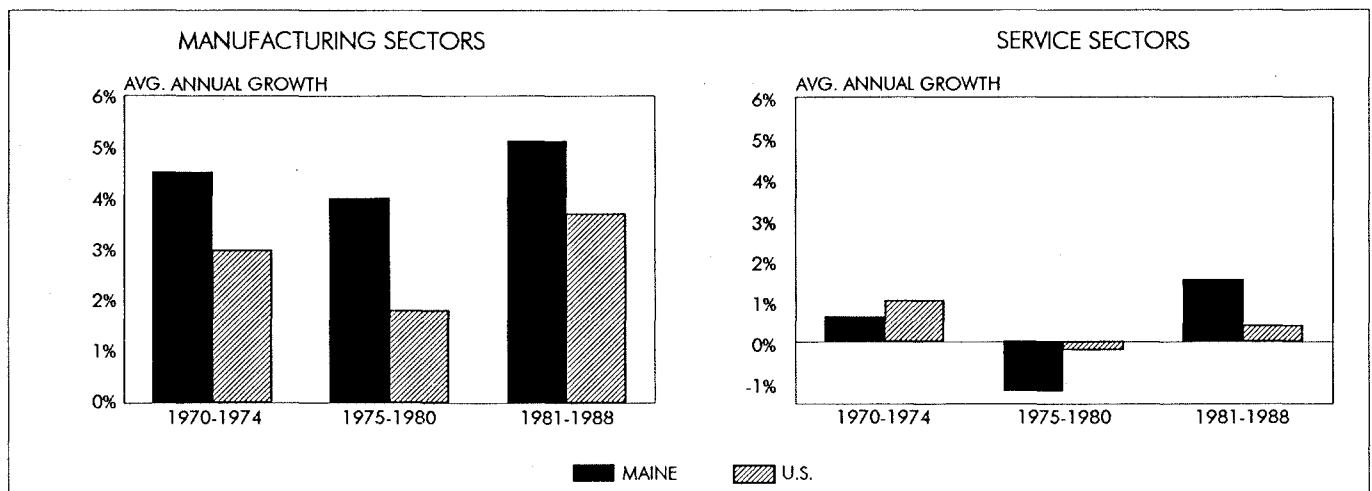
productivity—output per worker—remains well below the U.S. average, reflecting both lower wages and less sophisticated production in Maine,¹³ growth in productivity in Maine has remained markedly higher throughout the period (see Figure 24). Especially notable is Maine's robust rebound from the mid-seventies productivity slowdown, achieving an average 2.1% real annual growth between 1981 and 1988, in comparison to only 1% for the nation as a whole. In fact, the Maine economy has achieved productivity rates equal to or higher than most major developed nations except Japan during the 1981-1988 period.

Figure 24
PRODUCTIVITY GROWTH
TOTAL PRIVATE SECTOR



Source: U.S. Bureau of Economic Analysis & State Planning Office

Figure 25
AVERAGE ANNUAL PRODUCTIVITY GROWTH



Source: U.S. Bureau of Economic Analysis & State Planning Office

The productivity record of Maine and the larger U.S. economy varies among sectors. Closer analysis of the productive performance of individual industries reveals that the service-producing sectors are the principle source of the poor productivity record in both Maine and the U.S. As shown in Figure 25, the manufacturing sector has surpassed pre-slump productivity rates while the productivity of the service sectors have remained weak. The more capital-intensive service industries have achieved significant productivity gains but on the whole, the productivity of the service sector has been poor, registering low or declining rates since the late 1970's.¹⁴

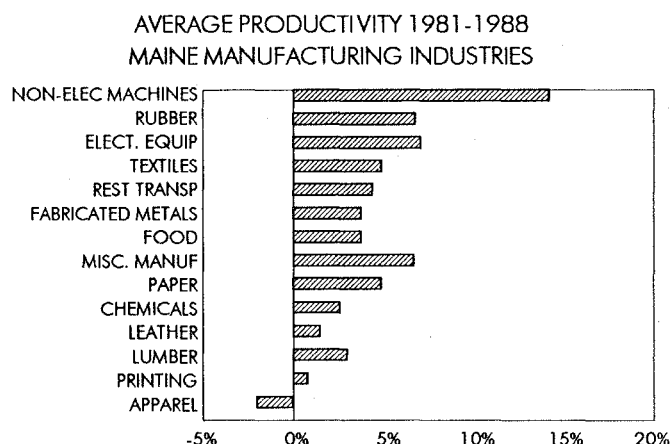
PRODUCTIVITY OF MAINE MANUFACTURING INDUSTRIES

The recent productivity record of the manufacturing sector offers a source of encouragement for the competitive positions of both the Maine and U.S. economies. Maine goods-producing industries, like those nationally, have improved in productivity growth during the 1980's from the slow-down of the 1970's. In fact, since the late seventies, Maine manufacturers have generally matched or bettered their national industry counterparts in real output per employee. This productivity performance has supported a steady climb up the value-added ladder for many Maine industries and a gradual improvement in real wage rates, as noted earlier and illustrated in Figure 21.

Maine manufacturing's productivity strength has come largely from the durable goods producers, in particular non-electrical machinery and the electronic equipment industries which recorded average real annual productivity gains of 14.2% and 7.1% respectively between 1981 and 1988. Rebounding from the 1982 recession more strongly than their national counterparts, these Maine industries have raised their value-added per worker to 72% of the U.S. average, from only 58% in 1969. Other durable goods producers, however, like the lumber and wood products industry, have only slightly outperformed the national industry since the late 1970's, but have exhibited steadily improving productivity through the 1980's.

The nondurables sector in both Maine and the U.S. have begun to regain the pace of productivity growth witnessed in the early 1970's, with Maine's nondurables sector displaying the stronger productivity record. Among the better performers in this sector, Maine's rubber and plastics industries have lessened their dependence on the nation's faltering footwear industry by shifting to a

Figure 26



Source: U.S. Bureau of Economic Analysis & State Planning Office

broader array of products. Similarly, the textile industry in Maine has boosted productivity and shifted from low-end commodities to a more diverse mix of new and higher-value products, such as industrial textiles, office space dividers and space vehicle heat shields, and Maine's paper industry has benefited from substantial investment in new capital. Figure 26 displays the recent productivity growth of Maine's manufacturing industries.

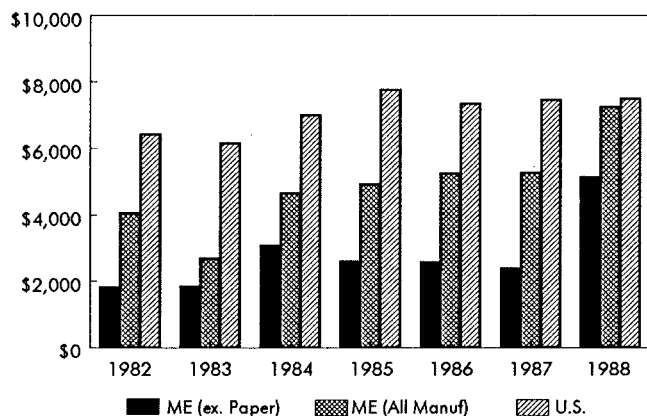
Disturbing signs exist regarding the long-term "productive edge" of Maine's manufacturing sector. Part of Maine's stronger productivity gains relative to U.S. manufacturing may be attributable to an historically less developed productive capacity. Output per worker produced by Maine manufacturing was 35% below the U.S. average in 1969. Stronger productivity gains would be expected as Maine industries "catch up" with the national average. In addition, some of the recent gains are the result of one-time actions like the closing of uncompetitive plants with concomitant work force reductions. This may explain some of the productivity growth in Maine's lumber, textiles and food processing industries which have eliminated significant capacity over the last decade. Achieving additional gains will be more difficult as opportunities for further consolidation diminish and as Maine productivity levels approach the national average.

Perhaps most troubling, Maine manufacturing industries have invested in new plant and equipment at rates far below the national average, as evidenced in Figure 27. Notwithstanding the importance of human capital, much of the technological progress driving productivity growth results directly from the use of new capital equipment.

Thus, the pace of capital investment is a critical determinant of an industry's rate of productivity growth. Maine industries have managed to outperform their national counterparts recently despite lower per-employee capital expenditures. However, these lower investment rates call into question the ability of Maine manufacturers to sustain competitive productivity gains into the future.

Figure 27

REAL CAPITAL INVESTMENT PER WORKER
MANUFACTURING (1982\$)



Source: Maine Bureau of Labor Standards

Maine's investment pattern relative to the U.S. is particularly distressing given that capital investment by U.S. producers has lagged behind that of other industrial countries, averaging 17% of GNP between 1975 and 1987 while investment in the other industrialized countries averaged 22% of their GNP.¹⁵

PRODUCTIVITY OF MAINE SERVICE-PRODUCING INDUSTRIES

Most analyses of America's industrial base focus exclusively on the manufacturing sector. This is principally an artifact of an historic bias of economists toward manufacturing. Adam Smith and Karl Marx both dispose of the service sector as little more than parasites leeching off the income generated by "productive" goods-producing activities, a sentiment reflected today in such derogatory phrases as "doing each others' laundry."

In fact, nearly 75% of Maine and U.S. employment is supported by the service-producing sector. Further, many tangible goods, such as airplanes, telecommunica-

tions and broadcasting equipment have no value in the absence of service industries that use them. Finally, services are crucial to generating demand for manufactured products:

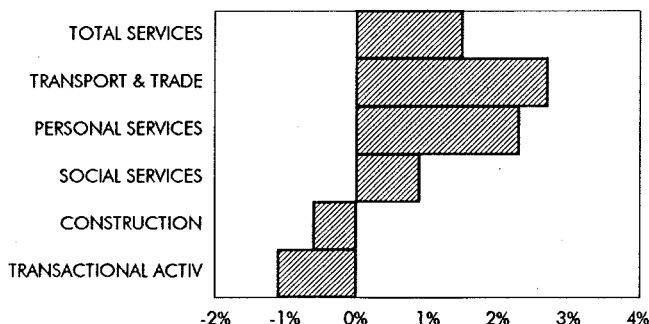
An automobile's value can be determined by the value of its inputs. But its real value is nil if its only purpose is to be lined up in the thousands on factory floors. Without advertising, transport, credit, and maintenance services used to market the carcasses of metal, they will remain objects without utility.¹⁶

Furthermore, the service content of most tangible goods is significant. One recent study estimates that private service industries supplied 17 cents of inputs to each dollar of U.S. manufacturing output.¹⁷ Certainly, manufacturing productivity relies in no small measure, on the cost and quality of services that are an integral part of production processes. Thus, slumping productivity in service industries will have deleterious consequences for the wages rates of their employees, the productivity of firms they service and the cost of living and of doing business in Maine and across the U.S.

The historic bias against services has created a scarcity of information on service sector industries. While federal and state governments compile numerous statistical series gauging structure and change in manufacturing, similar data simply does not exist for services. One result has been an inordinate amount of confusion in measuring productivity in the service sectors. Claims of some analysts to the contrary, it is no more difficult to

Figure 28

AVERAGE ANNUAL PRODUCTIVITY 1981-1988
MAINE SERVICE SECTORS



Source: U.S. Bureau of Economic Analysis & State Planning Office

estimate services outputs than manufactured goods.¹⁸ The industry value-added estimates produced by the U.S. Bureau of Economic analysis allow at least a cursory analysis of the productivity of Maine's service sectors. However, the historical inattention to this sector argues for caution when interpreting productivity data.

The importance of the service sectors makes more alarming their apparent poor productivity performance as shown in Figure 28. Of particular concern, Maine's production-related services have largely followed the national trend of weak or even declining productivity since the mid-1970's. These **transactional activities**, including communications, finance, business, professional and legal services, have all exhibited a long-term steady decline in value-added per employee in Maine and the U.S.¹⁹

The experience of the **transportation and trade sector** has been only modestly more sanguine. This sector, comprised of wholesale and retail trade, transportation services and public utilities, represent much of the overhead of industry activities throughout the economy. As a group, this sector has registered slight improvements in productivity during the eighties. Both transportation services and utilities have seen little recovery from their sharp declines of the mid-1970's, however. These sectors were among the most severely affected by the oil price shocks of the 1970's.²⁰

The trade industries have exhibited some improvement from mid-1970-early 1980's lows. Wholesale trade has seen considerable productivity gains, owing to the more capital-intensive nature of warehousing and related activities. Retail sectors have achieved more hesitant improvements. However, while showing weak productivity performance, Maine's transportation and trade sector has tracked the national sector closely, somewhat diminishing the competitive damage done to the Maine firms they support.

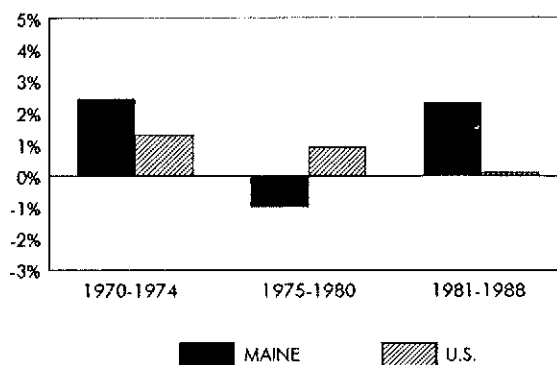
Personal services, the industries serving a variety of general personal needs, have met the same fate as most of the service sectors, as shown in Figure 29. The uniquely personal interaction required of these activities, including beauticians, barbers, miscellaneous repairs, amusements, hotel and lodging, and private household services, make them inherently more resistant to technological labor-saving fixes.

Private household services present an interesting exception. The advent of labor-saving devices and the increasing cost of hired household help threatened the very viability of this industry. More recently, however,

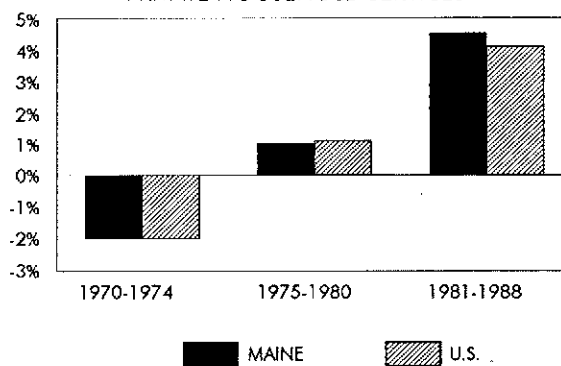
Figure 29

AVERAGE ANNUAL PRODUCTIVITY GROWTH

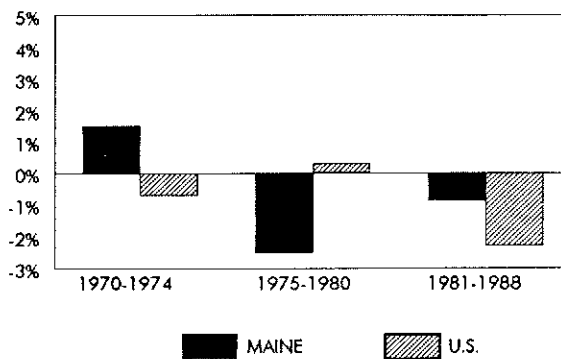
PERSONAL SERVICES SECTOR



PRIVATE HOUSEHOLD SERVICES



HOTELS & LODGING



Source: U.S. Bureau of Economic Analysis & State Planning Office

expanding incomes and the growing number of two-earner and single-parent households have refueled the demand for household services. Armed with the technology that nearly eradicated them, private household services have been able to log hefty productivity gains in recent years, as Figure 29 illustrates.

In an important trend for tourism in Maine, the hotel and lodging industry has witnessed a dramatic drop in productivity since the 1970's (see Figure 29). Like many in the personal services sector, the hotel and lodging industry has been particularly immune to significant efficiencies. However, this industry, more than any in Maine, has felt most keenly the effects of an increasingly competitive labor market. As labor force pressures are unlikely to abate soon, this industry must make greater efforts to rationalize operations or watch the cost of this pivotal part of Maine's tourism activity escalate dramatically.

Social services, including health, social, education services and government, represent a unique sector. The role of government in financing and providing public goods presents very different dynamics than those governing the private sector and special problems in measuring productivity in a meaningful way. The importance of providing quality public service at low cost for enhancing business productivity and the general quality of life is clear. However, measuring the value of these services, which are not purchased in the open market, is problematic to say the least.

The productivity of health services, of all the industries in the social services sector, has perhaps the most widespread impact on Maine's economy. Failure to achieve productivity gains in the provision of health services has contributed to deepening the cost burden for both Maine businesses and households. The unique

payment structure of health services in the U.S., the third-party-payer system, has had a significant influence on the productivity record of health services. According to the Office of Technology Assessment, the retrospective payment system, which long dominated health insurance practice, "encouraged procedures that exceeded any reasonable estimate of benefit, and in some cases may actually have encouraged practices that entail more risk than benefit. These procedures continue even under the current payment system."²¹

The result has been anemic productivity gains by health services throughout the 1970's and into the 1980's. Recent efforts to contain health costs seem to be yielding some improvement in health service productivity.

The industrial structure of Maine's economy has come to more closely resemble its national counterpart. For the manufacturing sector this has involved achieving higher levels of value-added per worker, increased wage rates and strong productivity growth. Tempering these gains are concerns that this sector has not made sufficient investments in its productive capacity and hence that current manufacturing productivity strength may not be sustainable over the long term.

The productivity imperative is just as urgent for Maine service industries as it is for manufacturing. The apparent poor record to date of most industries in this sector suggests that many service industries face a much greater challenge in improving their productive performance. However, the fate of the people they employ, the productivity of the businesses they serve and the cost of living in Maine will all be affected by the success of Maine's service sectors in meeting the challenge.

Chapter 4

MEETING THE PRODUCTIVITY IMPERATIVE

If all Americans—in labor and management, who make steel or cars or shoes or textiles—made their products with as much energy and confidence as [Bruce] Springsteen and his merry band make music, there would be no need for Congress to be thinking about protectionism. No “domestic content” legislation is needed in the music industry. The British and other invasions have been met and matched.

George Will

For most of the Twentieth Century, industry's approach to long-term productivity growth has focused on developing increasingly specialized equipment to supplant the skills of workers. But the incessant flux in market conditions that characterizes the new economic environment is driving dramatic changes in this formula. A new mode of operation is emerging that is setting the standard for production in the global economy well into the 21st Century.

This new production mode is imposing demands upon workers and managers that are qualitatively different from those made by the former work regime. Indeed, it is dictating an elemental change in the philosophy of production of goods and services in America, and the transformation of public institutions designed to serve a now outdated paradigm. To meet the productivity imperative today, Maine's private and public sectors must recognize and adapt to the fundamental changes occurring in the work regime.

THE EMERGING WORK REGIME OF THE GLOBAL ECONOMY

The common mode of production during most of the Twentieth Century has been the mass production of standardized goods. This was the means by which most

of America's vast land, capital and labor resources were mobilized most efficiently to serve burgeoning U.S. and world markets.²² Firms benefitted from economies of scale by focusing all of their equipment and workers on the production of identical copies of a single product.

Emerging from the “scientific management principles” advanced by Frederick W. Taylor, mass production dictated that all work on the shop floor be planned and laid out by a centralized managing unit. It was in offices far from the shop floor that decisions were made regarding how discrete tasks could be most efficiently combined and assigned to individual workers and machines. The automobile assembly line, with its long runs of standardized products, fragmented tasks performed by highly specialized equipment and narrowly trained workers, was the quintessential prototype of mass production.²³ It was a successful system for the times and was widely imitated throughout the industrial world.

By the 1980's, however, the demand for many mass produced goods is on the wane. Rising incomes, increasing competition and technological advances have undermined the stable markets for many standardized goods which were the basis for mass production. Increasingly sophisticated consumers and diverse cultural preferences are making it impossible for firms selling in a global

market to produce standard products which appeal to buyers everywhere in the world. New micro-chip technology has fostered fragmentation of markets by permitting the low cost production of heterogeneous products in small batches and, hence, by its very existence stimulated the demand for differentiated goods. By saturating the market for standardized goods the very success of mass production may have contributed to its own demise.²⁴

Whatever the causes, the virtues of long production runs of standardized products are diminishing and firms can no longer afford to dedicate their equipment and work forces to the production of a single item. Mass production is being displaced by a more flexible mode of production which allows an enterprise to produce an array of products with the same machinery and workers, switching product lines or attributes as dictated by consumer tastes or production costs.

The emerging flexible mode of production organizes work on principles in sharp opposition to those of traditional mass production. Flexible production requires that every machine and worker be capable of performing many diverse tasks and of moving rapidly from one repertoire to another. Changing procedures employed in the automobile industry highlight the contrasts between the old and new systems.

Before beginning production of a new model car, the dies which stamp body panels must be changed. In the mass production system, this task is performed by a team of specialists, who shut down the line for eight hours while they change every die on the line. Similarly, equipment maintenance is performed by specialized laborers. In the new system, however, every stamping machine operator changes his or her own dies, and operators maintain their own machines.²⁵ This reduces the time and effort required to change model specifications. Toyota customers, for example, are allowed to change the specifications for their cars up to four days before production, while a single Nissan assembly line produced 106,000 different versions of three cars in one year.²⁶

"Just-In-Time" (JIT) inventory control, a frequent feature of flexible production, provides another example of how changes in technology are meshed with adjustments in work routines. JIT inventory management is designed to more closely match the volume of output to demand. When successful, a JIT system allows a firm to change its product instantaneously in response to the changing composition of orders without having to work

off large inventories. This approach forces much closer communication and coordination among separate work stations and departments and between insiders and vendors. Moreover, since JIT systems cannot tolerate high defect rates, line-workers, rather than a detached central office, take on greater responsibility for quality control.²⁷

PRODUCTIVITY IN THE NEW WORK REGIME

The ground breaking work of Nobel laureate Robert Solow demonstrated the importance of new technology in sustaining productivity growth.²⁸ Technological progress, not merely capital intensity, was the principle source of improved productivity. For years, technology-driven productivity growth has been sought through efforts to introduce "smarter", more specialized machines that limited the participation of workers. While this formula seemed to fit the requirements of mass production and reduced labor costs, it neglected the importance of workers in productivity growth.²⁹ Moreover, it is ultimately failing to provide the flexibility demanded by constantly changing market conditions.

The emerging work regime is designed around a broader interpretation of technological progress. It is based on a recognition that sustaining growth in productivity depends not only upon smarter equipment, but also upon smarter workers and new relationships among workers, managers and their machines. The efficiencies gained from computer-controlled and integrated equipment, for example, are being magnified by operators capable of reprogramming the equipment to make new or modified products. Advanced telecommunication networks between retailers and producers are keeping the shop floor in constant contact with markets and consumers. And participation by knowledgeable workers in searching out and implementing cost savings has spawned innovative and effective alternatives to plant relocations to low-wage regions.

To date, successes among Maine and U.S. industry to capture the gains offered by melding new technologies and broader worker skills are more the exception than the rule, however. This deficiency is, in part, the result of complacency by many American and Maine firms in adequately tending to the health of their physical and human capital. More importantly, firms seem reluctant to abandon production and management techniques with which they have become comfortable despite their growing obsolescence.³⁰

INVESTMENT IN PHYSICAL CAPITAL

Private Sector: New Plant and Equipment

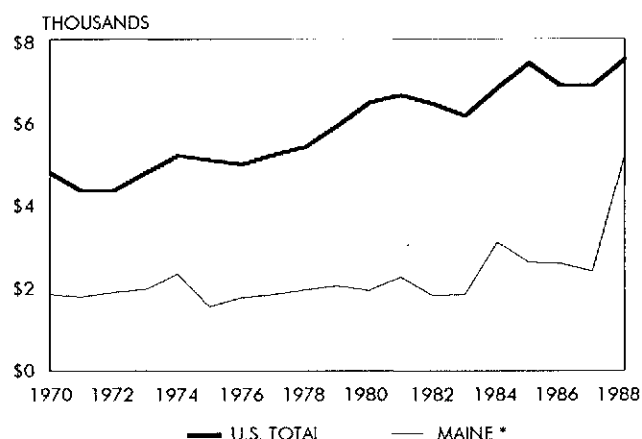
America's current economic expansion has fueled a steady growth in capital investment by American industry. This trend is particularly pronounced in manufacturing sectors which raised average real per-worker investments 17% since the 1980-1982 recessions. Per worker investment gains were strongest in the electrical and electronic equipment and machinery industries which raised per-worker capital investments during the 1980's more than 60% above levels achieved during the 1970's.

In comparison, Maine manufacturing firms present a more mixed record in investment trends.³¹ Per-worker equipment expenditures by Maine's goods-producing sector have roughly followed the U.S. growth trend but at levels far below the national rate, as shown in Figure 30.³²

Some Maine industries, notably pulp and paper, textiles, and electrical and electronic equipment, have equalled or bettered the per-worker investment record of their national counterparts during the 1980's. But most others, in particular Maine's food processing, fabricated metals, and leather products industries have displayed flat or declining per-worker investments since the mid-1970's.

Figure 30

MANUFACTURING INVESTMENT PER WORKER
NEW PLANT & EQUIPMENT (1982\$)



Source: Maine Bureau of Labor Standards & U.S. Bureau of Economic Analysis

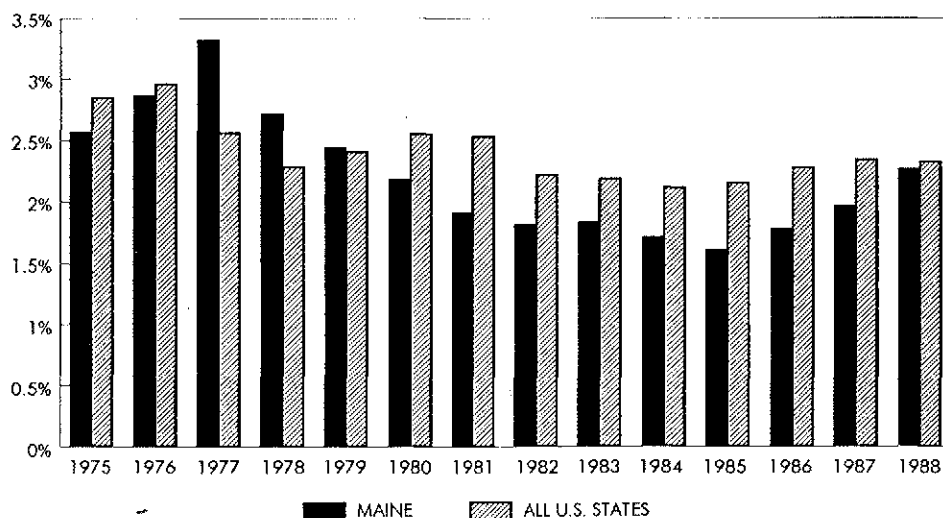
* Pulp & paper, comprising 60% of Maine manufacturing investment, has been excluded to reveal the underlying trend for this sector.

Public Sector: Infrastructure

The public infrastructure, literally the underpinning of modern society, plays a pivotal role in the productivity of the Maine economy. Indeed, economic efficiency is directly linked to high-speed, low cost and safe transpor-

Figure 31

STATE & LOCAL GOVT CAPITAL OUTLAY
AS A PERCENT OF GROSS STATE PRODUCT



Source: U.S. Bureau of the Census.

1987 & 1988 GSP Estimated

tation networks, adequate water quality and supply and economical management of the waste products of modern society. A weak public infrastructure can quickly thwart the most aggressive private sector productivity strategies. Poorly maintained highways slow traffic and damage vehicles, deficient water quality and supply risk public health and restrict the expansion of production, inadequate waste handling facilities escalate the cost of waste disposal. Moreover, the greater expense of deferred maintenance of all classes of public infrastructure raises tax burdens on businesses and consumers, alike.

Public works spending in Maine has failed to keep pace with the expanding economy. State and local government capital spending in Maine has fallen from 3% of Gross State Product in 1970 to only 1.7% in 1985, although it has rebounded to 2.4% in 1988, as illustrated in Figure 31. At this pace, investment in Maine's public infrastructure will be inadequate to maintain the quality of the existing capital stock, let alone adequately service expanding needs. Increasing congestion on major Maine thoroughfares and inadequate landfill capacity plague many Maine communities. For example, the Maine Development Foundation reported that bringing drinking water standards in rural Maine up to federal standards will cost up to \$500 million, while water treatment needs around the State total \$1 billion. The Maine Department of Transportation estimates that State and local highways and bridges will require over \$2 billion between 1989 and the year 2000 to achieve and maintain optimum conditions.

While Maine has yet to experience some of the dramatic infrastructure failures witnessed elsewhere, growing capacity constraints in transportation networks, water supply and environmental facilities are gradually endangering the competitive position of Maine industry.

INVESTMENT IN HUMAN CAPITAL

Private Sector: Businesses and Individuals

Efforts to increase the productive potential of human capital have also accelerated in the U.S. Improvements in part-time adult education over the past two decades, with its emphasis upon cognitive skills and the need to continually upgrade workers' skills and knowledge, indicate some effort by both workers and employers to adapt to the changing work regime.

From 1969 to 1984, there was a 40% increase in the proportion of the U.S. adult population enrolled in formal part-time courses.³³ The proportion enrolled in

job-related courses (courses taken to improve skills in the students' current jobs or to qualify for promotions and better jobs) grew by 100% over the same period. As a result, by 1984, over 9% of the adult population of the U.S. were enrolling annually in part-time job related courses. In 1969, employers offered or sponsored 25% of all part-time job related courses taken by U.S. adults and paid tuition for 23% of the courses taken by their employees. By 1984, these proportions had grown to 43% of all job related courses taken by U.S. adults and 36% of the tuition for the courses taken by their workers.

Comparable figures for adult education in Maine are not compiled. However, information from the Maine Technical College System indicates trends similar to the U.S. experience. An informal survey of Maine Technical Colleges revealed that there has been a substantial increase over the last five years in the proportion of tuition financed directly by businesses. Indeed, by far the largest portion of private business expenditures to the Maine Technical College System has been the outright purchase of courses, as opposed to tailored training programs.

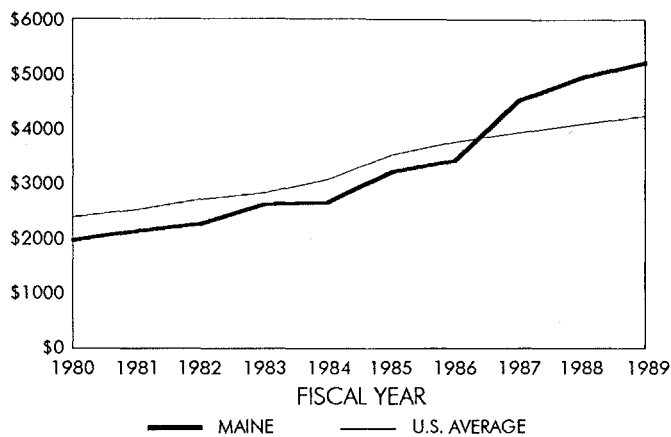
Public Sector: Education Investments

Investment in Maine's primary and secondary education system has increased dramatically during the 1980's, rising from \$434 million in 1982 to \$844 million by 1989. In conjunction with the reform of the State's education system, real (inflation-adjusted) per-pupil primary and secondary school spending in Maine grew by nearly 60% during this period (averaging \$1,918 in FY1982 to \$3,036 by FY1989). While steady through the early part of the decade, State government's share of primary and secondary education expenditures grew from 55% in 1986 to 57% in 1989.

Maine's citizens have likewise supported substantial growth in public investment in higher education. In fact, since 1978 Maine has led the nation in growth in investments in its public higher education systems. Between 1978 and 1989 the value of per-student appropriations to public higher education in Maine grew by 229%, as seen in Figure 32. This compares with just 108% across the United States. Over the same period, Maine has raised its allocation of State revenues to public higher education to 8.2% of State appropriations, just above the U.S. average of 8.1%.³⁴ This commitment by Maine citizens has brought Maine per student appropriations, relative to per capita tax revenues, to 10th in the nation and 124% of the national average.³⁵

Figure 32

HIGHER EDUCATION APPROPRIATIONS PER STUDENT:
MAINE vs U.S. AVERAGE



Source: Research Associates of Washington

ADOPTING THE NEW WORK REGIME

While increasing their investments in physical and human capital, evidence suggests that U.S. industries have been slower than competitors to adopt the structures and practices that take best advantage of new technologies and broader knowledge. A recent study of the productivity of twenty-four plants in the U.S. and Japan, all employing the most advanced technology (flexible manufacturing systems), found the Japanese plants to be much more productive than the U.S. plants.³⁶ Indeed, the U.S. plants, in some cases, were less productive than the conventional plants they replaced. What set these plants apart was the ability of Japanese plants to adapt their practices to the new mode of production. The study revealed that:

- forty percent of the Japanese workers were engineers, while only eight percent of the workers in the U.S. plants were engineers;
- every worker in the Japanese plants had been trained to operate the computerized, numerical control machines which are the brains of a flexible manufacturing system. Only a quarter of the workers in the U.S. plants had been trained to operate these machines;
- the operators of the computerized, numerical control machines in the Japanese plants were encouraged to monitor the machines' actions and make adjustments to increase output. The U.S. operators of these machines were forbidden to adjust the

controls. Only engineers in the U.S. plants were allowed to change the control settings; and

- the Japanese devoted three times as many hours to upgrading workers' skills as the U.S. plants.

The failure of U.S. industry to adopt new technologies and new approaches are, in part, a result of technical illiteracy of many managers. Traditional business education has focused more on finance and marketing than on production management. At the same time, engineering instruction has typically neglected the importance of management skills.

Indeed, some observers suggest that industrial managers who are cautious and detail-driven, coupled with a corporate decision-making process that stresses short-term financial considerations over the potential for long-term gain, have substantially delayed redesign and retooling of the U.S. manufacturing sector.³⁷

Maximizing productivity in the new environment requires that workers not only have access to the latest technology, but also understand the productive potential of their new tools. As the new technology empowers workers to be more versatile, it also requires that they accept greater responsibility for its performance. It demands of them more abstract and theoretical knowledge and a broader understanding of the entire production process than is necessary under traditional production systems. Moreover, it requires that workers receive more frequent training to adapt to changes in the production system. An increasing mastery of the new technology and the requisite responsibility over its performance will allow each worker to contribute significantly to the productivity of the enterprise.

MEETING THE PRODUCTIVITY IMPERATIVE: RECOMMENDATIONS FOR MAINE INDUSTRY AND LABOR

The emerging work regime places demands upon owners, managers and workers that are quite different from those generated by mass production. Under the new regime, sustained productivity will be largely a function of owners' willingness to invest in adapting to the new regime, of workers' ability to master new technologies and shoulder new responsibilities, and managers' capacity to orchestrate the new technological and human potential.

Flexibility, quality and collaboration are the essence of the new production regime. Responding to the pro-

ductivity imperative within this emerging milieu calls for flexibility in the type and design of goods and services, in production processes, in work tasks and responsibilities. For Maine industries it means melding enhanced knowledge and skills of their employees with new production and communication technologies. Moreover, it calls for a new commitment from workers, managers and owners

to work cooperatively toward constant improvement in quality and efficiency.

FLEXIBILITY

Flexibility, the capacity to shift rapidly from one product, design or input to another using the same equipment, is increasingly defining an industry's competitive

FOSTERING TECHNOLOGY DEVELOPMENT IN MAINE: MAINE CENTERS FOR INNOVATION

The Centers for Innovation program of the Maine Science and Technology Commission (MSTC) is designed to improve the ability of Maine industries to develop new products and processes and to make the most effective use of technology. Initiated in 1987, this program seeks to forge partnerships between business and Maine's higher education and non-profit research establishments. Through these alliances MSTC hopes to enhance the use of technology in Maine enterprises, commercialize technical research and accelerate the development of new businesses in Maine. To date three Centers have been established targeting a specific industry and developing strategies and projects to bolster Maine's competitive position in aquaculture, biomedical technology, and metals and electronics manufacturing. A complementary fourth Center provides technical assistance to individual firms in a range of industries. Each Center is guided by a consortia of private business and non-profit research institutions which share the financing of the Center with MSTC grants.

MAINE AQUACULTURE INNOVATION

CENTER—is playing a pivotal role for Maine's burgeoning aquaculture industry. Building upon the technical expertise at the University of Maine, Bigelow Laboratory, and the Maine Department of Marine Resources, the center is conducting a range of projects to meet industry needs. One project uses state-of-the-art satellite imagery to identify ideal coastal sites and helps farmers monitor their environment. In another initiative, the center uses advanced microbiological techniques to track subtle changes in disease strains, improving the efficiency of fish disease monitoring.

THE CENTER FOR INNOVATION IN BIOMEDICAL TECHNOLOGY

—is an unprecedented alliance of Maine's biomedical talent, combining Jackson Laboratory in Bar Harbor with major hospitals in Bangor and Portland, select researchers at the University of Maine and in private institutions and a dozen entrepreneurial firms in Southern Maine. Through the center, firms and institutions can explore new opportunities in biomedical technology that may be beyond the reach of a single organization.

THE CENTER FOR TECHNOLOGY TRANSFER (CTT) IN METALS AND

ELECTRONICS—fosters the development of "production networks" through which small and medium-sized firms can overcome the disadvantages of size. Similar to initiatives in Europe and Japan, center projects are designed to help firms work together in flexible networks to commercialize new ideas, add new value to products or bring new technology to Maine industry. Examples of networking projects include joint access to sophisticated computer systems, collective bidding on large projects, and joint new product manufacturing.

THE MAINE RESEARCH AND PRODUCTIVITY CENTER (MRPC)

—provides prompt technical assistance to a broad array of Maine firms. MRPC links firms seeking assistance to a number of qualified technical experts. Most of the work to date has been performed at a research facility in neighboring New Brunswick. Maine businesses have used MRPC to optimize manufacturing processes, analyze chemical composition, and develop new products and packaging. The center also assists in the development of new products through subsidized services.

position. It is this ability that allows a firm to respond to shifting consumer tastes or business needs at lowest cost and with a minimum of delay. Flexible manufacturing systems, or FMS, represent the epitome of this new approach to production. These systems combine advances in robotics, electronics, software development and computer-aided design to provide short turnaround times on a wide variety of specialty products.

Small and medium-sized firms are typically least able or inclined to make significant investments in training and technology. Consequently, Maine industry, dominated by such firms, faces a significant challenge in producing managers with knowledge of and interest in the new flexible approaches. However, to adopt new flexible technology, managers will have to acquire an intimate understanding of the production processes of their firm, whether a goods- or services-producer. A reorientation toward long-term goals and the management of technology, and away from a focus on central control and short-term financial results is necessary if managers are to integrate new technology with an evolving business strategy.³⁸

Implementing flexible systems with greater worker responsibility will require flatter organizational hierarchies in Maine businesses, as well. The traditional multi-layer management structure is incompatible with new information-intensive technology. In the emerging work regime where time is a source of competitive edge, the flow of information cannot be impeded by bureaucracy. Improving efficiency and quality requires providing workers with the know-how, the discretion and the responsibility to participate in production decisions. Workers, for their part, must adopt a flexible approach to the emerging work regime. To take advantage of the efficiencies offered by new technologies, workers must be able to perform an array of tasks beyond operating equipment, including monitoring its condition and assuring the quality of its output.

For many firms, flexibility will require more of an emphasis on restructuring tasks and tailoring products to consumers than on new technology. This is especially true for service sector industries where consumers are resistant to the automation of service tasks. The automatic teller machine, for example, has failed to live up to the expectations of many in the banking industry. Instead, firms in this industry are developing an array of products designed to meet the needs of a diverse customer base. At the same time they are cross-training workers to perform a variety of tasks. Teller's, for ex-

ample, are being trained to sell the banks' new products, in addition to performing their traditional tasks.³⁹

Maine firms face a particularly difficult road in adopting new flexible technologies. As the vast majority of Maine businesses are small or medium-sized firms, simply evaluating new technologies and changing markets is an arduous undertaking for much of Maine industry. Financing a major re-tooling effort can be especially difficult for these firms. Training costs, too, can seem prohibitive to Maine's smaller firms particularly if a firm fears losing newly-trained workers to larger competitors. However problematic the risk faced by these firms in making investments in new technology, the alternative presents a more certain danger to the long-term viability of the firm.

Collective action may be the only way that many of Maine's small firms can adopt new technologies. While individual firms may lack the time or expertise to evaluate complex and rapidly advancing technologies, they may be able to support such efforts through a trade association. Shared production and information capacity is another way that small firms, acting in concert, can finance costly technology.

QUALITY

As opportunities to hold down costs through lower-priced inputs and low wages diminish, quality is becoming an increasingly important component of an industry productivity strategy. Process quality reduces the amount of time and material spent on each unit of output by cutting the number of flawed products and is an integral part of the efficient use of new production technology. Flexible production systems, designed for small batches of changing products and rapid turnaround, tolerate a minimum of error. Improvements in product quality increase the value of the product and will be an important source of comparative advantage in an increasingly competitive marketplace.

A productivity strategy based on quality will require a transformation of the business culture of many Maine firms. Rather than being relegated to one segment of a multidimensional organization, quality control must be an integral part of every aspect of operations, and it must begin at the highest levels of decision-making. As noted by one company president, "if its [quality] not in the corporate board room, it will not be on the factory floor."⁴⁰ Perhaps most importantly, workers must be recognized as a crucial partner in a quality-based strategy. In this regard, workers must be knowledgeable

about the broader context of process, product and strategy. They must have the latitude to experiment in search of improved quality in their processes and the motivation to assure quality in their product.

Seeking quality improvements by enhancing workers' roles is especially important for much of the service sector, which is often unable to substitute capital for labor. The merchandise of these firms is often the product of the synthesis and communication of information and of direct contact between service provider and customer. In these cases, a firm's product quality depends entirely on the knowledge, skills and effort of its employees.

COLLABORATION

Continuous improvements in efficiency and quality using the flexible technology needed to achieve them dictate a more collaborative work environment in Maine industry. In stark contrast to the tradition of discrete tasks, workers must now have an understanding of how their tasks relate to those of others in the process. Moreover, much of the new technology being employed by businesses is information technology. It presents the operator with continuous status reports that require a worker to contemplate the implications of the data, to separate the chaff from the wheat, and to respond accordingly.

In this setting, workers clearly need to have more decision-making authority over their tasks. And manag-

ers need to disavow the traditional notion that technology is used to limit worker discretion. Employee collaboration is a matter of persuading the workers who make the products and deliver the services to participate in quality improvement. "The companies that have been most successful in improving quality have found that it is necessary to empower their employees, to give them more responsibility to turn on their creative juices."⁴¹ At the same time, employees will rightfully demand a greater role in strategic managerial decisions, and to share in the fruits of their efforts. In return for a greater responsibility for output, workers must be more intimately involved in plant reorganizations, new technology investments, job restructuring and the like.

These changes in interpersonal and worker/manager relations represent a significant shift in the practices of firms in Maine and across the U.S. The productivity imperative demands a break in the adversarial relationships that are the tradition in U.S. labor/management relations. This change does not require magnanimity of rival parties but rather acts of enlightened self-interest. It begins with a recognition that a commitment to quality and efficiency is necessary for the survival of the firm and security of the jobs it provides.

Collaboration offers other tangible benefits to industry's productive performance. Workplace safety, an area of special concern for Maine's productive potential, is a case in point. Shouldered with one of America's worst work-related injury records, Maine industry and workers

NEW MANUFACTURING SYSTEMS

The key to strategic employment of advanced manufacturing technologies is integrating them with other operations to obtain a competitive advantage. These are not at all like the stand-alone accounting and payroll packages that firms installed in the past with only minor difficulty.

Just *having* the technology does nothing for the firm. The trick is to put it in the hands of creative, innovative people who will develop novel uses and applications . . . The learning curve for these technologies should itself be managed, with users constantly striving for further improvements in the manufacturing process.

The firm must learn as it goes, and the learning cannot be limited to the manufacturing people.

Everyone—accounting, marketing, top management—must become involved, or else there will be only "islands of knowledge". The whole firm will not be able to move forward because the ignorance in one area will hold it back.

The point here is a sensitive one. Automation demands excellence of management—lacking that, it will not pay off. The greatest mistake a firm can make is to automate the production process in place—we have yet to find a firm whose existing manufacturing process could not be improved.

Excerpts from "Justifying New Manufacturing Systems: A Managerial Approach" by Jack R. Meredith & Marianne M. Hill, in Sloan Management Review, No. 49, Summer 1987.

face the anguish of injury and the expense of downtime and workers' compensation insurance. To date, solutions to this quandary have proven elusive in Maine.

Maine state government has taken the lead in workplace safety through the Industrial Safety Division of the State Department of Labor and the new Center for Occupational Health and Safety at the Central Maine Technical College in Auburn. These programs offer education and training to Maine businesses and workers on improving the safety of their workplaces. But the private sector response has been slow. A 1987 survey of small Maine businesses found that while all respondents believed reducing workplace injuries is important, only 60% had any safety program at all.

A cooperative effort by labor and management can offer significant return in this regard. Greater investment by Maine firms in workplace safety will go a long way toward reducing the human and economic costs of work-related injuries. At the same time, workers must facilitate the introduction of new practices that will allow a greater attention to safe work habits. The move from piece-rate compensation to an hourly wage in forest harvesting, introduced by Scott Paper Company, is an example of new work practices that offer significant gains in both workplace safety and productivity. The successful introduction of such innovations will depend upon the willingness of labor and management to forego short-term benefits, and the comfort of tradition, for the promise of greater longer-term gains.

MEETING THE PRODUCTIVITY IMPERATIVE: RECOMMENDATIONS FOR MAINE STATE GOVERNMENT

The vitality of Maine's productive potential depends principally upon the collective actions of private sector decision-makers, be they owners, managers, workers, or investors. Nevertheless, State government can play an important role in supporting and facilitating private-sector decisions that enhance the long-term productive edge of Maine's economy. Expanding the knowledge of Maine's future and current workforce and maintaining an adequate transportation and environmental infrastructure are the most important responsibilities of State government in enhancing productivity.

PRIMARY & SECONDARY EDUCATION— "THE NEXT WAVE"

The provision of quality education is the single most important area of government influence on the produc-

tive performance of its industry. Only a citizenry with the flexibility, knowledge and skill to take full advantage of new technology and adapt to rapidly changing market conditions will be able to support the development of competitive industries within its borders. In Maine, as in states around America, state and local governments have implemented significant reforms of the primary and secondary education system. These reforms have included raising teachers' salary, improving curricula, and increasing the state's share of local education cost.

However, Maine has just begun the process of educational reform and these first steps, alone, are unlikely to achieve sustained improvements. Many of the steps necessary to improve the productive performance of industry apply as well to education. Just as a new work environment is emerging, so too must the educational paradigm evolve to take advantage of new technologies. The traditional model of education where a teacher relays specific bits of knowledge to 25 or more students fails to take advantage of technologies and techniques available to offer individualized, high quality learning. Computers, for example, can provide individualized instruction and interact with students, and can do so at lower cost. Alternatively, a team approach to teaching, a method borrowed from new production techniques, has been proven as an effective innovation in instruction.

To date the environment of learning has not adapted to new technologies, however. Like industry, schools have yet to appropriately meld new technologies with the new organizations needed to respond to an evolving environment. Teachers, for example, have not been trained to use the new technologies. And administrators are resistant to giving teachers the discretion to offer innovative instruction and do not know how to organize instruction to take advantage of new techniques.⁴² State and local government in Maine must encourage and facilitate experimentation and innovation in our local school districts, in our local schools and in the classroom, itself.

State government has begun to solicit new approaches to school in Maine. The Restructuring Schools Project was initiated by the State Department of Education in 1987 to encourage innovative approaches to organizing school instruction and administration. It is designed to encourage schools to improve students' educational progress through an ongoing planning process based on the most recent research on teaching and learning. Of the nineteen sites submitting proposals ten schools have

SOME VIEWS ON TECHNOLOGY AND STRUCTURAL CHANGE IN EDUCATION

"The introduction of a substantial amount of information technology into conventional classrooms as they operate today will, in my belief, produce only marginal improvement in educational effectiveness. It will take substantial institutional changes to bring about the improvement that we are seeking; the school environment must be altered to provide motivation, self-paced progress and integration of out-of-school learning experiences. It will also be necessary for parents to develop new expectations for their children's education."

Lewis Branscomb
Harvard University
(formerly of IBM)

"I am persuaded that the existing K-12 school bureaucracy is having its last hurrah, and that designing new models for education that serve all Americans is of vital importance. A fundamental shift in the nature of the education system is not only possible, but essential."

TheodoreSizer, Chairman
Department of Education
Brown University

"If technology cannot be used to bring about a radical restricting of how we teach, then its effect will be nil."

"We should not flinch from the fact that we are talking about a revolution in education."

Richard M. Cyert, President
Carnegie Mellon U.

Source: U.S. Congress, Office of Technology Assessment, Technology and the American Economic Transition. Washington, DC, 1988.

been selected to participate. Three sites are receiving \$50,000 implementation grants for each of three years and seven schools have been awarded \$10,000 planning grants. In addition, all participants are eligible for waivers from State rules that interfere with implementing their plans.

Just as in private industry, teachers and administrators must work more cooperatively to improve the quality of their efforts. New contract arrangements between teachers and administrators in school districts around the country are improving incentives for teachers to excel and make teachers responsible partners in the design and development of an improved educational environment. Through enhanced salaries and investments in professional training, teachers will be more capable of using their professional judgment in deciding how best to use the available resources to educate students. At the same time, teachers will take on more responsibility for the progress of their students.⁴³

High school diplomas no longer signify that a graduate can read and write and has a basic understanding of math and science. As new standards of educational achievement are developed, we will need better indicators that we are fulfilling our responsibility to students to provide them with the power to succeed. Toward this end, Maine must assure that students leave the educational environment with the requisite knowledge to function in the economic one.

Finally, as Maine improves the quality of its education services it behooves us to provide our children adequate access to them. Today, Maine's 175-day school year is the second shortest in the United States and only 75% as long as most developed nations. Combined with innovations in instruction and organization, an extended school year can set Maine children on a more competitive footing with those in the rest of the United States and the world.

EDUCATING MAINE ADULTS—THE WORKFORCE OF THE 21ST CENTURY

While crucial to our long-term development, the current focus on primary and secondary education will not address the immediate problem of improving the skills and knowledge of the workforce of the next decade, Maine's current workforce. It will be 30 years or more before students benefiting from primary and secondary education initiatives will even approach a majority of the active workforce. To meet the productivity imperative Maine must address the crisis of education among its

current workforce, which will make up over 80% of Maine's workforce as we enter the 21st Century. As noted by one observer, it is "the **adult** learning crisis that is what really put this nation's economy at risk" (emphasis added).⁴⁴ The prominence of life-long learning in economic growth was not lost on the MIT Commission on Industrial Productivity:

*Our research on productivity and the quality of the work force suggest . . . that without major changes in the ways schools and firms train workers over the course of a lifetime, no amount of macroeconomic fine-tuning or technological innovation will be able to produce significantly improved economic performance and a rising standard of living.*⁴⁵

In this area, too, Maine has made significant strides. Some of the symptoms of the adult learning crisis have been addressed effectively through State programs of job training and retraining. A national leader in this field, Maine was named the "State of the Year" in 1989 by the National Alliance of Business for the array of innovative job training and assistance programs developed and administered by the State Department of Labor. However, the longer-term issues related to working in the new economy remain to be confronted. While the citizens of Maine have come to recognize the need for continual education, programs of life-long learning are limited in Maine.⁴⁶

Maine's most powerful tools for providing working adults the broader knowledge and skills needed to tackle new problem-solving responsibilities and the ability to rapidly adjust to new processes and technologies are the State's higher education complex—the University of Maine System (UMS) and the Maine Technical College System (MTCS). Through popular support for expanding public appropriations and voter approval of multi-million dollar capital investment programs, Maine's citizens have shown a heightened commitment to improving the State's higher education system.

It is clear that Maine's higher education complex must improve the delivery of higher education services to Maine adults. From 1978 to 1989 Maine led the nation in expanding investments in public higher education.⁴⁷ Nonetheless, Maine's post-secondary institutions continue to lag behind in improving the access of quality education services to its adult workforce. Only 15% of Maine adults hold a college degree and 38% of Maine adults do not even hold a high school diploma or its equivalent. Maine's enrollment in two-year programs

of just 6 students per 1,000 population remains one-half the national average,⁴⁸ while participation in Maine's public higher education institutions ranks 45th in the nation.⁴⁹

The challenge for these institutions is to more rapidly adopt changes in focus and structure that will allow them to serve the emerging needs of both Maine's traditional and nontraditional students. The career-related programs of instruction offered must be more relevant to the characteristics of businesses in Maine. Like Maine industry, these institutions must depart from traditional approaches to providing higher education services and find new ways to meet the rapidly evolving needs of Maine citizens.

University of Maine System (UMS)

As with industry, adapting to the emerging socio-economic environment demands radical change in the way courses are offered. Meeting the needs of nontraditional students requires more than providing assistance to be successful within the traditional setting. It requires altering that setting to reflect the needs of this growing percentage of the University population who are juggling employment and family responsibilities with their educational pursuits.

Flexible scheduling, for example, appears to offer a very high return at very little cost. It is clear that nontraditional students have far more demands on their time than traditional students. Nonetheless, traditional scheduling practices place the greatest burden on those with the least flexibility—adults with family and workplace responsibilities. Given the fewer constraints on traditional students, a convincing argument can be made for giving preeminence to nontraditional students in developing course and session schedules.

The University of Maine System is achieving mixed results in addressing the needs of Maine adults seeking career-broadening instruction. The University of Southern Maine (USM), for example, has instituted an array of approaches to improve access of nontraditional students to its instructional services. The University's Continuing Education evening program has been fully integrated into daytime academic programming, providing access to adults with work and family responsibilities. An aggressive outreach program provides USM business management, industrial technology and other career development courses at worksites like UNUM, Portsmouth Naval Shipyard and even Loring Air Force Base in Aroostook County.

The Integrated Management program offered by the University of Southern Maine is one innovative means of improving accessibility to its graduate level expertise. This program is designed to help working adults improve their value as managers and upgrade an array of managerial skills. It is offered by the Continuing Education for Business Office and taught by the graduate faculty of the USM School of Business, Economics and Management. By combining the scheduling flexibility required by working adults (it is offered all day each of seven consecutive Fridays) and the expertise of its graduate faculty, nontraditional students can gain access to the same quality instruction available to USM's traditional students.

USM is now considering a proposal to fully integrate its Summer Session into year-round academic programming. This potentially far-reaching innovation will allow the new Summer semester to become an increasingly important component of program planning for part-time students, while allowing traditional students to continue to rely principally on the Fall and Spring semesters.

The University of Maine at Augusta (UMA) has recently developed an exciting innovation in higher education accessibility. Melding advances in communication technology with an alternative approach to providing higher education services, the Community College of Maine Telecommunications System promises to bring a variety of courses and programs to the most remote communities of Maine. But while this initiative offers great promise, alone it will not meet the needs of Maine's workforce for advanced education. A recent survey of adult students found that adults prefer to study on-campus.

Evidently the campus is an oasis for many adults facing competing demands within their daily lives . . . [Moreover] It may be that 'high tech' cannot replace 'high touch' when it comes to learning—terminals and telescreens don't smile and wave when you walk in or chat with you when the class is over.⁵⁰

These efforts are instructional of the types of innovations necessary on all the campuses of the University of Maine System. Their success depends upon the collaboration of faculty and administration of Maine's public University system to assure access for nontraditional students to the same quality instruction available to traditional students.

As UMS achieves greater accessibility for Maine's working adults it must make its career-related offerings more relevant to Maine businesses. Traditional business

management offerings, for example, are generally geared more toward large finance and insurance sector industries than the divergent array of small and medium-sized firms that dominate the Maine economy. In addition, instruction in production management is needed to empower Maine's firms to understand and manage the technology they will need to compete. Some level of commitment to these types of instructional needs has been made by some segments of UMS, as evidenced by a proposed joint USM/UM graduate program in Manufacturing Management and a proposed Manufacturing Technology Program at USM. However, the timing and form of their implementation remain uncertain.

The University of Maine System has been bolstered by significant increases in State government financing of both operations and capital facilities. As previously noted, since 1978 public appropriations per student to the University System have grown by 229%, the highest in the United States. This has placed Maine tenth in the nation in higher education appropriations per student, and 25% above the national average. Now, rapid innovations in providing higher education services are needed to make life-long learning available to more of Maine's workforce and Maine businesses. By building flexibility in the scheduling, administration and design of instructional offerings inside and outside formal degree programs, UMS must make its offerings more accessible and relevant to Maine's nontraditional students and the enterprises they represent.

Maine Technical College System (MTCS)

Accessibility to nontraditional students is already a tradition throughout Maine's Technical College System. In fact, nearly 6,000 of its 8,700 enrollees, are part-time students. The challenge for the Maine Technical College System is to provide students both those specific skills immediately needed by Maine businesses, and the broader life-long learning skills and the capability to adjust to the frequent modification of job requirements common to the new business milieu.

As the industrial environment is transformed, technical instruction needs are becoming more elaborate. Workers increasingly require conventional mechanical know-how, as well as the ability to apply it in new ways utilizing new technologies. The growing recognition of the importance of managers with greater technical expertise will place an increasing demand on the Technical College to broaden its clientele to include this level of worker. Finally, the rapid evolution of production tech-

nologies will require new approaches to gaining access for their students to state-of-the-art equipment.

The Maine Technical College System has begun to break from its narrow skills training tradition. It has embraced a broader role in serving Maine's businesses and workforce, evidenced by increased program offerings in areas of general instruction such as math, science, English and human relations. Through these programs MTCS campuses provide students the greater breadth of knowledge and transferable decision-making skills increasingly important in the evolving workplace. A newly established program of occupational health and safety at Kennebec Valley Technical College and the beginnings of a supervision and management program at Central Maine Technical College represent a move toward further diversification of MTCS's traditional services to Maine businesses and workers.

Other innovations by the MTCS campuses are needed to serve the changing needs of Maine businesses and workers. By virtue of its special relationships with both businesses and their employees, MTCS is uniquely positioned to instruct owners and managers, as well as workers, on how to meet the productivity imperative. In this vein, MTCS could develop programs that better acquaint managers with emerging technologies and with practices that make the most efficient use of workers' skills in the emerging work regime.

By the same token, MTCS may also be in a position to offer a forum for facilitating greater collaboration between workers and managers necessitated by the new economic environment. Occupational training stressing team concepts and joint worker/manager instruction on new technologies, for example, could help build more cooperative work environments within Maine businesses, while providing crucial education and training to managers and workers.

PUBLIC INFRASTRUCTURE—PRESERVING MAINE'S ECONOMIC LIFELINES

Public sector budget decisions are made within a political context. As the repair and maintenance of public facilities usually lacks an effective constituency in this process, it receives short shrift, particularly in periods of tight revenues. As a result, provisions for maintaining and repairing the State's capital assets are generally inadequate, accelerating the deterioration of public infrastructure facilities.

Government needs a straightforward way to assure that it is providing sound stewardship of costly public

THE ROLE OF PUBLIC INFRASTRUCTURE IN ECONOMIC DEVELOPMENT

Economists have only recently begun to assess the effects of infrastructure on regional economic development beyond simply a stimulus of construction activity. The consensus among economists is that public infrastructure stimulates economic activity, either by augmenting the productivity of private inputs or through its direct contribution to output. Furthermore, by enhancing a region's amenities, public infrastructure may also attract households and firms, which further contributes to an area's growth.

The critical question is at what point, if any, does an additional increase in public infrastructure cease to have any effect on economic development? Alder sums up the effect of transportation on economic development: "it is frequently assumed that all transport improvements stimulate economic growth. The sad truth is that some do, and some do not . . ." In a broader context, it can be concluded that some types of infrastructure investment will have significant effects, while others will not.

Many local and state governments in the United States are faced with the monumental task of replacing and upgrading their present public capital stock. But the challenge is more than simply maintaining existing structures. The challenge facing these governments is to meet the future infrastructure needs of a U.S. economy that is undergoing dramatic changes with the restructuring of both manufacturing and service industries and the spacial redistribution of these activities. Innovations in areas such as telecommunications and computer automation, to mention only two, are changing the way businesses operate, and infrastructure investment must adapt to this changing technology.

Excerpts from "Public Infrastructure and Regional Economic Development" by Randall W. Eberts in *Economic Review*. Federal Reserve Bank of Cleveland. Vol. 26, No.1 1990.

facilities. Failure to adequately assess and provide for infrastructure needs will result in higher maintenance and replacement costs in the future and a less efficient infrastructure today. Capital plans and budgets help do this. Accordingly, the State of Maine should accelerate efforts to institute capital budgeting for the State's transportation, environmental and governmental facilities.

Appropriate investment is of at least as much importance as adequate levels of financing of public infrastructure. The shifting economic environment is reshaping the infrastructure needs of private industry. For example, the economy is becoming less intensive in its use of materials like steel, cement, paper, and chemicals. At the same time, bulk commodities are being shipped further, and manufacturing centers appear to be moving away from sources of materials. Increasing interest in better inventory control and the integration of geographically dispersed production centers has placed a premium on fast, reliable delivery of relatively small shipments.

While there may be an upper limit to the tons of material per person that an economy needs to move, there is no apparent limit to the amount of value per pound that can be added by sophisticated production. Increasing the value per unit weight of goods, coupled with production systems that are paying close attention to inventory controls, is requiring higher quality from transportation services.⁵¹

Thus, as production technologies change so will the infrastructure needs of the private sector. Moreover, as

the capital stock has grown so, too, have the returns to maintenance investments relative to new construction.⁵² Therefore, it is imperative that new infrastructure investment decisions be accompanied by an appreciation for the changing needs of an evolving economy.

Just as the need for improved infrastructure becomes more urgent, the competition among public priorities for financial resources is intensifying. Financing public education, health care for the uninsured and affordable housing are as important to securing Maine's long-term future as improving the public infrastructure. In this environment, the rigorous application of cost/benefit analysis of a wide variety of options will help assure that public works investments are adequately focused on approaches that offer the greatest return.

Finally, State government has an important role in ensuring an efficient and modern communications infrastructure. Maine must continue to use its influence as a purchaser, regulator and policy maker to enhance the modernization, accessibility and cost-effectiveness of the communication services available in Maine.

The economic milieu is in the midst of irrevocable transformation, both within Maine and in the broader national and world economy. While Maine businesses and government have not ignored these changes, their responses have yet to equal the challenge. Meeting the productivity imperative demands a decisive break from practices and attitudes shaped during an era that is rapidly drawing to a close.

Chapter 5

CONCLUSIONS

The human race has had long experience and a fine tradition in surviving adversity. But we now face a task for which we have little experience, the task of surviving prosperity.

Alan Gregg

Through most of the 20th Century, Maine industries have been able to compensate for low capital investment with below-average wages, access to resources and captive trade and service markets. However, these advantages are dissipating before the mobility of advanced production and communications technology and increasingly sophisticated workers throughout the new world economy. Consequently, Maine enters this the last decade of the 20th Century with great possibilities and responsibilities. The sheer speed of the changes occurring around the globe adds urgency to our decisions, for the decisions made in Maine today will have a dramatic impact on the shape of Maine well into the 21st Century.

Maine has witnessed a great deal of change over the last decade. It must now affect a great deal more within its public and private institutions, organizations and relationships to maintain its economic vitality. Meeting the productivity imperative may be especially demanding for Maine, with its many small firms, its traditional industries and occupations and its history of lower investment in physical and human capital. But Maine also enjoys a new economic reality, a stronger position from which to acquire the tools and the know-how that will enhance its productive edge.

By the latter half of the 1980's, Maine had reached a new level of economic vitality. A more diverse and vibrant mix of industries has offered expanding employ-

ment opportunities and rising income. It has slowed the exodus of Maine's young people and improved the standard of living for a growing number of Maine citizens. The new Maine economy has become less dependent on southern New England for its economic vitality. At the same time, it has become more vulnerable to forces and competition from around the globe.

Many of the forces that carried Maine to its current station have begun to wane. The resurgence of the Northeastern economy that fueled the diversification of Maine's industrial base seems to have largely run its course. The economic catalyst to industrial growth offered by the U.S. defense build-up is shrinking before the enormity of government deficits and the momentous easing of world tensions. Sustaining and further enhancing Maine's present condition—even supporting the moderate growth anticipated for the decade ahead—must derive from sources within Maine. Maine's people and industries must empower themselves to participate fully in the rapidly evolving world economy.

The productivity imperative will precipitate fundamental changes in the way that Maine citizens, as workers, managers, owners and voters, interact with each other and with the rest of the world. Admittedly, this report has merely scratched the surface of the complexity of issues surrounding productivity and economic development in Maine. There are numerous social, political and economic aspects of the dynamics and

prescriptions described in the previous pages that have gone unexplored here. However, it does offer a starting place for broader analysis. Moreover, it is hoped that the assessment offered here can inform the inevitable debates of how best to secure Maine's economic future.

Maine, like the rest of the U.S. economy, has reached a critical juncture in its development. The relentless acceleration of technological advance and growing world competitiveness are reducing the time available to make

crucial decisions. The way of life enjoyed by Maine citizens in the year 2000 will depend in large part, upon the decisions made today. While an admittedly narrow focus, the health of a modern economy is as much a measure of a State's overall quality of life and human potential as a gauge of its material wealth. And the level of income and quality of employment enjoyed by Maine households and the competitive position of Maine industries will be shaped largely by the way Maine citizens—as businesses, workers, and government—respond to the productivity imperative.

NOTES

- ¹ The economic growth index was developed by the State Planning Office as a measure of general economic activity. It is comprised of manufacturing hours worked, resident employment, retail sales and service employment.
- ² U.S. Bureau of the Census. 1980 Census of Population. 1987 Current Population Survey-Maine.
- ³ Information collected by the Maine Bureau of Motor Vehicles on new resident license applications provides some verification of the Census Bureau estimates. From 1976 to 1985 the number of new State residents applying for driver's licenses fluctuated between 11,500 and 13,800 per year, averaging 13,000 annually. In 1986, 1987 and 1988 the number increased successively to 16, 18 and 20 thousand. These new applicants yield an average in-migration of 18,000 licensed drivers per year.
- ⁴ U.S. Census Bureau, Current Population Reports, Series p-25, nr. 1044.
- ⁵ Unpublished data from the Current Population Survey of the U.S. Census Bureau.
- ⁶ Maine Bureau of Labor Standards, *Survey of Maine Manufacturers*. Due to its dominant place in Maine trade, Paper is excluded from this analysis. Maine's paper industry accounts for nearly 40% of all Maine manufacturing exports and over 60% of all manufacturing imports. Between 1978 and 1988 this industry has witnessed a 100% increase in the value of imports used as an input to production and a 140% increase in the value of its exports.
- ⁷ The Bureau of Labor Statistics forecast predicts Gross National Product to average 2.4% annual growth between 1989 and 2000, down from the 2.9% averaged between 1976 and 1988.
- ⁸ Schumpeter, Joseph, *Capitalism, Socialism and Democracy*. Harper Bros., New York. 1947. Page 83.
- ⁹ U.S. Dept. of Commerce, International Trade Administration, *United States Trade Performance in 1987*, quoted from Dertouzos et al., page 32.
- ¹⁰ Commodity is used here to denote goods produced with a minimal amount of value added by the producer, that are largely indistinguishable from that of other producers and compete principally on the basis of price.
- ¹¹ Maine State Planning Office. *The Maine Economy: A Forecast to 1995*. 1986. Page 33.
- ¹² Estimates of the value-added by industry for states and the U.S. have recently been developed by the U.S. Bureau of Economic Analysis (BEA). Value-added, a proxy measure of industry output, is the value of output of an industry less the cost of purchased inputs to production. This experimental data set offers a gauge of industry output which, when combined with annual employment data, allows an analysis of changes in output per worker, providing an opportunity to examine the productivity of a state's industries.
- ¹³ The BEA value-added estimates are derived, in part, from labor earnings in the State's industries. Maine's relatively lower wages may artificially skew Maine value-added estimates.
- ¹⁴ Some evidence suggests productivity gains of many service industries have been underestimated. Gaps in available data on service industry inputs, and methodical problems with identifying sources of productivity may have resulted in crediting service sector productivity gains to the manufacturing industries that they serve. See also footnote #18 & #19.
- ¹⁵ *Economic Report of the President*, February 1990. U.S. Govt. Printing Office. Page 118.
- ¹⁶ Jacques Nusbaumer, *The Service Economy: Lever to Growth*, Kluwer Academic Press. 1987. Page 52.
- ¹⁷ Office of Technology Assessment from Dertouzos, M.L., R.K. Lester and R.M. Solow, *Made in America: Regaining the Productive Edge*. Page 40.
- ¹⁸ "It is conventional wisdom that it is very difficult, if not impossible, to measure service outputs. But in principle they are no more difficult to measure than outputs of tangible goods. Services can

- be classified by type, just as goods are, and the number of times services of each type are rendered can be counted--haircuts, tooth extractions, tonsillectomies, wills probated, and so on." ("Outputs, inputs, and productivity in the services industries," John W. Kendrick, in *Statistics About Service Industries*. National Academy Press. 1986. Page 67
- 19 The apparent poor productivity record of business and professional services may actually reflect the role of this sector in absorbing the inefficiencies once burdening the industries they serve. Businesses that rely on temporary personnel services, for example, are able to assert more flexibility in the size of their work force in response to fluctuations in product demand. This productivity gain is reflected in the record of the business using the service but not the provider.
 - 20 It is important to note that the complex structure of the utilities industry dictates particular caution when interpreting the value-added estimates. This industry includes Maine's regulated energy-related utilities, which have begun to place a greater emphasis on demand-management and brokering power between non-regulated independent power producers and consumers than on operating company-owned power plants. Despite the poor productivity performance indicated in the BEA data, Maine's energy-related utilities have greatly improved their competitive position, and have passed those benefits on to Maine's industries, residential consumers and their owners.
 - 21 OTA, *Technology and the American Economic Transition*. May 1988. Page 220.
 - 22 Kaplinsky, R. and Kurt Hoffman, *Driving Force: The Global Restructuring of Technology*. Westview. 1988. Page 456.
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 - 24 Piore, 1987. Page 26.
 - 25 Kaplinsky. 1988.
 - 26 Ibid.
 - 27 Kaplinsky. 1988. Page 459.
 - 28 See, for example, Solow, Robert M., "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics*, February 1956, 70, 65-94. More recently, Dr. Solow noted, "... the permanent rate of growth of output per unit of labor is independent of the savings (investment) rate and depends entirely on the rate of technological progress in the broadest sense." Robert M. Solow, "Growth Theory and After," *The American Economic Review*, June 1988. Page 309.
 - 29 Improved education of workers is estimated to account for over 30% of the increase in output per worker between 1929 and 1982. See Leslie, L.L. and P.T. Brinkman, *The Economic Value of Higher Education*. Macmillan. 1988. Pages 82-86.
 - 30 Dertouzos et al., *Made in America*. 1989. Page 48.
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 - 32 Differing data compilation techniques prevent direct comparisons between U.S. and Maine manufacturing investments. However, evidence suggests that investments per worker by Maine manufacturers may be as low as 35% of the U.S. average.
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 - 34 Halstead, Kent, *State Profiles: Financing Public Higher Education 1978 to 1989*. Research Associates of Washington. 1989. Table 1.
 - 35 Ibid.
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 - 37 *Computerized Manufacturing Automation: Employment, Education and the Workplace*. Office of Technology Assessment. U.S. Congress. April 1984. Page 239.
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 - 40 Harold L. Corner, President, C&J Industries quoted from "The Sum of the Parts," Bruce Stokes. *National Journal*. August 13, 1988. Page 2087.
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