

Winning Technologies:  
A New Industrial  
Strategy For California  
and the Nation

83 00922



Executive Summary

Report of the California  
Commission on  
Industrial Innovation

**INSTITUTE OF GOVERNMENTAL  
STUDIES LIBRARY**

NOV 2 1982

**UNIVERSITY OF CALIFORNIA**

September, 1982

**Gov. Edmund G. Brown Jr.**  
Chairman

**Appointees of the Governor**

**Richard Atkinson**,  
Chancellor, University of  
California, San Diego.

**William C. Demers**, Interna-  
tional Vice President, Com-  
munications Workers of  
America.

**Don Gevirtz**, Chairman, The  
Foothill Group.

**Ira Michael Heyman**, Chan-  
cellor, University of California,  
Berkeley.

**Steve Jobs**, Chairman of the  
Board, Apple Computer, Inc.

**Regis McKenna**, Chairman,  
Regis McKenna, Inc.

**Rene C. McPherson**, Dean,  
Stanford Business School.

**David Packard**, Chairman of  
the Board, Hewlett-Packard.

**Leland Prussia**, Chairman of  
the Board, Bank of America.

**Jim Quillin**, Secretary-  
Treasurer, California Confer-  
ence of Machinists.

**Lynn Schenk**, Secretary,  
Business, Transportation and  
Housing Agency.

**Charles Sporck**, President,  
National Semiconductor  
Corporation.

**Don Vial**, Director, Depart-  
ment of Industrial Relations.

**Jerry Whipple**, Regional  
Director, United Auto Work-  
ers, Region 6.

**Appointees of the President  
Pro Tem**

**David Commons**, Consultant

**Robert P. Marr**, Director of  
Public Relations, Operating  
Engineers Local #3

**Appointees of the Speaker  
of the Assembly**

**Ruth Jernigan**, International  
Representative, United Auto  
Workers.

**G. Rip Ridley**, President,  
WAMS, Inc.

**E. Allison Thomas**, Executive  
Director



Leland Prussia,  
Gov. Edmund G.  
Brown Jr.

Ruth Jernigan,  
Lynn Schenk,  
Richard Atkinson



Steve Jobs



Charles Sporck,  
Don Gevirtz

Richard Atkinson,  
Regis McKenna





Ruth Jernigan



Melinda C. Luedtke,  
Don Vial



Gov. Edmund G.  
Brown Jr., Ira  
Michael Heyman



Jim Quillin



William C. Demers

David Commons,  
Ruth Jernigan



Robert P. Marr,  
David Commons,  
Gov. Edmund G.  
Brown Jr., Regis  
McKenna



E. Allison Thomas  
with Gov. Edmund  
G. Brown Jr.

David Packard



Rene C. McPherson



## Contents

---

Executive Order #B-91-81 (Excerpts) P.7

---

Preface: Toward A "Winning Technology" Industrial Strategy. P.8

---

Winning Technologies: A New Industrial Strategy For California and the Nation. P.10

---

A National Industrial Strategy for Innovation in the 1980s. P.21

---

Investment For Innovation in the 1980s. P.24

1. Promoting Free Trade. P.27
2. Increasing Research and Development. P.28
3. Increasing Investment Capital. P.30

---

Education and Job Training For Innovation in the 1980s. P.37

1. Elementary and Secondary Education. P.40
2. University Engineering and Computer Science Education. P.46
3. Community Colleges and Job Training Programs. P.48

---

Employee-Management Productivity For Innovation in the 1980s. P.52

---

Table of Recommendations. P.57

---

List of Documents Submitted to the California Commission on Industrial Innovation. P.60

---

**Special Design  
and Production  
Contributor:**  
Apple Computer, Inc.

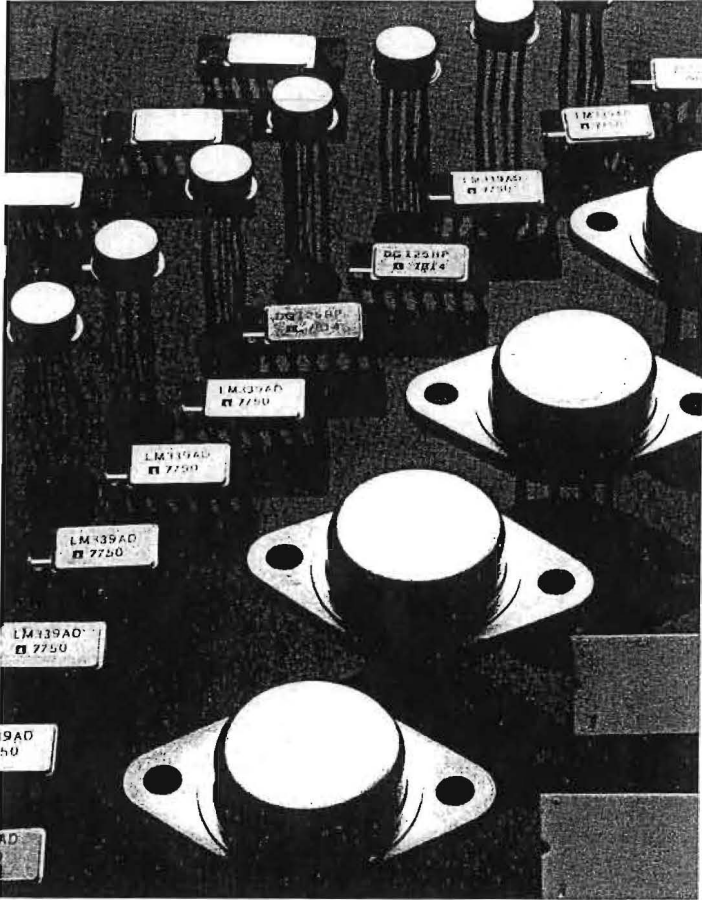
Not printed at State  
expense

**Contributors:**  
Advanced Micro  
Devices  
Bank of America  
David Packard  
Genstar Rental  
Electronics

Hewlett-Packard  
Intel Corporation  
National Semicon-  
ductor Corporation  
Pacific Telephone  
and Telegraph  
Regis McKenna, Inc.

**Photo Contributors:**  
Lockheed Corporation  
(Pages 6, 24 & 43)

National Semiconductor  
Corporation,  
Scott Allen (Page 2,  
second column,  
photo #2)



**Anne A. Dachs**, Vice President, Professional Development, American Medical International, Inc.

**Elva Lynn Dreisbach**, Vice President, Marketing, TICOR Printing Group

**John M. Harker**, Director of Technology, General Products Division, IBM Corporation

**Pat Hill Hubbard**, Vice President, American Electronics Association

**Charles Jeszeck**, Director of Research, California AFL-CIO Council

**Frank J. Kane**, Assistant Vice President, Labor Relations, Pacific Telephone Company

**Michael Kirst**, Professor, Stanford University

**Leslie Koltai**, Chancellor, Los Angeles Community College District

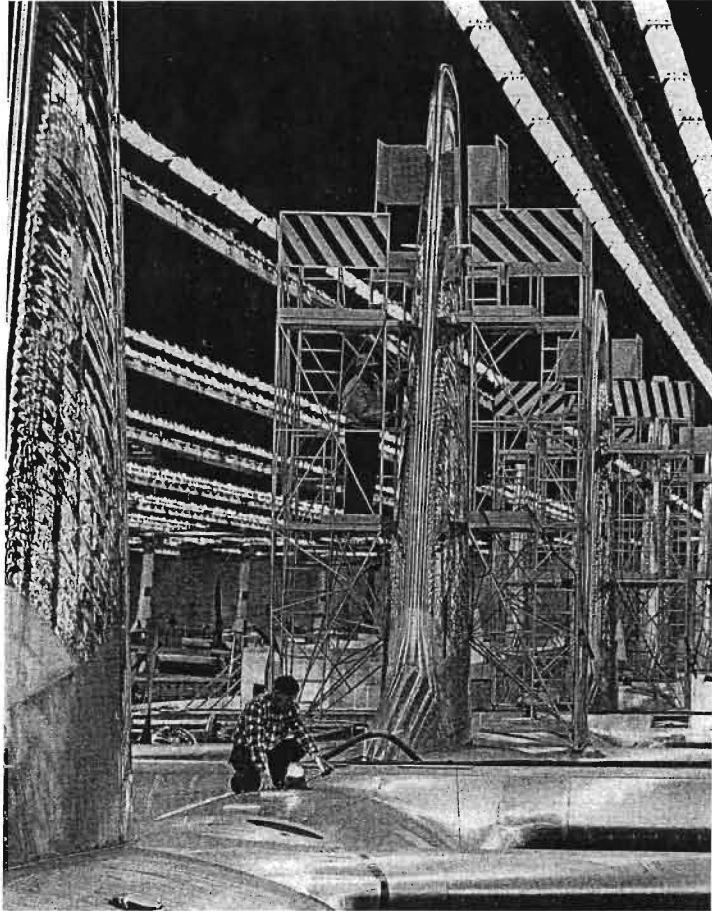
**John Nesheim**, President, Ministry Management Systems

**Elizabeth Stanley**, United Auto Workers

**Bardyl R. Tirana**, Chairman of the Board, Technics Inc./ Limited

**John Zysman**, Professor, University of California, Berkeley

The aerospace and aircraft industry will continue to expand in California, growing 11.4% by 1990



**The Establishment of the  
California Commission On  
Industrial Innovation**  
Executive Order #B-91-81  
(Excerpts)

---

The continued prosperity of California depends upon our fundamental reordering of priorities. The challenge of foreign competition and domestic industrial obsolescence requires that our genius for technological innovation become the guiding concept of the next decade.

California is strategically positioned to take advantage of technological advances in electronics, communications, aerospace, agriculture, and genetic sciences. Such technological advances will be a major benefit to all California industries. These benefits can best be realized through the creation of a new partnership between business, labor, academia, and government. This partnership can both advance and serve basic human values and enhance economic productivity.

A California Commission on Industrial Innovation is hereby established in the Governor's Office... The Commission shall provide a forum for discussion, debate, and policy guidance for the Governor and the Legislature on the role of technological innovation in maintaining California's leadership in the national economy and in retaining its international competitive position.



*Edmund G. Brown Jr.*

Governor of California  
November 17, 1981

**Preface: Toward  
A "Winning Technology"  
Industrial Strategy**

---

The California Commission on Industrial Innovation has been founded on the premise that long-term strategies promoting innovation and productivity are an essential part of any national economic response to the current situation of high interest and unemployment rates.

Today's economic news inevitably focuses on immediate problems: high budget deficits and interest rates, unemployment, business failures, and home mortgage foreclosures, to name a few. Policy debates also center on finding short-term solutions to these problems: the proper size of a tax cut or increase, the appropriate rate of money supply growth, or fixing the level of government spending.

As important as such

short-term policy issues are, however, we must not lose sight of our need to develop long-range economic policies as well.

It has become clear in recent months that today's economic problems are not merely cyclical in nature, but reveal structural problems in our economy. One of our most significant economic problems for example, is the slowdown in capital investment for new plant and equipment. Occurring at a time when foreign governments are channeling billions into new technologies for cutting-edge and heavy industries alike, our domestic failure to invest in productive technologies and equipment could cause American industries to fall fatally behind their international competitors.

It is clear that unless America invests in new technologies, research and development, and education, we may be forced to pay the

price in continued declines in productivity, slow growth, and high unemployment for years to come.

Our goal must be no less than reinvigorating our entire industrial and service sector base:

— We must ensure that our cutting-edge industries, from semiconductors to computers to robotics to telecommunications to biotechnology, retain their international lead; they must not be allowed to succumb to targeted competition from foreign governments marshalling national resources against segments of American industry.

— At the same time, we must restore such established industries as auto, steel, and textiles. Our manufacturing sectors must be supported



It is clear that unless America invests in new technologies, research and development, and education, we may be forced to pay the price in continued declines in productivity, slow growth, and high unemployment for years to come.

---

in their efforts to modernize and increase productivity.

—We must effectively address the serious impediments to growth in foreign trade, rising protectionism, and subsidization of foreign industries, all of which have created a growing pattern of unfair competition in foreign trade.

To accomplish this, we need a national strategy designed to encourage the spread of "winning technologies," —i.e., product, process, and service innovations— throughout our entire industrial structure.

The success of such a strategy depends on the restructuring of government policy so as to ensure that our tax, research and development, credit and investment, trade, education and job-training policies are in fact promoting innovation and modernization. Present government policies encouraging innovation should be expanded. Those that do

not should be altered or eliminated.

We need to ensure that national industrial strategies in the 1980's:

- *Seek aggressively to eliminate trade barriers and other unfair trade practices;*
- *Assist American industry to enjoy an "equivalent financial environment" to their foreign competitors;*
- *Increase the level of research and development both in universities and industry;*
- *Encourage American industry to invest in long-term product and process innovation;*
- *Take the steps necessary to guarantee every child computer literacy;*
- *Provide extensive job training to Americans in advance of displacement due to modernization;*

- *Encourage our community colleges and universities to train computer scientists, technicians, and other trained personnel for growth industries.*
- *Encourage American industry to increase worker participation in production processes and to increase the stake of both employees and managers in industry success.*

In large part, such a new industrial strategy for "winning technologies" means expanding current policies. Most of the fifty recommendations in this report involve new or expanded policies designed to spur innovation, —from investment incentives like tax credits, and pension fund investment flexibility to beefed-up trade policies; to a massive push to promote "technological literacy."

In addition, such a strategy means eliminating current policies which do not encourage technological

progress through innovation, such as tax schemes like "Safe Harbor Leasing" that yield minimal benefits relative to fiscal revenue losses. Exim Bank policies and support should be strengthened to assist U.S. business in effectively meeting foreign competition.

The achievement of these goals requires a new consensus among American business, labor, government and academic leaders. In the past, our nation has thrived in spite of adversary relationships between managers and employees, public and private sectors, and East and West. We can no longer afford this luxury. The California Commission on Industrial Innovation is living testimony that new governing coalitions will form to meet the challenges of the future.

## Winning Technologies

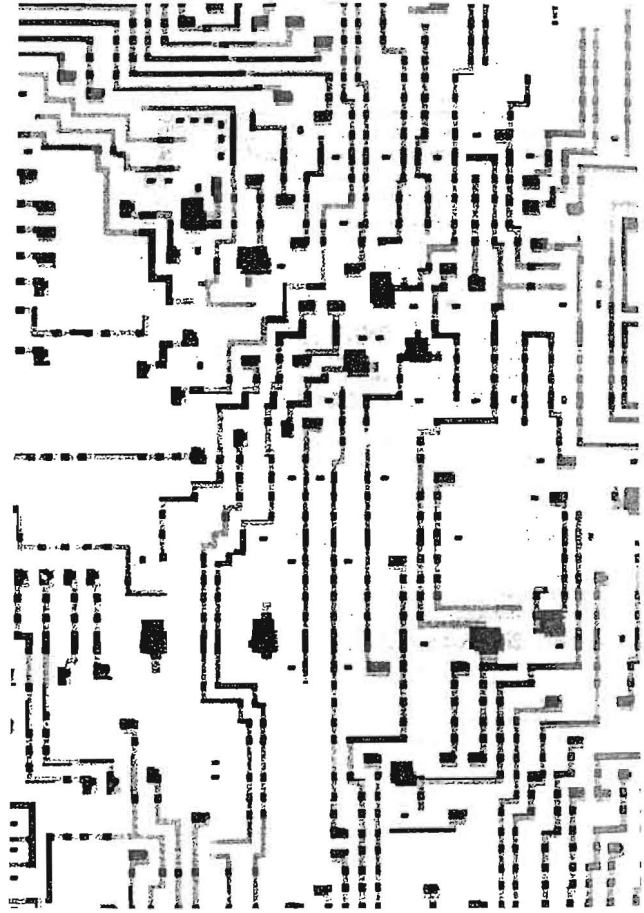
A New Industrial  
Strategy For California  
And The Nation

---

The United States needs a new basis for national policy in the 1980s. Our former policy goals of a strong economy built on heavy industry and cheap energy are no longer appropriate for an age marked by national economic sluggishness, fierce international competition and emerging third world nations reclaiming their resources. Instead we must look to a new, "post-industrial" economy built around relatively resource-efficient information technologies and innovation.

In this new economy, promoting innovation for new growth industries, and modernization for older ones, must become the driving imperative of our economic thinking. New growth industries are defined here as the producers of innovation, such as computers, robotics,

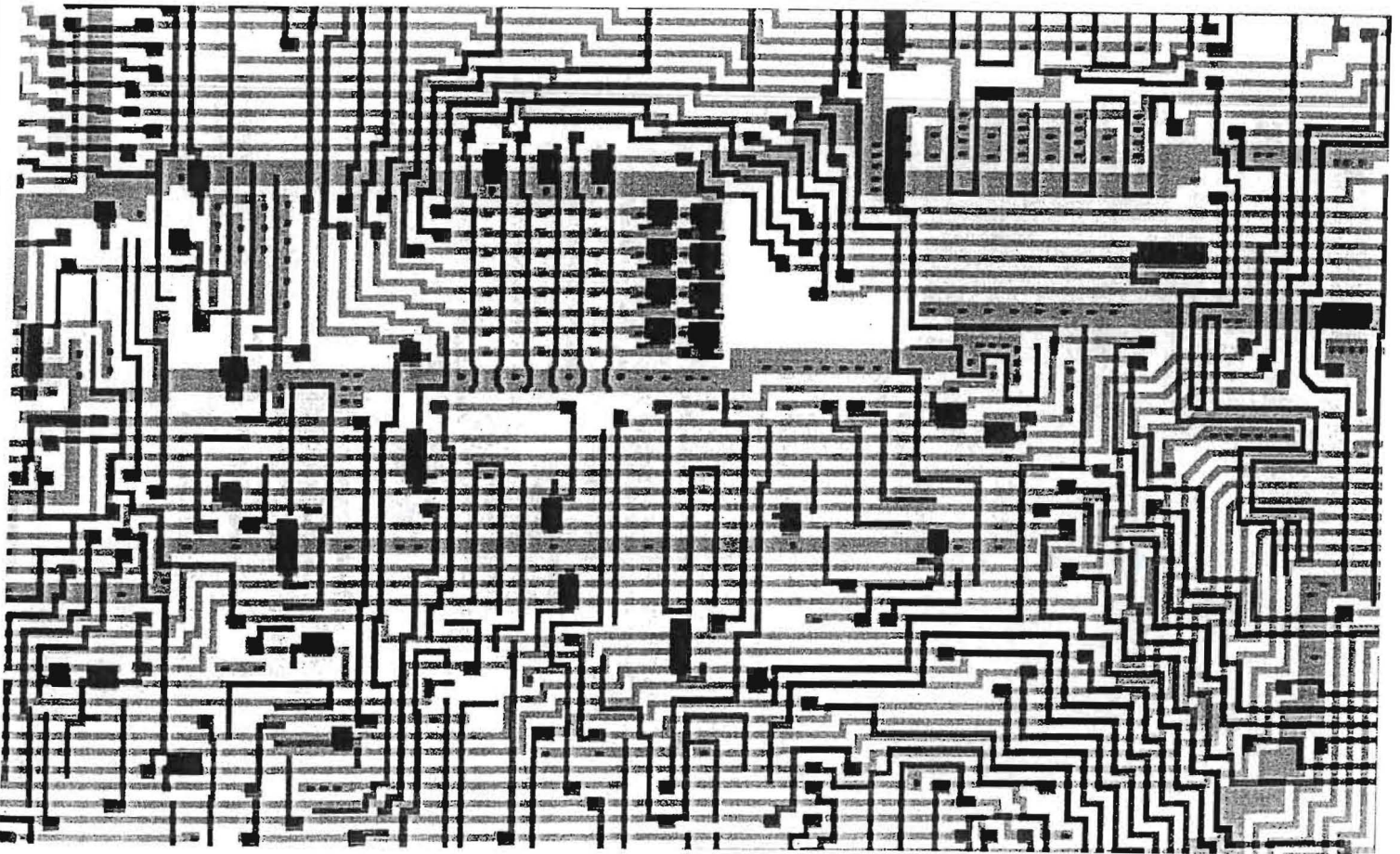
and biotechnology. Clearly, these industries' success in developing innovative products can have a major positive effect on present industries such as textiles, autos and agriculture, classified as users of innovation. In fact, continued technological innovation is the only long-term solution for today's manufacturing industries facing international competition. Therefore, an industrial strategy for California and the nation must incorporate measures which facilitate the adoption of new technologies by mature industries as well as encourage their production.



"We are now in the midst of a revolution that is of the same magnitude and power as the industrial revolution of the 19th century. It is changing our society, our skills, and the character of employment in the United States. This revolution is driven by

advances in microelectronics, transitioning the contemporary world from an industrial to an information society.

*Steve Jobs, Chairman of the Board, Apple Computer*



---

Commissioner Steve Jobs, Chairman of the Board of Apple Computer, clearly states this need:

*"We are now in the midst of a revolution that is of the same magnitude and power as the industrial revolution of the 19th century. It is changing our society, our skills, and the character of employment in the United States. This revolution is driven by advances in microelectronics, transforming the contemporary world from an industrial to an information society.*

*"At its heart is the electronic computer — invented in America 36 years ago and destined to become as essential and pervasive a tool in the 1980s as the calculator became in the 1970s."*

As a leader in the global transformation to post-industrial, information economies, California can play a major role in developing this new industrial strategy. This

State's history during the past decade demonstrates that new, information technologies can become the driving force of overall economic growth. The accompanying chart dramatizes the growth rates of this sector. The fastest growing sector of California's economy, the new technologies must be a major focus of any solution to our national economic morass.

The California Commission on Industrial Innovation (CCII) was founded on November 17, 1981, to "prepare a report to serve as a blueprint for industrial innovation policy in California, in order to assure our continued leadership in the emerging technologies for old and new industries in the 1980's."

Since California's economy can only prosper along

with the nation's, such a blueprint must necessarily focus on national economic policy as well as state-level activities.

The CCII believes that such a "strategic blueprint for industrial innovation" is even more necessary now than a year ago. National economic stagnation since November has not only hurt the economy as a whole, but slowed growth in the high technology sector itself. Meanwhile, strong international competitors have continued to target high technology industries for special assistance, thereby threatening our international leadership.

Although the CCII continues to hope that present national economic policies will work, it believes that the time has come to develop a more comprehensive national industrial strategy to ensure rapid technological growth, revitalize our older sectors, and put our people back to productive work.

Governor Edmund G. Brown, Jr., Chair of the California Commission on Industrial Innovation, has summed up the need for support for new technologies in these words:

*"Our top economic imperative is to invest in the information technologies which will become our major growth sector — semiconductors and software personal and business computers, biotechnology and the new telecommunications, robotics and the new space industries of the 1990s.*

*"More importantly, the information technologies are key to saving our existing industries — from textiles to aerospace, to autos — with computer-aided design and manufacture, robotics, and word processors are already in wide use.*

California Jobs, 1970-1990  
(Thousands)

	1970	1980	1990	Growth 1980-1990
Total Jobs	8,023.9	11,146.5	13,917.0	24.9%
High Technology	273.0	492.2	726.7	47.6
Computer Services	11.4	43.3	128.3	196.3
Computers	52.8	97.1	163.0	67.9
Instruments	50.3	123.1	147.5	26.4
Communication Equipment	102.9	130.1	163.3	25.5
Electronic Components	55.6	98.6	124.6	19.8
Service	1234.8	2082.9	2856.6	37.1
Trade	1530.8	2267.5	2917.2	28.7
Finance, Insurance, Real Estate	374.5	620.9	794.5	28.0
Other Manufacturing	1078.7	1338.9	1642.0	22.6
Mining	31.4	42.9	51.9	21.0
Aircraft/Space	217.7	213.3	237.7	11.4
Self Employed, Household Workers, Other	1858.3	2321.1	2736.5	17.5
Government	1424.7	1766.9	1953.9	10.6

Source: Center for  
the Continuing Study  
of the California  
Economy, California  
Employment Devel-  
opment Department.

---

*"And these technologies are also driving growth in the service sector—as anyone can testify who has dealt with an airline clerk, done computerized research, or banked through an electronic teller.*

*"The potential markets for these new technologies are enormous. The Congressional Office of Technology Assessment, for example, has cited figures indicating that the U.S. electronics market alone will grow 250% from 1978 to 1987. The personal computer market, according to industry analysts, is expected to grow 700% during the next 5 years—from 500,000 units sold in 1980 to 3.7 million units in 1985."*



We must set a national goal of supporting "technological winners," modern, resource-efficient tools and production processes, throughout our industrial and service sectors, so as to increase productivity, income and employment.

---

We must set a national goal of supporting "technological winners," modern, resource-efficient tools and production processes, throughout our industrial and service sectors, so as to increase productivity, income and employment. We must do whatever is necessary to guarantee that our cutting-edge industries — like semiconductors, computers, telecommunications, robotics and biotechnology — retain their competitive lead. And we must also modernize and rebuild our old sectors.

If a choice must be made, policies should be developed to discourage the allocation of capital to "technological losers," i.e. non-productive uses of capital which do not modernize our industrial and service sector

base. We cannot maintain our economic growth if more capital goes into financing art imports than into new plant and equipment utilizing the most modern technologies.

Like our 19th century shift from agriculture to industry, the Information Revolution offers profound promise to the people of the world.

The development of today's information technologies can create new horizons for human potential; free workers from dangerous, arduous and repetitive tasks; offer citizens far greater access to information and opportunities for lifelong learning, and opening new intellectual and creative vistas for our youth.

It also opens a path for rising incomes, employment and growth for the world's economies. Today's new information technologies are relatively resource-efficient, offering a means of increasing productivity with-

out demanding expensive and scarce energy and resources.

The Information Revolution can create millions of new jobs in new information sectors, as well as increase productivity in existing manufacturing and service industries.

But the very pervasiveness of this shift from an industrial to an information economy brings with it a potential for major economic and social disruption. Without advance planning and increased investment, competition for increasingly scarce funds will choke off new growth, and speed the decline in older sectors. Only through a major investment in education and job

training, in research and development, and in the introduction of new technologies to basic industries will major social disruptions be avoided.

The inevitability of economic dislocation if measures are not taken is shown by current trends. For almost a decade, culminating in the present recession, the national economy has exhibited disturbing overall signs of stagnation and drift.

— Productivity growth rates have slowed, until America today lags behind Japan, West Germany, France, the Netherlands, Denmark, Canada, Italy and Sweden.

— Overall growth has slowed, with the nation paying the price in high unemployment and stagnant income. Poverty today is at its highest levels since 1967.

— Both private and public investment in research and

Because of the lack of a coherent policy for industrial growth and job creation, government policy has favored older industries over new technology sectors.

---

development has declined as a share of gross national product since 1965. West Germany, for example, spends a greater portion of her GNP on R&D at present than does the United States.

—Lastly, corporate liquidity has reached record low levels. For the first time, a recession and reduced inflation have not produced lower interest rates. As a result, corporations have accumulated short-term debt, forcing them to defer needed investments in new plant and equipment.

Commission members believe that such national trends are evidence of serious structural problems in our economy, Commissioner Leland Prussia, Chairman of the Bank of

America, recently summarized these trends and concluded:

*"All this would be bad enough if our present economic malaise were merely cyclical. But something much more fundamental is at work—structural change. The sad decline of our heartland industries is powerful testimony to that.*

*"Steel, for example, was once a proud flagship for American heavy industry. Now it lies listing in the competitive backwash of foreign producers. Last year, in a truly seismic shift of the industrial landscape, Tokyo displaced a humiliated Detroit as the new epicenter of world's automobile industry.*

*"Our competitive position is eroding even in semiconductors, the touchstone of U.S. technological leadership.*

*"Clearly, some truly hazard-*

*ous currents lie beneath the turbulent economic waters of the Eighties."*

These national economic conditions have had a potentially devastating effect on sunrise industries—the engines of growth in the economy. *Because of the lack of a coherent national strategy for industrial growth and job creation, government policy has favored older industries to the detriment of new technology sectors.* Established industries pay lower effective tax rates than the new technology industries, for example. This is not the benign neglect of laissez-faire economics, but a policy which has affected the international competitiveness of American industry, both old and

new, and caused the loss of thousands of jobs in the United States.

The decline of American productivity, investment, and R&D expenditures cannot be solely attributed to national government policy. American corporate leaders must share some of the blame.

Commissioner David Packard, Hewlett-Packard Board Chairman, enumerates some of the failures of national policy and corporate management:

*"I think we have a very serious problem facing the country. We have made a number of decisions in the 1970s that have lowered the basic level of research, and has given us a smaller base upon which to build our innovative devices than before. In addition, there has been a very low state of research and development from the major industries. I would say that our automob-*



*ble industry is in trouble not only because of the Japanese, but because our automobile industry did not do what it should have done. Their rate of expenditure on research and development is pitifully low.*

*"There has also been a deterioration in our educational system. It's been in part a deterioration in the relations between industry and the universities as a result of the Vietnam syndrome. We need to strengthen the educational system at all levels and particularly in the technical areas. Industry can be a constructive participant in that process."*

While hostage to many of these national trends, however, California has in many ways demonstrated an alternative. California's experi-

ence has demonstrated that development of "technological winners" can spark dynamism throughout the entire economy.

The California economy remains based on such traditional pillars of strength as banking, agriculture, aerospace, and oil. But the high technology sector has emerged during the past decade as a new source of vital growth creating, directly and indirectly, 23% of all new jobs.

Whole new industries have sprung up in California during the past decade. We have seen the semiconductor industry grow from a handful of small firms to a multi-billion dollar sector employing tens of thousands of Californians. The personal computer industry, nonexistent in 1975, has already become one of our most dynamic growth sectors.

The prospects for the 1980s are even more

encouraging. A recent California Economic and Business Development Department study found that the growth rate of high technology jobs in the 1980s will be nearly double that of the state's overall job growth rate. New industries like robotics and biotechnology are poised for takeoff.

Even more significantly, such technological "winners" have also been a key to productivity growth in older sectors.

Aerospace companies report that the availability of new computer-aided design and manufacture techniques have already become a key to increasing productivity growth. Foreign workers who often barely speak English are routinely

using computer-aided design and marketing methods in the Los Angeles garment industry. California's agriculture industry is already beginning to enjoy the benefits of new discoveries in bioscience, and computerized exchanges of information. Tens of thousands of California small businesses have already seen microcomputers increase their productivity.

The role of high technology in the California economy has been made possible by an infrastructure that includes the world's most sophisticated venture capital market and one of the finest educational systems in the nation. California regularly attracts over 1/3 the venture capital available throughout the nation. The state's extensive public university and community college system, and private institutions like Stanford and Cal Tech, have both produced top technical personnel, and

provided an attractive environment for out-of-state engineers and scientists.

This California experience must become America's experience in the 1980s. The United States must set out on a conscious path of fostering technological innovation and creativity if we are to foster increased economic growth.

One critical element to realizing such a goal is the creation of a new governing coalition between business, labor, academia and government. We can ill afford continued confrontation between these sectors. The California Commission on Industrial Innovation, composed of business, labor, academic and government leaders is a visible example of this kind of cooperation.

<b>Industry</b>	<b>1980 Employment</b>	<b>1990 Employment</b>	<b>1980-1990 Growth Rate</b>
Biotechnology	2,000	9,000	300.5%
Photovoltaics	1,000	4,000-10,000	900.0%
Robotics/Computer Aided Manufacturing	1,000	5,000-10,000	900.0%
Computer Software and Data Processing Services	43,300	128,300	196.3%
Computers and Peripherals	97,100	163,000	67.9%
Electronics Components	98,600	124,600	19.8%
Aircraft and Space	213,300	237,700	11.4%
Instruments	123,100	147,500	26.4%
Communication Equipment	130,100	163,300	25.5%
TOTAL High Technology	709,500	993,400	40.0%
TOTAL California	11,146,500	13,917,000	24.9%

Source: Office of Economic Policy, Planning and Research Center for Continuing Study of the California Economy.

California shows that the spirit of risk-taking and innovation is alive and well in America. Government must promote policies to foster this spirit throughout the nation in the 1980s.

*Don Gevirtz, Chairman, The Foothill Group*

---

As Commissioner Lynn Schenk, Secretary of the Business, Transportation, and Housing Agency, summarized.

*"One of the great economic strengths of this nation has been its leadership in international trade. This leadership is being challenged and has severely impacted our economic base.*

*"A national industrial policy would not only address this leadership issue but would bring together the positive force of government, labor, business, and our educational institutions in a focused effort to develop a cohesive and definite program that Americans will identify with and implement during this decade."*

It is clear that the 1980s will be an era of increasing interdependence and cooperation. Cooperative agreements and social contracts between business and labor will become increasingly

necessary in coming years, if the United States is to remain internationally competitive.

Perhaps paradoxically, the 1980s will also be a period for rediscovering the entrepreneurial spirit which built much of Silicon Valley. Public policy must recognize the importance of the continued existence of small businesses, side by side with the larger, established firms, for innovation and creativity to flourish. The Commission feels it is critical that government policy recognize the key role played by small and innovative businesses in maintaining innovation in the 1980s.

Commissioner Don Gevirtz, Chairman, The Foothill Group, has commented,

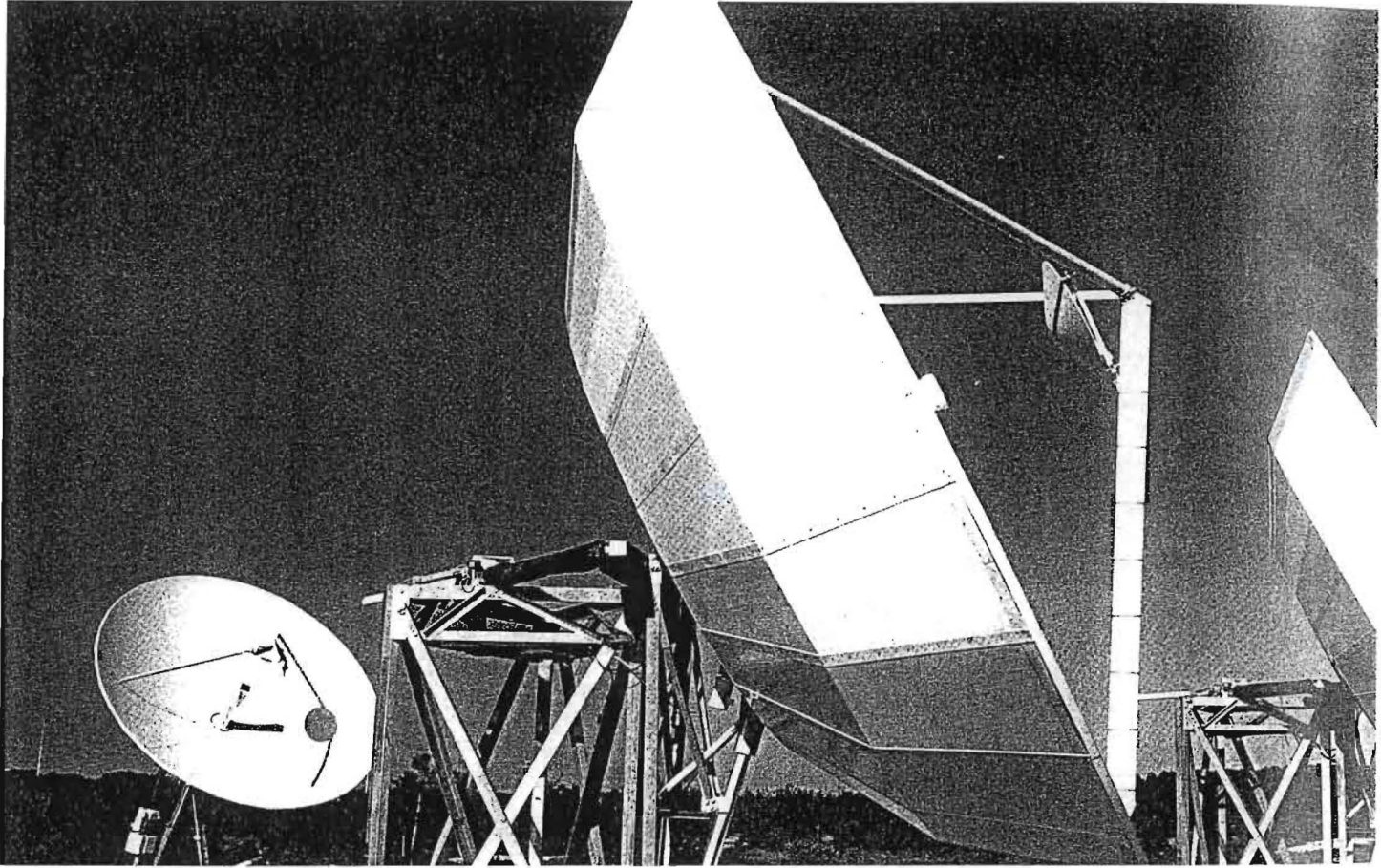
*"Policies favoring large economic units are undermining the innovative process, which is vital if we are to improve our productivity and meet the Japanese challenge in the marketplace.*

*"Large units simply are not as innovation-oriented as smaller, entrepreneurial companies.*

*"A National Science Foundation study concluded recently that small businesses produce 24 times the number of innovations per federal research dollar than large firms do.*

*"Fifty percent of productivity increases in the United States between 1948 and 1969 were the direct result of entrepreneurial technological innovation."*

*California shows that the spirit of risk-taking and innovation is alive and well in America. Government must promote policies to foster this spirit throughout the nation in the 1980s."*



## A National Industrial Strategy for Innovation in the 1980s

To realize the goal of a strong and innovative America in the 1980s, the United States will need a national Industrial strategy designed to encourage innovation and modernization.

The success of sunrise technologies and industries like computers, semiconductors, and telecommunications in the 1970s was so dramatic that many assumed these industries would enjoy automatic growth in the 1980s. Public policy therefore focused more heavily on saving older industries, like autos and steel. In fact, however, we can no longer assume automatic growth for even our most technologically advanced sectors. New domestic and international conditions demand new policy responses at both the national and state levels. The United States must focus national policy

debates on important issues such as the ordering of economic priorities in times of recession, the deployment of natural resources, and the provision of education and job training for a technological society. These issues are especially important because of three factors.

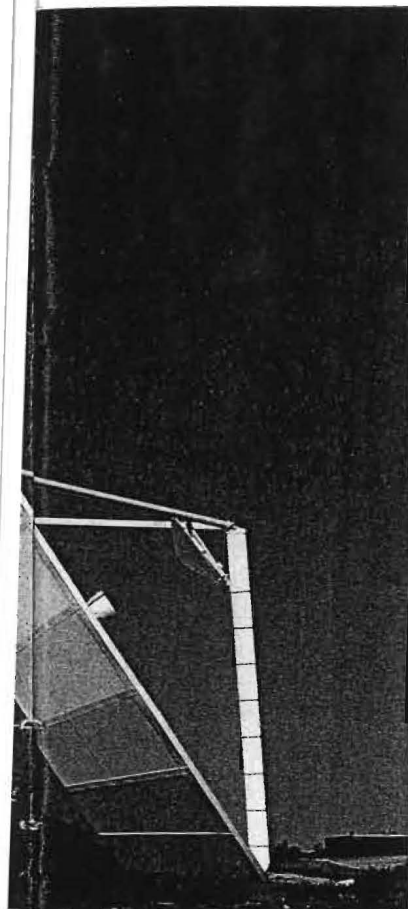
1. Internationally, we have entered a new era of fierce competition, in which U.S. companies find themselves competing against foreign governments that have targeted their domestic industries to excel over American technology leaders;
2. Domestically, the overall U.S. economy will grow far more slowly and unevenly in the 1980s than it has in the past, as the combined pressures of resource constraints, the maturing of American technological leaders, and tough international competition take their toll. U.S. growth technologies and sectors will find it

far more difficult to attract the capital they need to keep pace than ever before.

3. At the State level, diminishing revenues make it more difficult for the needed investment in education and job training to occur for citizens to be prepared for work and life in a technological society.

These domestic and international challenges mean that macro-economic policy alone—whether tax-cuts and tight money, or “pump-priming” and looser money—will not guarantee the widespread innovation and modernization that American industry needs in the 1980s.

We need a new emphasis on specific industrial policies designed to encourage innovation throughout our economy.



*"We need a policy targeting what is critical to this country over the long-term. We have to have an industrial policy."*

*Charles Sporck, President, National Semiconductor*

Commissioner Charles Sporck, President of National Semiconductor Corporation, has most forcefully described the need for a national industrial policy:

*"The feeling that many of us have is that without countering the increasing effectiveness of our trading partners targeting on high technology, the United States in the 1990s is going to look like a Third World country.*

*"We are talking about a very bleak situation if we lose our position of being a leading high-technology country. It would make it impossible to maintain our current institutions or indeed, in my mind, our democratic society.*

*"We need a policy targeting what is critical to this country over the long-term. We have to have an industrial policy.*

*"Currently, inflation in the United States has been substantially reduced if not eliminated. But the tools used by our government to*

*attack inflation really have made it increasingly difficult for us to attract investment.*

*"The unavailability of funds has impacted our ability to continue to progress in the high technology industries that bring about improvements in productivity— which is just the opposite of what we really need to attack the high inflation economy.*

*"While the U.S. government has not seen the critical role of high technology in our future prosperity, very clearly our trading partners— especially Japan— have. And over many years now they have pursued an aggressive policy of targeting those industries.*

*"Now when we start talking about targeting financially, frequently the response has been description of the need to return to a free market.*

*"I think all of us are very much in favor of a free market. The problem is that we don't exist in a free market. The world is made up of countries that are not pursuing a free market philosophy and strategies, and they are capturing positions in important areas of trade.*

*"This being the case, we have to respond in some manner.*

*"The winning technologies that promote innovation, productivity and lower inflation need to become the focus of a state and federal industrial policy."*

The Commission agreed that the goal of national social and economic policies should be to promote winning technologies, through state and national policies that encourage innovation and modernization by both old and new industries. They therefore focused on three sets of necessary policies:

**1. Investment for Innovation** We need a national industrial strategy that will encourage the flow of investment to new and innovative technologies. These include (a) trade policies that ensure that U.S. growth technologies have fair access to world markets; (b) policies to ensure adequate research and development by American firms in new and old industries alike; and (c) investment policies that foster a steady flow of venture and expansion capital into growth industries, and modernization capital into older industries.

**2. Education and Job Training for Innovation** We need national policies to produce a "Sputnik-like" push in education to develop the engineers, computer scientists, technicians and technologically-aware cit-

"It's (declining productivity and rising unemployment) not a labor problem. It's not a government problem. It's not a workers' problem. It's an American problem."

"We want a partnership, so that we can feed workers, and people around this nation can have their interests protected."

*Ruth Jernigan, International Representative, United Auto Workers.*

izens needed for today's society. Basic reforms are needed in our education and job-training institutions to ensure jobs with a future for both students and workers displaced by automation or foreign competition, through (a) elementary and high school technological literacy; (b) university engineering and computer science; and (c) vocational education training for jobs with a future.

**3. Workplace and Management Productivity for Innovation.** We need national policies which encourage productivity among workers and managers alike. Workers will increase productivity and share the burden of making the transition to a new economy if they are given a stake in success. Managers will take risks, think long-term, and reinvest in new products and processes, if they know they own a share in the future.

The success of any industrial strategy, all Commissioners believed, depends on the participation of business, labor, government and academia in its development. As Commissioner Ruth Jernigan, International Representative of the United Auto Workers, asserted:

*"We need to make sure that when workers and taxpayers of this nation give up that dollar, it is spent wisely.*

*"It's (declining productivity and rising unemployment) not a labor problem. It's not a government problem. It's not a workers' problem. It's an American problem."*

*"We want a partnership, so that we can feed workers, and people around this nation can have their interests protected."*

---

### **1**

---

**Recommendation No. 1. The California Commission on Industrial Innovation calls for the United States and California to develop national and state industrial strategies, aimed at accelerating the invention and utilization of winning technologies.**

---

Such policies could be developed under guidelines established by a nonpolitical agency similar to the SEC or the Federal National Mortgage Association. Alternatively, policy direction to the President and officials such as the Secretaries of Commerce and Treasury, and the Special Trade Representative could be given by the Council of Economic Advisers in its annual economic forecast. These guidelines for industrial policies would have four goals:

1. to guide the United States government, particularly the Department of

Commerce, in its identification of those industries facing international competition due to foreign government subsidized capital or tariff and nontariff barriers, and to negotiate in good faith with foreign governments to resolve inequities;

2. to remove the contradictions in U.S. policies which discourage technical innovation and modernization;

3. if other measures to spur international competitiveness fail, to employ appropriate measures to create an equivalent financial environment for American companies; and

4. to increase the rate of job creation and to mitigate the impact of unemployment due to industrial restructuring through education and job training programs.

## Investment for Innovation in the 1980s

The California Commission on Industrial Innovation places a high priority on ensuring adequate financing for technological innovation in the 1980s.

Adequate investment is critical to innovation because cutting-edge technologies cost far more in research and development, and for installing new process technologies, than simply replacing older equipment. Many of the older industries most in need of such new process innovations as robotics and computer-aided manufacturing are also among the most cash-poor of American industries.

Commission members view most seriously the present slowdown in corporate investment, accompanied by high levels of corporate illiquidity.

Commissioner Rene McPherson, Dean of the Stanford Business School and former head of the Dana Corporation, recently

stated at a Commission meeting:

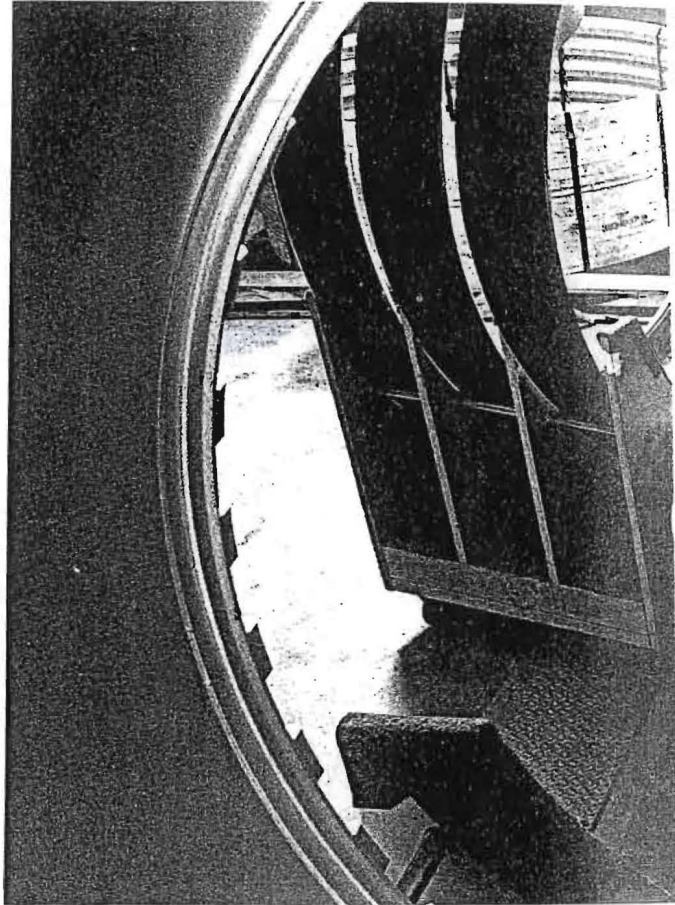
*"I think everybody really understands that we have a good possibility of getting into very serious trouble in our country, because you can't run your business in pretty close to zero profit and have to spend what we have to spend to borrow money.*

*"We're not borrowing money for anything other than to pay our people. We are not expanding our facilities. We're just borrowing money to pay our people.*

*"You can't do that very long.*

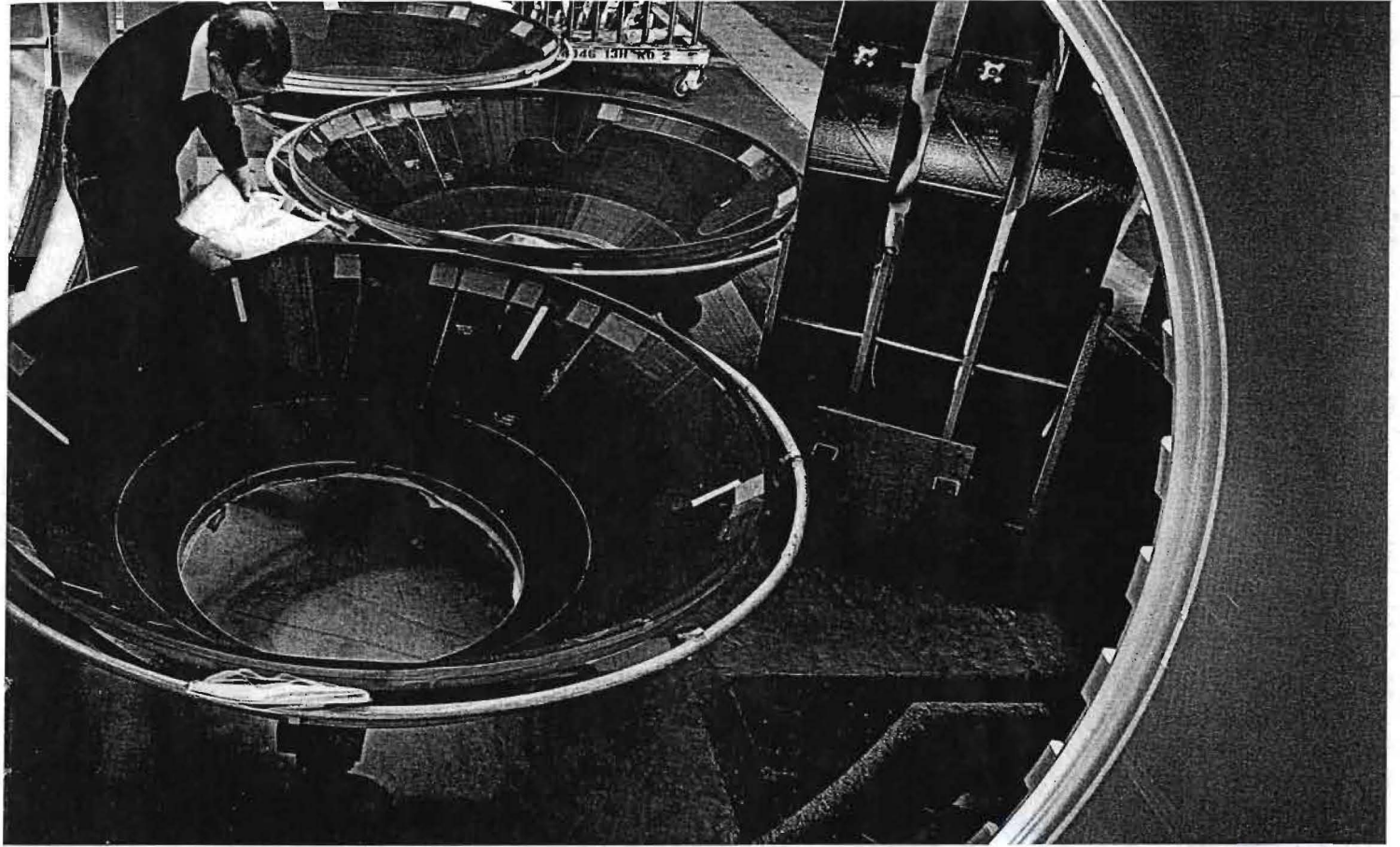
*"We haven't got a lot of time. We've got 6 months, 12 months, and then we have the tube facing us, the tube—that means going down.*

*"I'm serious. It's kind of like if you've been on a 40-day*





Because of the research performed in leading universities in California, new types of materials which are resistant to oxidation, hot corrosion and erosion are being developed



drunk, you do have to expect a half-day hangover.

*"And that's exactly what we've been on, a 40-year drunk. And the problem is we have some very bad situations facing us and time is not going to allow us very much leeway.*

Commission members stress that one critical need to the continued growth of the industry is to create a "competitive financial environment" with other nations. This need is most acute in relation to Japan, whose government has explicitly targeted the dominance of American companies from semiconductors and software to biotechnology.

According to a study prepared for the Semiconductor Industry Association by Chase Manhattan Bank, the structure of the Japanese financial system allows Japanese semiconductor companies to enjoy a cost of capital advantage of one-quarter to one-third that of

American companies. This cost of capital advantage is aggravated by other forms of support, such as tax waivers and direct subsidies, for fledgling technology-based industries provided by foreign governments. For American companies to compete, they must reduce their own profit margins, thus making them less attractive to investors.

As Commissioner Sporck summarized, *"If in fact those industries that Japan is targeting are the ones that are critical to the future [competitiveness of American industry], then they will be suffering from a shortage of capital. Because this means that the long-term return on investment in these key U.S. industries, like my own, is going to be lousy—which means that these will be the industries that are not going to get any money [from*

*investors]. And these are exactly the industries that you need to pump money into [to maintain America's technological leadership]."*

This inadequate flow of capital towards innovation carries serious implications for American efforts to remain internationally competitive:

1. Further decline in older industries—strong international competitors are rapidly introducing robotics and other advanced technologies into their basic industries. U.S. auto, steel, textile and other older sectors may never catch up unless they devote substantially greater resources toward modernization and productivity improvements.

2. Decline in newer growth industries—aided by huge government subsidies, the Japanese have captured a 40% market share in 16K Ram memory chips and 70% market share in 64K Ram memory chips.

Although U.S. semiconductor manufacturers have recovered, and look to regain their lead in such basic technologies, they cannot continue to do so without adequate financial resources. Other U.S. technology leaders in the 1980s may also find themselves threatened by inadequate supplies of competitively-priced capital.

3. A threat to infant sectors—a study prepared for the CII on robotics found that the industry has a potential to grow from \$1 billion in sales in 1980 to \$1 billion in 1990, and that "significant opportunities exist for the emergence of new California industries (1) applications engineering (2) software development, and (3) systems integration.

The same study noted, however, that this industry could only prosper if customers could afford to purchase robots, and that "current

through such a trade policy will competitiveness be determined solely on the grounds of price and performance of products.

---

high interest rates are a significant barrier to the rapid diffusion of the equipment . . . Given the fact that Japan is focusing this decade on the rapid development and application of robots and automated manufacturing, California cannot stand by and watch our international competition improve their cost and quality of production position."

Similarly, a CCII-funded study on photovoltaics reported that "the 1980s will see the global photovoltaic industry become a billion dollar industry." The study also noted that without an adequate flow of capital to this industry, however, "the grid-connected market for photovoltaics in the U. S. will probably be very small or non-existent!"

Given the particularly strong focus given by foreign governments like Japan on such infant industries, the United States could see these industries die

without adequate financial assistance.

Despite these problems, the Commission remains optimistic that given the proper trade, research and development, and investment policies, the United States will be able to keep its technological lead in the 1980s.

#### **Promoting Free Trade**

The California Commission on Industrial Innovation is strongly committed to free trade policies. At the same time, Commissioners believe that unless America's trading partners practice "fair trade," protectionist sentiments in the U. S. will increase, threatening a major step backward in international trade relations.

**Robert Galvin, Chairman of the Motorola Corporation,** summarized these sentiments in a recent speech before the Electronic Indus-

tries Association, "*Free trade will be fair trade if an undistorted market makes the decisions in both countries over a period of time.*"

Commissioners are particularly concerned with trade practices by the nation of Japan. A major comparative study of the American and Japanese semiconductor companies, jointly financed by the Commission on Industrial Innovation, the California Office of International Trade, and the U. S. Congress, has concluded:

*"Through most of the 1970s, Japanese government policies limited foreign access to the domestic market and ensured that the advantages of rapid domestic growth would accrue mostly to domestic Japanese firms."*

*The Commissioners unanimously agreed that the United States needs to pursue a much more aggressive policy of opening markets abroad, using whatever leverage is needed. More-*

over, all agreed that tariff parity must include a consideration of nonmarket mechanisms which give foreign competitors an advantage over American companies. *Only through such a trade policy will competitiveness be determined solely on the grounds of price and performance of products.*

---

## **2**

---

### **Recommendation No. 2. The United States Congress should pass the Reciprocal Trade and Investment Act of 1982**

---

This act is designed to open up foreign markets to U. S. high technology products to ensure that U. S. industries are afforded no less favorable treatment in doing business in foreign countries than are the nation's own domestic firms. The Act instructs the President to

---

place a top priority on ensuring fair trade in our high technology products, and authorizes him to use the full means at his disposal to assure parity.

---

**3**

---

**Recommendation No. 3.** The President should aggressively negotiate lower trade barriers for high-technology products under the General Agreement for Tariffs and Trade (GATT).

---

The President should elevate high technology products to the highest possible priority in ongoing GATT negotiations.

**Increasing Research and Development**

The California Commission on Industrial Innovation believes that a national focus on encouraging research and development is central to this nation's economic survival in the 1980s. R&D

has been at the core of the success of America's high-technology firms, as shown by the high percentage of sales devoted to research compared to other industries. Computer and semiconductor firms devote three to five times the resources to research, according to a staff paper prepared for the Commission.

In spite of the importance of research to the continued competitiveness of industry, overall levels have declined.

Commissioner Richard Atkinson, Chancellor of the University of California at San Diego, and former Director of the National Science Foundation, has stated:

*"There is a simple explanation for the U. S.'s drop in productivity and leadership in new technologies. In*

*1968, we as a nation invested about 4.2% of our Gross National Product in Research and Development. Today, we invest less than 2%. If this trend continues, we cannot expect to maintain world leadership in high technology areas."*

Given their greater need for research, one way to maintain the leadership of America's high-technology companies is to support increased R&D expenditures in the 1980s. The Commission therefore recommends that the nation set a goal of maintaining American inventiveness and ingenuity through the support of university research, and by taking other measures to support industrial research.

---

**4**

---

**Recommendation No. 4.** The United States should expand the incremental research and development tax credit.

---

In 1981, Congress passed a 25% incremental R&D tax credit. The Commission recommends that this tax credit be expanded to apply to all costs associated with conducting R&D, including overhead and support staff. The Department of Treasury should be urged to issue its regulations on the definition of R&D which will qualify for this tax credit, and to interpret the definition of R&D as broadly as possible.

The Commission also recommends that this tax credit be increased in the future.

---

**5**

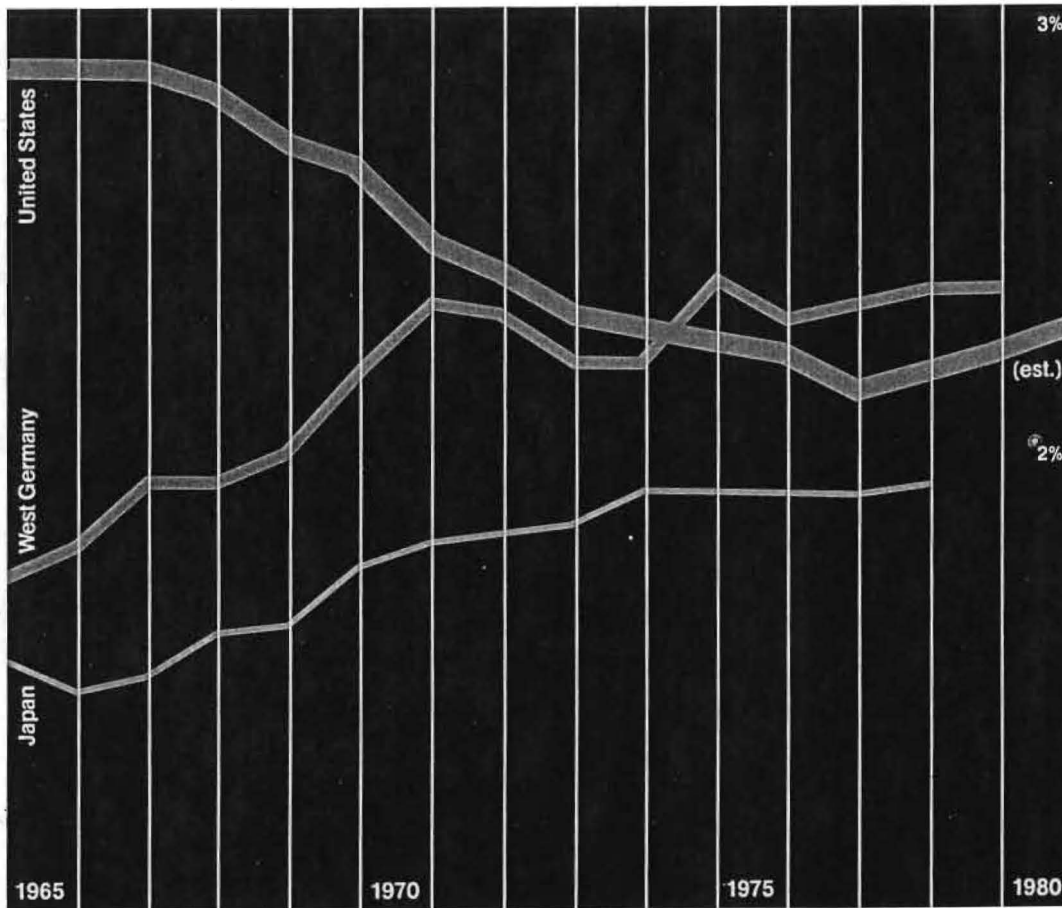
---

**Recommendation No. 5.** The United States should enact an antitrust exemption for joint research by high-technology companies.

---

Share of GNP Spent on  
Research and Development

Source: National  
Science Foundation



Present law discourages joint research between companies, resulting in costly and unnecessary duplication, and a competitive disadvantage with international competitors who encourage, and frequently fund, cooperative R&D projects. The Commission supports legislation introduced by Congressman Don Edwards of California which would exempt R&D partnerships from antitrust regulations. It is hoped that this legislation would permit the financing of more research projects due to the sharing of costs amongst a larger number of firms.

**6**

**Recommendation No. 6.**  
California should establish antitrust exemptions for research and development cooperative ventures.

Alternatively, if federal legisla-

Computer-aided manufacturing is one step along the path to increased productivity and

competitiveness of America's manufacturers.



tion to establish an antitrust exemption for R&D partnerships is not passed, California could create an umbrella for such ventures which would qualify for an exemption.

---

## 7

---

**Recommendation No. 7. The United States should restore budget cuts in research in such critical areas as the National Institutes of Health, the National Science Foundation and the national laboratories of the Department of Energy and NASA**

All Commissioners expressed dismay at recent budget cuts in leading national research laboratories and in grants to university researchers. Research budgets should be restored, particu-

larly in commercial, as opposed to defense, areas.

### **Increasing Investment Capital**

*Commissioners feel that a critical problem confronting America in the 1980s is ensuring a flow of capital to innovation at a cost equal to that paid by our international competitors.* The fact that foreign firms, often supported by their government, enjoy steady access to capital at a cost far below that available to American firms remains the critical obstacle to retaining our technological lead.

The comparative study between the American and Japanese semiconductor industries referred to above found that:

*"the most significant advantage offered by the Japanese industrial and financial structure compared to its U. S. counterpart is a stable availability of capital for continued growth—the basic*

Commissioners feel that a critical problem confronting America in the 1980s is ensuring a flow of capital to innovation at a cost equal to that paid by our international competitors.

---

*need for semiconductor companies whose markets are expanding and whose products changing rapidly . . .*

*"The Japanese semiconductor companies, with the exception of Matsushita, have debt-to-equity ratios of 150 to 400 percent, compared with U. S. firm ratios of 5 to 25 percent . . .*

*"The long-term risk born by lenders is . . . reduced by the structural participation of the Japanese government, working through the Bank of Japan, in assisting financially troubled firms . . .*

*"By contrast, the availability of capital is much less stable for U. S. firms, who raise most of their capital through retained earnings and equity investment (as their debt-equity ratios suggest) . . .*

*"The financing of projects from current earnings could well force a firm to forgo*

*promising projects, which would ultimately yield market share and profits, because of a current slump in sales. Long-term planning becomes much more difficult.*

*"Moreover, a return to the equity markets might not provide a meaningful choice most of the time. New equity issues must be timed to coincide with variable evaluation of the stock in the market. High stock prices may be poorly correlated with a firm's internal requirements for capital."*

The Financing Subcommittee staff report confirmed these findings, noting that high technology firms in general have higher capital costs of expansion than manufacturing industries in general.

It also notes that high technology firms also experience far greater equipment obsolescence, with computer companies, for example,

retiring 9.4% of equipment in place, as compared to 4.2% for all manufacturing industries.

In general, U. S. policy does not recognize the special capital treatment needed to promote industrial innovation.

In some cases, federal policy actually discriminates against innovation. The Administration's 1981 Accelerated Cost Recovery System, for example, speeded up depreciation schedules for industrial real estate and long-lived equipment, but actually slowed depreciation for the kind of short-lived equipment used by our high technology industries. Tax leasing provisions similarly worked primarily to the benefit of older industries.

The California Commission on Industrial Innovation recommends a number of

federal and state policies designed to spur investment in new technologies.

#### **Tax Policy For Innovation**

The Commission felt strongly that the federal tax code should be reexamined in reference to the needs of high-technology industries. Present tax rates of these companies far exceed applicable rates of older, more established industries, such as steel and oil. The elimination of these tax biases would significantly affect the ability of technology companies to finance research and development (as discussed above), expansion, and innovation.

---

### **8**

---

**Recommendation No. 8. The United States should move toward the complete elimination of taxation of long-term capital gains. As a first step the government should eliminate capital gains tax on investments in new com-**

panies, while taxing gains from investment in non-productive investment as ordinary income, as has been legislated in California.

Elimination of capital gains taxation for long-term investments in smaller businesses will significantly increase the flow of capital toward innovation. Revenue losses can be compensated for by taxing nonproductive capital gains, such as collectibles and precious metals, at ordinary income tax rates.

Federal action could follow the model established in California in the 1981-82 Legislative session, when the state tax on capital gains for investments in firms with less than 500 employees was eliminated, and the revenue loss was made up by raising taxes on gold and other collectibles.

**Recommendation No. 9.** The United States should allow corporations, at their option, to writeoff equipment at the rate at which it becomes obsolete if this would result in faster depreciation than current schedules permit.

The United States should reform current depreciation tax schedules to allow equipment which becomes technologically obsolete to be depreciated at their actual rate of obsolescence rather than at mandatory writeoff provisions.

**Recommendation No. 10.** The United States should create financial free trade zones to attract foreign investment.

The establishment of financial free trade zones in the United States would allow

foreign investors to purchase U.S. equity or debt free of U.S. withholding tax assessments, thus encouraging the flow of capital into American industry.

**Recommendation No. 11.** California should bring its treatment of incentive stock options and employee stock ownership plans into conformity with recent federal changes.

The passage of the Economic Recovery Act of 1981 instituted several tax reforms which benefit rapidly growing sectors. California should act, fiscal realities permitting, to bring state laws into conformity with these federal changes. Governor Brown signed AB 2595 (Deddeh) to accomplish these goals.

### **Other Investment Policies Not Using the Tax Code**

**Recommendation No. 12.** The United States should increase support for the Export-Import Bank, and other institutions, which are currently providing credit to foreign countries.

The current activities of the Export-Import Bank are focused on the neutralization of low cost financing arrangements on large-scale transactions offered by foreign-based companies in competition with American exporters. This activity has proven to be a successful countermeasure in the battle against this single unfair competitive practice and should be continued in an aggressive manner. However, the potential for the Exim Bank to recognize and counteract additional artificial



While our overall policy goal is a free market where capital flows to the most profitable investment, all Commissioners agreed that certain policies pursued by foreign governments distort the market, requiring special counter-measures by the U.S.

---

ally induced economic constraints has been limited by the Bank's narrow charter.

The Bank's charter should be modified to better meet the needs of American exporters facing foreign competition with a cost of capital advantage. In this way, the Bank's charter would be better coordinated with more general strategic objectives of the American economy.

---

### 13

---

**Recommendation No. 13. States should enact pension fund flexibility to invest in innovation, as called for in Proposition 6 on the November 1982 ballot in California.**

---

State pension funds should be allowed to invest a higher percentage of their holdings in growth firms than is now the case.

States should initiate actions similar to California, where the November, 1982 ballot contains a measure, SCA 21, which accomplishes this. SCA 21 increases from 25% to 60% the portion of total pension fund assets that can be invested in stocks; raises from 0 to 5% the amount of total assets that can be invested in companies that have less than \$100 million in assets, and/or have not been paying dividends; and increases from 0 to 0.5% the amount of assets that can be put into venture capital.

---

### 14

---

**Recommendation No. 14. The United States should encourage investment in existing U.S.-based growth technologies targeted by government policies of our major industrial trading partners.**

---

Commission members feel

in general that national action should be specifically directed toward U.S. growth sectors targeted by foreign competition. While our overall policy goal is a free market where capital flows to the most profitable investment, all Commissioners agreed that certain policies pursued by foreign governments distort the market, requiring special counter-measures by the U.S.

Some Commissioners believed that such national support should only be given as a last resort, once all other trade and tax policies had failed. Others felt that time was running out, and immediate action was required.

In general, Commissioners feel that such federal support should be: (a) available to "all comers" producing and using new technologies; (b) targeted

to activities which foster innovation, such as R&D and the purchase of new process technology; and (c) extended on the basis of performance criteria guaranteeing a company's contribution to economic growth.

In extending national support, Commission members feel that assistance should be available to all firms which meet strict performance-based criteria. Some suggestions as to which criteria could be met are:

1. devoting a significant specified percentage of sales to R&D;
2. devoting a significant specified percentage of sales to depreciable investment in plant and equipment;
3. producing a minimum annual average rate of employment growth in the United States; and
4. producing a product which has been explicitly targeted for development in an industrial policy of a major international competitor.

---

Actions that might be taken include: (a) tax incentives designed to increase the competitiveness of American technology industries and to encourage the purchase of new technology by industry; (b) the creation of savings accounts to provide capital for investment in new technologies; and (c) revising the charter of the Export-Import Bank to allow it to extend both export promotion and import protection assistance to companies.

The most controversial issue addressed by the Commission was the role that the United States government should play in providing direct assistance to industries which met these criteria.

A number of Commissioners felt strongly that such targeting was necessary, and commonly practiced in this nation already.

Commissioner David Commons, a Los Angeles

consultant, stated at a recent Commission meeting,

*"I'll give you a perfectly good example of targeting that works marvelously. It's the aircraft industry and the national defense industry.*

*"They are specifically prospering due to government policy. Without targeting, Boeing would not survive. Nor would McDonnell-Douglas, Pratt-Whitney, nor Rolls-Royce.*

*"The fact is that we have all sorts of targeting in this country."*

Clearly documentation exists to support these claims. According to a Spring 1982 *Foreign Policy* magazine article by Robert Reich, the federal government spent five times more money on R&D for commercial fisheries in 1980

than it did for research on steel. In addition, in 1980 the government provided over \$6 million in loans and loan guarantees to the ship building industry, and \$445 million in tax credits to the timber industry, to give just a few examples.

The current practice of industry targeting by the federal government is not the issue then, as Commissioner Don Gevirtz states, *"the issue is coordinating it better, making it more efficient and tying it in with a consensus that improves our position in international trade and enables us to increase our productivity."*

These Commissioners felt that the United States should form an Innovation Finance Corporation, which would be publicly capitalized, to provide direct low-cost loans, guarantees, and other incentives on a discretionary basis. In addition, such a Corporation might serve to organize a second-

ary market for pooled and guaranteed loans made to eligible corporations.

A number of other Commissioners felt equally strongly that the U.S. government should play no such role, and that the goal should be less, not more, direct government involvement in financing and investment.

Commissioner Lee Prussia summarized this point of view.

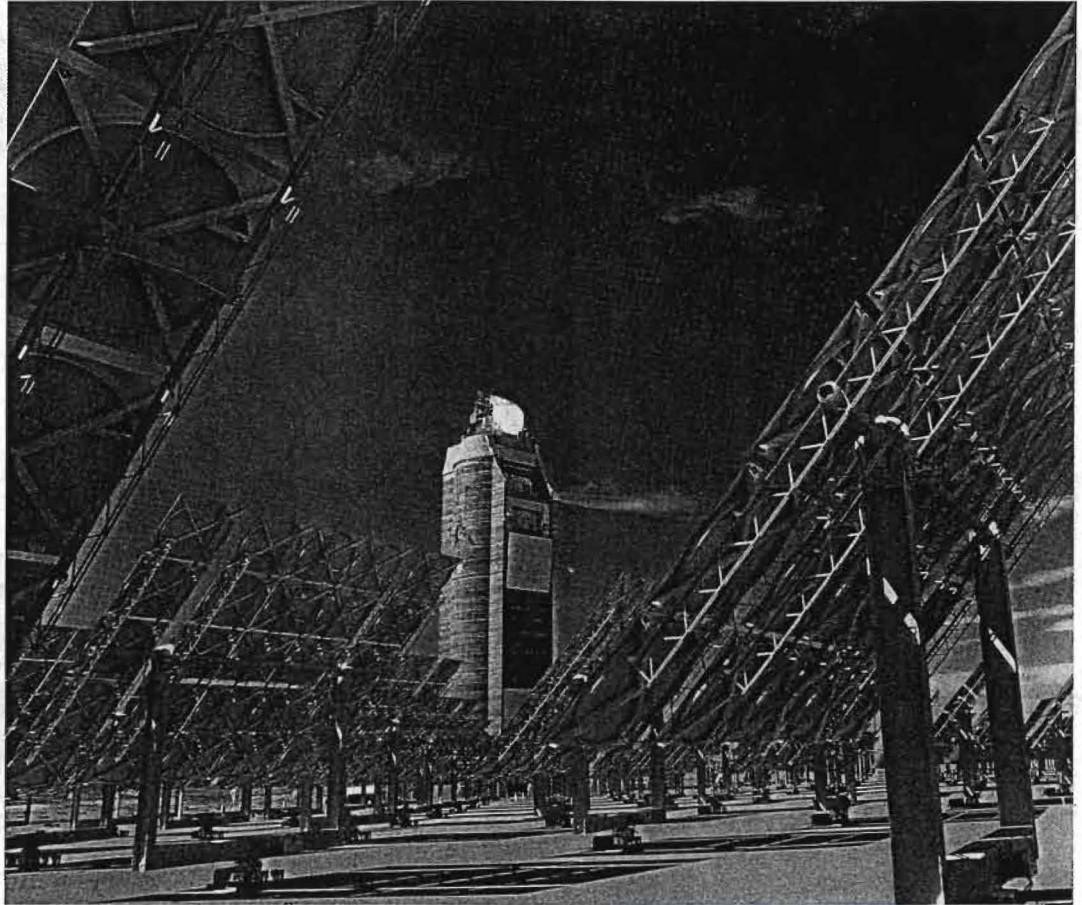
*"I agree that we have targeted governmental assistance in many ways to help various industries in the United States. This is what bothers me the most because we have frequently done a poor job in this regard. Generally speaking this targeting has followed no specific plan to encourage a more appropriate allocation*

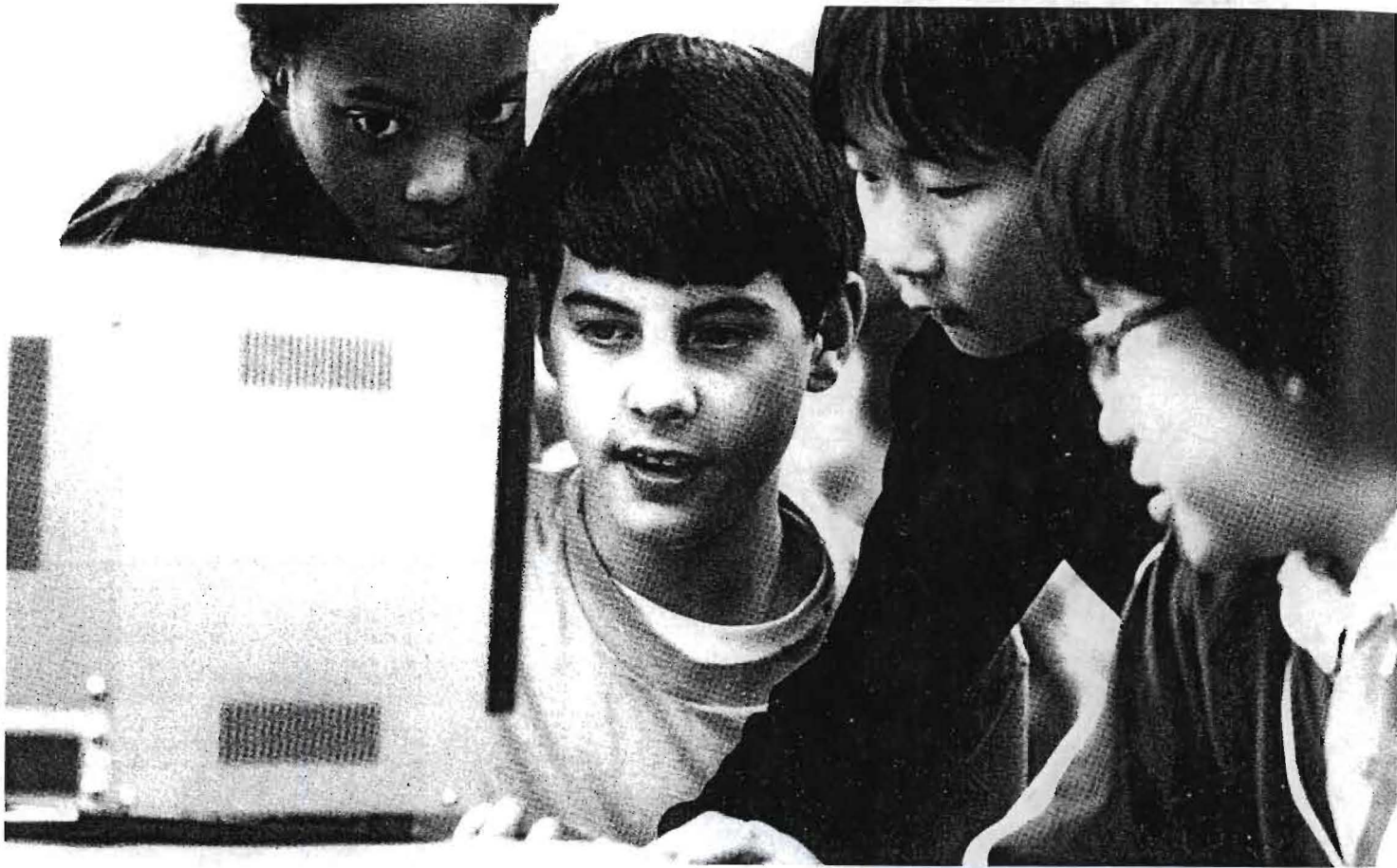
New technologies, if properly supported, can provide an answer to existing shortages of energy and resources.

*of scarce resources and has generally followed a course of favoring interest groups that are successful in exerting sufficient pressure on government bodies to win assistance for their specific targeted objectives. Overall, we have done a poor job at targeting as a consequence.*

*"Nevertheless, I do believe we can develop better utilization of scarce economic resources by more effective general targeting; for example, by reduced capital gains taxation across the board or by encouraging much greater research and development expenditures which will tend to flow toward industries where the expected rate of return is superior to others that demonstrate less vigorous growth characteristics."*

The Commission was unable to reach consensus on this issue of the direct role to be played by government in financing and investment for innovation.







The California Commission on Industrial Innovation believes a "Sputnik-like" push promoting math, science, engineering, computer and high-technology vocational education is critical to rebuilding our economy in the 1980s. Such an investment in people is necessary not only to have the trained workforce necessary to spur innovation, but also to produce a citizenry able to enjoy its benefits. Unlike other industries which rely on cheap energy and plentiful natural resources, information technology sectors depend upon the intelligence and skills of its inventors and employees.

The need for such an investment in education and job training is dramatized by two factors: the large number of jobs which will be affected by the new technologies, and the jobs which will disappear as a result of modernization.

Our first need will be to educate millions of new workers in technical, engineering and computer science fields. The Bureau of Labor Statistics reports that the greatest job growth in the 1980s will be in such careers as computer programming and electrical engineering.

We will also need to provide more sophisticated education for millions more white collar and service workers. The Xerox Corporation, for example, estimates that 60 million U.S. workers will be linked to electronic work stations of computers, video screens and telephone lines by 1990. Thirty-six million of these workers will need to be

literate in programming and other basic computer functions.

In California, this will especially be the case. Crocker Bank in a recent forecast predicted that growth in the California electronics industry will be 58%, almost double the growth in electronics nationally.

As the new technologies spread into more mature sectors, many existing jobs will either disappear or significantly change. *Business Week* magazine estimates that 45 million existing jobs in the United States will become obsolete or dramatically change during the next two decades. In California, recent plant closings in fields such as auto assembly are examples of this nationwide trend.

The new jobs which will be created by the information technologies will demand greater technological sophistication than ever

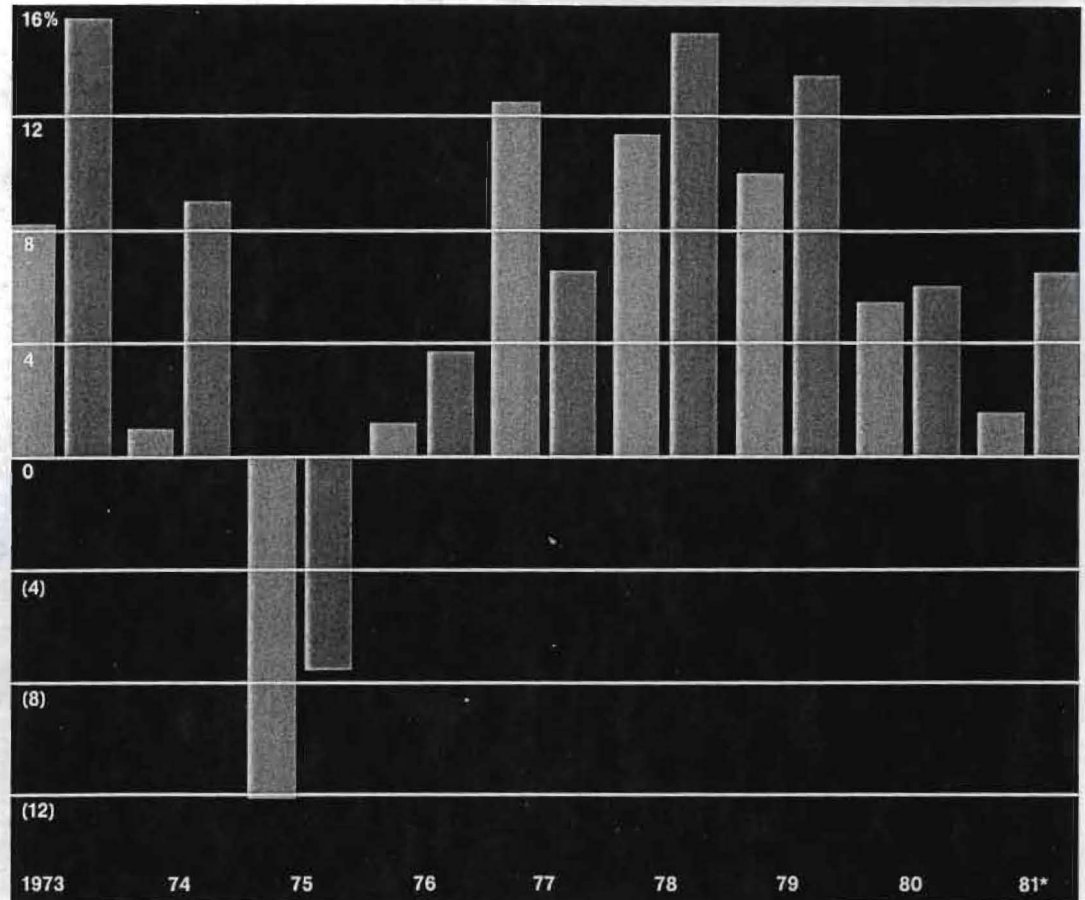
## Employment in the Electronics Industry (Annual Percent Change)

\*Based on first quarter data only. Source: Crocker Bank.

■ U.S.  
■ California

before. As high-technology becomes crucial to productivity increases in traditional fields from nursing to textiles to clerical work, training in these occupations will require computer literacy.

As all those who work in the new technology industries know, the key to our economic health will be the knowledge and ability of our people. As Governor Edmund G. Brown Jr. stated in an editorial in the *San Jose Mercury*, "California's most important challenge today is to retool its educational systems to meet the demands of an economy where less becomes more through the efficiency of high technology. Our goal must be to ensure that Californians are trained and educated for the work environment that is now being improved and radically restructured by the new



"California's most important challenge today is to retool its educational systems to meet the demands of an economy where less becomes more through the efficiency of high technology.

Governor Edmund G. Brown Jr.

information technologies."

Unfortunately, current fiscal realities have led to a declining revenue base for our education system. As Stanford University professor Mike Kirst noted in a report prepared for the commission.

*"At a time when the requirements for employment, the military and citizenship are increasingly technical, the capacity of public education to provide this additional preparation is decreasing. Declining time in school, shortages of math and science teachers, outmoded texts, inadequate technical equipment, unclear academic standards and a declining financial base are combining to prevent California's educational system from responding to the demand for technical education.*

*"The federal government is decimating its support and leadership, while state treas-*

*uries are being drained by the recession. Private sector leadership and funding has focused only on the apex of the system — prestige universities and engineering schools. Local agencies are wringing their hands, but are unable to reverse the negative tide."*

The Commissioners echoed these sentiments. Commissioner Robert Marr, Public Relations Director for the Operation Engineers Local #3 in San Francisco, summed up the Commission's feelings when he stated:

*"I believe that the most important finding of the Commission has been to demonstrate a definite, dire need to rearrange our educational system, to provide people with skills for the jobs that are coming.*

*"Everyone on the Commis-*

*sion is in consensus on this. But the question is, how are we going to fund the thing?"*

*"I think when you really get down to it, people don't mind paying higher taxes for education, as long as it's demonstrated that the final product is worth it."*

The Commission agreed that additional resources needed to be pumped into California's educational system from elementary and high school through the community college system to the universities. These resources should come from a combination of new revenues from the State and Federal governments and from a reallocation of resources toward technical education within existing budgets. The Commission agreed that the involvement of the Federal government in education was needed, although few believed that additional resources would be forthcoming.

## 15

**Recommendation No. 15. The U. S. should mobilize national resources to support math, science, computer, engineering and high technology vocational education, as was done through the National Defense Education Act in the 1950s.**

The Commission calls upon the federal government to mobilize a national push for upgrading technical education, as was done in the 1950s. Unlike the 1950s, however, the Commission feels that the actual initiative and responsibility for developing education initiatives should rest with state and local governments, with Washington, D.C. serving primarily as a source of "technology education block grant" funding.

Percentage of 1979-80  
High School Seniors  
Who Had Taken Specific  
Numbers of Years of  
Mathematics And  
Science Course Work

The Commission endorses in concept a number of proposals that have been made to accomplish this goal, including Governor Brown's proposed National Economic Security Education Act, and the proposed American Defense Educational Act currently before Congress, although it reserves judgment on final details until they have been completed.

The Commission believes that such national action could provide funding for the elementary and high school, university and vocational programs outlined below.

Commissioners emphasize, however, that such funding should accompany major efforts by the education system to use existing funds more wisely. Federal action is needed to help fund reform, not merely to support the status quo.

Number of Years of course work	Mathematics		Science	
	In the Nation	In California	In the Nation	In California
One year or more	92.2	90.3	89.2	87.2
Two years or more	64.9	58.2	51.5	41.3
Three years or more	31.4	25.6	21.6	13.3

Source: National Center for Educational Statistics. As cited in California State Department of Education, 1981.

**Elementary And Secondary Education**

The California Commission on Industrial Innovation believes that one of the highest priorities must be the fostering of general "technological literacy" for all students in elementary and secondary schools. *To remain internationally competitive, U. S. students must meet the highest standards in both the quantity and quality of math, science and computer studies pursued.*

The Commission endorses calls by Governor Brown, the University of California regents, the Community College trustees,

the State Board of Education and others for raising math, science, and computer course requirements for graduation from high school and entrance to post-secondary education.

In California, less than one-third of all high school graduates have taken three years of math and two years of science. As seen in the table above, Californians trail the nation in the number of math and science courses studied.

**16**

**Recommendation No. 16. University and community college governing boards should raise entrance requirements in math, science and computer studies.**

The Commission endorses the kind of action taken by the University of California which recently passed standards requiring all entering students to have at least three years of math and two years of science studies. The Regents have also endorsed the Governor's call to consider raising standards even



To remain internationally competitive, U.S. students must meet the highest standards in both the quantity and quality of math, science and computer studies pursued.

*California Commission on Industrial Innovation.*

---

higher, to four years of math, and three years of science, including at least one semester of computer studies.

---

### 17

---

**Recommendation No. 17. School boards should raise standards required for graduation from high school to at least three years of math and two years of science, including at least one semester of computer studies.**

---

The Commission endorses the recent action by the State Board of Education to urge all California school boards to require at least three years of math and two years of science, including one semester of computer study for all high school graduates. In order to implement this resolution, the State Department of Education must aid

school districts in the development of math and science courses for the non-college bound student.

---

### 18

---

**Recommendation No. 18. Private industry should extend support for summer study by students in math, science and computer studies.**

---

Particular attention should be given to efforts to encourage minority students and women to pursue math, science and computer studies, as done through the MESA and EQUALS program in California.

---

### 19

---

**Recommendation No. 19. California should include science and computer studies in statewide or local standard elementary and secondary school achievement tests.**

---

At present, only math is tested on statewide or local standard elementary and secondary school achievement tests. State universities and colleges should also be encouraged to use these tests as a regular part of their admissions process.

---

### 20

---

**Recommendation No. 20. State universities should train guidance counsellors to encourage students to take math, science and computer courses, especially women and minorities.**

---

Guidance counsellors should be provided with up-to-date employment trend data to assist them in guiding students. Women and minorities, who traditionally shy away from technical vocations and

engineering, should be particularly encouraged to enter these growth fields.

---

### 21

---

**Recommendation No. 21. California should reorient existing math and science achievement tests to stress problem-solving and not rote computation.**

---

The advent of the computer age will mean that problem-solving will become that much more important. Computers will provide access to information which previously was memorized by students.

Implementing these higher math and science standards will not be an easy task. Some of the obstacles include outmoded curricula that lack general introductory courses in technology, physical sciences and math, shortages of qualified math and science teachers, and the lack of computer-aided instructional materials in

Commissioner Regis McKenna: "We must begin to grow a generation of computer literate children. And we must begin at the elementary school level!"

schools. The Commission calls on the public and private sectors to work together to fill these gaps. The following recommendations are proposed solutions to the "technology literacy gap" of our students.

#### **Curriculum and Computer-Aided Instruction**

Commissioners felt strongly that public schools need to reexamine existing curricula with an eye toward the new technologies. As Commissioner Regis McKenna, Chairman of Regis McKenna, Inc., clearly stated, "*We must begin to grow a generation of computer literate children. And we must begin at the elementary school level!*"

### **22**

**Recommendation No. 22. The U. S. and California should match funds with private industry to develop**

#### **new curricula using new technologies like videos and computers.**

The CCII education subcommittee has reported that the development of a completely new curriculum has historically cost between \$5 and \$10 million, and that adaptation of existing curricula or development of a single course text could be done for less than \$3 million.

### **23**

**Recommendation No. 23. Post-secondary institutions should expand the number of course offerings in math, science and computers available to secondary school students.**

The estimated cost for 1,000 students to take science or math extension courses at each of 19 state universities would be \$2 million.

### **24**

**Recommendation No. 24. The U. S. Congress should pass legislation offering the same tax benefits for donations of computers to elementary and high schools as now exist for donations to universities.**

Specifically, Congress should pass the Technology Education Act of 1982, currently before it, which would create a tax credit for "computer and other technologically sophisticated equipment" to elementary and high schools.

### **25**

**Recommendation No. 25. California should promote the development of new computer software to expand computer education for interactive learning.**

Models for the kind of action

that needs to be taken include Minnesota, which has the nation's most extensive program to develop computer software, through the Minnesota Education and Computer Consortium (MECC). The Governor's "Investment in People" program in California makes funds available for 15 Teacher Education and Computer Centers around California to evaluate software for teachers, and establishes a software clearinghouse. Funds are also provided to institutions and individuals developing "exemplary" software programs.

### **26**

**Recommendation No. 26. Until computers become more common, California should expose students to computers through mobile vans such as those sponsored by the Industry Education Council of California.**

Employment in the communications equipment segment of California's economy is predicted to grow 25% by 1990.

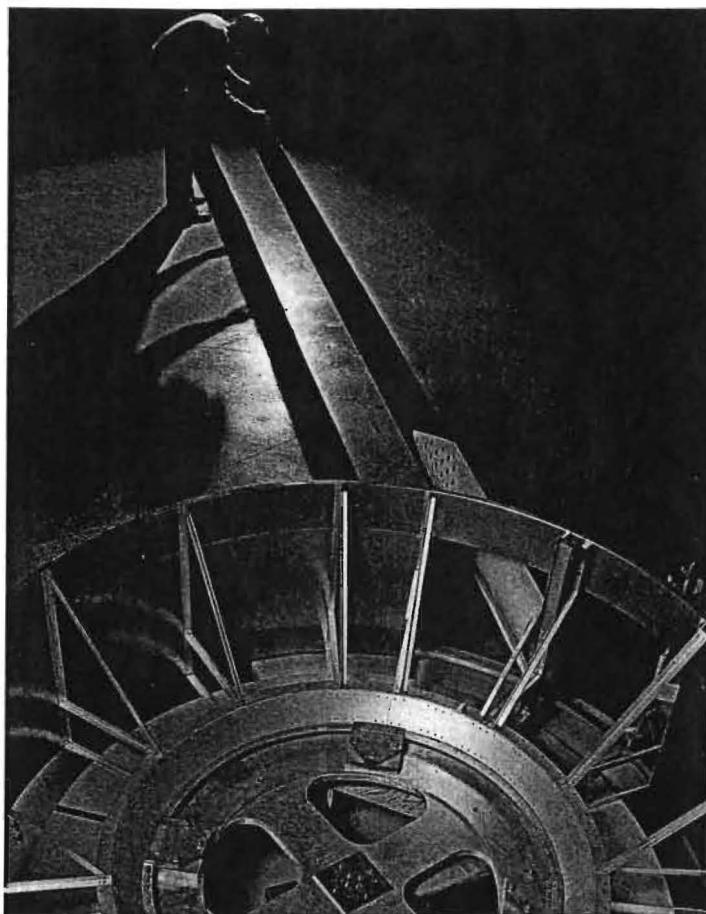
## 27

**Recommendation No. 27.** California should encourage school districts to form regional high-tech high schools which pool trained teachers, equipment and curricula.

One low-cost alternative to individual development of curricula, computer purchases and the hiring of computer teachers is the formation of regional schools. The Los Gatos and Fremont Union High School Districts have begun such a collaborative venture to form an Institute for Computer Technology in Sunnyvale.

### **Teacher Recruitment, Retention and Retraining**

One of the major obstacles to bridging the "technology literacy gap" is the shortage of qualified math and



science teachers. As illustrated in the accompanying table, the number of new math and science teachers has declined dramatically since 1971. Several trends contribute to this shortage: (a) increasing numbers of teachers are reaching retirement age; (b) the "reserve army" of housewives with teaching credentials no longer exists; (c) a declining number of college students are pursuing teaching careers in math and science; (d) an increasing number of teachers are being lured away from the profession by high industry salaries; and (e) the shortage of in-service training programs has resulted in the decline in quality of math and science teaching.

The Commission recommends that the public and private sector work together to bridge the gap in math

Average Numbers of  
Secondary School Science  
and Mathematics Teachers  
Produced in Teacher  
Training of U.S. Colleges  
and Universities

National Science  
Teachers Association  
Survey of 600  
Teacher Placement  
Offices, Dec. 1981.

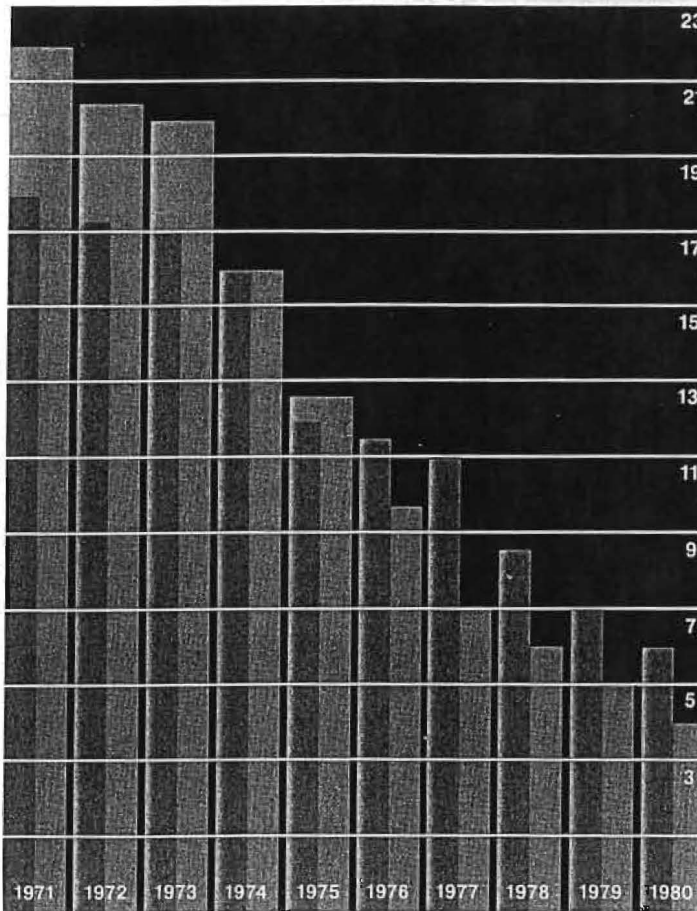
■ Science  
▨ Mathematics

and science teachers in the following ways:

**28**

**Recommendation No. 28.**  
School boards should offer teacher income supplements to math, science and computer teachers, based on what such skills are worth in the private sector.

Income supplementation could occur through summer employment in industry and sabbatical leaves. The estimated cost of 13-week summer work supplements for one-tenth of California's math and science teachers would range from \$18 million to \$32 million, depending on whether summer work was paid according to teaching or industry salary schedules.



**29**

**Recommendation No. 29.**  
Private industry should introduce recognition incentives for superior teachers. Universities should also recognize outstanding teachers.

Private industry could participate in such a program by extending annual recognition bonuses to superior teachers and providing fellowships for superior classroom teachers to receive additional training. The CIE education subcommittee found that it would cost approximately \$4 million a year for 10% of all California math and science teachers to receive a \$1500 recognition bonus annually. The University could also annually recognize superior teachers through some kind of award.

---

**30**

---

**Recommendation No. 30. The private sector should offer the use of employees as part-time teachers.**

The estimated cost would be approximately half of each employee's annual salary, in donated time. A CCI Education Subcommittee report estimated that placing one half-time industry/teacher in each California secondary school would cost about \$3 million a year.

---

**31**

---

**Recommendation No. 31. Private industry should provide employees to train teachers in math, science and computer studies, and provide industry sites for hands-on computer training.**

The private sector might be better suited as trainers of teachers, than as teachers themselves. Industry in this

capacity could provide equipment, classroom sites and personnel to upgrade train teachers.

---

**32**

---

**Recommendation No. 32. Universities and State Colleges should increase their commitment to math, science, and computer teacher education.**

State colleges and universities should encourage talented students to enter the teaching profession in math, science and computer studies, devote more time and resources to training teachers in these fields, target the introduction of computers for interactive learning, and become more active in working with public schools to develop new curricula.

---

**33**

---

**Recommendation No. 33. State and federal governments could fund incentives in the form of teacher education scholarships to attract teachers into math, science and computer studies.**

Such scholarships might be offered in exchange for a commitment to remain in the field for 3-5 years. It is estimated that each 1,000 scholarships would cost about \$6 million.

---

**34**

---

**Recommendation No. 34. Private industry could also hire high school math and science teachers during the summer session, as a way to supplement their income and to gain upgrade training in new technologies.**

While the summer employment of teachers by industry

has been a more common practice at the university level, some companies, such as Hewlett-Packard, have also established similar programs for high school teachers.

---

**35**

---

**Recommendation No. 35. School Boards should provide opportunities for all existing teachers to take training supplements in computer-aided education.**

Such actions could follow the model recently established in California, for the 1982-3 school year, as the result of funding provided under the Governor's "Investment in People" program. California is establishing 15 Teacher Education and Computer Centers around the state which are charged, in part, with establishing

"We will need a far greater national commitment to our research universities to maintain our economic strength in the 1980s."

Richard Atkinson, Chancellor, University of California, San Diego.

teacher training programs for promoting interactive learning with computers.

## 36

**Recommendation No. 36. The State and Federal governments should jointly fund inservice training for teachers in math and science, especially those with emergency credentials, through the establishment of math/science/computer institutes.**

Such programs should be developed and underwritten by the federal and state governments, state university and private industry.

California has taken the lead in setting up such a program through its 15 TEC centers, and separate funding provided to pay for school year release-time and summer stipends for teachers pursuing retraining in math, science and computer studies.

### **University Engineering And Computer Science Education**

Commission members, particularly those representing high technology firms, feel strongly that a steady supply of engineers, computer scientists and other top professionals is critical for the U.S. to maintain its economic leadership in the 1980s. Commissioner Richard Atkinson summarized the sentiment of the Commission when he stated,

*"The key to our high technology future is our universities, both in producing the basic research leading to innovation, and generating the highly trained people who provide the basis for industrial applications.*

*"But if we compare the great universities in the United States with corresponding institutions in Germany,*

*Japan and England, it's clear that our support of higher education is inadequate. Equipment and facilities available to university-based scientists today are far inferior to those available in nations with which we compete. Even the state of California, with one of the greatest public and private university systems in the world, imports more than half the engineers we need from other states.*

*"We will need a far greater national commitment to our research universities to maintain our economic strength in the 1980s."*

Commissioners report that the United States faces a critical shortage of electrical engineers, computer scientists, and other highly trained professionals during the 1980's. They emphasize that it is projected that California will need well over 76,000 new engineers over the next decade. Some 50,000 of these will be

needed by expanding high-tech industries. Although the number of California graduates with BAs in engineering has been increasing at a rate of 9 percent a year, we only graduated around 5,000 in 1980. Clearly, colleges and universities must place unfaltering priority on the continued expansion of engineering schools if we are to have any hope of meeting emerging demand.

Commissioners stress that this nation cannot keep its technological leadership indefinitely if other nations continue to produce more engineers per capita than we.

The California Commission on Industrial Innovation calls for a concerted national push to increase the output of engineers and computer scientists from our universities, and opposes any efforts to

reduce the ability of foreign nationals to work in American firms in these critical fields.

---

### 37

---

**Recommendation No. 37. The U.S. and California should increase financial support to Schools of Engineering, Computer Science and related fields, so as to expand their capacity to produce qualified graduates.**

---

The CCII prioritizes providing professors with income and conditions competitive with the private sector. The CCII supports increasing:

- faculty research grants and summer instructional opportunities;
- opportunities for faculty graduate and post-doctoral training;
- joint faculty appointments to universities and private companies for con-

sulting and research, particularly during the summer;

- the endowment of Chairs by private companies;
- the availability of up-to-date instructional and research equipment, through public sector donations and university equipment purchases.

The CCII also supports calls for increasing facilities so as to allow engineering schools to increase enrollment.

---

### 38

---

**Recommendation No. 38. The United States should not use the immigration laws to restrict the ability of foreign nationals to work as engineers for U.S. companies, or to serve as engineering faculty.**

---

Clearly, colleges and universities must place unfaltering priority on the continued expansion of engineering schools if we are to have any hope of meeting emerging demand.

---

The CCII strongly opposes current attempts in Congress to amend the immigration laws to require foreign graduates from U.S. schools to return home and apply for re-entrance to the U.S. Qualified graduates who can find jobs should be allowed to take them. As long as a shortage of American engineers exists, such restrictions would only further weaken the ability of our universities and industry to innovate.

---

### 39

---

**Recommendation No. 39. California should encourage the formation of university/industry research parks and expand other joint research efforts like MICRO, already established here, as a means of attracting new scientists and professors to the State.**

---

Engineering faculty and researchers tend to be

attracted to and stay at universities with up-to-date equipment, performing state-of-the-art research. The formation of research parks and other joint projects with industry thus attracts individuals to the universities.

These research parks would be collaborative efforts between small business and universities to fund basic and applied research. They could be initially funded by industrial revenue bonds, under existing authorities, then subsequently financed by leases and royalties on products resulting from the research.

The California Legislature should also expand funding for the University of California's MICRO project, a

"The key to effective vocational training in the 1980's is for industry to define its needs. The mutual reinforcement of public and private investment in human capital is best served through employment-based training, as in apprenticeships and CWETA-type programs."

*Don Vial, Director, California Department of Industrial Relations*

collaborative effort to support basic research in microelectronics initiated two years ago. Similar programs could be established in the area of biotechnology.

---

## 40

---

**Recommendation No. 40. California should encourage universities to revise patent policies to enhance industry cooperation.**

---

Again, any impediment to industry involvement with the university serves to drive away faculty and top-notch researchers. Existing patent policies discourage industries from participating in joint research because they must share the results with all other companies. Recognizing the public nature of inventions discovered due to public funds, and the need for the contributing company to have some proprietary rights to an invention,

current patent policies could be rewritten.

**Community Colleges And Job Training Programs**

The California Commission on Industrial Innovation notes that the modernization of our economy requires a steady supply of skilled workers, in both new and old industries. The community college system and a variety of job training programs must play critical roles in ensuring that our nation's vocational training provides graduates with the skills necessary for the jobs of the future.

The Commission stresses the key role that private industry must play in designing and developing vocational education programs.

Commissioner Don Vial, Director of the California Department of Industrial Relations, has explained,

*"The key to effective vocational training in the 1980's is for industry to define its needs—whether for entry or upgrade programs, whether for classroom or on-the-job training. The vocational education system should then respond to what industry needs, provided industry is willing to be up front with its own investments in skill development and human capital. The mutual reinforcement of public and private investment in human capital is best served through employment-based training as in apprenticeships and CWETA-type programs."*

*The problem today is that the state spends several billions dollars a year on vocational education in ways that support existing programs in community colleges or high schools. These pro-*

*grams may or may not be geared to industry needs, may or may not be actually preparing students to find jobs in the marketplace."*

To meet these needs, the Commission feels this nation must make an unprecedented commitment to job training with a future, built around the following principles:

**Employment-based training** Training programs should be as employment-based as possible, with employers participating in the design of vocational programs. Training programs should also attempt to secure *prior* commitments from employers to hire graduates upon completion of the training, and should involve as much *on-the-job* training as possible.



By 1990, the number of Californians employed in high technology industries will increase by almost 50%.



---

**New technology training** As much as possible, training should emphasize competencies in the new technologies, from computer use in general, to computer-aided design and manufacture, to robotics.

**Lifelong training** We need a new commitment to providing adults with the opportunity to learn and relearn new skills. As much as possible, planning should occur before displacement to ensure that workers are provided with training in new skills as they are displaced from their previous occupations. Society should see such training as an economic investment, and retraining should be seen as a public responsibility, not a burden to be borne by the displaced worker alone.

Following these principles, the California Commission on Industrial Innovation calls for a major effort by federal and state governments, and the private sector, to

provide effective job-training for the 1980s.

---

### 41

---

**Recommendation No. 41. The United States and state governments should encourage vocational programs to involve as much on-the-job training and employer participation as possible.**

---

Government funding of vocational programs should require evidence that training programs are in fact leading to private and public sector employment, that employers are involved in the design and execution of the programs, and that as much on-the-job training is involved as is feasible. Incentives should also be made available to upgrade apprenticeship training.

Programs should be modeled after California's Worksite Education and Training Act (CWETA) program, which meets these criteria.

---

### 42

---

**Recommendation No. 42. California should place a high priority on the development of vocational training programs in new and emerging technologies.**

---

Special efforts are needed to ensure that community colleges, high schools and other providers of job training are in fact offering programs in new and emerging technologies. Federal and state funding should require that such courses be offered, and should also encourage the creation of comprehensive technical centers offering coordinated training in high technology fields.

Models to be looked at would include two new Skills

Centers in the process of being established in California, in the community college districts of Los Angeles and San Jose.

---

### 43

---

**Recommendation No. 43. The private sector should establish Business/Labor Councils to review existing programs, develop new ones, and take other actions to promote effective job-training.**

---

Business and labor groups should establish bodies funded independently from the educational system itself to review existing vocational education programs, to ensure that they are in fact training students for jobs that exist in the marketplace. community colleges and job training programs should work closely with

"Business-Labor Councils" to identify obsolete courses, prioritize the updating of continuing programs, and design new ones where necessary. The private sector should also play a more active role in existing curriculum advisory committees, which should be given more power to influence existing curriculum.

#### 44

**Recommendation No. 44. The private sector should offer industry sites, equipment and employees to serve as faculty to the community colleges for job-training programs.**

Business can help improve vocational training by providing instructors, offering lectures and visits by prospective employers, using business sites as instructional resources, and donating equipment to training programs, and offering student

"coop" opportunities to work part-time and during the summers.

#### 45

**Recommendation No. 45. California should make a comprehensive effort to retrain existing teachers for the new skills of the 1980s.**

Government, the universities and private industry should join together to develop training programs for vocational teachers, to upgrade their skills for the 1980s. Programs should be modeled after efforts to retrain high school teachers in math, science and computer studies.

#### 46

**Recommendation No. 46. The U. S. and California**

**should make special efforts to develop effective job-training programs for displaced workers.**

Special programs must be targeted to the needs of displaced workers. Actions could follow the model of the Governor's 1982-3 "Investment in People" initiative in California for displaced workers, which will see funds expended to set up Reemployment Training Centers in regions affected by plant-closings, as well as other funds allocated to the community colleges to set up programs targeted to the needs of displaced workers.

#### 47

**Recommendation No. 47. The U. S. and California should take major fiscal actions designed to allow displaced workers "portable benefits" to be used in obtaining job retraining.**

Federal and state budget revenues will not be adequate in the 1980s to fund the tens of millions of American workers who will need retraining. Instead, existing benefits systems need to be adjusted to allow workers to use funds for retraining. The California State Legislature, for example, is considering a proposal to allow surplus unemployment insurance funds to be used to fund retraining. Others have proposed that incentives be given workers to use IRA funds for retraining, or that employers and/or workers be given special tax incentives for retraining.

Whatever method or set of methods is chosen, however, the CCII recommends that urgent attention be given to this problem.

## Employee-Management Productivity For Innovation in the 1980s

The California Commission on Industrial Innovation believes that improvement of productivity is the cornerstone of economic revitalization.

While American productivity remains unmatched, and California continues to lead the nation, productivity growth has been declining until we lag behind other nations as the accompanying chart illustrates.

As Commissioner Richard Atkinson, Chancellor at the University of California at San Diego, notes,

*"The U. S. worker is still the most productive in the world. But the difference is rapidly diminishing, and in many industries we are already behind other nations."*

The United States will need to make dramatic efforts to improve our productivity in the 1980s.

In the 1980s, proper investment, education and job training policies will all

play a critical role in increasing productivity. Ultimately, however, it is the human element, the behavior of employees and managers, which will be most critical.

As a report prepared for the Commission's Subcommittee on Human Productivity noted,

*"While productivity is enhanced by effective investment in capital equipment, it is also critically influenced by the efficient utilization of human resources within organizations."*

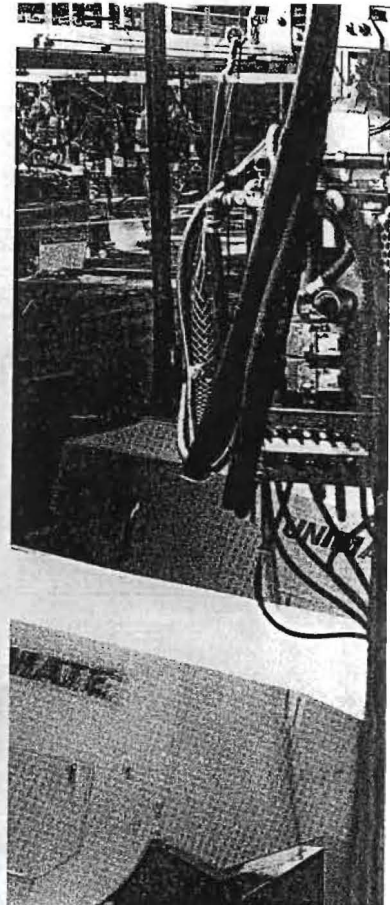
*"As such, the development and maintenance of organizations which fully motivate and utilize human contributions to productivity are among the most important investments that can be made to improve the performance of our economy."*

*"Productivity is determined not only by capital and materials, but also by how well managers utilize and improve their use of available resources."*

The California Commission believes that the key to increasing human productivity is to increase labor-management cooperation. Commission business and labor leaders unanimously report evidence from their own experience which indicates that such efforts have yielded positive results.

In recent years, the United States has begun to make major strides in developing successful approaches to improving productivity through labor-management cooperation.

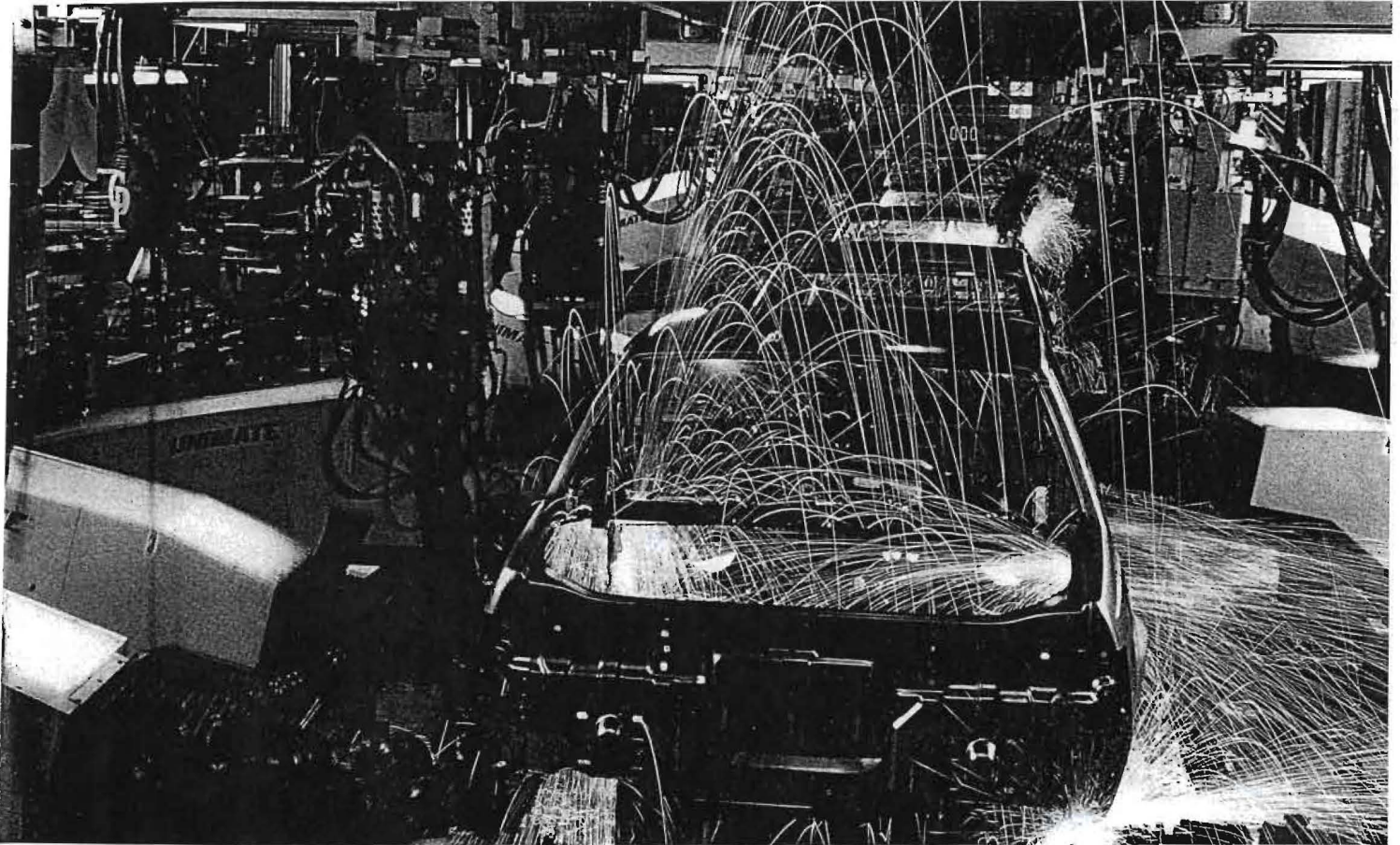
One leading business magazine recently observed that "quietly, almost without notice, a new industrial relations system with fundamentally different ways of managing people is taking shape in the U.S."



"Productivity is determined not only by capital and materials, but also by how well managers utilize and improve their use of available resources."

*Subcommittee on Human Productivity Report*

While still lacking the dexterity of the human hand, robots can perform many hazardous, repetitive tasks currently held by humans



## Average Manufacturing Productivity Growth 1973-1979

U.S. Productivity growth lags behind other industrialized countries.

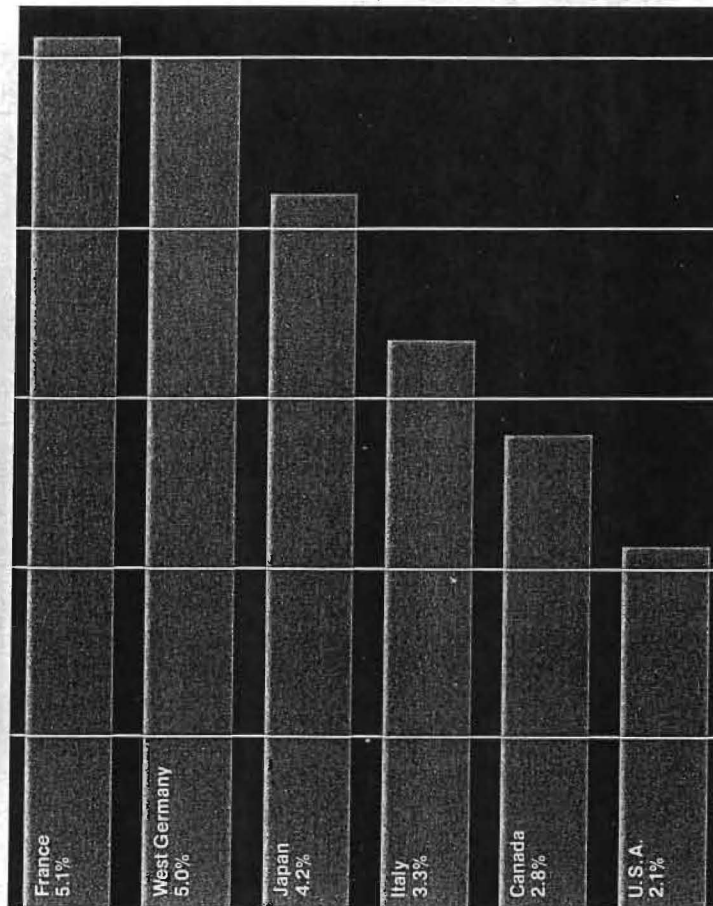
Source: U.S. Department of Labor/Bureau of Labor Statistics.

The Commission notes that such new management approaches are based on three general premises.

First, they endeavor to motivate the "total person." Material rewards are not underplayed, but employees are also motivated by supportive social surroundings, a sense of achievement and recognition on the job, interesting work, and opportunities to grow and pursue individual potentials.

Second, they seek to involve employees at all levels in decisions which affect their jobs and working conditions.

Third, these approaches commonly entail a variety of workplace reforms which meet the specific needs of particular groups of employees and their organizations. Such reforms vary, but include initiatives like participatory decisionmaking, flextime, profit-sharing programs, flexible benefit options, and various job



enrichment benefits.

Despite the general successes of these approaches however, Commission leaders report a fear among workers in recent years that productivity gains resulting from such initiatives may go unrewarded and even lead to job loss. Such fear which has intensified recently due to high unemployment and displacement of workers, undercuts the potential of such approaches to increase economic output.

Workers who feel they are literally "working themselves out of a job" are unlikely to embrace these initiatives enthusiastically.

As William Demers, Commissioner and International Vice President of the Communication Workers of America, emphasizes,

Labor supports technological advances and increased productivity. But we're certainly not interested in losing jobs because we've helped increase output. Workers want a stake in economic progress."

*William Demers, International Vice President, Communication Workers of America.*

*"Workers I talk to feel that they could increase productivity. At the same time they feel their ideas and desire to participate are ignored, and that they are unlikely to receive rewards for increased contributions. Labor supports technological advances and increased productivity. But we're certainly not interested in losing jobs because we've helped increase output. Workers want a stake in economic progress."*

For this reason, the Commission feels that the key to systematically increasing employee-management productivity in the 1980s is the development of more explicit "social contracts" among both groups to share in the benefits of enhanced productivity. Job security must be a primary condition for such contracts to succeed.

As the CCIJ Subcommittee on Human Productivity report noted,

*"If we are to revitalize the*

*American economy, there will be a need for some type of framework to facilitate labor-management cooperation in pursuit of mutually beneficial goals.*

*"In many cases, this cooperation may require sacrifices in pursuit of greater productivity.*

*"There are indications that both labor and management are willing to sacrifice for the future. However, neither labor nor management can be expected to make such sacrifices unless some assurance exists that the risks and payoffs will be fairly shared."*

The Commission notes that such employee-management cooperation to improve productivity is primarily a matter for the

private sector. The role of public policy in encouraging such arrangements is at best to promote public education and understanding of such efforts.

## 48

### **Recommendation No. 48. California should establish tripartite boards to promote increased worker participation and productivity.**

The government should encourage productivity enhancement efforts by private industry and labor. One way would be to establish tripartite boards, composed of business, government and labor representatives, and organized on a regional, statewide and national level, to fund research, disseminate information and provide technical assistance to interested workers and managers.

Tripartite boards would

also encourage planning to prepare for the wrenching changes awaiting employees and managers in the 1980s, concerning themselves with:

- the need for massive job retraining efforts;
- the development of programs calling for temporary sacrifice shared equally, followed by mutually shared productivity benefits;
- preparation for employee displacement where necessary;
- development of profit-sharing techniques to give employees a stake in economic progress.

Such programs would not interfere with traditional managerial decision-making or collective bargaining.

## 49

**Recommendation No. 49. California should set up a clearinghouse to provide technical assistance and information to public and private sector efforts to increase workplace productivity.**

## 50

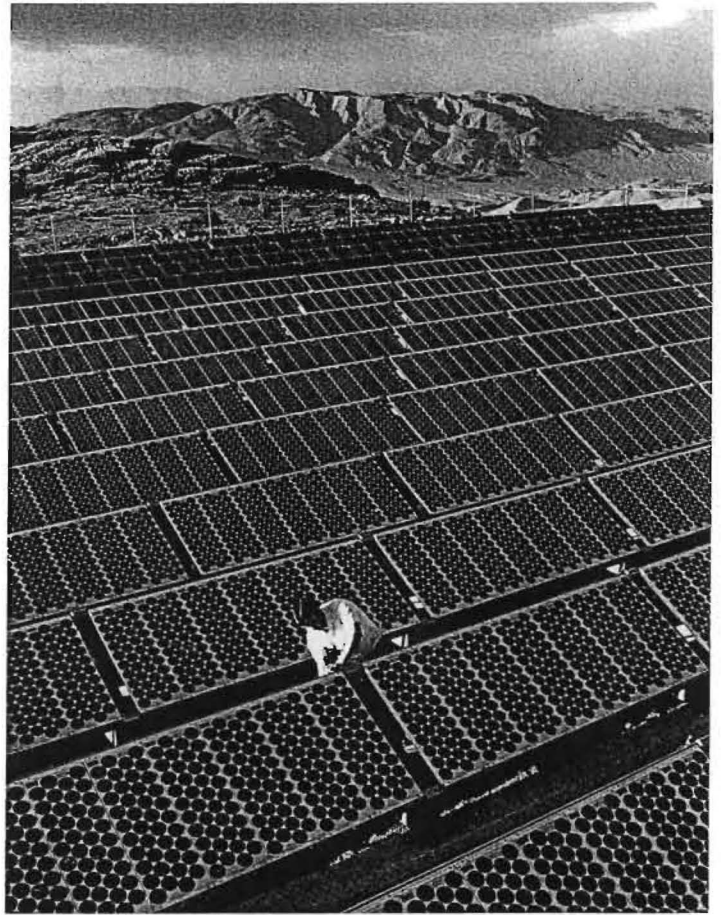
**Recommendation No. 50. California should encourage the development of employee stock ownership plans, and incentive stock option proposals for both workers and managers.**

The Commission supports the many efforts being made both nationally and at the state-level to support, where appropriate, worker ownership and management

incentive plans, at the company level. Employees work better, and managers manage better, if they feel they have a stake in the companies by whom they are employed. Such efforts should not, of course, compromise traditional collective bargaining arrangements.

The Commission particularly stresses the importance of states bringing their treatment of incentive stock options and ESOPS into conformity with federal tax rates, as noted in Recommendation No. 11 above.

California employment in the photovoltaics industry could grow nine-fold by 1990.





**Table of Recommendations**  
Winning Technologies  
A New Industrial Strategy For  
California and the Nation

---

**Industrial Strategies for Innovation**

**1.** The California Commission on Industrial Innovation calls for the United States and California to develop national and state industrial strategies, aimed at accelerating the invention and utilization of winning technologies./P.23

**Investment for Innovation**

**2.** The United States Congress should pass the Reciprocal Trade Trade and Investment Act of 1982./P.27

**3.** The President should aggressively negotiate to lower trade barriers for high-technology products through the General Agreement on Tariffs and Trade (GATT)./P.28

**4.** The United States should expand the incremental research and development tax credit./P.28

**5.** The United States should enact an antitrust exemption for joint research by high-technology companies./P.28

**6.** California should establish antitrust exemptions for research and development cooperative ventures./P.29

**7.** The United States should restore budget cuts in research in such critical areas as the National Institutes of Health, the National Science Foundation, and the national laboratories of the Department of Energy and NASA./P.30

**8.** The United States should move toward the complete elimination of taxation of long-term capital gains. As a first step, the government should eliminate capital gains tax on investments in new companies, while taxing gains from investment in nonproductive investment as ordinary income, as has been legislated in California. P.31

**9.** The United States should allow corporations, at their option, to writeoff equipment at the rate at which it becomes obsolete if this would result in faster depreciation than current schedules permit./P.32

**10.** The United States should create financial free trade zones to attract foreign investment./P.32

**11.** California should bring its treatment of incentive stock options and employee stock ownership plans into conformity with recent federal changes./P.32

**12.** The United States should redirect policies and increase support for the Export-Import Bank to assist U.S. business in effectively meeting unfair foreign competition./P.32

**13.** States should enact pension fund flexibility to

invest in innovation, as called for in Proposition 6 on the November 1982 ballot in California./P.33

**14.** The United States should encourage investment in existing U.S.-based growth technologies targeted by government policies of our major industrialized trading partners. P.33

**Education and Job Training for Innovation**

**15.** The United States should mobilize national resources to support math, science, computer, engineering and high-technology vocational education, as was done through the National Defense Education Act in the 1950s./P.38

**16.** University and community college governing boards should raise entrance requirements in math, science and computer studies./P.40

**17.** School boards should

---

raise standards required for graduation from high school to at least three years of math and two years of science, including at least one semester of computer studies./P.40

**18.** Private industry should extend support for summer study by students in math, science and computer studies./P.41

**19.** California should include science and computer studies in statewide or local standard elementary and secondary school achievement tests./P.41

**20.** State universities should train guidance counselors to encourage students to take math, science and computer courses, especially women and minorities./P.41

**21.** California should reorient existing math and science achievement tests to stress problem-solving and not rote computation. P.41

**22.** The United States and California should match funds with private industry to develop new curricula using new technologies like videos and computers./P.42

**23.** Post-secondary education should expand the number of course offerings in math, science and computers available to secondary school students./P.42

**24.** The U.S. Congress should pass legislation offering the same tax benefits for donations of computers to elementary and high schools as now exist for donations to universities./P.43

**25.** California should promote the development of new computer software to expand computer education for interactive learning./P.43

**26.** Until computers become more common, California should expose students to computers through mobile vans such as those sponsored by the Industry Education Council of California./P.43

**27.** California should encourage school districts to form regional high-tech high schools which pool trained teachers, equipment and curricula./P.43

**28.** School boards should offer teacher income supplements to math, science and computer teachers, based on what such skills are worth in the private sector./P.44

**29.** Private industry should introduce recognition incentives for superior teachers. Universities should also recognize outstanding teachers. P.44

**30.** The private sector should offer the use of employees as part-time teachers./P.45

**31.** Private industry should provide employees to train teachers in math, science, and computer studies, and provide industry sites for hands-on computer training. P.45

**32.** Universities and State Colleges should increase their commitment to math, science, and computer education./P.45

**33.** State and federal governments could fund incentives in the form of teacher education scholarships to attract teachers into math, science and computer studies./P.45

**34.** Private industry could also hire high school math and science teachers during the summer session, as a way to supplement their income and to gain upgrade training in new technologies. P.45

---

**35.** School boards should provide opportunities for all existing teachers to take training supplements in computer-aided education. /P.45

**36.** The State and Federal governments should jointly fund inservice retraining for teachers in math and science, especially those with emergency credentials, through math/science computer institutes. /P.46

**37.** The United States and California should increase financial support to Schools of Engineering, Computer Science and related fields, so as to expand their capacity to produce qualified graduates. /P.47

**38.** The United States should not use the immigration laws to restrict the ability of foreign nations to work as engineers for U.S. companies or to serve as engineering faculty. /P.47

**39.** California should

encourage the formation of university/industry research parks and expand other joint research efforts like MICRO, already established here, as a means of attracting new scientists and professors to the State. /P.47

**40.** California should encourage universities to revise patent policies to enhance industry cooperation. /P.48

**41.** The United States and state governments should encourage vocational programs to involve as much on-the-job training and employer participation as possible. /P.50

**42.** California should place a high priority on the development of vocational training programs in new and emerging technologies. /P.50

**43.** The private sector should establish Business/Labor councils to review existing programs, develop new ones, and take other actions to promote effective job-training. /P.50

**44.** The private sector should offer industry sites, equipment and employees to serve as faculty to the community colleges for job-training programs. /P.51

**45.** California should make a comprehensive effort to retrain existing teachers for the new skills of the 1980s. /P.51

**46.** The U.S. and California should make special efforts to develop effective job-training programs for displaced workers. /P.51

**47.** The U.S. and California should take major fiscal actions designed to allow displaced workers "portable benefits" to be used in obtaining job retraining. /P.51

### **Employee-Management Productivity for Innovation**

**48.** California should establish Tripartite Boards to promote increased worker participation and productivity. /P.55

**49.** California should set up a clearinghouse to provide technical assistance and information to public and private sector efforts to increase workplace productivity. /P.56

**50.** California should encourage the development of employee stock ownership plans, and incentive stock option proposals for both workers and managers. /P.56

**List of Documents  
Submitted to the California  
Commission on Industrial  
Innovation**

- American Electronics Association, "Planting the Engineering Seed Corn," August 1981.
- Arbisser, Aton, "Financing Technological Innovation," Staff Report to the California Commission on Industrial Innovation, January 1982.
- Best, Fred, "Working Paper on Human Productivity," Report of the Subcommittee on Human Productivity, June 1982.
- Borrus, Michael, James Millstein and John Zysman, "International Competition in Advanced Industrial Sectors: Trade and Development in the Semiconductor Industry," January 1982.
- Business Week*, "The New Industrial Relations," May 11, 1981.
- Business Week*, "The Speedup in Automation," August 3, 1981.
- Cano, Herb, Rozanne Enerson, Nathan Gardels and Michael Kieschnick, "An Innovation Finance Strategy for the 1980s," June 1982.
- California Department of Economic and Business Development, "California's Technological Future: Emerging Economic Opportunities in the 1980s," March 1982.
- California Office of Appropriate Technology, "High Technology and High School," June 1982.
- Chase Financial Policy, "U.S. and Japanese Semiconductor Industries: A Financial Comparison," June 9, 1980.
- Coyle, Eugene P., et al., "Report on the California Photovoltaic Industry," June 1982.
- Dorf, Richard C., "The Study of the Robotics and Automated Manufacturing Industry in California," June, 1982.
- Feldman, Marshall M. and Elisabeth P. O'Malley, "California's Biotechnology Industry," August, 1982.
- Galvin, Robert W., "Remarks before the Communications Division of the Electronics Industry Association Hyannis Conference," June 2, 1982.
- Hall, Peter and Ann Markusen, et al., "The California Software Industry: Problems and Prospects," July 1982.
- Kieschnick, Michael, "An Industrial Strategy for California in the Eighties," November 1981.
- Kirst, Michael W., "Improving Math, Science and Technical Education," August 1982.
- Reich, Robert B., "Why the U.S. Needs an Industrial Policy," *Harvard Business Review*, January-February, 1982.

California Commission  
on Industrial Innovation

Office of the Governor  
State Capitol  
Sacramento, CA 95814  
916-324-0401

