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California and the 21st Century: Foundations for a Competitive Society, Volume III

Senate Select Committee on Long Range Planning

CALIFORNIA AND THE 21st CENTURY: FOUNDATIONS FOR A COMPETITIVE SOCIETY

VOLUME III

"MEETING CALIFORNIA'S COMPETITIVENESS CHALLENGE"

A Report to the
Senate Select Committee on Long Range Policy Planning
Senator John Garamendi, Chair

Prepared by

Public Policy Center
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ACKNOWLEDGMENTS

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I CALIFORNIA'S COMPETITIVENESS CHALLENGE

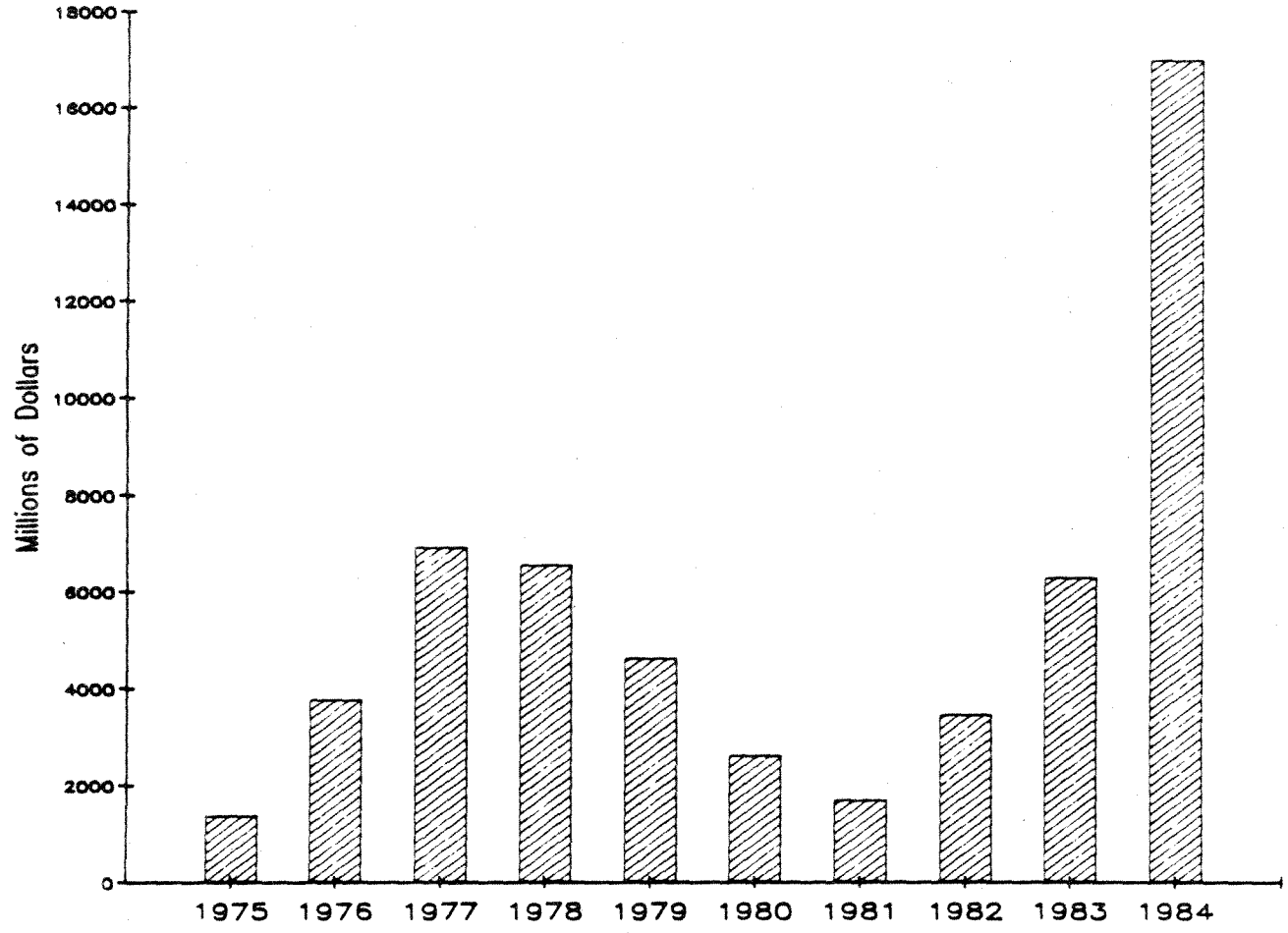
This report examines the nature of the competitiveness challenge facing California, analyzes its causes, and suggests strategies for meeting the challenge. This section provides an overview of the major findings of tne report.

California's Declining Competitive Advantage

California has been losing its competitive advantage in key industries since the early 1970s. Because industrial competitiveness is not an end in itself but rather the means for achieving a high standard of living, this threatens the economic well-being of every Californian. In short, the loss of competitiveness will reduce California's standard of living. Reversing this trend will take concerted effort by both the private and public sectors.

While the loss of competitiveness is revealed most vividly in the growing trade imbalance between California's exports and imports (Figure 1) the imbalance only highlights a problem with much longer term, deeper root causes reflected in California's declining productivity advantage. (Productivity advantage is the comparison of productivity in California relative to the United States average.) Superior productivity--measured in terms of value added per production hour--has been a key source of California's comparative advantage. That productivity advantage is eroding in key industries.

Competitiveness is the ability to produce goods and services that meet the test of international markets while simultaneously maintaining and expanding real incomes for residents. Productivity plays a central role in



Source: Economic Report of the Governor

FIGURE 1 CALIFORNIA'S FOREIGN TRADE DEFICIT
IMPORTS MINUS EXPORTS

competitiveness because high productivity in the use of human and capital resources translates directly into high levels of real wages and returns on capital, which in turn provide an increasing standard of living for current and future generations. Without productivity gains, a state or nation would have to compete on the basis of lower relative wages and hence a lower standard of living.

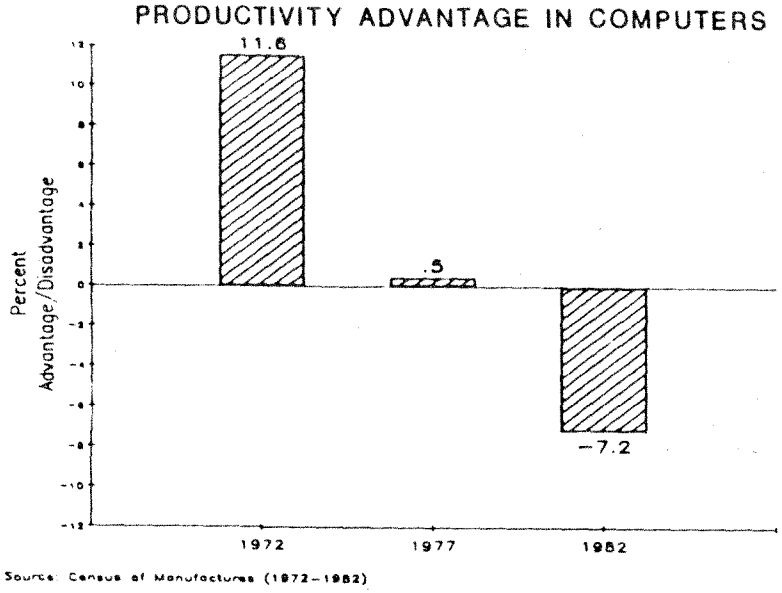
This report examines the competitiveness of the major export industries which create the highest value added and thus bring wealth and income into California. (Value added is the best measure of production in the state, representing the value of output minus the cost of materials and supplies.) These industries not only create jobs and income for those employed in each industry but generate significant demand for services and supplies that in turn creates jobs and income for those employed in supporting industries, especially new and small businesses.

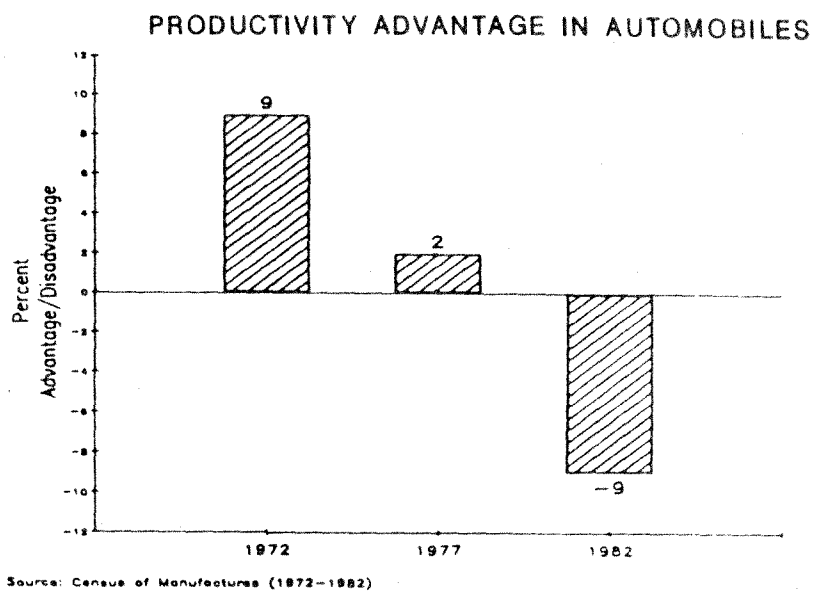
Each of these key industries is facing significant competitive threats. The degree of the erosion of competitive advantage in each industry is revealed by the statistics in Figure 2. The competitiveness analysis in this report reveals the following basic points about each industry:

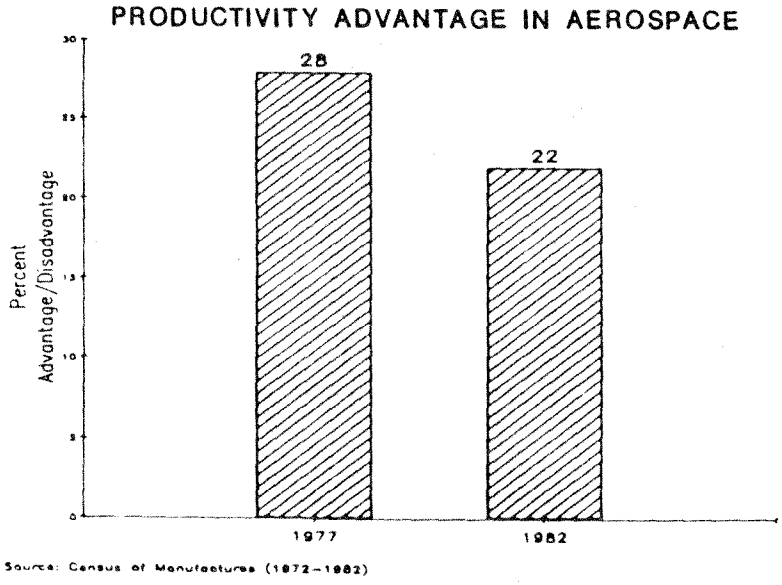
- Agriculture--California exports of agricultural products declined by 27% between 1981 and 1984, causing an erosion of farm incomes. California's strength in agriculture has been its diversity of specialized crops. California must continue to move toward higher value added products while, at the same time, aggressively marketing its products abroad.

- High technology manufacturing--California's preeminence in this area is eroding. California has been losing its productivity advantage in computers (a 12% productivity advantage in manufacture of computers in 1972 had eroded to a 7% disadvantage by 1982). The Japanese are gaining increasing market shares in world exports of high technology products. While California has retained its research base, it is losing its manufacturing base in high technology.

- Basic manufacturing--While California has lost much of its traditional manufacturing base (for example, a 9% productivity advantage in automobile manufacture in 1972 had eroded to a 9% disadvantage by 1982), specialty manufactures in such areas as apparel and printing have been growing to serve new markets. Opportunity for growth exists in designing, producing, and marketing high-value products.







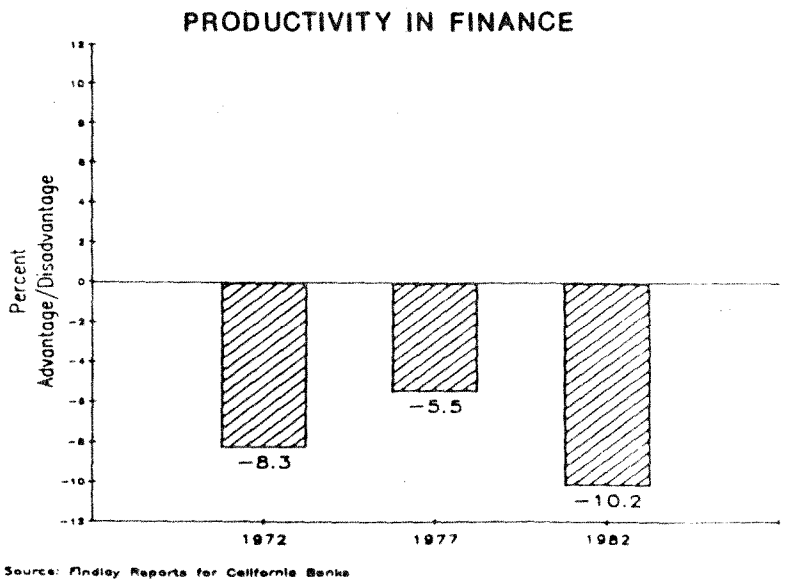
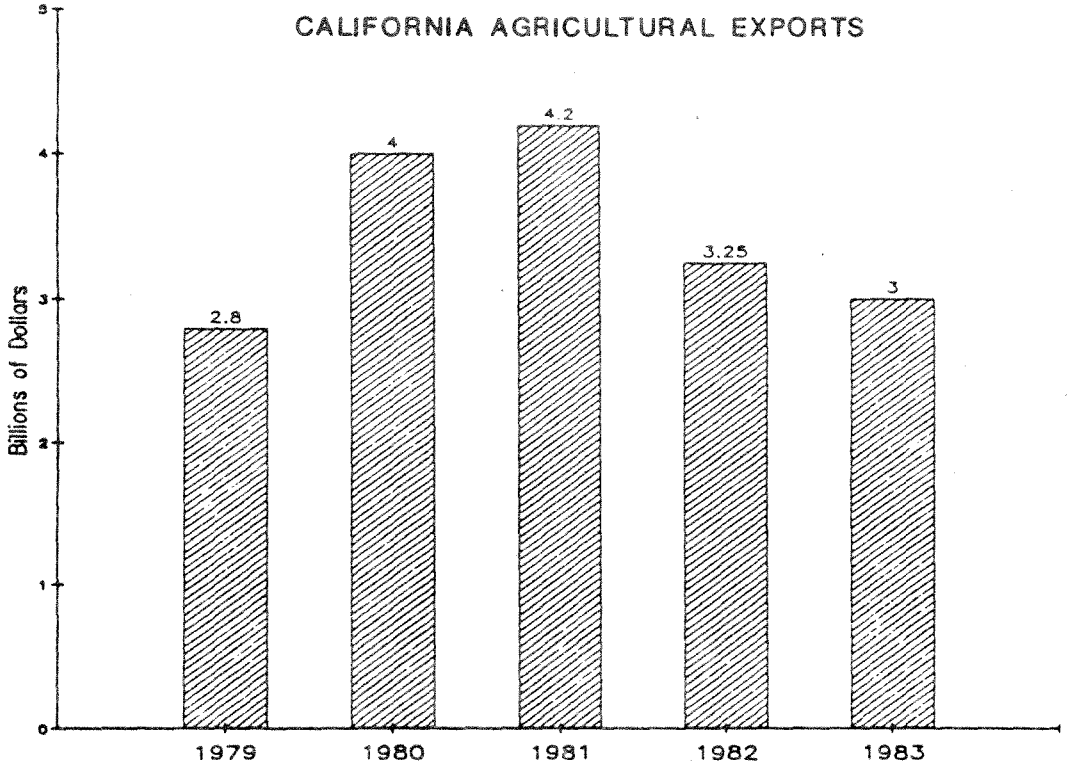
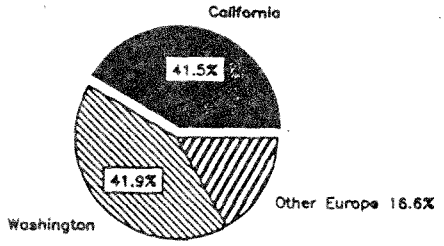


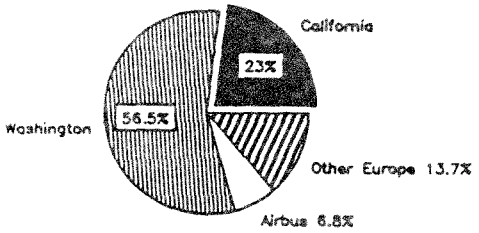
FIGURE 2 INDICATORS OF COMPETITIVENESS



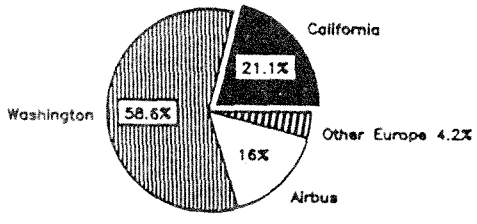
Source: California Crop and Livestock Reporting Service



1972



1977



1982

CALIFORNIA SHARE OF COMMERCIAL JET DELIVERY

Source: McDonnell Douglas Corporation

FIGURE 2 INDICATORS OF COMPETITIVENESS

- Aerospace--While defense spending has promoted the growth of this sector, California is losing its ability to compete in commercial aircraft. California's share of commercial jet deliveries declined from 41.5% of the total market in 1972 to 21.1% in 1982 and productivity advantage in aerospace eroded from 28% in 1972 to 22% in 1982. The industry may thus be vulnerable to the next slowdown in defense spending.

- Finance--Deregulation and interstate banking have created great turbulence in this industry. While some institutions are doing poorly and others are taking advantage of the new environment, overall the productivity of California's financial industry has lagged behind that of the rest of the nation. In 1972, California gross profit per employee (an equivalent measure to productivity) was 8.3% less than the U.S. average. By 1982, that disadvantage had widened to 10.2%.

What is especially troublesome about the declining productivity advantage of key California industries is that California lost ground to a U.S. national average in productivity which has been significantly lagging behind productivity growth in other major industry countries. Between 1977 and 1982, U.S. manufacturing productivity grew by only 0.6% compared to 3.4% in Japan, 3.0% in France, and 2.1% in West Germany. While productivity growth in the United States improved in 1983, registering a 4.2% gain nationally, this was still behind Japan (6.2%), France (6.1%), and Germany (4.6%). In sum, while the United States has a major productivity growth problem, key industries in California have been losing ground to the rest of the United States.

Overall, the basic finding of the analysis can be summarized as follows: while California industry is still a world leader in the invention of new technologies and the development of new products, it is falling behind in the application of technologies in production and the marketing of these products in global markets. It is losing the race in manufacturing and marketing high value added products.

A recent, vivid example of this can be found in video casette recorders (VCRs). While the basic technology was invented and patented by a California-based firm, Japanese firms have totally captured this rapidly growing market. No VCRs are manufactured in the United States. Over half of the VCRs made in Japan are built for the U.S. market.

Toward a Strategy

California can best compete in an increasingly global economy through higher value added (or wealth creating) production based on innovation and investments in technology and human resources. To compete, it must significantly increase its productivity advantage by adding more value per production hour rather than by lowering wages. California industries cannot compete on the basis of low cost, commodity products which can be manufactured far more cheaply in other places and still maintain its high standard of living. Instead, California industry must constantly search for more innovative ways to produce value-added products for increasingly sophisticated, differentiated markets. This can be accomplished only through more flexible production which relies on advanced technologies and a skilled and adaptable workforce. Yet, it is in just this area of advanced manufacturing that California has been losing its competitive advantage. Ironically, advanced technology and a well trained workforce have been California's strengths in the past. It is now necessary to redirect these strengths toward production and marketing.

Meeting the Competitiveness Challenge

To meet the competitiveness challenge, California needs a strategy for increasing value-added production, enhancing worker productivity, and expanding markets. In short, to compete California must "outproduce, outsmart, and outsell" its competitors. This requires a private sector effort supported by investments by the state. Innovation is required by the private sector to move to higher levels of value-added production through investments in new technologies and advanced manufacturing. Innovation by the private sector is also required in enhancing worker productivity and aggressive marketing. The state, however, can play a critical role helping to build the capacity to compete through its investments in applied technology at the state's universities, investments in education and training of the work force, and assistance in opening up new export markets.

There is a critical relationship between California's industrial competitiveness and its human resources. Competing through higher value added production based on advanced manufacturing will require a skilled and flexible workforce. Projections of California's future workforce indicate a higher percentage of minorities and immigrants who will need significant investments in education and training to be able to fully participate in the more competitive economy. Without major attention to enhancing human resource quality, California's ability to compete effectively in the global economy may be constrained.

A competitiveness strategy for California thus consists of three basic elements:

- Applying technology for value-added production--using process technologies to achieve flexible manufacturing. Initiatives in this area might include establishing Centers for Manufacturing Competitiveness as university/industry consortium partnerships, forming Manufacturing Engineering Centers of Excellence at universities, and encouraging the development of shared flexible manufacturing facilities to provide common production centers for several small and medium sized firms.

- Enhancing worker productivity and adaptability--increasing the skills, flexibility and commitment of the work force. Initiatives in this area might focus on basic skills training, retraining and adjustment assistance, and improving labor-market matching efforts.

- Expanding markets--promoting export markets and stimulating import substitution. Initiatives in this area might include export promotion, especially for medium-sized and small businesses, and regional networks to increase linkages between major producers and small business suppliers.

The report suggests specific actions that can be taken to promote each of these areas. In summary, California needs to focus on building its manufacturing capacity through investments in technology and human resources and expanding the markets for California products. The state can target critical investments in the areas of technology, human resources, and market development while the private sector must continue its historic role of innovation and entrepreneurship if this strategy of competitiveness is to succeed. A creative partnership is needed based on a shared vision of what

needs to be done. This report tries to outline the elements of such a shared vision.

Overview of the Report

Section II of this report examines trends in the overall California economy as a context for examining competitiveness of specific industries. It describes the loss of California's manufacturing capacity. Section III indicates the growing competitive threats facing the state's agriculture and suggests how California must compete through strategies for producing and marketing value added crops in world markets. Section IV reveals that California is losing its dominance in high technology manufacturing and points out the need to regain our productivity advantage. Section V shows that while California has clearly lost its traditional manufacturing base in older industries, it is gaining an edge in value-added aspects of specific industries such as apparel and printing which suggest important "niche" strategies for the state. Section VI points out while defense spending has expanded production in the aerospace industry, California is losing its capacity in commercial aircraft. Section VII points out the effects of deregulation and interstate competition on the financial services industry and threats and opportunity for the future. Finally, Section VII outlines a competitiveness strategy for California based on the core elements: advanced manufacturing, increased worker productivity and flexibility, and expanded markets.

Creating a competitiveness strategy for California requires a clear understanding of the magnitude of the threat and a shared vision by all sectors of the directions that need to be taken to meet that threat. This report, which highlights California's competitiveness challenge in key industries, is a first step in helping to define the problem, diagnose its basic causes, and suggest new directions. It will have succeeded if it stimulates state government and private sector leaders to join together to begin developing and implementing a California competitiveness strategy that will preserve our high standard of living and quality of life for future generations.

II CALIFORNIA ECONOMY: PAST AND PRESENT

California's Industrial Evolution

An overview of the California economy provides a context for the analysis of competitiveness of key industries and the strategy of addressing competitiveness problems. Historically, the state's economy has grown rapidly, stimulated by a series of five industrial "surges" fueled by gold, agriculture, oil, aerospace, and microelectronics. As California made the transition from a resource-based to a technology-based economy, each surge was based on innovation and entrepreneurship--the willingness of the private sector to take advantage of opportunities and engineer new solutions.

From the beginning, California had to be an innovation-based economy because its natural comparative advantages in some key areas were limited--water was limited, much of the state was desert or desert like, major markets were a long distance away. California has had a history of helping create its own comparative advantage through investments first in infrastructure (water systems, railroads, highways) and later in education and technology (master plan for higher education). Largely because of critical investments especially in education and technology, California was able to take advantage of opportunities presented by the development of the aerospace and microlectronics industries during and after World War II.

Following World War II, California became the world's foremost advanced technology economy. The state has more workers employed in high technology manufacturing industries, more scientists and engineers, and a higher percentage of value added in high-technology production than any other state. Both Silicon Valley and Southern California have become leading high-technology regional clusters linking major producers with suppliers and service support industries. These clusters have provided exceptionally

good environments for entrepreneurship and innovation. By 1980, high technology manufacturing maintained over 3,700 business facilities with a total payroll of $6 billion and 400,000 workers, or 23% of the state's total manufacturing labor force.

The growth in high technology manufacturing has stimulated the growth of financial and business services in support of these growing industries. Together high technology manufacturing and finance have been the fastest growing industries in term of employment (Figure 3). High technology has also driven the growth of exports and value added in California. The three leading manufacturing exports in California are transportation equipment (largely aircraft), nonelectrical machinery (largely computers and office equipment) and electrical equipment (communications equipment and electronics components). In terms of value added, the leading industries in 1981 were electronic equipment ($10.6 billion), transportation equipment ($10.3 billion), and nonelectrical machinary ($8.2 billion). These were followed by food products ($7 billion), fabricated metals ($3.9 billion), printing and publishing ($3.6 billion) and instruments ($2.9 billion).

The Loss of Manufacturing Capacity

In recent years, California's innovation-based advanced technology economy has been losing its manufacturing capacity. While the state's industries have continued to design and develop new technology-based products, the manufacturing and production activities have been shifting away from California to other states and offshore. Hence, the state has not been capturing the full economic (value added and employment) benefits of its research. This has been due in part to the search for lower production costs. It also appears to be due to a lack of innovation and investment in manufacturing process technologies.

Evidence of this loss of manufacturing capacity can be found not only in California's loss of production in basic industries such as automobiles and steel (as described in Section V) but also in high technology manufacturing, the key source of growth in the past two decades.

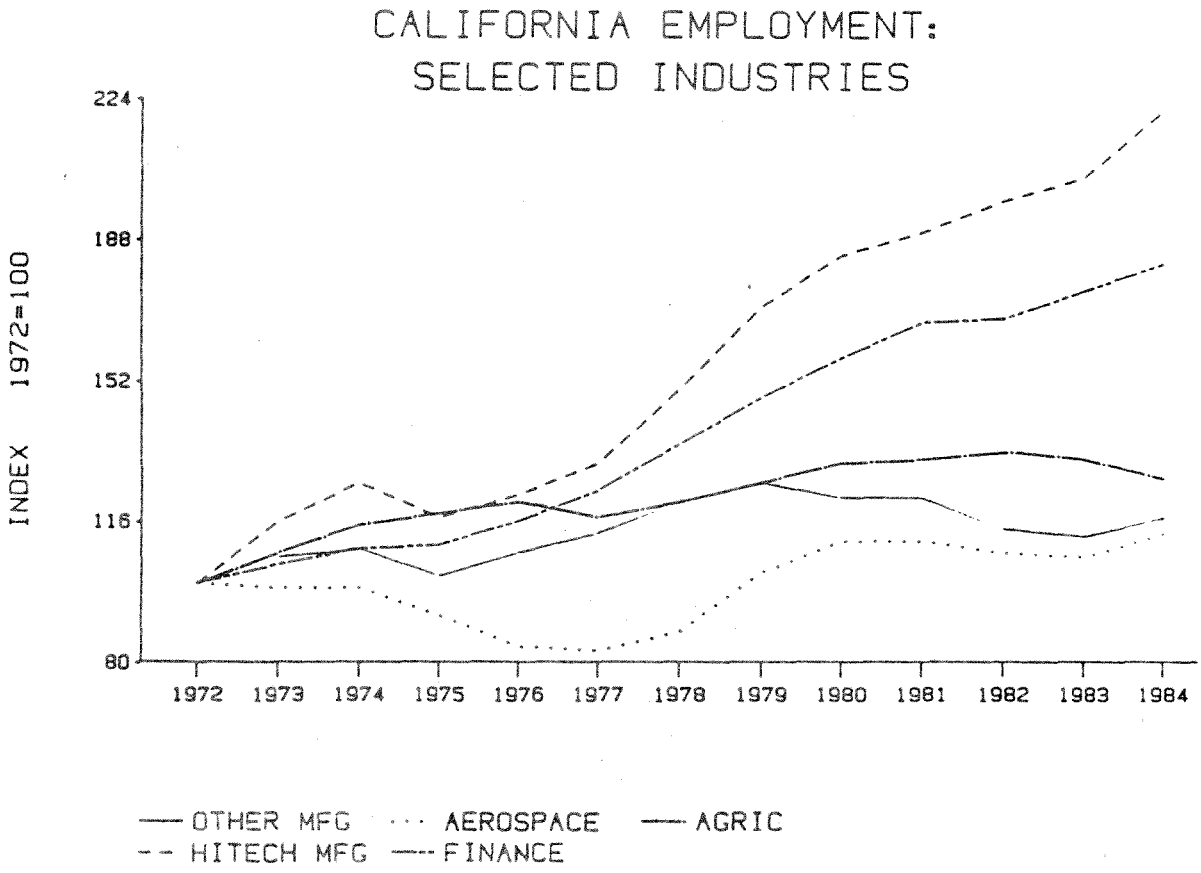


FIGURE 3 EMPLOYMENT GROWTH OF KEY CALIFORNIA INDUSTRIES

Increasingly, high technology manufacturing has been leaving Silicon Valley as the area becomes more of a research and development center. In recent years, new production facilities have been built outside of Silicon Valley in such areas as Texas, North Carolina, and Oregon as well as offshore. On the other hand, major high technology companies are opening research labs in Silicon Valley.

One important way to look at the problem facing California is the product life cyle, consisting of several key stages: basic research, applied research, product development, manufacturing, and marketing.* In terms of the product life cycle, California has continued to be a world leader in the product research and product development phases but appears to be lagging in the manufacturing and marketing phases. The product lifecycle is breaking down not in the area of innovation but in the area of production.

California is threatened on the one hand by foreign capture at the front end of the cycle (e.g., licensing and commercializing our basic research) and at the back end of the cycle (e.g., higher quality and lower cost foreign manufacturing combined with aggressive marketing). While the greatest present threat is from Japan, other countries and even other U.S. states are becoming an equally important threat. The Japanesse have relied on superior process technology rather than product technology to gain a competitive advantage. Between 1950 and 1978, Japan acquired over 32,000 new technologies, mainly through licensing agreements with U.S. firms, for approximately $9 billion. The United States spent over $500 billion developing that product technology. The Japanese invested in production capacity (process technology), the ability to manufacture technology products, and superior marketing; they now own major high technology markets in such areas as communications and semiconductors

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* The following discussion of the importance of the product lifecyle to understanding the California competitiveness is based on work by Regis McKenna, Chairman of the Industrial Competitiveness Task Force for this project. See particularly his "Manufacturing Competitiveness and the Life-Cycle of Innovation" (1985).

Investment in basic and applied research and product development (the areas where California is strong) can pay off only in the manufacturing and marketing phases. If production increasingly occurs outside of California, the state does not capture the benefits of its investment and loses a signficant number of jobs, especially for the middle and lower level production and service workers.

One significant aggregate measure of the imbalance in California's product life cycle can be found in relative investment in basic science vs. technology applications in industry. This is illustrated when California is compared to the United States and to other U.S. regions on key indicators for each area. On the following indicators reflecting commitment to research, California leads the nation: quality of science and engineering faculty, research articles per faculty member, and science and engineering Ph.D. graduates. However, on indicators reflecting the application of technology in manufacturing, such as industry R&D in universities and industry's own R&D, California lags the United States and especially the Northeast and Midwest regions (Figure 4). Part of this can be explained by the high degree of government-supported R&D in California, most of which is sponsored by the Defense Department and is not focused on industrial needs.

Another clear indicator of loss of manufacturing capacity can be found in an analysis of California's growth in manufacturing value added from 1977 to 1982. For all manufacturing industries (including high technology and aerospace), the relative contribution of capital to value added declined by 0.38% and the relative contribution of production workers declined by 9.09%. On the other hand, the relative contribution of nonproduction workers increased by 11.37%. Overall, the ratio of nonproduction to production workers increased by 22.5%. While this reflects the increasing importance of research, design and development in California, its also clearly reflect the decline in importance of production itself in the creation of value added.

For example, one semiconductor firm in Silicon Valley that is specializing in custom chips now finds that of a total of 225 employees, only 25 are assembly workers and another 25 are technicans. The majority of

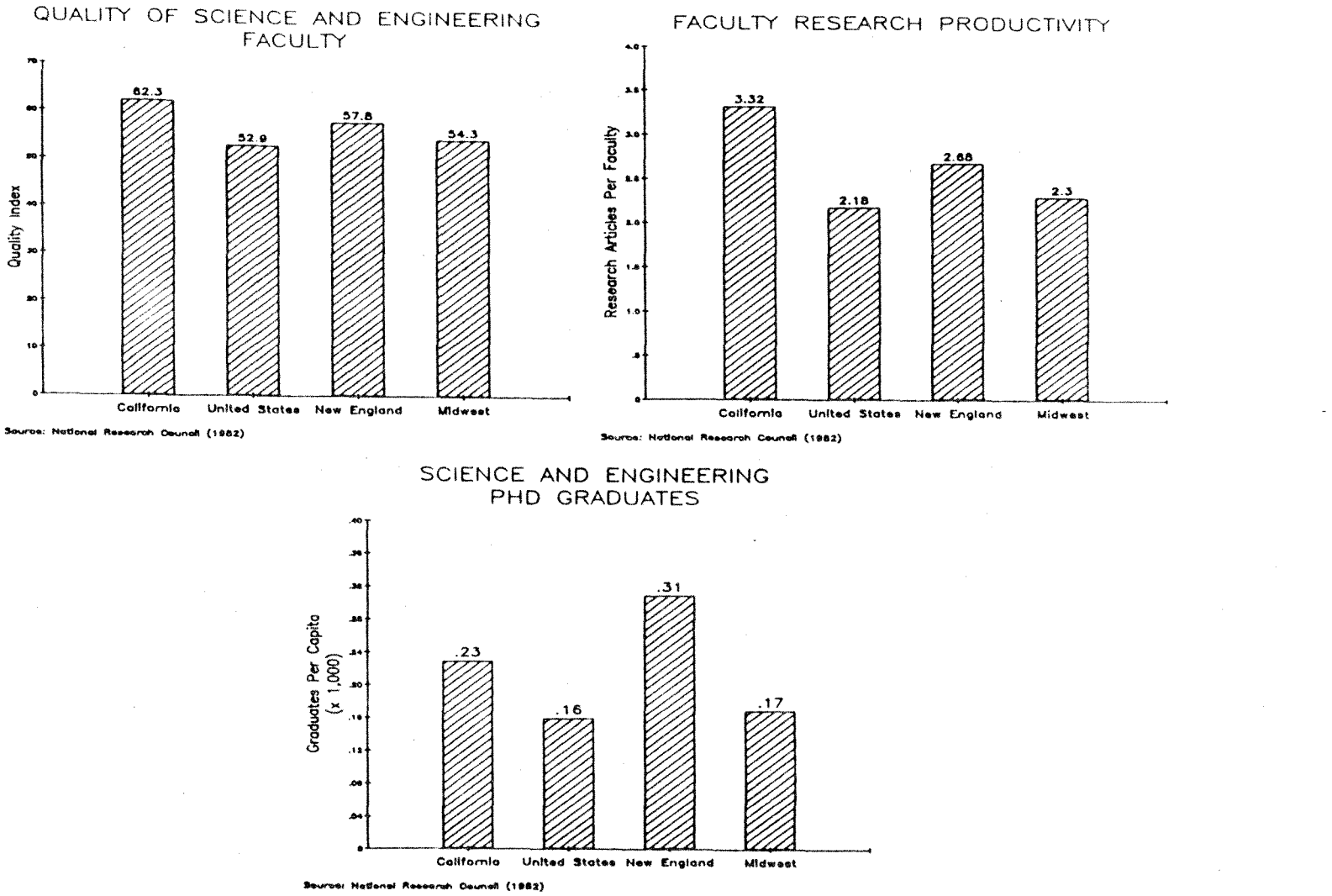

FIGURE 4 INDICATORS OF RESEARCH AND TECHNOLOGY CAPACITY

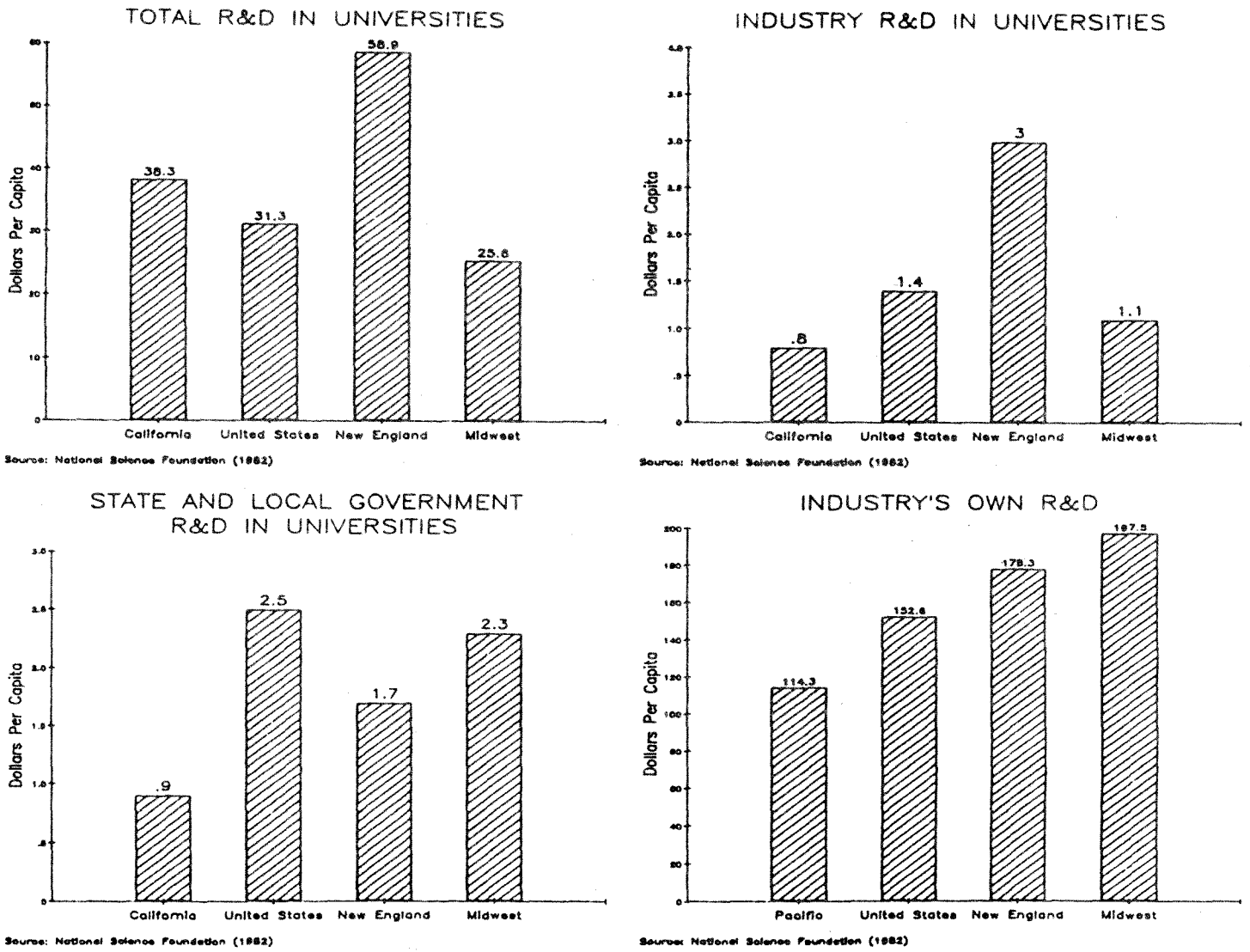

FIGURE 4 INDICATORS OF RESEARCH AND TECHNOLOGY CAPACITY

the rest are engineers and scientists. The implications are that Silicon Valley is increasingly becoming an R&D and design center; new products are developed in Silicon Valley, then designs are sent to manufacturing facilities outside the state.

Production, especially in advanced manufacturing remains critical to California's economic future. Its loss will mean the loss of value added for the state's economy and the loss of jobs. It is a fundamental misperception to assume that a "post-industrial" economy means a "post manufacturing" economy. While over 70% of all jobs in California are in services and services remain the major source of jobs in the state, the value added created by manufacturing provides the basis for much of the state's service growth in such areas as finance, insurance, real estate, transportation, communications, and wholesale and retail trade. The fastest growth in services in California from 1977 to 1982 was in business services, which grew by 48%.

Recent research at the University of California at Berkeley suggests that about 25% of services can be considered "tightly linked" to manufacturing.* These include engineers and designers as well as maintenance personnel for production facilities because many work on a contract basis. Thus the estimate for the value of manufacturing, when increased by these tightly linked services, would account for approximately 50% of value added and 45% of employment nationally, and probably slightly more for California.

Export industries act as an important driving force for the rest of the economy through a set of important linkages. High technology manufacturing, aerospace, and agriculture are the key export industries in California. Basic manufacturing and financial services are also important export industries.

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* Based on research by Michael Borrus, Codirector, Berkeley Roundtable on International Economics (BRIE) and member of the Industrial Competitiveness Task Force for this project.

These industries bring dollars into the state that: create jobs and income in those industries; create demand from a network of small and medium-sized suppliers in the region, and create demand for support services--both business services and those that are tightly linked. The income generated in all three areas creates demand for products and services from the core economy of retail trade, construction, health services, entertainment.

While the majority of jobs are found in the small and medium size businesses of the core economy, the driving industries have the dynamic effect of bringing dollars into the state, which continues to create additional jobs as the dollars are spent and respent by the support industries and then the core economy. The total income and jobs created is called the multiplier. The multiplier for driving export industries is estimated to range from 2.0 to 3.5, depending on the sector. The higher the value added, the greater the additional benefit generated. Hence a dollar generated by the driving industries can generate up to 3.5 additional dollars in the economy as it circulates through the support industries and core economy. A dollar spent in the core economy does not have the same multiplier effect (the multiplier is close to 1.0, meaning a dollar spent here has little additional job creating impact). Hence, two important economic development objectives for any state are (1) increasing the amount of income flowing into the state by exporting goods and services that have large portions of value added and (2) keeping as much income flow as possible by increasing the number of linkages among driving and supporting industries in the state.

Recent California Economic Experience

While the California economy was hit hard by the 1981-1982 national recession, experiencing a net loss of manufacturing jobs and an overall unemployment rate of 9.7%, it has grown faster than the U.S. economy since then, largely as a result of the stimulus of defense spending in aerospace and high technology manufacturing. One-fifth of the state's employment growth in 1984 was in aerospace, electronics, and defense-related activities.

In 1985, however, the competitiveness of key California industries began to be questioned. High technology manufacturing has been experiencing its worst shakeout yet as a result of overcapacity and increasing foreign competition. This year has seen a decline in high-technology manufacturing employment in Silicon Valley for the first time. Agriculture continues to be hurt by the effect of the overvalued dollar, which reduces exports. Basic manufacturing continues to undergo a significant restructuring. Finance is undergoing major changes as a result of deregulation and the movement toward interstate banking. While aerospace continues to grow as a result of the stimulus of defense spending, it may be affected by a leveling off of defense spending. This raises the fundamental issues of where the new sources of California economic growth will be.

This study is being done, therefore, at a critical time in California's economic history. The key question has become whether the state has capacity in manufacturing and marketing to compete in higher valued products or will it continue inventing new technology products that will be manufactured and marketed outside the state. In other words, can California capture its own R&D for benefit in the state through its production and marketing? The answer to that question will have an important impact on wealth creation and job generation in California in the next decade and beyond.

III AGRICULTURE IN CALIFORNIA

Introduction

Agriculture's importance in the California economy is often overlooked as the spotlight increasingly falls on the state's glamour industries. The magnitude of the state's agricultural output is especially overlooked: California is by far the nation's largest agricultural producer; it has eight of the country's top ten agriculture counties (in value of production). Fresno County alone has the largest agricultural production of any U.S. county; its output even surpasses that of 20 states. California agriculture is also a diverse industry producing a wide variety of agricultural products and having many businesses involved in food processing and in less direct support of the growers.

Also overlooked is the fact that high technology and advanced consumer products are fast becoming as much a part of agriculture as they are a part of the state's aerospace and electronics industries. Thus, agriculture enjoys a natural fit in California's overall economy. While the economic fortunes of agriculture are receding at both the state and national level, the fortunes of some of the more glamorous industries are also receding. In this context, these conclusions emerge from the following analysis:

- California agriculture has developed as a particularly strong industry because of the state's natural resources but also for many of the same reasons that California's aerospace and manufacturing have grown strong such as product and process innovation (e.g., the navel orange and the almond huller), and creativity (e.g., propagation of superplants by new cloning technology).

- The industry is affected by many of the same internal and external forces that are affecting most California industries (e.g., the strong dollar, high interest rates, foreign import barriers, stiff foreign competition).

- The solutions to the real and perceived problems of the agriculture industry fall in many of the same categories as solutions to the problems of other industries (especially improved marketing and financing).

In short, despite the economic transformations under way in the world, California's agriculture industry is now and can continue to be an integral part of the state's economic growth.

Background

California's fertile soil, temperate weather, and abundant low cost labor of the late 1800s and early 1900s were natural advantages on which to build a diversified agriculture industry. Early products included some fruits and vegetables; however, California's early farmers and ranchers concentrated mostly on producing basic commodity crops. Cattle, grains, and feed corn were the primary products for the industry's first century, although olives, dried fruit, and oranges were exported east as soon as train service became reliable enough for shipping perishables.

Farmers, ranchers, and agricultural experiment stations were active from the late 1800s on in trying to find the best crops and strains for California conditions. By 1910, cotton was being tried in Palm Springs, breeding new types of citrus was a craze, and travelers to other lands were being urged to bring back seeds to try out. Between 1920 and 1930, basic agriculture technologies gave way to more advanced technologies based on irrigation, chemical fertilizers, and pest control. The state's land grant colleges and agriculture extension services were established, and begin to institutionalize experimentation initially done by entrepreneurial individuals like Luther Burbank. By 1950, California was not only feeding much of the United States, but much of the world.

Declining export trends tell much of the story of the industry since 1980. Very rapid growth in the 1970s has given way as the dollar has strengthened and exports have declined. The export problem, however, isn't just a result of changing currency rates. Today, developing countries are increasingly being encouraged not only to produce much of their own basic food needs but to produce for export and earn foreign currency. Some (like Mexico, Brazil, and Turkey) now produce and export to the U.S. market many of the specialty fruits and vegetables that 20 years ago came primarily from California.

The industry has also been undergoing a technological transformation. Biotechnology has led to new products, advanced pesticides have improved yields (and damaged the environment in some areas) and new electromechanical technologies are reducing labor costs and increasing production. There are charges that many of the "improved" strains adopted by California agriculture increased yield or bruising resistance but at the cost of taste. Some irrigation and pest control practices also improve yield and appearance but not flavor.

Today, as the changing economic realities of the 1980s take hold, California has an advanced agriculture industry, but one that must continue to adapt. There are clear obstacles to continued industry growth based merely on "more of the same". The barriers to improved foreign trade are considerable. The advances being achieved in other sunbelt states with citrus and in other countries (EEC countries, Israel, Egypt, Latin America) with a variety of crops may mean further trouble. The value of land may continue to decline, for economic and environmental reasons (e.g., the build-up of salts in the southern San Joaquin valley).

The challenge now to industry leaders and supporters is to improve sources and kinds of financing, continue to improve management of land and water resources, continue technological progress, improve products, and develop new markets and marketing methods. These are serious challenges but California's agriculture leaders have shown that creative problem solving and innovation are among the industry's strongest comparative advantages. The

future for economic improvement in agriculture is probably brighter for California than for any other state.

Overview of Current Status

Table 1 shows that California's overall agricultural industry employment in 1982 stood at about 275,000. The industry contributes about $50 billion to the state's gross product of $500 billion. In this regard, agriculture is the state's number one industry. Nationally, California accounts for about 50% of the U.S. cash receipts for fruits, nuts, and vegetables produced. Figure 5 highlights other specific features of California's agriculture industry.

Figure 5(a) shows that net farm income has dropped somewhat since 1980, down to about $3.3 billion in 1985. California's share of U.S. agricultural income, however, was 18.7% in 1982 compared with only 9.3% as recently as 1970. This is strong evidence that California agriculture has been outperforming that of other states, even during the troubled 1980s.

Figure 5(b) shows California's farmers receiving little more for their products in 1984 than they did in 1979. Depressed prices in the face of increasing business costs is behind much, but not all, of the problem facing farmers. Another part of the problem is shown in Figure 5(c). Land values are dropping fast. This is troubling because as farmers need new agricultural loans, the value of their primary asset is sinking.

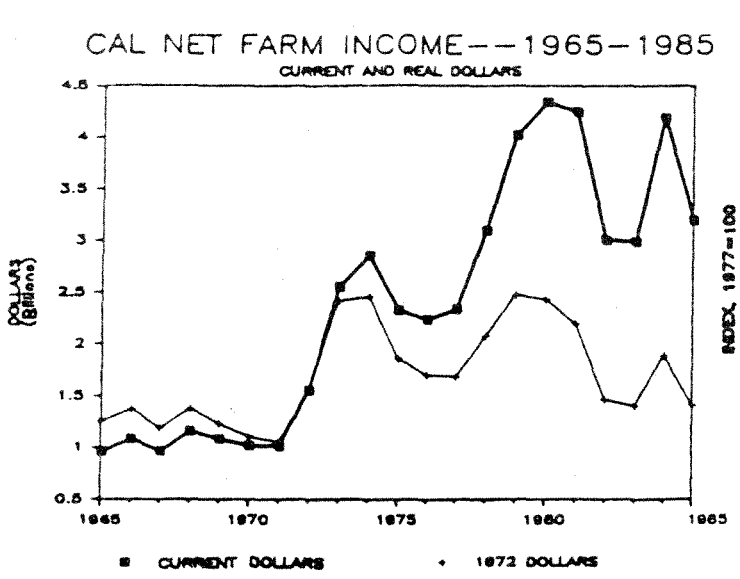
The extent of foreign trade in California agricultural products is significant. California ranks among the top three agricultural export states. Of total farm acreage one out of three acres is reportedly producing for export markets. In 1983, more than 20% of the state's farm income was produced by export sales and agricultural exports totaled about $3 billion (8% below 1982, which in turn was down 21% from 1981). This downward trend is especially troubling at a time when the industry is increasingly relying on exports for overall industry growth. For example, during the high growth

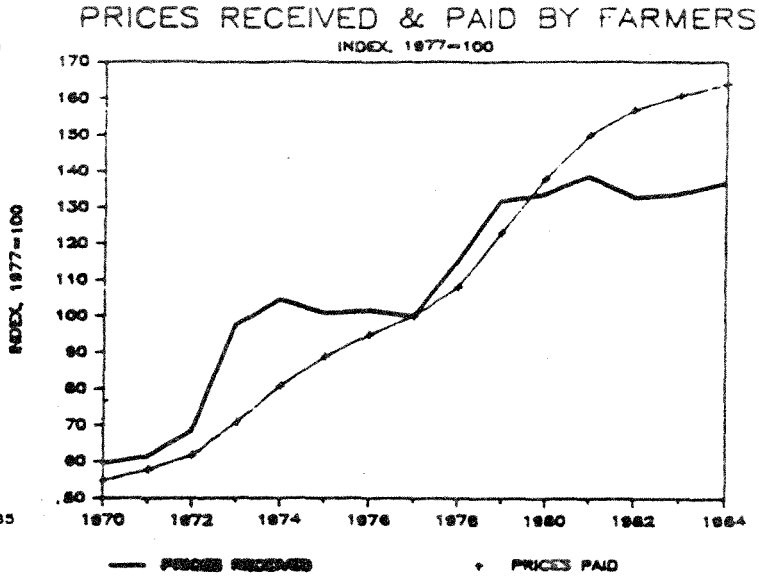
Table 1

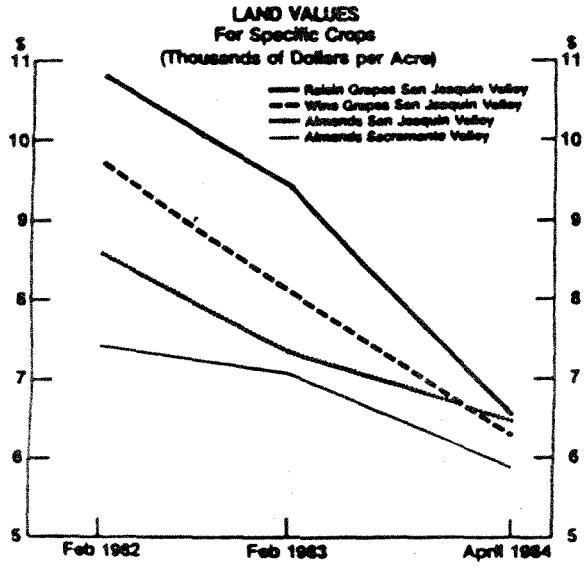
PROFILE OF CALIFORNIA AGRICULTURE

	1972	1974	1976	1978	1980	1982	1983
EMPLOYMENT (full & part-time jobs)							
California							
Proprietors	70,513	73,676	73,733	75,932	77,726	77,497	
Farm Employees	201,379	230,000	239,167	190,111	200,133	197,403	
Total	271,892	303,676	312,900	266,043	277,859	274,896	
California Share of U.S.							
Proprietors	2.3%	2.5%	2.6%	2.7%	2.8%	2.8%	
Farm Employees	16.4%	17.0%	16.8%	14.6%	15.0%	14.9%	
Total	6.4%	7.1%	7.3%	6.5%	6.8%	6.8%	
FARM INCOME							
California (000s $)	2,162,059	3,656,185	3,495,880	3,980,449	5,418,302	5,054,072	4,805,410
Cal. (000s of 1972$)	2,162,059	3,177,081	2,641,590	2,646,223	3,036,824	2,437,107	2,231,545
Cal. Share of U.S. Farm Income	9.6%	11.5%	13.6%	11.8%	18.4%	15.7%	18.7%
U.S. (000s $)	22,577,000	31,709,000	25,716,000	33,627,000	29,395,000	32,175,000	25,740,000
U.S. (000s of 1972$)	22,577,000	27,553,876	19,431,767	22,355,405	16,475,171	15,514,997	11,953,190

SOURCE: Bureau of Economic Analysis, U.S. Department of Commerce







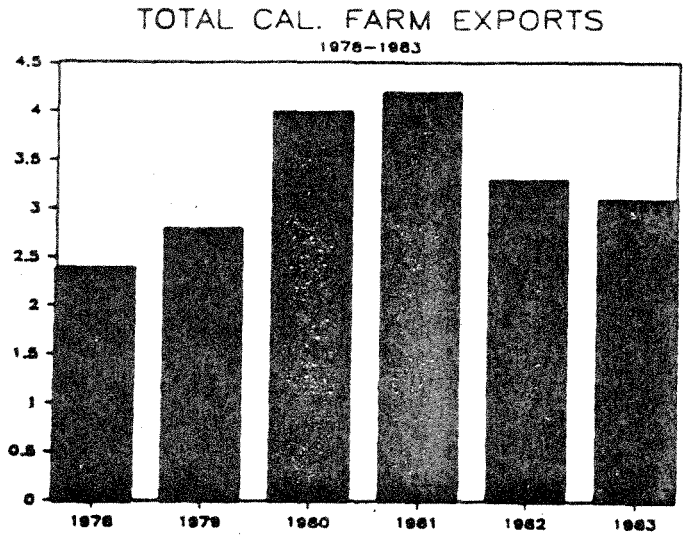


FIGURE 5 INDICATORS OF AGRICULTURAL COMPETITIVENESS

period, 1978 through 1981, the value of total exports jumped from $2 billion to $4.2 billion. By 1983, however, the increase was only 9% above 1978 (thus only 9% total increase in exports over 6 years). Figure 5d shows how this trend has developed since 1978. Far Eastern markets receive 60% of the agricultural exports shipped from California ports.

While California agriculture is thought of as mostly characterized by big corporate operations, less than 1% of the state's 80,000 farms are owned by nonfamily corporations. The average California farm is actually smaller than the U.S. average, 432 acres as compared to 437 acres (the California nonfamily corporate farm with 11 or more stockholders is about ten times that size).

Analysis of External and Internal Factors

California's agriculture is affected by a variety of external and internal factors. External factors, largely outside the state's control, include the typical business cycles periodically affecting the entire economy, shifting federal policies, changing market demand, and changing patterns of foreign trade. Internal factors, those most susceptible to influence by state policy include the application of advanced technology (including process technology--those advances for processing agricultural products that add value to commodity crops), improving the availability and skill of human resources, making financial capital available, and further developing marketing and management skills and access to up-to-date market information. Each of these factors, and how it affects California agriculture (summarized in Table 2) is discussed below.

External Factors

The external factors identified are these:

. Business cycles--Agriculture continues to remain in a nationwide recession and is struggling to restructure in the face of the new

TABLE 2

SUMMARY OF FACTORS AFFECTING AGRICULTURE

External Factor	Effects
Trade	The strong dollar has hurt agricultural exports. Foreign countries are aggressively competing with U.S. products. System needs to respond faster to trade shifts.
Business cycle	High interest rates have raised farming cost. While agriculture remains in recession, however, California is performing better than many other states due to its specialty crops.
Federal policies	Affected by federal farm support programs, trade agreements, land-use and water policies, and monetary policy. Inappropriate federal support price and production policies encourage commodities at a time of diminishing demand.
Changing markets	Trend away from commodity grain and beef products toward higher value added specialty fruit and vegetable products and food processing favors California. However, market shifts also need new responses.
Internal Factor	**Effects**
Technology	Adoption of advanced crop and production technologies has been a key to California's agriculture. The continued adoption of new technologies (for irrigation, seeds, hydoponics, sensors in farm equipment), especially for medium and smaller operations, depends on attention to grower needs for new kinds of financing and new crop markets.
Human resources	While university training for farm management has been excellent, there have been gaps in training for new management skills, especially through voc-ag training at community colleges.
Financial capital	Serious debt problems limit ability of highly leveraged operations to respond to change. New types of equity and debt financing will help.
Management	Improved management throughout the system (not just growers) is critical as agriculture restructuring continues and new opportunities open for use of advanced technologies. Need to train entrepreneurs to use technologies.

economy. The decline has worsened in California's agriculture industry since 1982. However, because of fertile soil, relatively abundant water, good weather, and agricultural diversity California can be expected to outperform other agriculture states. On the whole, California has adapted faster than other states to market shifts by developing new products and production methods. The result has been to further insulate California agriculture from some of the industry dynamics that affect other agricultural states. Nevertheless, California is increasingly threatened by foreign competition, disinflation in land values, and, more recently, toxic contamination in some areas (e.g., Kesterson Reservoir). The long-term emphasis on increasing income by raising output and improving appearance of fruits and vegetables using advanced chemicals has led to a slowly growing market backlash that can be taken advantage of by some foreign countries.

- Federal Policy--Agriculture is significantly affected by federal policies: farm price supports, monetary and trade measures (including bilateral agreements made for nontrade reasons) and land use (e.g., grazing and water rights). Trade embargoes, like that on soybeans or the export embargo on wheat to the USSR have long term effects on California exports. (Australia benefited from becoming a wheat supplier to the USSR in 1980 and has kept a share of that market.) Subsidized exports (such as Food for Peace) are constrained by the cost of shipping in American vessels (required by law). World agricultural prices are soft because of increased supply. Further, domestic markets are undergoing significant change, reflecting diminishing needs for commodity agricultural products (e.g., beef, grains, some crops like sugar beets). Finally, U.S. economic policy has, in general, led to high rates of U.S. growth relative to other countries and the attractiveness of the United States as a place to invest has increased the price of the dollar in foreign currencies, putting additional restraints on U.S. agriculture exports.

While California is being affected by many of these federal policies, the full impact has been delayed and may be less severe than in other agricultural states. Nevertheless, many California operators need more appropriate policy support, with the state government being an appropriate source of policy support in application of advanced technology, human resources, new financing methods, and technical assistance in marketing and in conforming products to foreign market requirements. Technical assistance and applied research are needed not only for growers but also for wholesalers and processors. For example, growers may need technical assistance as to what extent changes in irrigation practices could allow existing nectarine orchards to produce for Asian markets while wholesalers may need applied research in packaging for Asian markets and in meeting their demands for freedom from pests and pesticides.

- Changing Markets--As export markets change, commodity products are becoming less competitive, especially beef and grains. There are clear trends toward higher-value-added products (e.g., specialty fruits and vegetables), and food processing (e.g., ready-to-cook/eat products).

  Responding to market changes includes such things as conforming to common practice in selling to foreign markets (e.g., using 5-kilo boxes instead of 23-lb lugs to sell table grapes in Europe), meeting foreign regulatory demands (e.g., finding a substitute for prohibited wooden boxes for shipping fruit to Australia, developing a surer method for removing aphids from lettuce without fumigating to allow sales to Japan), and meeting foreign taste standards (e.g., nectarines that are both high sugar and high acid for Asia, smaller and more flavorful pistachios for several markets).

- Trade--The high-valued dollar and high domestic interest rates have hurt U.S. agriculture more than any other factor. This problem is particularly severe at a time when foreign countries are becoming more self-sufficient and, in some cases, more competitive exporters of their own products (e.g., Australia, Thailand). Adding further to this problem, some countries (e.g., Japan) are also subsidizing their products. Trade opportunities do exist however (e.g., South Korea, Thailand, Japan), but strategic and aggressive marketing is required. In sum, even though world food demand is increasing, many agriculture states are competing for fewer foreign market niches not being filled by the countries themselves. While California is well positioned for improvements in foreign trade situations (because of past successes, a good understanding of new economic realities, and its western-most location), for California to be ultimately successful, the currently high-valued dollar must conform more with the true value of other market currencies and interest rates must moderate. However, market shares lost to other countries because of the high dollar are unlikely to be regained fully. (The offsetting factor is that California is able to grow many kinds of crops so that, given enough market information for both growers and middlemen, lost markets can be replaced by new ones.)

Internal Factors

These internal factors are significant in California:

- Technology--Agriculture is going through an explosive adaptation to key advanced technologies (e.g., computers, biotechnologies). Opportunities still exist, however, for continuous adaptation to existing technologies and development of new technologies (e.g., for irrigation management, seed treatment, managing pesticide use, advanced mechanization like sensors and robotics in farm equipment). While California's large operators may be leading the

nation into the most promising new technologies, there will always be a need to keep abreast of changing technologies and to apply them at the point of cost effectiveness -- not merely in raising output and cutting labor costs but in cutting spoilage while shipping, reducing the amount of fertilizer needed, finding ways to comply with foreign restrictions.

- Human Resources--California's specialty crops are especially sensitive to the need for timely harvesting. Advanced mechanization is eliminating some, but not all need for semiskilled farm labor. While the cost of farm labor is climbing, so is productivity. The real need is for new types of managerial training, (not in how to do the job but in how to use the information that is becoming available) especially in the area of marketing. New voc-ag curricula at higher educational levels, especially in California's community colleges would help growers learn about new financing possibilities, new crops, new markets and new marketing techniques. The state's land grant and community colleges need to establish stronger relationships with the industry--particularly, shippers, wholesalers, and distributors, who are often left out--and jointly develop opportunities for more applied research and for more programs in advanced agricultural marketing for grower coops as well as vertically integrated corporate farms and independent middlemen Using California's educational system to disseminate information might also foster the development of new entrepreneurial ventures, among packers as well as growers.

- Financial Capital--Nationally, large operators and some small operators are relatively debt-free, but there are very serious problems with middle-sized, mostly family-run operations too small to have competitive economies of scale and too large to remain debt-free in time of major recession. In California, however, the problems are reportedly with large operators that took on heavy debt in the expansionary 1970s. Their problems also include depreciating assets and, in serious cases, lenders now unable to continue carrying the debt. There is a compelling need to identify new ways to share financial risk. While there are some signs of urban capital flowing to meet rural needs, major initiatives are still needed to support new equity and debt financing methods. Falling land values are a serious problem, however, as equity and collateral diminish.

- Management--Management that fosters effective responses to market changes may be the most significant area of opportunity. World demand patterns are changing--old markets are closing (e.g., feed commodities) and new ones are opening (e.g., for new processed food products). Both growers and middlemen/processors need new ways of responding to those changes. In some cases direct marketing of specialized products can be more successful than traditional marketing approaches. California agriculture needs to undertake more information sharing through workshops in specific products. Finally, California's educational institutions must provide new academic programs for further development of the industry's marketing skills.

- Policy view--Traditionally, government has attended mainly to problems of growers without seeing agriculture as a system. Thus, technological improvements and applied research focused on any portion of the system beyond the grower tend to receive less public sector attention. This often leaves the grower unable to change because problems further on or earlier in the system have not been addressed.

From the brief summary above, it is clear that California's agriculture industry is affected by many of the same external and internal factors that are affecting other industries in the state. But if one set of factors can be said to be dominating the industry today it would be the following: increasingly stiff foreign competition is developing at the same time that the dollar is unusually strong, interest rates are high, and trade barriers are developing (e.g., Japan has import quotas on oranges). California, it will be argued, competes very well in domestic markets. The problem then is California's decreasing competitiveness in foreign markets at a time when California is increasingly an agricultural exporter.

Competitive Assessment

Domestic Competition--Products

Table 3 lists 29 major agricultural products for which California's production currently leads the nation. California's top ten products have been capturing the same or a greater share of U.S. production since 1980.

California dominates all other agricultural states in high value products. Where Wyoming is strong in sheep and wool production, and Iowa in corn and other grains, these are relatively low value products in which U.S. agriculture is losing (or has lost) its competitive edge overall with foreign countries. California, always strong in basic agricultural commodities, is increasingly moving "up-scale." Almonds, pistachios, artichokes, asparagus, kiwifruit, and the like bring premium prices in rapidly growing specialty markets. The advantage is not only that these products bring high prices, but that these crops can be grown in only a few

Table 3

AGRICULTURAL PRODUCTS IN WHICH CALIFORNIA LEADS THE NATION

Commodity	California Share of U.S. Production (Percent) 1983	1980
Prunes	100.0%	100.0%
Pistachios	100.0	95.0
Kiwifruit	100.0	NA
Almonds	99.9	95.0
Olives	99.9	95.0
Pomegranates	99.9	95.0
Figs	99.9	65.0
Dates	99.8	65.0
Walnuts	99.0	95.0
Nectarines	97.2	95.0
Apricots	95.7	96.6
Broccoli	89.9	95.3
Grapes	88.9	91.6
Plums	88.4	100.0
Avocados	95.3	73.3
Processing Tomatoes	84.9	NA
Lemons	79.8	NA
Safflower	75.0	NA
Cauliflower	72.1	74.8
Honeydew Melons	71.7	71.0
Strawberries	70.0	75.3
Lettuce	69.4	74.4
Celery	68.0	NA
Peaches	58.9	66.4
Carrots	51.3	53.0
Onions	30.1	78.4
Alfalfa Seed	25.4	39.7
Nursery Products	24.6	NA
Eggs	12.0	NA

California also leads the nation in the following commodities, although information is not available for their shares of U.S. production: artichokes, asparagus, Brussels sprouts, cantaloupes, casaba melons, Crenshaw melons, cut flowers, garlic, green lima beans, jojoba, Ladino clover seed, fresh market mushrooms, oriental vegetables, Bartlett pears, Persian melons, persimmons, potted plants, and spinach.

Source: Security Pacific National Bank

areas in the world so that California's competition is limited. Nevertheless, specialty products are import sensitive and many developing countries are producing one or more to earn foreign currency. Therefore, California cannot afford to lose any more of its edge.

Domestic Competition--Processing

California's agriculture industry is not limited to specialty crops characterized by high intrinsic value. The state also has a growing food processing industry that is adding value to basic products like beef, chicken, fruit, and vegetables. Meeting new demands for new, fast preprocessed, precooked, prepackaged, "home-cooked" meals, California's food processors are responding by, for example: breading, flavoring, and cooking chicken parts; slicing and cooking french fried potatoes and onion rings; and packaging all kinds of food products for today's microwave cooking.

At the same time, the state's traditional food processing industry is not faring well. For example, ten fruit processing operations in California have closed since 1981; exports of canned peaches, pears, and fruit cocktail have declined, and imports have grown significantly. According to the Agricultural Council of California, imported canned peaches are $2 a case cheaper on the East Coast than California canned peaches.

Shipping technology is an area in which public sector R&D has been scant. However, the development of trade with southern hemisphere nations could provide small but growing markets for California stone fruit, nuts, and salad vegetables given methods of packing that would assure arrival in good condition.

While university research aimed at providing a long-shelf-life product in a lighter, easier to transport form (while retaining flavor) might make California processed fruits competitive once again, the food processing industry is changing. Success in the long run is more likely in innovative new processed food products than in new methods of processing traditional

products. Industry, university and government policy should be directed as both new products and products for which there are signs of new demand, and efforts should be made to leverage public financial support of the industry (e.g., basic and applied research) to attract new private foreign and domestic investments.

Foreign Competition

California is a significant producer of cotton, rice, almonds, oranges, and grapes, with much of the production destined for foreign markets. Exports of these five crops comprise 56% of all exports. Table 4 summarizes California's comparative advantages, disadvantages, how these five crops are faring now in foreign markets, and what future they face.

While export crops are being hurt by the high-valued dollar, each is also being affected (although differently) by other factors. For example, cotton exports are increasingly threatened as end-use markets for cotton are leaving the United States for Far East locations. Many countries have developed vertical integration in cotton; while California grows the raw material, there is little textile production in the state. Shipping costs offset much of the quality advantage of the California product. This fact, coupled with an increase in worldwide cotton acreage, is likely to cause cotton exports to decline over the next few years. One big California cotton co-op is predicting that 10% to 20% of the state's cotton growers may go out of business next year. Whatever the actual outcome, it seems likely that next year will see a permanent cut in cotton production.

Almonds are a specialty crop for which California faces competition from Mediterranean countries, far from growing markets in Southeast Asia. Domestic almond prices have dropped from their 1979 peak of $1.90 lb to $1.20 or less. A 2-year oversupply of almonds is exacerbating the already serious problem. Oranges have been affected by EEC arrangements and by quotas imposed by Japan to protect their Mandarin orange industry which competes domestically and in Southeast Asian markets. The outlook is for a

Table 4

MAJOR CALIFORNIA CROPS IN
FOREIGN COMPETITION
1984

Crop	Percent Exported (Value of Total Value)	Expected Export Trend	Primary Markets	Primary Competitor	Competitive Advantage	Competitive Disadvantage
Cotton	70-80%	Down	Japan, other Pacific Rim, Russia, PRC	PRC, Russia	High quality product	End-use markets leaving U.S., over-valued dollar, competitors improving production quality, worldwide cotton acreage increasing.
Almonds	50-60	Down	W. Germany, Japan, Taiwan, S. Korea	Spain, Italy	Ideal growing conditions, high quality product, product variety.	Over-valued dollar, Spain expect admittance into EEC could hurt California producers.
Oranges	30	Flat	Worldwide, Japan, other Pacific Rim	Mediterranean countries	High quality product, ideal growing conditions, seasonal differences make California oranges attractive in European markets, juice processors in California.	Over-valued dollar, Japan has imposed trade barriers.
Grapes, Raisins, Table Wine	12-15	Down	Hong Kong, Singapore	Greece, Turkey, Australia	Ideal growing conditions	Over-valued dollar, trade barriers, EEC very aggressive and surplus very large.
Rice	40-45	Flat	Developing Pacific Rim	Thailand, Japan, Korea	Ideal growing conditions	Over-valued dollar, high labor costs.

mostly flat orange export market over the next few years. (Brazilian orange juice competes mostly in eastern U.S. markets, and mostly with juice from Florida.)

California's grapes, raisins, and table wines increasingly compete with products from Mediterranean countries and from Australia. The European Common Market is also increasingly competitive (some observers speak of the EEC "wine lake"), so that the outlook is for modest declines.

Finally, California rice is facing increasingly stiff competition, especially from Thailand. It is likely that the state will lose export market share through the end of the century.

Summary of Major International Trade Problems Confronting California Agriculture

These appear to be the major trade problems:

- Overvalued Dollar--Raises cost to foreign countries that import U.S. agricultural products, thus, limits demand. Lowers cost to U.S. buyers of foreign food products, thus limiting domestic demand for domestic products. California's dollar problem is more severe for European currencies and markets than for Asian currencies and markets.

- Trade Barriers--California is facing both tariff barriers (restrictive Japanese custom duties on citrus fruits) and nontariff barriers (kiwifruit and walnut restrictions because of fumigants and packaging employed by California producers).

- Subsidies and Dumping--While the United States is attempting to control this problem through GATT negotiations, it is doing so industry by industry, and with little hope of success. Agriculture is not a priority at this time (the California fig industry faces subsidized dried fig imports duty free at a price below domestic costs of production).

Overview

As with U.S. agriculture, California's agriculture industry is troubled by macro factors that are affecting many industries today. But what is particularly important are the trends in foreign trade. An increasing foreign ability to compete in agricultural production for home use and for export coupled with today's overvalued dollar are hurting California agriculture in ways not felt before. While California is blessed with ideal growing conditions for many crops, higher quality products, and higher overall yields, foreign competitors have the advantage of growing domestic markets, less expensive labor, more government support, and direct trade protection.

The difficult question is whether California's inherent strengths (geography, weather) alone can stem the export decline. As the dollar weakens (as expected in late 1985 and 1986), exports might be expected to rise; however, in many cases Third World countries will keep the markets they gained while the dollar was high. The advantages held by foreign countries may well outweigh California's advantages between now and the turn of the century. Furthermore protectionist threats against U.S. products are widespread today. It is possible that U.S. countermeasures to foreign competitive practices (such as quotas or high import duties) will result in foreign retaliation. If Pacific countries chose to retaliate by closing their markets to U.S. goods (as was the experience when the Smoot-Hawley Tariff Act of 1930 became law), California agriculture would be hurt. There is also the threat that as some of the Pacific nations (especially Japan, Korea, and Thailand) move to even more advanced production technologies, these countries can begin to move their products into California's currently captive export markets, permanently damaging California agriculture. State leaders must be aware of these threats and be alert to the fact that California's specialty crops are increasingly sensitive to foreign competition.

Will California's agricultural industry follow the path of California steel, automobile and electronic industries? The answer lies in the extent

to which California agriculture becomes even more aggressive users of technology, new financing, new marketing, and advanced technology. Table 5 revisits the list of external and internal factors affecting agriculture discussed earlier. For each factor, Table 5 shows whether California is at an advantage, a disadvantage, or is about at parity with the major foreign competition. The table shows that the state's Ag industry is at a distinct disadvantge in terms of federal policy support (trade and fiscal policies are hurting the industry) and high cost of capital (real interest rates are causing problems for debt-laden operators). California is at an advantage in terms of changing U.S. markets (the move to special high-value added products by today's "fashion eaters" and the newly diet-conscious consumer is helping California), applications of product and process technology (California is leading the world in labor-saving technology), new marketing aproaches, and management (California is strong but there is still room for improvement in accessing and using new types of information).

Table 5 can help serve as a guide for designing public policy, education, and lobbying remedies for those areas where a significant disadvantage exists and for developing further public policy support to those areas characterized by parity or a significant advantage.

At the same time, California could benefit even further by looking at agriculture as a set of systems that include packers and shippers, suppliers, lenders, and wholesalers, not just growers. In some cases, advances need to be made in other parts of the system to allow growers to make adequate responses to market changes.

Future Prospects

There are already some signs that segments of California's agriculture industry are at the bottom of a deep cycle and are recovering. The Almond Growers Exchange, for example, recently reported a 40% increase in 1985 exports and an 18% rise in domestic shipments. Much of this improvement comes from innovative products such as almond butter (from 40,000 pounds in 1981 to 3 million pounds in 1985).

Table 5

KEY CALIFORNIA AGRICULTURAL PRODUCTS
VS
MAJOR FOREIGN COMPETITION

	Disadvantage			Advantage	
	Major	Minor	Parity	Minor	Major
External Factors					
Federal Policy				[redacted]	
Changing Markets					[redacted]
Trade Policies	[redacted]				
Internal Factors					
Technology					
Process				[redacted]	
Product					[redacted]
Human Resources					
Quality				[redacted]	
Quantity		[redacted]			
Cost of Capital	[redacted]				
Management/Marketing				[redacted]	

These improvements, while encouraging, are not universal across all products. Some products like cotton and rice may be permanently damaged by foreign advances. Where California has unique comparative advantages, such as ideal growing conditions (e.g., kiwifruit, nuts), the now diminishing dollar value, and moderating interest rates should improve economic performance. Mobilizing political pressure against subsidies and dumping practices (and threats of retaliation) may reduce these competitive pressures, but because foreign relations are so complex and other U.S. interests may be involved (e.g., the need for U.S. banks to have Third World loans repaid) such mobilization may not be feasible in all cases.

Overall, while there are positive signs, foreign countries are becoming more self sufficient and able to compete effectively in international agriculture trade. California's edge in high value, specialized products is likely to diminish slowly over the next 10 to 15 years. To keep the industry's overall economic performances at 1980 to 1985 average levels, or better, will require research, and new products and processes only now on the horizon. Aggressive and strategic marketing must accompany both new breakthroughs and maintaining sales of today's products. California can maintain a viable agriculture industry by building on its most obvious comparative advantage--the power of technology, creativity, and innovation.

IV HIGH-TECHNOLOGY MANUFACTURING IN CALIFORNIA

Introduction

High technology manufacturing in California has been an engine of growth in employment and output in California manufacturing. Since World War II, employment in high tech manufacturing has increased nineteenfold--from 18,355 in 1947 to over 350,000 in 1982. The most rapid growth has occurred in communications, electronics, computers and office machinery, and instruments.

California's success with high technology manufacturing and the growth of such high technology regions as Silicon Valley have made California the envy of the world. Today, however, there appears to be a slowdown in leading high tech sectors in California because of foreign competition, overcapacity, and decentralization of the industry to other regions and countries.

California could become the "electronic rustbelt" of the 1990s unless its electronic, computer, and communications industries are able to remain at the forefront of new product and process innovation and development. The question facing these sectors is how they can maintain their competitive edge. Even if they find a way, however, the "electronic" industrial revolution is now well advanced and many of the current electronics industries are becoming mature. California cannot stake its future on the sources of past economic success. Instead, it should seek continuous innovation and adaptation to new market opportunities in advanced technologies.

The primary key to California's economic future lies in its ability to remain a seedbed for innovation across many existing, emerging, and yet-to-be-seen high tech industries and to retain manufacturing capacity in these areas. To do so, the state must revitalize its ability to support advances in technology, entrepreneurship, and human and capital resources. It also needs to stimulate the emergence of tomorrow's high technology industries which will ultimately be the source of new jobs and opportunities in California in the 1990s and beyond.

The Emergence of California's High Tech Industry

For California, World War II marked the turning point in the state's transition from a resource-based economy to one based on advanced technology. What spearheaded the drive to an advanced technology economy was the phenomenal growth of increasingly sophisticated defense industries. After the war, a number of major firms--Douglas, Northrop, Hughes--that had supplied the war effort with aircraft and other advanced technology systems from California continued to invent new technoloqies and develop new products such as jets, missiles, radar, and lasers. The expansion of these firms continued throuqh the Korean War. Between 1950 and 1954, military prime contracts awarded to California firms totaled nearly $13 billion or about 14% of all awards nationwide. In 1957, the launching of Sputnik expanded and broadened the significance of nonmilitary space development. Again, California was able to lead the way. In that year, employment in aerospace topped 270,000.

Throughout this period, defense spending helped to promote advanced technology development, especially in the aerospace industry. At the same time, the application of these technologies to commercial use was beginning to increase, which led the way to the next phase of California's industrial revolution.

In the 1960s, California made the transition from dominance by aerospace into a more diversified manufacturing sector, which began to serve effectively commercial markets. While aerospace still accounted for over 34% of all manufacturing employment in 1965, the advanced technology manufacturing base was broadening.

During the 1950s, a new nucleus of high technology activity was forming in what was to become known as Silicon Valley. Several electronics firms, such as Hewlett-Packard and Varian, had already been launched in Santa Clara County by engineers from Stanford University. However, it was not until the mid-1950s when William Shockley, inventor of the transistor, and other semiconductor pioneers came to Palo Alto that a critical mass of electronic engineers and entrepreneurs collected in the area. The age of the transistor and semiconductor arrived swiftly thereafter. In addition to the continuing military market, the growing number of transistor firms discovered a consumer market in the mid-1950s, first for portable radios and hearing aids, and then for computers. The computer market, which was expanding rapidly, entered the Silicon Valley when IBM opened a research and manufacturing plant in San Jose in 1956.

The major change in the 1960s was the commercial application of the integrated circuit--a central element in microelectronics. The first integrated circuit was put into production in 1960 by Fairchild for NASA and a variety of commercial equipment manufacturers. In 1962, the government purchased 100% of the integrated circuits produced in the United States. In 1965, the government purchased 55% and by 1969 it was purchasing only 36%. During the decade of the 1960s, the transition from military to commercial use was completed. By 1978, only 10% of integrated circuits were purchased by the government.

The invention in 1969 of the computer-on-a-chip known as the microprocessor launched the next round of growth in commercially driven microelectronics. Between 1972 and 1982, the 30 or so chipmaking firms in Silicon Valley grew to over 3,000 assorted firms who were by then offering a wide varlety of high technology products and services for commercial

markets--nearly all based on the integrated circuit and the microprocessor. The key point is that while defense procurement played an important role in the birth of Silicon Valley, it was the transition to commercial markets in the 1960s and 1970s that sustained its growth.

High Technology Industry in California Today

High technology manufacturing in California has been the most dynamic and vital segment of the state's economy. In 1972, only 14.8% of manufacturing employment was in high tech manufacturing (including computers and office machinery, electronic components, communications equipment, instruments, and drugs). By 1982, nearly one-fourth of all manufacturing employment in the state was in high tech manufacturing. Table 6 shows the growth in high tech manufacturing employment and value added from 1947 to 1982.

The growth of high technology industry has occurred in rather specialized locations. Most high technology firms, early in their product life cycle, have tended to cluster because of communication and innovation economies. In California, two major high technology clusters have developed in the Santa Clara Valley and one in Los Angeles and Orange Counties. A high proportion of California's high tech manufacturing is concentrated in these two agglomerations.

High tech manufacturing is likely to remain important to the California economy, particularly in electronics and solid state technology. These technologies will also be central to the future modernization and survival of older sectors, perhaps giving them a new lease on life in the face of foreign competition with low-cost labor.

Table 6

CALIFORNIA EMPLOYMENT AND REAL VALUE ADDED IN HIGH TECH MANUFACTURING, 1963-1982

Sector	Employment (in thousands)				
	1963	1967	1972	1977	1982
Drugs	3.7	n.a.	8.7	11.8	14.9
Computers	n.a.	n.a.	43.1	63.4	112.7
Communications	96.7	99	75.6	89.5	137.3
Electronics	45.8	59.4	53.2	85.2	135 1
Instruments	22.5	33.3	48.1	69	91.8
Total	n.a.	n.a.	228.7	318.9	491.8

Sector	Real Value Added (in millions of 1972 dollars)				
	1963	1967	1972	1977	1982
Drugs	62.1	n.a.	245.7	343.2	451.9
Computers	n.a.	n.a.	932.6	1,644.8	2,879.5
Communications	1,627.5	1,914.5	1,535.3	2,033.3	3,324.4
Electronics	648.6	886.7	910.9	1,699.5	3,013.6
Instruments	362.1	600.4	927.3	1,384.7	2,093.4
Total	n.a.	n.a.	4,552.0	7,105.5	11,762.9

Source: U.S. Census of Manufactures, 1963-1982.

Factors Affecting Development of High Technology Manufacturing in California

Both external and internal factors shape the opportunities for high technology manufacture in California.

External Factors

While the high value of the dollar hurt exports of high technology manufacturing, the major external factor affecting the industry was a slowdown in world demand beginning in 1984. This was especially severe for semiconductors: world demand actually dropped by 10.4% in the fourth quarter of 1984. The rapid growth in demand for high technology products in 1983 resulted in a build up of excess capacity in the high technology industries which was not needed when purchases slowed down in late 1984 and 1985. Major purchasers of high technology equipment slowed down their procurement of new equipment in 1984 as they made inventory adjustments. This resulted in slowdown of production and layoffs in many high technology firms. At the same time, the Japanese began to gain an increasing share of the semiconductor market. Furthermore, the Japenese became important in markets once dominated by U.S. high technology manufacturers, especially in communications equipment, instruments, and computers. These developments appear to be cyclical in nature and should be corrected as demand increases again.

The strongest external threat is the degree to which foreign competitors are penetrating world markets and reducing U.S. market share. The high value of the dollar has contributed to this problem. So have focused Japanese efforts to penetrate specific markets in semiconductors, communications, and instruments. However, external factors do not account for all of the competitiveness threat. U.S. manufacturers must continue to innovate in producing higher value added, quality products that meet changing world demand. Thus we must examine factors critical to competitiveness within the internal control of the industry itself.

Internal Factors

Beyond external factors, a number of critical factors internal to high technology manufacturing have a critical impact on future development. In technology, while California remains the leader in the product innovation, it is losing its lead in manufacturing process innovation, reflected in the decline of California's productivity advantage in critical industries such as computers and office equipment. Shortages of key technical personnel and engineers are critical problems in production improvements. The higher cost of capital in the United States than in Japan places high technology manufacturers at a comparative disadvantage in new capital investment. Thus, several key internal factors are creating problems for California high technology industries and their ability to produce competitively using new process/manufacturing technologies.

The Case of Semiconductors

The semiconductor industry provides a specific illustration of the importance of these external and internal threats to competitiveness. (Table 7 summarizes key internal and external factors affecting this industry.) Semiconductors are the basic building blocks for advanced technology products. The complex electronic circuitry possible with semiconductors made possible the development of advanced computers, telecommunications equipment, a wide range of consumer electronics products, industrial robots and "smart weapons." Manufacturing and service industries are increasingly electronics-intensive, and semiconductors are the source of a rising share of the value of such products as automobiles and manufacturing equipment.

If California and the United States fall behind Japan in semiconductor technology, surely the technological gap would extend to other fields. In industrial machinery, for example, there is increasing use of microprocessors and other electronic components. Were Japan to dominate technological advances in semiconductors, Japanese robotics firms,

TABLE 7
FORCES AFFECTING SEMICONDUCTORS

External	
Trade	Concerns about barriers to Japanese markets and Japanese "dumping" chips in American markets. (Japanese share of U.S.market increased from 7% in 1980 to 17.4 % in 1984, while U.S. share of Japanese market was constant at 11.9%.)
Business Cycle	Slowdown in world demand began in third quarter of 1984, creating a downturn in the industry.
Federal Policies	Extension of R&D tax credit important for technological innovation. Concerns about tax reform proposal concerning depreciation and tax treatment of international operations.
Changing Markets	New uses for semiconductors critical for future growth especially in automated manufacturing and communications.
Internal	
Technology	Process technology improvement is critical for rapid changes in product cycle and value-added production.
Human Resources	Shortages of engineers and key technical personnel. Quality improvements linked to human capital investment.
Financial Capital	Cost of capital much higher than in Japan. Debt to equity ratio much higher in Japan.
Management	Innovative management of technology is key; so is effective human resources management.

industrial machinery producers, and automakers would be the first to benefit from innovations in design and application.

Overall, the trends do not look favorable. Despite the impressive performance of the U.S. semiconductor industry in the 1960s and 1970s, U.S. producers of semiconductors have been outperformed by the Japanese. Japanese exports of total semiconductors surpassed U.S. exports to Japan in 1977. Integrated circuit imports from Japan surpassed exports to Japan in 1978. U.S. imports of metal oxide semiconductor (MOS) integrated circuits from Japan surpassed U.S. exports in 1979. Japanese semiconductor makers increased their share of the U.S. market from 7% in 1980 to 17.4% in 1984, while the U.S. share of the Japanese market stagnated at 11.9%.

It is also expected that Japanese demand for semiconductors will continue to grow more rapidly than American demand over the rest of this decade. By the early 1990s, Japan could be the largest semiconductor market in the world. In 1979, Japan's market for semiconductors was only about a third of the size of the U.S. market.

This year, many chipmakers in the Silicon Valley continue to suffer from extremely stiff international competition. The semiconductor industry is faced with a continuing erosion of its competitive position. Many companies are closing production facilities in California or are shifting production offshore while other firms are building new, highly automated facilities within California. The most successful California semiconductor firms are those that have been able to remain in the forefront of advanced chip technology. The product life cycle in this industry averages 3-5 years.

Major semiconductor firms, faced with a rapid decline in the price paid for commmodity random access memory (RAM) chips, have been attempting to meet the challenge of competition by shifting the production of much more complex customized chips. One major California manufacturer, Intel, recently announced it was withdrawing altogther from the production of commodity RAM chips and concentrating on high value added chips (e.g., logic chips and erasable-programmable read-only memory, or EPROM, chips).

The Japanese have been more competitive in manufacturing chips than California firms in part because they enjoy a lower cost of capital in Japan. This means that Japanese firms have been able to make investments in R&D and in new capacity at much higher levels than California firms and thus can overcome the rapid obsolescence of semiconductor products and production technologies. The major difference is that Japanese companies raise their money from banks while U.S. firms raise money on the stock market which emphasizes short-term profitability. Consequently, Japanese capital investment has averaged 27.6% of sales since 1980, against U.S. investment at only 17.4%.

The U.S. semiconductor industry must find a way to keep profits high in order to raise money. Many industry leaders maintain that the only way they will be able to successfully compete in the future is to penetrate the Japanese market. And to do so, they need U.S. government pressure on trading relationships with Japan. At the same time, semiconductor firms must continue to concentrate on improvements in both product technology and process manufacturing to capture increasing shares of the higher value, customized part of markets. This emphasis on both trade and higher-value-added production is remarkably similar to the key ingredients for agricultural competitiveness.

Competitive Assessment

How competitive California's high technology manufacturing has been is based on how well manufacturers have performed in the domestic and international markets. The competitiveness of California's high tech industry relative to that of other states can be measured using three methods. First, simple measures of California's share of U.S. employment and value added in high tech manufacturing and the relative California U.S. growth rates in value added by high tech manufacturing reflect the comparative advantages of plant location in California. Second, productivity in California's high tech manufacturing industries can be compared with that for the nation as a whole. Obviously, California's

productivity advantages in high tech manufacturing help to explain the overall growth of the industry in California. Third, the export performance of high tech industry in California can be compared with that of the nation.

In the international economy, California's high tech competitiveness can be inferred by examining the relative share of U.S. high tech manufacturing exports.

California's High-Tech Competitiveness in U.S. Markets

The competitiveness of California's high tech manufacturing within the domestic economy becomes evident by examining California's increasing share of national employment and output in these industries. Since World War II, California's share of both national employment and value added has increased dramatically. In 1947, California's share of national high tech manufacturing employment was a mere 2.5%. By 1972, California's share was 14.5%; and in 1982 it had increased to 21.3%. California was the vortex of the electronics and computer revolution.

In individual high tech industries, California's dominance in high tech manufacturing is most pronounced in computers and office equipment, electronics, and communications equipment. The state's share of U.S. employment in computers rose from 3.9% in 1947 to nearly 28% in 1982. In communications equipment, California's share climbed to 22.9% in 1982. In electronic components and parts, California's share of national employment in the industry rose from 10.1% in 1963 to 26.2% in 1982. California's shares of national employment in instruments and drugs have increased at a much slower pace than the shares in computers, electronics, and communications. In instruments and drugs, California's shares of national employment in 1982 were 14.7% and 9.0% respectively.

The competitiveness of California's high tech manufacturers is also reflected in a comparison of the growth rate of output of high technology manufacturing in California against the output for the nation. The growth

rate of real value added in California high tech industries clearly exceeds that of high tech producers for the nation as a whole. Between 1977 and 1982, the average annual real growth rate in value added in California high tech industry (10.1%) nearly doubled the U.S. growth rate in these industries (5.1%).

Another way to gauge the competitiveness of California's high tech manufacturing, however, is to compare the productivity of high tech industries in the United States overall with those in California. Productivity is measured in terms of dollars of manufacturing value added per paid hour of production work.

California's electronics and communications equipment industries have maintained a strong productivity edge over producers elsewhere in the United States since 1963, remaining on average 15% to 20% more productive.

On the other hand, California's productivity advantage in computers and office machines has eroded from an 11.6% advantage in 1972 to a 7.2% disadvantage in 1982. The shifts in production facilities out of California reflect this erosion in California's productivity advantage in computers.

California has never had a productivity advantage in drug or instrument manufacture. California's instrument producers are coming close to matching the productivity of instrument makers nationwide. In 1982, California's productivity gap in instruments dropped to 6.9%. In drugs, however, although California's productivity disadvantage is declining, it remains substantial. California drug manufacturers were only two-thirds as productive as their national counterparts in 1982.

Overall, as shown in Table 8, California has a productivity disadvantage in computers, instruments, and drugs and has not gained significant advantage in communications and electronics.

California's Competitiveness in International Exports

Manufactured exports in California have grown rapidly in recent years. In 1981 California was the largest producer of manufactured exports among the 50 states, with export shipments totaling an estimated $18.8 billion, representing 11.4% of total U.S. exports of manufactures.

California also led the nation in high technology exports in 1981. The state ranked first nationally as an exporter of electric equipment, most notably in electronic components and communications equipment; second in nonelectrical machinery and instruments; and third in transportation equipment.

California high tech industry has increasingly focused its marketing efforts on international markets, particularly the expanding Pacific Rim. As output in electronics, computers, instruments have grown, so have international exports. Table 9 shows the increasing importance of exports in high technology sectors (data available only at the 2-digit SIC level).

Since 1970, transportation equipment, nonelectrical machinery, and electric equipment have been the most important California exports. From these three industries alone, sales to foreign countries were valued in 1981 at nearly $12 billion or more than three-fifths of the state total.

In transportation equipment, California exports constituted 14.5% of all U.S. exports; transportation exports were heavily concentrated in aircraft. Nonelectrical machinery showed the most rapid growth among California's top three exports, rising 64% in real terms from 1977 to 1982. Computers and office machines were the most significant export in this industry. Electric machinery exports--mostly electronic components and communications equipment--increased by 50% in real terms from 1977 to 1982.

The international competitiveness of California's high tech manufactures can be inferred by looking at the U.S. share of world exports. Overall, the U.S. trade balance in high technology manufactures has remained

Table 8

CALIFORNIA'S PRODUCTIVITY ADVANTAGE IN HIGH TECH MANUFACTURING, 1963-1982
(Percentage above or below U.S. average)

Sector	1963	1967	1972	1977	1982
Drugs	-15.1%	n.a.	-43.5%	-37.6%	-33.8%
Computers	n.a.	n.a.	11.6	0.5	-7.2
Communications	19.9	30.9%	21.9	19.0	23.8
Electronics	23.5	44.5	12.5	17.0	15.7
Instruments	-14.3	-10.7	-14.7	-11.9	-6.9

Source: U.S. Census of Manufactures, 1963-1982.

Table 9

CALIFORNIA EXPORTS AS PERCENT OF TOTAL PRODUCTION IN SELECTED SECTORS, 1972-1982

	1972	1977	1982
Transportation	6.3%	13.7%	18.1%
Nonelectrical Mach.	10.8	19.1	23.1
Electric equipment	7.3	14.0	15.2
Instruments	6.3	20.0	20.5
Total Manufacturing	4.5	7.5	9.8

Source: U.S. Department of Commerce, International Trade Administration, State Export Series, 1984.

positive but it is shrinking rapidly. It peaked in 1981 at $23.6 billion and declined in 1982 and 1983. Partial year data indicate that the U.S. high technology trade surplus for all of 1984 may fall to less than $5 billion.

Although the United States remains by far the leading exporter of high technology manufactures, the decline in U.S. market share shows that other nations, particularly Japan, are increasingly competitive with the United States. Japan's share of the industrial countries' exports of high technology products more than doubled between 1965 and 1982 to reach 17.3%. Japan dominates the export market for communications equipment and electronic components.

Computers--In office, computing, and accounting machines, U.S. exports grew at an average annual compound rate of 19.2% between 1965-1982. The U.S. share of total exports, grew slightly from 32% to 36.6% during this period. Japan recorded the fastest rate of growth among the major U.S. competitors, averaging a 31% annual rate of increase between 1965 and 1982. Japan's share of total exports rose from 3% in 1965 to 17.% in 1982. The emphasis placed on the computer industry by the Japanese government will make it increasingly difficult for the United States to maintain or improve its dominant positon in this market. The United States kept its lead in this high technology group largely because of its strong position in computers and related equipment. The U.S. market share in the other office equipment included in the overall grouping was generally much lower than in computers.

Communications Equipment and Electronic Components--Japan is the world's leading supplier in communications equipment and electronic components. Japan's exports in this group grew at an annual average rate of 22.4% between 1965 and 1982. During this period, Japan's share of total exports rose from 16.4% to 36.6%. Shipments by the United States grew much more slowly, averaging a 17.0% per year increase. The U.S. share of total exports grew slightly from 20.3% to 21% between 1965-1982. The deteriorating U.S. share in this product group can be traced to weak

performance in the two largest sectors: telecommunications equipment and electron tubes, transistors, and semiconductors.

Instruments--Japan has overtaken the United States as the world's leading exporter of professional and scientific instruments. Japan's exports averaged a 21.8% annual growth rate from 1965 to 1982 with strong performances in photographic and motion picture equipment and supplies and in medical instruments. During this period, Japan's share of total exports rose from 8.6% to 21.9%. U.S. exports of instruments grew at 14.4% per year over the same period. U.S. market share of total exports declined from 24.9% to 21.8% during this period. California's exports of instruments grew at an annual average rate of 24.8% between 1969 and 1981, which was higher than the comparable growth rate of the United States (16.0%) but lower than that of Japan, 25.1%.

Drugs--U.S. exports of drugs grew at an annual average rate of 13.4% from 1965 to 1982. In contrast, those of the other suppliers grew at an annual average rate of 14.9%. Export shares are relatively unchanged over this period. However, in 1981, the United States recaptured its position from Germany as the leading world exporter of drugs.

Summary of Competitiveness Assessment

While California's high technology manufacturing has expanded rapidly in terms of both employment and value added, it is facing increasing competitive threats. California's productivity advantage has eroded in computers and office equipment and has not grown significantly in either communications, electronics, or instruments. Japan is increasingly dominating international markets for communication equipment, electronic components, and instruments and is rapidly gaining market share in computers and office equipment.

To maintain competitiveness in high-technology manufacturing, California must increase its productivity advantage by creating higher-value-added output through improved process technology. It must increase worker productivity and aggressively market its products.

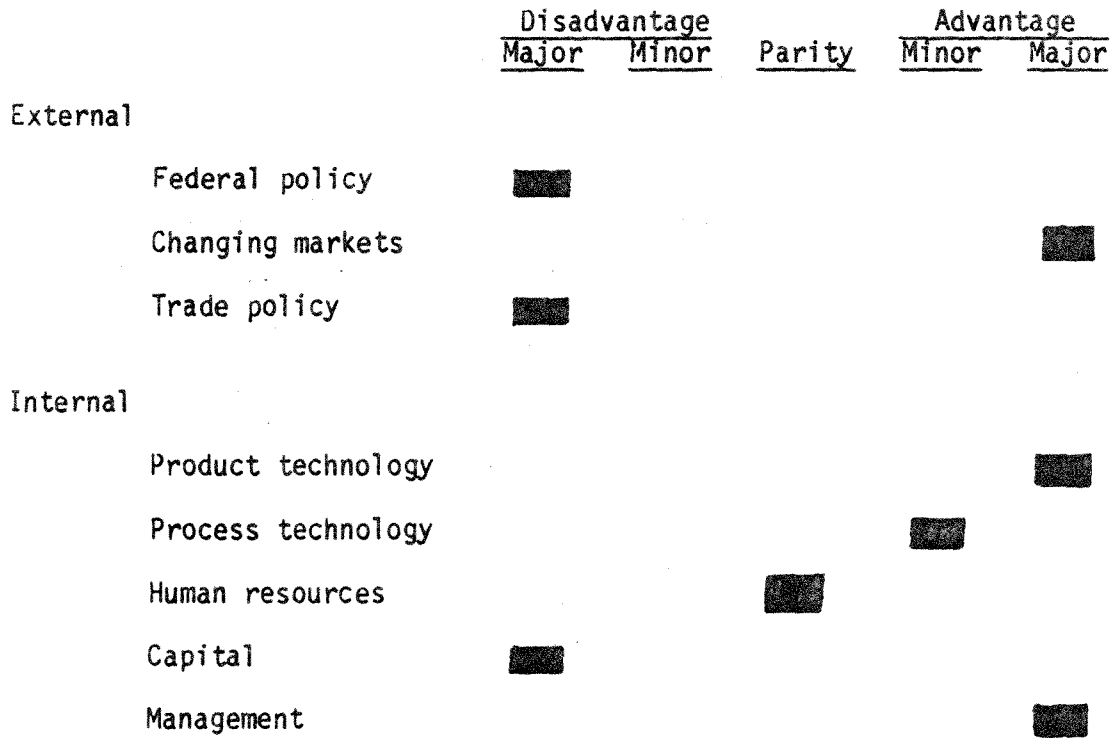
Table 10 summarizes the key competitive advantages and disadvantages in high technology manufacturing. In particular, advantages in technology (especially in process technology) can be improved. Human resource quality can be improved to become a greater advantage. Federal tax and trade policies are a current disadvantage and California should lobby for changes to increase competitive positions for these industries. The cost of capital, especially the high interest rate, another area that requires additional attention primarily at the federal level.

The Case of Biotechnology in California-- An Emerging High Technology Industry

No analysis of high technology in California can be complete without a discussion of biotechnology. While biotechnology is still primarily in the research and development phase and thus cannot be analyzed as a high technology manufacturing industry in California, it is important to examine its current status and future potential for the state in terms of competitiveness. On the one hand, California's current disadvantage in drug manufacturing may suggest the state is not well positioned to be a major manufacturer of pharamaceutical products created through biotechnology. While California may be a center of R&D, production may occur elsewhere. On the other hand, California has advantages as center for the application of biotechnology in agriculture and, because of its positive climate for entrepreneurship, has become a center for stimulating new applications of biotechnology. Again, however, the question becomes California'a capacity to capture the benefits of its own research.

Table 10

COMPETITIVENESS PROFILE OF HIGH TECHNOLOGY MANUFACTURING



Biotechnology is defined as the use of genetically modified living cells, or the enzymatic machinery derived from such cells, to produce commercial products. While the initial incentive to develop biotechnology came from medical research (and specifically from research on genes associated with cancers in some animals), biotechnology products include far more than pharmaceuticals--special seeds that produce high-protein corn or plants that can fertilize themselves by fixing nitrogen already available in the soil or air, products that can be used to clean up hazardous or toxic wastes (including a bacterium that breaks down spilled oil), and products that may cut the cost of producing paper and improve the yield by converting the lignin that binds the fibers into a less binding substance. However, it is still the pharmaceutical aspect of the biotechnology business that offers the greatest glamor in the near term, even though the attraction is not nearly as strong as it was in the late 1970s and the first two years of the 1980s.

Everyone (investors, academics, governments) agrees that the biotechnology industries now emerging will eventually prove economically rewarding. However, there are two questions that particularly affect biotechnology in California: will the state be the beneficiary of significant new employment in biotechnology or will companies (or their technology) go elsewhere to establish commercial production, and are there steps California can take that will encourage high-value-added production to take place within the state rather than elsewhere?

Industry Structure and Economics

Table 11 lists the biotechnology companies in California that already have revenues from the sale of biotechnology products. Table 12 lists the California biotechnology companies that are still developing products and that might be expected to expand into commercial production at some point. In addition, California has 53 other biotechnology companies that have neither sales nor employees and are likely to consist primarily of a single academic researcher.

Table 11

CALIFORNIA BIOTECHNOLOGY COMPANIES WITH PRODUCT SALES

Name	City	Ownership
Amgen	Thousand Oaks	Publicly owned
Applied Biosystems, Inc.	Foster City	Publicly owned
Bio-Rad Laboratories	Richmond	Publicly owned
Breit Laboratories, Inc.	West Sacramento	Publicly owned
Cetus Corporation	Emeryville	Publicly owned
Cooper Laboratories	Palo Alto	Publicly owned
DDI Pharmaceuticals, Inc.	Mountain View	Publicly owned
Diagnostic Products Corporation	Los Angeles	Publicly owned
Hybritech, Inc.	San Diego	Publicly owned
Intelligenetics	Palo Alto	Subsidiary
Molecular Biosystems, Inc.	San Diego	Publicly owned
Monoclonal Antibodies	Mountain View	Publicly owned
NMS Pharmaceuticals, Inc.	Newport Beach	Publicly owned
Synbiotics Corporation	San Marcos	Publicly owned
Syncor International Corporation	Sylmar	Publicly owned
Tago, Inc.	Burlingame	Publicly owned
Techniclone International, Ltd.	Santa Ana	Publicly owned
Urlta Systems, Inc.	Irvine	Publicly owned
Viratek, Inc.	Covina	Subsidiary
Zymed Laboratories	South San Francisco	Privately owned
Chevron*	San Francisco	Publicly owned
Crown Zellerbach*	San Francisco	Publicly owned
Syntex Corporation*	Palo Alto	Publicly owned

*Divisions of these companies are engaged in biotechnology.

Table 12

CALIFORNIA BIOTECHNOLOGY COMPANIES WITH EMPLOYEES BUT WITHOUT SALES

Company	City	Ownership
Advanced Genetic Sciences, Inc.	Oakland	Publicly owned
Alpha Therapeutic Corporation	Los Angeles	Subsidiary
Antibodies, Inc.	Davis	Privately owned
Arco Plant Cell Research Institute	Dublin	Subsidiary
Bio-Response, Inc.	Hayward	Publicly owned
Calgene, Inc.	Davis	Privately owned
California Biotechnology, Inc.	Mountain View	Publicly owned
Chiron Corporation	Emeryville	Publicly owned
Collagen Corporation	Palo Alto	Publicly owned
Creative Biomolecules, Inc.	South San Francisco	Privately owned
Engenics, Inc.	Menlo Park	Privately owned
Genentech, Inc.	South San Francisco	Publicly owned
INGENE (International Genetic Engineering, Inc.)	Santa Monica	Privately owned
International Plant Research Institute, Inc.	San Carlos	Subsidiary
Liposome Technology Inc.	Menlo Park	Privately owned
Microgenics Corporation	Concord	Privately owned
Mycogen, Inc.	San Diego	Privately owned
Phytogen, Inc.	Pasadenia	Privately owned
Plant Genetics	Davis	Privately owned
Sungene Technologies Corporation	Palo Alto	Privately owned
US Agri Research	Newport Beach	Privately owned
Xoma Corporation	San Francisco	Privately owned

The biotechnology-based pharmaceutical industry has the highest costs of all biotechnology-based enterprise. The cost for the early development of a potential product by university-based research has been about 3% of the total technical operations cost. However, the actual costs for the pharmaceutical products are very high because of the long time frame and the labor required for development.

Scale-up for quantity production, purification to ensure homogeneity of the product, stabilization of the process, and product trials usually cost from $5 million to $10 million per product. Subsequent clinical trials for pharmaceuticals can range from $20 million to as high as $50 million for each new product. It is estimated that at least 75% of those developing biotechnology pharmaceuticals will not bring the product to market. Requirements for testing of products for animal use are somewhat less exacting, although it is necessary to show that any residues that remain will not be toxic to consumers of meat products. At present, tests for crop biotechnology products (e.g., a bacterium to keep potatoes from freezing) are held up in some cases by environmental issues (the need for an environmental impact statement, for example for biotech products that fall under the purview of EPA) and by regulatory issues (which group or agency governs use and testing).

Industry Finance

The oldest biotechnology-based pharmaceutical firm is less than 15 years old. New firms are still being started while only the oldest firms are now beginning to bring products to market. Until about 1982, new biotechnology firms tended to be judged by investors on the basis of their scientific promise, not their commercial products. Since the late 1970s, well over $1 billion has been invested in biotechnology companies, at least 75% in new firms promising products relating to human or animal medicine. However, since 1983, biotechnology stocks have fallen 42% and companies that went public and have since been living on the investment are finding that

interest is declining and that some other way of financing is needed if the company is to survive long enough to bring its products to market.

Genentech is an example of a company that has found a way to survive. Genentech was started in 1976 by a venture capitalist and a Stanford professor and when it went public in 1980, the stock offering raised $203 million. However, the company moved quickly to license its early products to big companies that already had marketing and production capabilities, such as drug firm Eli Lilly & Co. Since then, Genentech has begun to build its own capacity and marketing organization. Other corporations have sought out corporate investors as the venture capital market has lost enthusiasm for biotechnology. Firms using R&D limited partnerships, in which the investment is primarily made by those looking for tax shelters rather than immediate returns, have increased.

Investor sophistication has increased significantly since the early 1980s; potential investors now demand not just a wonderful product but a large potential market and sound business acumen. Areas such as plant genetics and animal medicine are attracting more capital than human medicine.

The Competitive Environment

Because this is an emerging set of industries, and because production for sale is still in its infancy, it makes little sense to discuss the competitive environment in the usual way. It makes more sense to discuss where California's competition lies for biotechnology. California now has slightly over a third of all of the biotechnology industry in the country. Past investments in California university system are substantially responsible for these accomplishments. However, within the United States, New York, New Jersey and North Carolina are investing in measures aimed at increasing the level of biotechnology industry in their states. Massachusetts, which initially had some biotechnology activity, has developed highly vocal opposition to research and production based on recombinant DNA and may not be a serious competitor for industry expansion

in the future, although it will be a center of research. Michigan, Illinois, Ohio, Tennessee have established biotechnology research centers although not on a large enough scale to make them significant competitors in the near term.

Midwestern states, and the eastern seaboard (notably New Jersey), however, have competitive advantages which may in the future cause the production side of biotechnology to become a growth industry. In the Midwest, the high concentration of chemicals industry (over 40% of the nation's total) and agriculture suggest that potential biotechnology applications for industry (specialty chemicals) and farming (genetically manipulated plants, fertilizers, pesticides, improved animal medicine and livestock improvement) will lead to rapid development of commodity and smaller scale biotechnology production.

In the east, the high concentration of pharmaceutical industries and their distribution capabilities may lead to rapid benefits from licensing of new technologies, possibly developed in California, among other technology sources. As noted earlier, California is at a substantial disadvantage in drug manufacturing relative to other states such as New Jersey.

While California could benefit most from developing the applications of biotechnology to agriculture and natural resources (forestry and hazardous waste disposal, for example), this is less likely than in the Midwest and the East, for the time being. The reason for this is California's biotechnology industry emphasis on the more exotic technologies in medical diagnostics and treatment. These take longer to develop and gain approval for, and require smaller production facilities to manufacture (since many are based on production methods that require little more than a slightly scaled up laboratory to produce sufficient supply for the market).

The evidence to date is that most biotechnology firms are emphasizing these more advanced developments, and are licensing technologies to larger non-California pharmaceutical producers. This is characteristic of most biotechnology firms, not only because of the need for a large scale production capacity, but also because few biotechnology firms have the capacity to market and sell their products. As a result, alliances with large producers provide both production and distribution capacity that builds on the pharmaceutical firm's capabilities. While a few California based firms are attempting to develop their own production and distribution system, this is likely to be the case in very few future firms. The exception to this rule would be firms whose products require neither large scale production nor traditional distribution systems. Specialized products that fit this description might emerge in fields, such as instrumentation and industrial processing. Yet, even here, the scale of production will not be so large as to employ significant numbers of personnel, with the exception of sales representatives.

California lacks two significant ingredients for a large-scale integrated biotechnology industry. First, it lacks the necessary expertise in processing technology. For example, California accounts for 22% of the PhDs in biology, but less than 10% of the PhDs in chemical engineering. The University of California, Irvine is planning to set up a program in biotechnology engineering because it sees a significant need in that field. Once the initial research step has been passed, California has less of the knowledge resources essential to commercialization than eastern and midwestern states that have existing chemical plants.

Second, California lacks a significant pharmaceuticals or chemicals industry. While there are a few chemical plants in the state, the parent firms generally do not appear to have been among those national companies investing heavily in the application of biotechnology to industrial, agricultural, and human needs. By contrast, other regions have not only the headquarters and plant capacity, but also an extensive prior history of investment in biotechnology--both within the firm (i.e., UpJohn and Dow, for example), and as investors in "technology windows" provided by new

biotechnology firms in California (Monsanto, Lubrizol). This is not to say that large firms in California are ignoring this field. Both Arco and Chevron--large petrochemcial firms--have invested in California biotechnology companies. However, the comparative scale of investments and strategies for incorporating findings into existing operations appear less extensive.

The lack of the basic industry, perhaps, inhibits the development of professional development in the industrial field. As a result, the environment for moving from a high-tech, product-development industry to a more employment-intensive production industry does not appear very good. While California biotechnology firms will be at the forefront of innovation as well as product development, even those firms that produce here will be relatively small. The state will most likely benefit from tax revenues from product sales and royalties to California firms in the future.

Globally, Japan and Germany are the two biggest competitors for commercial biotechnology production. Japan has targeted the pharmaceutical industry and has made long-term investments in food processing (fermentation) technology. Germany also has more experience (and more university resources) invested in relevant process technologies than do the other European countries. Thus, California faces significant competition from both domestic and international markets.

Future Prospects for Biotechnology in California

California does have options to increase the economic benefits that could be derived from biotechnology. These could include increasing the industrial and commercial applications of emerging biotechnologies to the state's agricultural and natural resources industries. California's already large (though troubled) agricultural markets could be the ideal candidate for the use of biotechnology for what are called "technology capture" strategies. These strategies involve using technical innovations to generate new, high value-added products from natural assets that might not be available elsewhere. This might mean using new biotechnology approaches to create

chemical feed stocks from agricultural and forestry wastes, generating high value minerals and chemicals from mining tailings, and using biotechnology to address hazardous waste (which lower industry costs and undesirable consequences of production).

California's universities are working on such applications (U.C. Davis, for example), but are still far from direct commercial application. In fact, an underlying problem in mobilizing the potential of biotechnology in California is the reluctance of the University system to more aggressively pursue technology commercialization within the system, and in conjunction with industry.

In addition, while California's current industries may not be investing in the large-scale application of biotechnology, there are opportunities for joint-ventures with overseas firms. The joint venture between Amgen of Thousand Oaks, California, and Kirin Breweries of Japan is one current example of this strategy. In the long run, biotechnologies can be expected to play a role in virtually every large scale chemical production process--and a good many nonindustrial applications, such as drain cleaners--in addition to the more visible medical and agricultural applications.

Other aspects in which California may find itself at a competitive disadvantage include housing costs (biotechnology production workers are expected to be paid on a level similar to that of biology lab technicians rather than a level similar to that of computer designers or chip process engineers), the time it takes to get permits, and perhaps environmental politics.

Although environmental and health regulation have been raised as issues that might impede the development of the biotechnology industry--and they certainly do at the federal level--the impact of state laws, present and future is not yet clear. At the present time, the state regulatory climate appears cautious but supportive. Industry fears that regulations may impede commercialization have not yet been realized, and the California state government appears, at a minimum, inclined to help make any regulatory

procedures work as effectively as possible. Every industry and government leader in California recalls the administrative horrors of the Dow Chemical plant permit application process of the late 1970s. Today, both the public and private sector seem oriented towards a more rational regulatory system. Nevertheless, there need only be one incident of note to precipitate a more stringent state role in overseeing this emerging industry.

In the final analysis, the prospects for biotechnology to become a major economic asset for California will stem more from the ability of this highly science-based industry to identify and realize commercial applications than from any incentives that the state could provide.

The state will need to continue to invest in creating and maintaining production of skilled professionals in biotechnology. It will need to improve university capacity to explore the commercial applications of science--particularly focusing on "technology capture" strategies that will pay off in California. And it will need to help to keep business costs for this industry within reason, relative to competing states (i.e., housing, taxes, and environmental regulation).

For the most part, the biotechnology industry's success in California will depend on the gradual maturation of the industry itself. At present time, the high concentration of firms in California looks good, but the industry is struggling with difficulties in identifying and producing commercializable products. It is also wrestling with management that has a science bias and lacks business direction, has not faced production scale-up technology problems (in many instances), and has lost its favored child status with the venture capital industry.

Today biotechnology firms are rapidly being acquired by out of state owners, whose corporate cultures sometimes clash, and technology is being directed to out-of-state labs and plants. They are licensing the production and distribution to out-of-state companies, which diminishes return to the local firm. Firms struggling to remain free of larger buyers are merging to combine research and development strengths with production scale-up

capabilities. Finally, some of the surviving firms are discovering, much to their disappointment, that "magic bullets" of biotechnology have indeterminate markets that may take many years to cultivate.

This industry is not analogous to the now more mature computer and semiconductor industries. Biotechnology straddles both old and new markets, with the potential for dramatic transformation of each. The promises of this technology will eventually be realized, but with economic benefits being distributed far more broadly than in the case of the Silicon Valley.

V BASIC MANUFACTURING IN CALIFORNIA

Introduction

Basic manufacturing--consisting of all manufacturing outside of aerospace and high technology manufacturing--may be considered a "hidden sector" in the California economy. Most analyses and forecasts of the state's economy tend to focus on more glamorous industries such as aerospace, high tech, and financial services or on such obvious California strengths as agriculture. The analysis and projections of the Center for Continuing Study of the California Economy are the only major, continuing analyses and projections that break out the basic manufacturing sector. It is often assumed that, because of the highly visible declines in such basic manufacturing sectors as autos and steel, basic manufacturing as a whole is in severe decline and of little importance to the state. This is hardly the case.

After government, the leading producer of jobs in the state is not agriculture, not high tech, not aerospace, not finance. It is basic manufacturing. There are two important introductory points to make concerning this sector. First, as Table 13 illustrates, it is still a very large sector of the economy and likely to remain so in the foreseeable future, although it will become steadily less important over time. In 1981, for example, 66.5% of all manufacturing jobs in the state were in the basic manufacturing sector, while aerospace and high tech accounted for 10.3% and 23.2% of manufacturing jobs, respectively.

Table 13

ANALYSIS OF BASIC MANUFACTURING EMPLOYMENT IN CALIFORNIA

(Thousands)

	Jobs		Basic as a Percent of all		Basic Manufacturing Jobs as a Percent of all Jobs
	Basic Manufacturing	All Manufacturing	Manufacturing	Total Jobs	
1972	1,104.8	1,536.0	72.0%	8,208.5	13.5%
1981	1,342.8	2,018.8	66.5%	11,298.0	11.9%
1991	1,558.8	2,532.8	63.0%	13,900.0	11.4%

Source: California Growth in the 1980s: Update 1983, Center for Continuing Study of the California Economy, 1983.

* * * * *

Second, as Table 14 illustrates, it is an extremely diverse sector. Unlike a state like Michigan where autos dominate or Pennsylvania where steel is so strong, California's manufacturing sector does not contain any single industry that is an overall national leader. Thus, while autos and steel are in decline, other key industries such as printing and publishing and apparel are growing. But, perhaps because in no one of these industries is California visible as a national leader (as it is in aerospace and high tech), the sector as a whole does not get as much attention and is not as well understood as other sectors.

Given its continued importance to the overall state economy, however, and particularly in light of the strengths of certain basic manufacturing industries, it is important for the state to develop a better understanding of this part of its economy. Because of the diverse nature and relative lack

Table 14

TYPES OF BASIC MANUFACTURING IN CALIFORNIA

	Employees (Number)		Value Added ($000,000)	
	1977	1982	1977	1982
Food	163.4	173.5	6,578	10,936
Apparel	101.1	106.3	1,770	2,505
Lumber	67.1	48.4	1,840	1,445
Furniture	51.9	52.6	1,065	1,710
Paper	35.9	35.5	1,310	1,978
Printing and publishing	97.1	131.1	2,877	5,473
Chemicals	52.7	52.6	2,803	4,058
Petroleum	18.5	18.8	2,540	4,155
Rubber	63.6	66.1	1,618	2,398
Stone and glass	53.0	49.0	1,828	2,283
Metals	49.0	42.4	1,349	1,718
Fabricated metals	136.2	139.9	4,012	5,786
Machinery[a]	110.9	135.2	3,327	6,195
Transportation equipment[b]	92.9	60.9	2,806	2,944
Miscellaneous	40.0	38.3	1,070	1,667

a Excluding office and computing machines (high tech)
b Excluding aircraft and missiles (aerospace)

of information on this sector, three key industries--autos, steel, and apparel (and to a lesser degree, printing)--which have received some degree of study in the state will be examined in this section.

The key points to be made in this section are:

- California's large and diverse basic manufacturing sector is strongest in those industries that have been creative, exploited advanced technologies, developed special market niches (either for export or for import substitution), and grouped themselves in economic clusters.
- California's manufacturing industries are affected by the same internal and external forces (e.g., foreign trade, adoption of new technologies) that affect other U.S. manufacturers. These forces present California industries with both threats and opportunities in the future.
- Dealing with the threats and taking advantage of the opportunities will require continued efforts to promote technological advancement, creativity and innovation, market development, and local economic agglomerations.

Background and History

It is useful to think about basic manufacturing in two broad categories:

- The traditional "smokestack" industries, such as autos, steel, and rubber.
- Diversified manufacturing, including apparel, printing, appliances, metal products, and other industries.

Most of the smokestack industries were established in California during and immediately after World War II. The steel industry, for example, built the fully integrated Fontana steel mill to meet wartime needs. General Motors and Ford built major assembly plants (GM in Fremont, South Gate, and Van Nuys, and Ford in Pico Rivera and Milpitas) in the state during the 1950s and 1960s. The tire industry developed around the same time (Firestone in South Gate and Salinas and Goodyear in Los Angeles). Historically, California has also had strong lumber and food processing industries.

In general, these capital-intensive smokestack industries have declined severely in California in recent years. This is where most of the plant closings and job losses have occurred. Those firms that survive have generally adopted some kind of niche strategy (e.g., using new technologies such as minimills to serve local steel markets and using new production processes in the NUMMI plant in Fremont to produce small cars).

The diversified manufacturing industries have grown in the state primarily as a result of a process of "import substitution," whereby a wide variety of industries shift some production facilities to California as older facilities become unproductive and new location decisions are made. Import substitution occurs when goods produced within the state replace goods brought in from other states or other countries. It is understandable given the magnitude of the California market that this would happen.

With some exceptions, most of the diversified manufacturing is for the California market rather than for export. And, except for a few special cases such as motion pictures, no industry in the diversified manufacturing sector can be considered a national leader. Most of the basic manufacturing in the state (about two-thirds) takes place in or near the Los Angeles Basin.

The diversified manufacturing sectors in the state, unlike the smokestack industries, are generally healthy and may expect moderate growth in the future. Such growth is predicated on the fact that California is one of the nation's fastest growing markets for all kinds of manufactured goods and yet it still has a substantially below-average share of jobs in most industries in the basic manufacturing sector.

Current Status

The diverse nature of the basic manufacturing sector makes it difficult to generalize about the sector as a whole. Therefore, three different industries within the sector will be examined (autos, steel, and apparel) and printing will be examined to a lesser degree. These industries are profiled in Table 15.

Table 15

PROFILES OF BASIC MANUFACTURING INDUSTRIES IN CALIFORNIA

Autos	1963	1967	1972	1977	1982
Number of Establishments	418	397	527	718	624
Employment (000s)	27.0	33.2	39.4	48.6	28.8
Employ. Share	3.9%	4.5%	4.9%	5.5%	4.7%
Value Added ($1,000)	583,424	639,100	1,121,100	1,977,600	1,500,800
Constant 1972 Dollars	814,042	808,373	1,121,100	1,412,067	723,696
Prod. hrs. (000s)	48,403	52,400	64,500	80,000	42,600
V.A./Prod. hr.	12.4	12.2	17.4	24.7	35.2
Constant 1972 Dollar	16.8	15.4	17.4	17.7	17.0
Cal. Prod. Advantage over U.S. (1972 $)	19%	9%	9%	2%	-9%
V of Shpmts. ($1,000)	na	2,344,600	3,991,800	7,352,200	4,691,600
Constant 1972 Dollars	na	2,965,596	3,991,800	5,249,697	2,262,320
% of U.S. Shpmts.	na	5.8%	6.2%	6.2%	4.2%
Steel					
Number of Establishments	69	84	80	115	93
Employment (000s)	19.5	22.4	19.6	17.8	11.8
Employ. Share	3.4%	3.6%	3.5%	3.4%	3.2%
Value Added ($1,000)	267,447	378,800	342,000	512,600	641,000
Constant 1972 Dollars	373,165	479,130	342,000	366,012	309,094
Prod. hrs. (000s)	30,104	35,000	27,800	26,200	16,500
V.A./Prod. hr.	8.9	10.8	12.3	19.6	38.8
Constant 1972 Dollar	12.4	13.7	12.3	14.0	18.7

Steel	1963	1967	1972	1977	1982
Cal. Prod. Advantage over U.S. (1972 $)	-7%	4%	-11%	-14%	24%
V of Shpmts. ($1,000)	na	907,600	964,500	1,741,300	1,833,200
Constant 1972 Dollars	na	1,147,989	991,500	1,243,342	883,981
% of U.S. Shpmts.	na	3.9%	3.4%	3.4%	3.9%

Table 15 (Concluded)

Apparel					
Number of Establishments	1108	1139	1441	2656	2746
Employment (000s)	31.6	33.1	40.9	58.6	63.0
Employ. Share	7.8%	8.1%	9.5%	13.1%	15.0%
Value Added ($1,000)	214,229	290,200	462,700	1,022,700	1,573,200
Constant 1972 Dollars	298,910	367,063	462,700	730,239	758,607
Prod. hrs. (000s)	48,436	50,200	62,000	86,600	92,000
V.A./Prod. hr.	4.4	5.8	7.5	11.8	17.1
Constant 1972 Dollar	6.2	7.3	7.5	8.4	8.2
Cal. Prod. Advantage over U.S. (1972 $)	13%	15%	20%	21%	28%
V of Shpmts. ($1,000)	na	635,000	971,000	2,104,600	3,317,600
Constant 1972 Dollars	na	803,187	971,000	1,502,749	1,599,769
% of U.S. Shpmts.	na	9.7%	11.7%	16.5%	18.2%
Printing and Publishing					
Number of Establishments	3671	3660	4535	5905	6556
Employment (000s)	74.4	82.7	88.0	97.1	131.1
Employ. Share	8.1%	8.0%	8.3%	8.9%	10.1%
Value Added ($1,000)	846,820	1,167,200	1,706,900	2,876,700	5,473,200
Constant 1972 Dollars	1,181,554	1,476,347	1,706,900	2,054,052	2,639,213
Prod. hrs. (000s)	85,810	90,500	93,000	100,800	129,200
V.A./Prod. hr.	9.9	12.9	18.4	28.5	42.4
Constant 1972 Dollar	13.8	16.3	18.4	20.4	20.4
Cal. Prod. Advantage over U.S. (1972 $)	2.0%	7.5%	7.3%	2.9%	2.1%
V of Shpmts. ($1,000)	na	1,713,500	2,541,800	4,463,100	8,592,100
Constant 1972 Dollars	na	2,167,341	2,541,800	3,186,790	4,143,167
% of U.S. Shpmts.	na	7.9%	8.4%	9.0%	10.0%

Source: Census of Manufactures

At one point, California was third among the states in automobile output. But automobile production has declined dramatically in the state in the past 5 years. This is a result both of the economic difficulties of U.S. auto firms and the decision by the Big Three to reconcentrate their facilities in the Midwest. Employment in automobile production in California dropped from a high of 55,000 in 1978 to 28,000 in 1982. Shipments dropped from $8.5 billion to $4.7 billion over the same period. Most of the major production plants have closed: Ford closed plants at Pico Rivera (1980,laying off 2,300 workers) and Milpitas (1983, laying off 4,900), GM closed plants in Fremont (1982, laying off 5,860) and South Gate (1982, laying off 4,700), and the Mack Truck plant closed (1981, laying off 1,400). Not surprisingly, the tire industry that supplied the auto industry closed plants about the same time. Firestone closed plants in South Gate (1980, laying off 1,400) and Salinas (1981, laying off 1,700) and Goodyear closed its plant in Los Angeles (1980, laying off 1,600).

Today, tire production has ceased completely and only two auto production plants remain open in California. One is the the GM plant in Van Nuys. The other is the NUMMI plant in Fremont, the new GM/Toyota joint venture to produce small cars in America using advanced technologies and new production processes. At the same time, almost all Japanese firms have established their North American corporate headquarters in the Los Angeles area and some Japanese firms build parts and do some final assembly in California (e.g., Nissan assembles trucks in Long Beach). Finally, it is interesting to note that all the major U.S. auto firms and some Japanese firms have established auto design studios in Southern California. This appears to reflect two factors: proximity to a leading school of auto design in Pomona and a desire to keep in touch with the style trends in what is perceived to be a trend-setting state.

Steel production has also declined severely in California. From 1978 to 1982, employment dropped from 18,000 to 12,000 and shipments dropped from $2.0 billion to $1.8 billion. US Steel, Bethlehem Steel, and Kaiser Steel closed down all the integrated steel plants in California between 1978 and 1983. Foreign steel now dominates the market. What remains are the

minimills, which use new technology and different manpower arrangements to produce specialty products to meet the state's construction and industry needs, and steel processors and service centers that act as middlemen between manufacturers (and foreign suppliers) and steel users in California. The firms that have survived the industry shakeout appear to be doing well. A new firm, California Steel, has purchased the Kaiser plant in Fontana with partners from Japan (who provided the capital) and Brazil (who provide low-cost steel slab).

In contrast to the smokestack industries (autos and steel), the California apparel industry has grown steadily. It is the second largest employer in the manufacturing sector. Between 1963 and 1982, employment doubled from 31,000 to 63,000, and shipments rose from $635 million to $3.3 billion. The industry is concentrated in downtown Los Angeles (and to a lesser extent, in San Francisco) in a fairly concentrated industrial district (analogous to New York's historic 7th Avenue garment district). There is an extensive network of small design firms, job shops, sewing contractors, cutters, most of which are independent. The industry has grown up around a cadre of creative and well known California designers. It makes use of the most advanced technologies in the industry (e.g., automated cutters, software for pattern-making) and employs mostly low-skilled, very low paid production workers, many of whom are recent immigrants.

California's apparel industry has succeeded by focusing on the high-price, high-value-added end of the market--both formal and casual wear, particularly for women and children. This segment of the market is very competitive, constantly changing (four to six seasons per year), consumer-responsive, and organized around small production runs. Thus, unlike market segments such as men's shirts or underwear which are much more stable, less design-conscious, and more suitable to mass production, the segments of concentration for California industry require the creativity of designers and the network of working relationships in the Los Angeles district, as well as proximity to the American consumer, particularly the style-conscious and trend-setting California consumer.

California's printing and publishing industry has also been growing. Employment rose from 97,000 in 1977 to 131,000 in 1982. Like apparel, it has employed new technologies, developed industry agglomerations, and succeeded in selected and highly creative market niches. Most of the major trade publishing houses continue to be based in New York. However, there has been an explosion of small and specialty publishing houses in California. There are now about 500 publishing houses in the state. They are concentrated in communities such as Berkeley (50-plus firms) and Santa Barbara (more than 100 firms). They focus on such specialty topics as bicycling, computers, vegetarian cooking, and solar energy. There are also important academic and textbook publishers such as the University of California Press, Stanford Press, Silver Burdette, and Addison-Wesley. Most make active use of new technologies such as computerization. And, while the sales of the major publishing houses have been stagnant in recent years, the smaller houses have seen steady growth.

Analysis of Internal and External Factors

California's basic manufacturing sector is affected by the same set of external and internal factors that affect other U.S. manufacturers. The external factors include trade, the business cycle, federal policy, and changing consumer tastes. The factors internal to firms include use of technology, human resources, financial capital, and management.

What remains of the auto industry in California is quite different from that in the Midwest in that it is more dependent on imports and relations with foreign producers, and has developed special niches within the industry. Almost half the cars purchased in California today are imports. In light of this fact and given the state's proximity to the Pacific Basin with its Japanese exports, the strength of the imports favors California. Japanese firms have established a variety of facilities here, and with pressure for more foreign production in the United States could expand further. NUMMI, for example, has announced plans to begin producing Toyotas as well as the Novas being produced with GM. The state has become the design center of the auto industry because of its role in setting trends and styles for the country.

Technology is clearly becoming a more critical factor in both the auto product and the production process. GM's purchase of California-based Hughes is intended to help GM bring new technology to the manufacturing process and could result in new technology links for the state to the auto industry. The Japanese involvement in the NUMMI plant may suggest the opportunity for more joint ventures with foreign firms in the state. Issues such as productivity, quality, and labor/management relations are seen as key issues for the industry, and NUMMI is seen as a potential model for new practices in these areas.

Steel is another industry heavily affected by external forces (imports) with foreign firms having developed a strong position in imported steel slab. California minimills use scrap steel and other firms process low-cost imported steel to meet the particular steel needs of California. Since California has no integrated steel mills, it is not as interested as other parts of the United States in imposing strict import quotas on slab steel. The market for steel in the state is radically different from that in the East. Here, the construction industry uses over half of the steel produced in California with cans for the food processing industry being the second largest user. In other parts of the country, the automotive and machinery industries use most of the steel produced. California's announced plans to renovate its highways, bridges, and other infrastructure could mean a boom for the state's steel makers.

The California firms that have best survived the recent shakeout in the steel industry have been those that adopted new work rules and styles of management, and applied more modern technology to both products and production processes. In the revived California steel plant, as in autos, joint foreign investment was particularly important.

The California apparel industry differs from the rest of the U.S. textile industry, which has been in severe decline and is actively seeking additional import restrictions. By focusing on the design-oriented end of the apparel market, California firms have found a niche that seems less vulnerable to competition from abroad.

Within the industry, the firms have attracted top designers and made use of immigrants as low-cost labor. Firms have tended to form agglomerations in the Los Angeles and San Francisco areas; these agglomerations have proven essential to keep up with the fast-moving apparel market California sells to. The firms have also made good use of the latest technologies, such as those being developed by the new industry-sponsored Tailoring and Clothing Technology Corporation.

Similarly, the printing and publishing industry has developed its special market niches, as described above. International competition and federal policy do not appear to be major concerns for this industry. But, again, as with apparel, printing is an industry that has relied on creative people, new production technologies, and agglomerations in both southern and northern California.

Competitive Assessment

In autos, California is at a significant disadvantage in that the major U.S. firms have decided to reconcentrate their plants in the Midwest. Productivity in the state has not improved in recent years and the state's share of U.S. shipments has declined dramatically. There appears to be little possibility that major U.S. producers will move back to the state in the foreseeable future.

On the other hand, there is at least the possibility (given the positive experience to date at NUMMI) that Japanese or other Asian firms may build additional plants in California either by themselves or in joint ventures with U.S. firms. Toyota, for example, has announced plans to build a major U.S. plant, which could be located in the state. However, most industry analysts expect future plants to be located in the center of the country, in lower cost areas such as Arkansas, Tennessee, and Texas. Another area of potential growth centers on the GM purchase of Hughes, which could provide the state's industries with a stronger link into the development of new technology for future cars and future auto manufacturing

processes. This could build on the links that some Silicon Valley firms already have with the industry, although, again, California firms would seem to be at a disadvantage compared to the new high-tech firms emerging in Ann Arbor's "Automation Alley." However, the NUMMI plant could already be providing a successful model of advanced manufacturing. If so, then auto manufacturers might see some benefit in establishing a plant closer to design sources and to those experienced in advanced manufactuing.

The outlook for steel is similar to that for autos in many ways. The industry's productivity rates and share of U.S. shipments have been relatively stable in recent years. There is no hope that large integrated mills will be built again in California or anywhere in the United States because of their extreme cost and competition from foreign producers. High transportation costs from the East mean that California firms have the best opportunity to meet the state's needs for steel. Because of the limited domestic competition on the West Coast, there may be an opportunity for innovative minimills and for steel processors and service centers in California to expand their markets. More joint ventures with foreign firms that produce slab more cheaply than U.S. firms may be in the offing (similar to the Kawasaki/California Steel venture).

Although much of the apparel industry has been subjected to foreign competition in the U.S. the California apparel industry has successfully carved out a niche in the high fashion area and appears to have an edge on both foreign and domestic competitors. While its productivity rates have been fairly stable, its share of U.S. shipments has approximately doubled over the past 15 years, growing from 9.7% to 18.2% of the U.S. market. The industry has been particularly aggressive in adopting new manufacturing technologies. Thus, future prospects for the industry look relatively bright.

Similarly, the printing and publishing industry has carved out its niche in the specialty publishing areas. While its productivity rates also have been stable, its share of U.S. shipments has risen from 9.0% to 10.0% of the U.S. market. Its future also looks bright.

A qualitative assessment of the four industries is shown in Tables 16-19.

Table 16

CALIFORNIA AUTO INDUSTRY VS. MIDWEST

	Disadvantage		Parity	Advantage	
	Major	Minor		Minor	Major
Federal Policy				[redacted]	
Changing Markets				[redacted]	
Trade Policy				[redacted]	
Technology		[redacted]			
Human Resources			[redacted]		
Capital			[redacted]		
Management				[redacted]	

Table 17

CALIFORNIA STEEL INDUSTRY VS. THE EAST

	Disadvantage		Parity	Advantage	
	Major	Minor		Minor	Major
Federal Policy		[redacted]			
Changing Markets			[redacted]		
Trade Policy		[redacted]			
Technology		[redacted]			
Human Resources			[redacted]		
Capital				[redacted]	
Management				[redacted]	

Table 18

CALIFORNIA APPAREL INDUSTRY VS. ASIA

	Disadvantage		Parity	Advantage	
	Major	Minor		Minor	Major
Federal Policy				[redacted]	
Changing Markets					[redacted]
Trade Policy				[redacted]	
Technology				[redacted]	
Human Resources		[redacted]			
Capital		[redacted]			
Management				[redacted]	

Table 19

CALIFORNIA PRINTING INDUSTRY VS. NEW YORK

	Disadvantage		Parity	Advantage	
	Major	Minor		Minor	Major
Federal Policy			[redacted]		
Changing Markets				[redacted]	
Trade Policy			[redacted]		
Technology			[redacted]		
Human Resources			[redacted]		
Capital			[redacted]		
Management			[redacted]		

Future Prospects--Basic Manufacturing

While making projections of any sector in the economy is always risky, projections of the basic manufacturing sector are particularly difficult because of the diverse nature of the sector. However, certain generalizations can be made.

Overall, projections by the Center for the Continuing Study of California suggest that the sector will continue to grow and add a substantial number of jobs in the future, although this growth will be at a slower rate than that of the high tech and aerospace sectors. As Table 113indicates, the sector is expected to grow from 1.34 million to 1.56 million jobs from 1981 to 1991. However, since this growth will be slower than the other manufacturing sectors, basic manufacturing's share of all manufacturing jobs will drop from 66.5% to 63.0% and its share of all jobs in the state will drop from 11.9% to 11.4%. However, it is interesting to note that the Center's projections indicate that the state's share of basic manufactruing jobs in the country will increase from 7.7 to 8.3% during the period of 1981-1991.

Most of the projected growth will be as a result of the process of import substitution, with the state expected to gain an increasing share of national jobs in a wide range of manufacturing industries. This seems likely because the state currently has a below average share of jobs in many basic manufacturing sector industries, in spite of the fact that it is one of the nation's fastest growing market areas for manufactured goods. Thus, whatever growth occurs in these industries nationally, California is likely to capture an ever-increasing share.

There seems to be little reason to believe that the "smokestack" industries such as auto and steel will ever return to their previous levels of activity and employemnt in the state as a result of such factors as international trade and the recentralization of the auto industry in the Midwest.

One would expect that certain manufacturing industries--particularly those such as printing and apparel which have established niches or those which supply and support the growing high tech and aerospace industries such as machinery--would have higher average growth rates than the sector as a whole. While it is impossible to predict, other industries in the sector that play on the state's strengths (e.g., creativity, growing markets) may emerge as particularly strong or whole new industries may emerge such as the manufacture of biotech products.

Implications

The analysis of the four basic manufacturing industries important to California--autos, steel, apparel, and printing--shows certain common success factors standing out. California's basic manufacturing industries are most successful when they:

- Make use of the creative talent in the state.
- Develop special market niches (whether for export or for import substitution).
- Make use of advanced manufacturing technologies.
- Group themselves in economic clusters.

Actions that need to be taken to support the further development of California's basic manufacturing industries should generally encourage the further development of these factors. Such steps could include:

- Investments in human capital, not just to develop technical skills such as business, science, and engineering, but also to develop creativity and innovation through support for programs such as the fine arts.
- Investments in the development and application of new manufacturing process technologies to keep California firms at the cutting edge. An institute for advanced manufacturing in the LA area might be appropriate.

- Promoting the further development and expansion of regional economic clusters by supporting producer-supplier relationships in key industries.

- Development of export markets to facilitate the expansion of firms that originally developed to serve the California market and now are ready for expansion.

- Development of additional markets through import substitution, particularly in those industrial sectors where California's share of jobs is below average.

VI THE AEROSPACE INDUSTRY IN CALIFORNIA

Introduction

California's aerospace industry is another prime example of the role that technology and innovation have played in shaping the state's economic development. Aerospace is one of the state's largest industries. For the past 50 years, the industry has ranked as one of California's largest employers. Furthermore, expertise in the scientific fields related to aerospace helped to spark the growth of the electronics industry in Silicon Valley.

The California aerospace industry--like high technology manufacturing--also illustrates the role that regional agglomerations can play in the growth of an industry. Over the past 50 years, aircraft production has been transformed into the more diversified aerospace industry; however, much of the industry remains concentrated in its original location in Los Angeles, Orange, and San Diego counties. This region had an early comparative advantage in the production and manufacture of aircraft. Some histories attribute the early choices to locate aircraft production there in part to a combination of the factors of climate (little rain) and the region's existing petroleum, automobile, and machine industries. The presence of established technology-oriented companies meant that both capital and a work force skilled in engineering were available in the area, and the Southern California climate was well suited to the testing and assembly of aircraft.

As the aerospace industry grew, the most important factor in California's success was the existence of universities and research centers such as Stanford, Berkeley, UCLA, and Cal Tech. These institutions were (and continue to be) important in that they supplied the growing industry with the engineers it needed and with a source of basic research that was

later applied to aerospace production. This expertise was not limited to research and skill in the aircraft industry; because of the complexity of the component systems of the industry's product, innovations in related technologies--such as metallurgy, fuels, and electric components--have been key to the industry's growth. For example, without breakthroughs in metallurgy, the development of the jet engine--perhaps the most important technological breakthrough in the commercial aircraft industry--would not have taken place. As the industry grew, it served to attract other national research centers, such as the NASA Ames, Lawrence Livermore, and Lawrence Berkeley laboratories.

It is also important to recognize the extraordinary influence that the Federal Government has played in the development of the aerospace industry. The U.S. government has always taken an active role in steering the course of the industry's development, starting in the 1920s with its air mail contracts and continuing through its role as a provider of research and development funding (in the areas of military aircraft, and later space technology) and as the major purchaser of the industry's products. However, although the Federal Goverment has played a decisive role in terms of being both a large source of demand and an actual funder of innovation within the industry, its decisions were probably not instrumental in affecting the heavy concentration of production in California. In fact, during World War II, the Federal Government made conscious decisions to locate new capacity outside of California and other vulnerable coastal regions. After World War II, as the industry consolidated, there was a definite shift back to the initial location pattern, in which a high percentage of firms were located in the coastal areas, especially California.

Because the Federal Government is the major purchaser of California's aerospace products, federal policy decisions will have a major effect on the overall level of industry activity within the state. However, California's future competitiveness within the industry will be determined by factors over which the state can have some control.

Description of Current Status

California's aerospace industry is currently riding high as a result of the combined effects of increases in military spending, the program to develop the space station, and the early stages of President Reagan's Strategic Defense Initiative (SDI). Figure 6, which illustrates California aerospace* employment between 1972 and 1985, shows that state employment in the production of aircraft, guided missiles, and space vehicles totaled 226,400 as of July 1985--the highest level since the post-Vietnam slowdown in defense spending. Although the above data do not distinguish between military and commercial production, recent industry trends indicate that California's aircraft production is increasingly concentrated in military planes. Furthermore, recent increases in spending on missiles and space vehicles will likely change the composition of production in California; in the past decade, the state has captured 50% of U.S. value added and 40% of government defense contracts in this industry.

However, several factors are affecting and will continue to influence the state's competitiveness within the aerospace industry. The current outlook for California's aerospace industry is for relatively flat employment over the near term. Industry experts predict that the DoD budget will remain at a constant level (in 1984 dollars) through 1995; spending on missiles, aircraft, and helicopters will decline slightly, while space spending should increase. However, it is also important to note that the overall level of defense funding is vulnerable to changes in political attitudes which tend to be highly volatile (perhaps even more so than the regular business cycles). Although the prospects for a large reduction in

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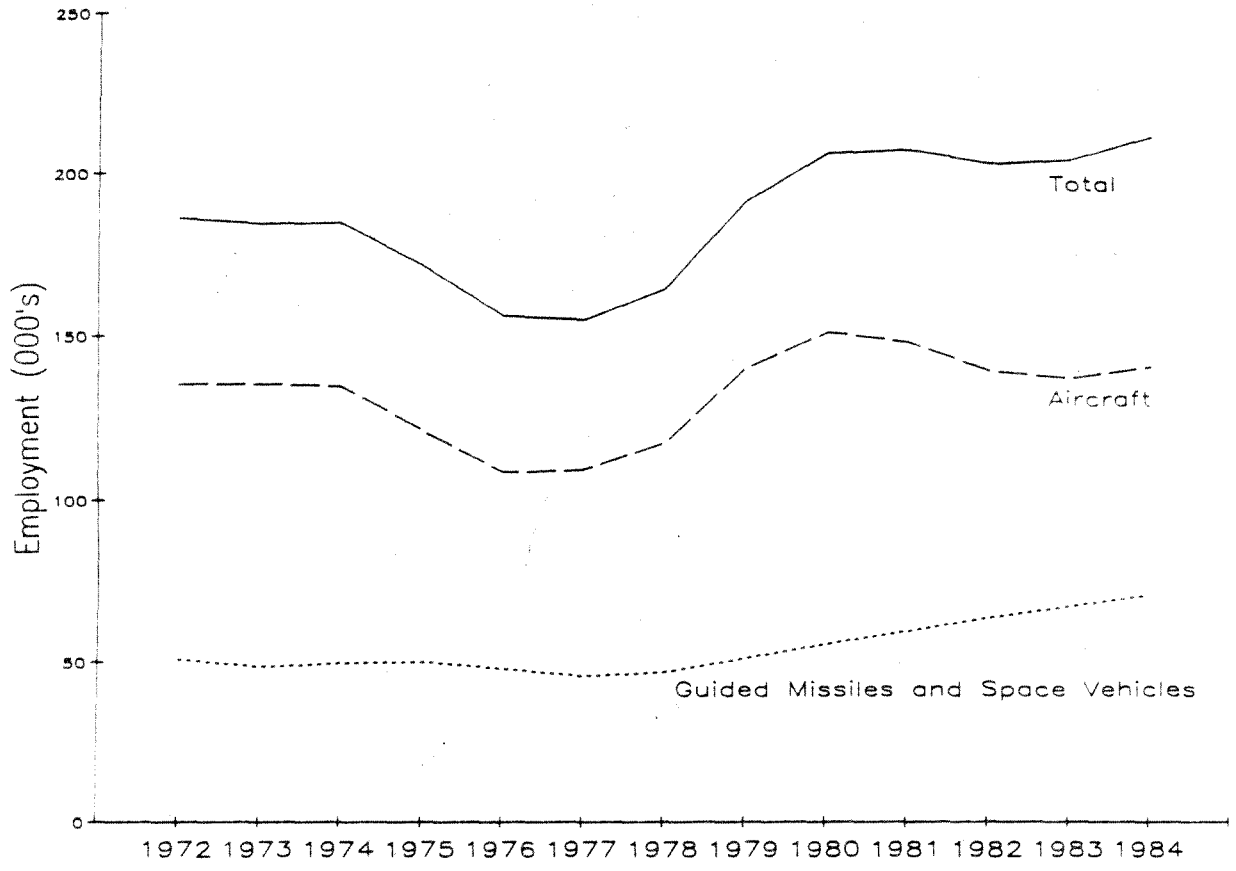
* In this analysis, unless otherwise noted, the aerospace industry is defined according to the U.S. Bureau of the Census definition, to include SIC codes 372 (aircraft) and 376 (guided missiles and space vehicles). The California Employment Development Department definition includes other high technology industries; these were not included in this analysis to avoid overlap with the high technology industry.



Source: California Employment Development Department

FIGURE 6 CALIFORNIA AEROSPACE EMPLOYMENT 1972–1984

military spending may be slim, the cancellation or reduction of individual programs can have serious consequences for California employment, as employees within specific divisions of the larger aerospace firms, or entire subcontracting firms are laid off. For example, the recent cancellation of the Sergeant York antiaircraft gun threatens the jobs of 1,900 workers at the Ford Aerospace plant in Newport Beach. Layoffs in the aerospace industry will also affect employment in the electronics and other industries, which produce many of the related systems.

Finally, there is evidence that concentration on military production inhibits the process of innovation and commercial product development that can keep California firms competitive in private sector markets. This occurs because military spending distorts both human resources and financial capital away from commercial products, especially in the area of high technology. The markets for engineering and technical workers have been very tight since the beginning of the arms buildup, inhibiting nondefense research and development. Economic analyses have also shown that as capital markets tighten (due to high levels of government spending), high-risk investments--e.g., lending to new and small businesses, like venture capital--are the first to suffer. Therefore, it is important that California policy makers ensure that California's natural competitive edge is not eroded in the face of both increasing competition from abroad and an increased emphasis on military production.

External and Internal Factors Affecting California's Aerospace Industry

Many of the same factors that are affecting California's other driving industries are also having serious effects upon its aerospace industry. The end result is that the industry is becoming increasingly affected by external factors--such as shifts in policy or market demand--and may be losing its ability to respond to those changes in a competitive manner.

Both the structure of the industry and the nature of its product differ significantly from those of more traditional manufacturing industries. The

aerospace industry includes military and civil aircraft, engines and subassemblies, space vehicles, and the systems parts and components incorporated into these final transports. It is characterized by high-value-added, low-volume products; the planes and missiles produced are expensive but sold in relatively small quantities. These products are highly complex, integrating a number of highly sophisticated technologies. The complexity of these systems means that products are expensive to develop and difficult to test; this leads to a higher than usual degree of risk because it increases the likelihood that products will be unsuccessful.

Industry structure, particularly for aircraft production, is also distinctive. Most aerospace work is concentrated among a few, very large (but diversified) firms. These firms are also highly interdependent. Usually, several firms will be involved in producing a single system, with the prime contractor subcontracting pieces of the work to other firms within the industry. Subcontracting emerged as a means of spreading the risk involved in aircraft production and has become more prevalent as firms try to cope with an increasingly competitive environment. In the future, subcontracts are increasingly likely to include foreign as well as domestic firms.

Finally, competitiveness is increasingly becoming important to the aerospace industry. The industry depends heavily on export markets to absorb its productive capacity. Although national defense needs will always guarantee some level of demand for domestic production capacity, the main industry strength in the past few decades has been in exports. Aerospace products--both civil and military--have been the largest source of U.S. export sales in recent years. 1982 aerospace exports totalled $15.6 billion, with an industry trade balance of $11 billion. In the years between 1977 and 1982, 75% of total aerospace exports were in civilian aircraft. It has become impossible for commercial aircraft firms to be profitable--let alone competitive--if they cannot continue to capture a significant share of foreign demand. Table 20 summarizes the forces currently affecting California's aerospace industry.

TABLE 20
SUMMARY OF FORCES AFFECTING AEROSPACE

External	
Trade	While the United States currently dominates, Europe is developing as a competitor with its Airbus. Japan is developing its aerospace industry as one oi: the industries targeted by its MITI.
Business CYCLE	Commercial aircraft sales are directly affected by recessions)such as the recent 1981 recession). While government spending (on aircraft, missiles, and space) is relatively more insulated from changes in the business cycle, it is vulnerable to political decisions concerning military spending.
Federal Policies	Domestic policies relating to the approval and development of new weapons systems, spending on basic research, and procurement processes will all have an effect on the level of defense spending.
Changing Markets	Recent increases in fuel costs and deregulation of the airline industry have led to an increase in demand for mid-size, fuel-efficient planes.
Internal	
Technology	Technological advancement is critically important in defense production,. 75% of aerospace spending (in recent years) has come from the Federal Government. Growing importance of network of technology producers and suppliers.
Human Resources	Existing shortage of qualified engineering and technical personnel machinists and tool and die casters) stems from competition with electronics and other industries as well as the recent rapid expansion in defense-related spending.
Financial Capital	Goverment funding has driven out private financing in this area. Little capital available for commercial aircraft.
Management	Reductions in the use of cost-plus contracting and increased competition in the federal contracting process will require firms involved in military production to adopt new management practices, more cost control.

External Factors

The business cycle has played an important role in California's increasing concentration in military production. Sales of commercial aircraft are directly affected by business cycles; the recessions and oil shocks of the mid 1970s and early 1980s were particularly bad times for commercial aircraft producers. During that same time Lockheed's near failure due to poor sales of the L-1011 (which was in part a result of these recessions) also contributed to an increasing degree of risk aversion within the industry. Because defense contracts rely on appropriated funding, military contracting is somewhat insulated from cyclical changes in the nation's economy. To some extent, this means that military spending can be advantageous in that it can reduce the state economy's sensitivity to cyclical fluctuations. For private firms this insulation--when combined with the government's willingness to subsidize the capital costs of developing a new product (thereby reducing the risk to the airline company)--provides a tremendous incentive for firms to concentrate on military rather than commercial production.

Changing markets in the commercial aircraft sector are another key factor in California's movement away from civil production. Several years ago, increases in fuel prices and deregulation of the airline industry led to a change in the demand for commercial aircraft. Airlines began to demand mid-sized, fuel-efficient planes in the face of higher fuel costs and changing service patterns brought about by deregulation; this trend continues today, although to a lesser extent.

Accompanying this change in demand has been the emergence of increasing competition in the supply of both commercial and military aircraft. The Japanese are the newest entrants; MITI plans to subsidize the development of their commercial as well as their existing military production capacity. Furthermore, the Japanese have been extremely successful in extracting licensing and joint production agreements which give them access to U.S. technologies. As a result, they will eventually be able to manufacture products completely within Japan.

The European Airbus consortium has emerged as the United State's strongest single competitor in the commercial aircraft industry. The recent success of Airbus has been due to a combination of technological, social, and political factors that ultimately affect the cost of its product. The governments of the consortium members have made a conscious decision to maintain a strong civil aircraft industry; their decisions to underwrite (or at least subsidize) the costs of development and production, and to protect domestic markets, have resulted in significant reductions in the price of the A300, A310, and A320. This price advantage as well as technological strength in the currently popular mid-size transport range has made Airbus a strong competitor in recent years.

In the area of military aircraft, Sweden, Italy, Germany, and Israel are all developing fighter planes, the area in which foreign technology is growing most rapidly. This trend threatens California in particular: almost all of the current model military fighters and bombers (the F-14, F-15 and F-18 fighters, A-6 attack plane and B-1 and B-52 bombers), as well as the major models of the future (the B-18 and Stealth bombers) are produced by in-state firms.* Competition is also increasing in the area of missile systems; several European nations are developing their own industries, and are pressing to have their own nations included as suppliers to NATO.

In an overall sense (in terms of military and civil production), when looking at the combined factors of price and technology, foreign aircraft are now competitive with U.S. products. Additionally, space technology--the area of greatest potential growth within the industry--is being taken up seriously in both Europe and Japan. Several nations--including Brazil--are developing and/or implementing long-term programs aimed at building their own space industries. This increase in competition is indicated by the U.S.

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*Some of the components and/or parts are produced by subcontractors in other states.

balance of trade in aerospace, which showed declines in 1982 and 1984 after steady increases between 1972 and 1982 (during which time the compound growth rate in exports exceeded the 6.7% growth rate for imports).

Because of heavy federal involvement as both a supplier of R&D funding and the number one purchaser of aerospace products (the Federal Government accounted for 70% of total 1983 aerospace sales), federal policy will continue to shape much of California's aerospace industry. The policies with the greatest effect will be those with a seemingly indirect connection to military spending. Although decisions regarding the total level of defense spending, the level and allocation of R&D funds, and the means by which DoD contracts are let will affect California firms, their effects on overall competitiveness will probably be marginal in California's aerospace industry.

Policies regarding U.S. trade and research and development practices will have more serious effects on the state. Trade policy is very important in terms of California's ability to compete in export markets. If other nations can continue to secure offset agreements with U.S. firms while maintaining policies of protecting domestic markets and subsidizing the cost of capital, it is likely they will be able to maintain existing price advantages and continue to siphon away our technologies while building their own ability to produce aircraft. Trade policies aimed at opening markets and securing a "level playing field" for competition could help to stem this current trend.

Policies and procurement practices that relate to research and development costs within the industry will also have a major impact on the competitiveness of the state's civil aircraft industry. The U.S. Department of Commerce has stated that the most important factors in the future competitiveness of the civil aircraft industry will be the cost and risk of developing new products. Decisions regarding individual weapon systems will also be critical issues because of their impact on employment. Although California is likely to continue to capture a good portion of defense and a majority of new space contracts, the high volatility of individual

development and procurement programs will continue to have major effects on employment in individual plants and communities.

Internal Factors

Technology is the area in which California has its strongest competitive edge. However, the nature of aerospace innovations has been strongly influenced by the heavy federal involvement in the industry. Advancements in military and space technology are well funded by the Federal Government, and California has traditionally been at the edge of technological change because its strong research institutions have allowed it to capture a large percentage of federally funded R&D spending. Many early accounts of the aerospace industry lauded the active federal participation in the development of the aerospace industry. It is true that the combined effects of government procurement and the research and testing facilities provided by the National Advisory Commission on Aeronautics (NACA) were instrumental in assisting the development and lowering the cost of both commercial and military aircraft. The availability of federal funding for military product development has the secondary effect of providing an incentive for firms to specialize in military hardware rather than risking exposure to the competition in the commercial sector. This is important in terms of competitiveness in commercial markets because recent analyses have suggested that newer military technologies result in relatively few commercial spin-offs. This trend is likely to grow stronger as military systems become more complex, incorporating even more costly advanced materials and more sophisticated and highly classified avionics and other electronic systems. Thus, the more recent federal involvement has worked to steer product development in the aerospace industry away from the path it would have followed if firms faced the rigors of the market.

In regard to process technology, advancement within the industry has been fairly rapid due to the Pentagon's recent push for robotization and overall cost containment in its contracts. This means that technology adapts quickly, but that future increases in defense spending will create

fewer and fewer new jobs in existing aerospace research, development, and production.

Human resources is also an area in which California has a comparative advantage, because of the high skill level of its labor force. In recent years, there has been a problem with meeting the industry's need for qualified personnel. Shortages of engineering and technical personnel resulted because of the combined forces of the recent buildup in defense spending and the aerospace industry's need to outbid the electronics industry for engineers and technical personnel. In the near future, it is likely that labor market conditions will ease (except in the area of electrical engineers), as defense spending levels off and especially if the U.S. electronics industry continues to face weakened demand.

Financial capital has always been a source of concern to commercial aircraft firms because development costs are so high. The cost of developing a new model of aircraft now runs into the billions of dollars. These high costs must be amortized over limited production runs. Thus, not only is product development more risky, but the cost of financing the development becomes a substantial portion of the price of finished aircraft. Therefore, foreign firms that receive capital directly from the government or borrow at subsidized rates have a significant cost advantage over U.S. firms that must pay the market price for capital. Because R&D costs for military aircraft or space projects are included in the contract fees, U.S. firms face a strong incentive to concentrate on government contracts. An important issue for the future will be whether domestic firms can find a way to compete in the commercial markets in the face of growing foreign competition that is relatively insulated from development financing costs and the concomitant high risks. Additionally, capital availability for commercial products may be a growing problem, as the success of Airbus reduces the attractiveness of investing in U.S. firms, which already tend to earn moderate to low rates of return on investment.

Management practices will be critical to aerospace industry success in the increasingly competitive environment for both military and commercial

products. Because of their long history of involvement with the Federal Government (especially the Department of Defense), aerospace firms tend to be highly bureaucratic. The riskiness of product development makes their decisions to concentrate on military production rational business practice. However, past military contracting practices have insulated these firms from the need to develop certain managerial skills and attitudes (such as marketing, or the ability to make tradeoffs between product costs and precision) firms must have to succeed in a competitive situation. Some firms would like to move away from a heavy dependence upon military production, but both risk aversion and managerial attitudes and abilities create substantial barriers to diversification.

Competitive Assessment--Civil Aircraft

This section takes a closer look at the competitiveness of California's civil aircraft production, one component of the aerospace industry. California's civil aircraft industry produces predominantly large transports and their component parts rather than the smaller civil aircraft used by commuter airlines or individual companies, or helicopters. Smaller civil aircraft are produced mainly in the central United States and aircraft engines in the Northeast and Middle Atlantic states. Because of the manner in which most economic data are collected, it is often impossible to differentiate between the civil and military aircraft contributions to state employment and value added. However, civilian and military products are sold in different markets, and each has a very different role to play in regard to California's overall industrial competitiveness. Therefore, some of the data exhibited below have been included as the best available proxy for indicators that would focus directly on commercial aircraft manufacturing.

Table 21 illustrates in California's share of total aircraft employment and value-added, and its productivity advantage in the aerospace industry

Table 21

CALIFORNIA AEROSPACE INDUSTRY

SIC	Value Added ($ millions) 1978	1982	Productivity Advantage 1978	1982
372	3,509.4	6,539.8	1.154	1.082
376	2,884.1	5,943.8	1.164	1.157

SIC	CA Share of Value Added 1978	1982	CA Share of Total Employment 1978	1982
372	23.89%	22.17%	21.16%	20.66%
376	65.73	60.30	57.33	52.76
Total	33.50%	31.72%	26.86%	26.16%

Source: U.S. Bureau of the Census, Census of Manufactures, 1978 and 1982

for the years 1977 and 1982.* The data for SIC Code 372 represents values for the aircraft portion of the industry. Table 22 illustrates California's share of Department of Defense and NASA procurements for the period between 1972 and 1984. These data indicate that the state's share of aircraft manufacturing has been relatively constant over the last two decades, and illustrate the point that California has to date been able to maintain its competitive advantage in aircraft production.

However, two other trends within the industry have important implications for the health of the state's economy. As Figure 7 illustrates, the yearly changes in aerospace employment indicate that the overall number of jobs tends to be very volatile. For example, while California aircraft employment declined by over 10% between 1975 and 1976, its growth rate between 1978 and 1979 (only 3 years later) was almost 20%. This volatility occurs because the commercial and military markets tend to be very unstable, with demand highly sensitive to business cycles and political winds, respectively. The nature of the airline industry is a key factor in the volatility of demand for civil aircraft; because the demand for airline travel is highly cyclical, the aircraft industry also suffers when the economy is in a recession.

Another measure that is often used to assess aircraft industry performance is the number of commercial aircraft deliveries. In the past few decades, the large transport market of the civil aircraft industry has been dominated by three major firms, McDonnell-Douglas (formerly Douglas Aircraft), Lockheed, and Boeing. Because these firms have concentrated their large transport activities within single states (McDonnell Douglas and Lockheed in California, Boeing in Washington state) it is possible to use data by company to represent at least a partial measure of the competitive advantage of a region.

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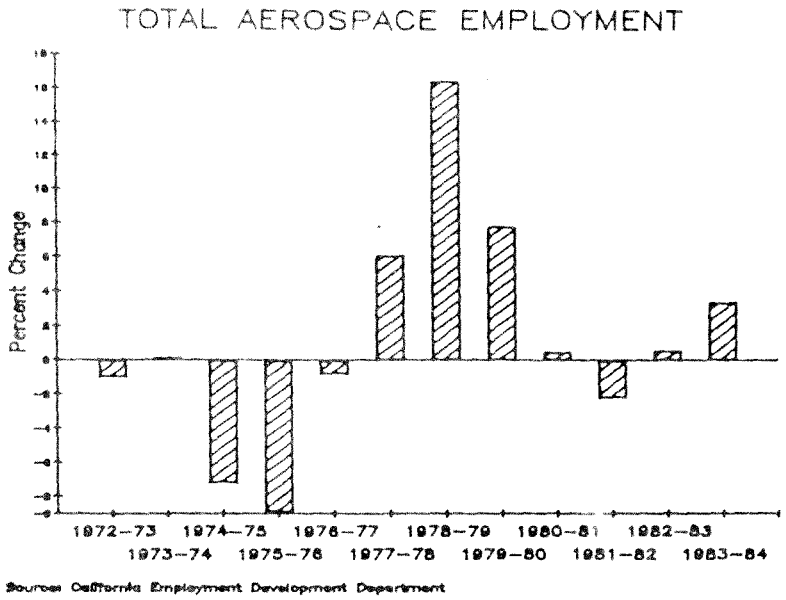
*These are the only years in which California data are available because of Census Bureau restrictions concerning disclosure and proprietary information. The data for SIC code 372 include military and civil production.

Table 22

DEPARTMENT OF DEFENSE AND NASA PRIME CONTRACT AWARDS BY STATE 1973-1983
Department of Defense Top Four States
(in Millions of Dollars)

Year	State	DoD Total	Percent DoD Total	State	NASA Total	Percent NASA Total
1973		$ 30,065	100%		$2,116	100%
	CA	6,215	21	CA	696	33
	NY	3,476	12	FL	215	10
	TX	2,232	7	CO	194	9
	MA	2,024	5	ML	182	9
1975		$ 37,319	100%		$2,299	100%
	CA	7,908	21	CA	1,082	47
	NY	3,744	10	TX	204	9
	CT	2,349	6	FL	170	7
	TX	2,024	5	CO	101	4
1977		$ 55,449	100%		$2,882	100%
	CA	10,078	22	CA	1,417	49
	NY	4,300	9	TX	237	8
	TX	2,778	6	FL	234	8
	MA	2,396	5	ML	196	7
1979		$ 56,653	100%		$3,487	100%
	CA	11,674	21	CA	1,439	41
	NY	4,912	9	FL	369	10
	TX	4,236	8	TX	306	8
	CT	3,777	7	ML	257	7
1981		$ 85,880	100%	NA		NA
	CA	16,629	22			
	TX	7,416	9			
	NY	6,481	8			
	MA	4,596	6			
1983		$ 131,891	100%		$5,668	100%
	CA	26,387	22	CA	2,131	38
	NY	9,635	8	FL	774	14
	TX	8,229	7	TX	526	9
	VA	7,072	6	ML	408	7
1984, Jan - Mar		$40,315,535		1984	6,142	
	CA	9,201,535	24.9	CA	2,150	35.1
	NY	3,293,458	8.9	FL	817	13.3
	MD	3,145,032	8.5	TX	587	9.6
	MA	3,019,854	8.2	MD	478	5.6

Source: Department of Defense; Directorate of Information, Operations, and Reports; 1974-1983 data as cited in California Assembly office of Research Briefing paper, "The Impact of Defense and Aerospace Funding on California's Economic Development, December 1984



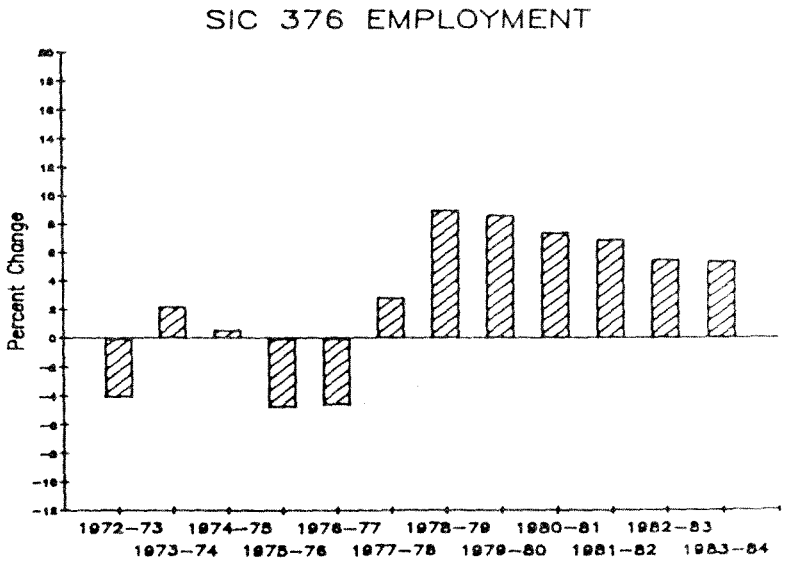


FIGURE 7 TOTAL AEROSPACE EMPLOYMENT IN CALIFORNIA

Figure 8 illustrates the share of commercial jet deliveries for those regions which have developed commercial jet industries. At this time, the United States and Europe are the only areas that produce large transport planes. California's share of completed aircraft deliveries has decreased steadily since the early 1970s, while the Airbus share has suddenly emerged from zero to 18.3% since 1973. This does not indicate that European competition has increased; instead, the Airbus consortium has emerged to take up what has always been a fairly strong European role within the industry. What is important for the future is the next step: how willing are the consortium governments to make a further commitment that will allow an already strong industry to maintain cost advantages as new, more advanced models of aircraft are developed? And how will European success reinforce the current trend for California producers to concentrate in military production?

These data do not tell the full story on California's competitiveness in commercial aircraft. A decline in the share of airplane deliveries need not indicate that California has lost much of its production of commercial aircraft. Even though firms may not be assembling completed planes, many California firms are involved in the production of commercial aircraft parts. For example, Northrop manufactures 40% of the Boeing 747, mainly the fuselage, which it ships to Washington state by train. The interdependence among U.S. aerospace firms means that a healthy and competitive Boeing benefits California residents as well as those in Seattle. However, a healthy McDonnell Douglas is likely to bring more employment benefits to California than will subcontracts for Boeing.

The decline in California's relative share of commercial aircraft deliveries has several causes. New models or design modifications require a long lead time; aircraft manufacturers cannot respond to sudden changes in the demand for planes. Therefore, in the short term, a company's success in selling particular models is a function of variables that are outside its control; for example, higher energy prices have been a major factor in the recent popularity of smaller, more fuel efficient planes (such as the MD80). Lockheed's near failure with the L-1011 resulted in part from the

Source: McDonnell Douglas Corp.

FIGURE 8 CALIFORNIA COMPETITIVENESS IN COMMERCIAL JETS

fact that it placed its "bet" at the wrong time, and could not sell its planes due to the combined factors of design problems and a severe recession during which airlines couldn't afford new planes.

Increases in the costs of development mean that firms must sell approximately 400 planes to break even on the cost of developing a new model (this figure varies of course, according to the exact type of plane). Models are not considered to be successful unless there are significant sales and deliveries over the first 10 years and sales are significantly above the break-even point. The Boeing 727 and DC-9 (now the MD80) are perhaps the only clearly successful programs of the last two decades; both had sales of over 700 in the first 10 years. Even at this sales level, the rates of return on projects tend to be lower than the average for all manufacturing industries.

As airlines become less willing to purchase new aircraft and new competitors emerge, the potential for reaching the break-even point is reduced. Table 23 shows the total sales and profits (losses) of the three U.S. firms producing large transports in 1971-1981. That Boeing was the only company to make a profit during this time highlights the degree of risk involved in producing large transports.

California's decline in the share of commercial jet deliveries also reflects strong incentives to specialize in military production. This decrease will occur even though projections of the demand for civil aircraft call for a relatively high number of bookings over the next 2 years. Since 1980, the increase in competition and level of risk has been accompanied by a huge increase in military spending. Because the government finances production, development, and testing costs for military hardware, firms have an incentive to concentrate on military (rather than high-risk commercial) production, even though military contracts also have lower-than-average rates of return. Lockheed is basically out of the commercial aircraft business, and even though McDonnell Douglas has been quite successful in selling its MD80 version of its DC-9, it plans to increase its share of military-related production by a significant percentage within the next few years. California firms will continue to manufacture civil aircraft parts, however.

Table 23

AIRCRAFT SALES AND PROFITS, 1971-1987

Year	Sales ($ billions)			Profit or Loss ($ millions)		
	B	MD	L	B	MD	L
1971	2.6	0.6	0	165	NA	(171)
1972	1.8	1.1	0.3	119	NA	(124)
1973	2.6	1.3	0.7	113	NA	(70)
1974	3.0	1.4	0.8	167	NA	(49)
1975	3.0	1.3	0.6	201	NA	(94)
1976	3.3	1.0	0.4	249	NA	(125)
1977	2.5	0.7	0.3	196	(50)	(170)
1978	3.8	1.0	0.3	417	(60)	(119)
1979	6.4	2.0	0.5	611	(56)	(188)
1980	7.6	2.2	1.0	678	(144)	(199)
1981	7.0	2.4	1.9	308	(85)	216

Source: U.S. Department of Commerce, "Competitive Assessment of the United States Civil Aircraft Industry," 1982

As for its future in civil aircraft production, California can expect to experience continued volatility in employment due to the cyclical nature of the demand for large transports. According to the U.S. Department of Commerce, the extent to which foreign competition will be able to continue to increase its share of production of both parts and final deliveries will depend to a great extent upon the degree of technological change within the industry. If technology remains essentially constant, U.S. firms (McDonnell Douglas and Boeing) should continue to do fairly well. In the face of a complete replacement of current models--meaning a replacement of jet engines with new propfan models currently under development by U.S. firms--U.S. firms choosing to remain in the market (particularly Boeing) will do very well because they have chosen to invest in the development of this new technology. Airline industry problems leading to continuing uncertainty and increasing competition for aircraft orders would threaten U.S. and California market share most, because the Airbus models are the cheapest and most efficient planes currently in production. To some extent, this magnitude of the threat also depends on Japanese decisions as to whether to produce planes entirely in Japan or to continue to negotiate joint production agreements. Maintaining the competitiveness of U.S. civil aircraft production will benefit California, regardless of which state delivers the planes. The key to that, and thus the most important factor to address, is the cost and risk of developing new aircraft.

Table 24 summarizes the competitive position of California's civil aircraft industry in regard to its foreign competitors (mainly the Airbus Consortium). An important conclusion of this analysis is that at least in part, California's disadvantages all relate to differences in national policies. Our own policies in the defense sector create large incentives to produce (and therefore, undertake research and development) for government rather than private markets. Industry policies in other nations place U.S. firms at a disadvantage because they insulate their producers from business cycles, and reduce their cost of capital below the market rates that U.S. firms face.

Table 24

COMPETITIVE ASSESSMENT
CALIFORNIA CIVIL AIRCRAFT INDUSTRY
VS FOREIGN COMPETITORS (AIRBUS)

	Disadvantage			Advantage	
	Major	Minor	Parity	Minor	Major
Federal policy		■			
Business cycles		■			
Changing markets			■		
Technology--process				■	
Technology--product				■	
Human resources					■
Financial capital	■				
Management				■	

This assessment also illustrates that California has managed to maintain its edge in those areas which provided it with an early comparative advantage in aircraft production. Firms within the state remain leaders in the areas of process and product technology, and our human resource skill is still a major advantage. Management is also a strong point in the area of commercial production because in-state firms have developed expertise in managing complex technology projects.

Projections for the Future

The preceding discussion highlights the fact that much of California's aerospace industry is in a mature stage, in which increasing competition opens the possibility for an increase in the state's concentration in military production, if not a loss in total employment. Providing that it maintains the superiority of its research and education institutions and its workforce, California's technological edge should allow it to maintain its existing share of aerospace employment. However, given the nature of the industry, employment will remain volatile, especially as it becomes increasingly dependent on military spending.

These trends are unlikely to have a major impact on the California economy in the very short term. The recovery in the airline industry, and therefore strength in bookings for commercial aircraft, is expected to continue through 1986. Military spending should not slow significantly during that same time period, as spending appropriated during the Reagan administration's early buildup is still in the pipeline. However, current political and economic trends, as well as past experience, indicate the possibility of a major downturn in the longer term.

Increasing competition, leading to greater internationalization of production (in which domestic producers are involved in co-production agreements with firms of other nations), will continue in the future, especially in the absence of a U.S. trade policy that can address the issue of protected overseas markets. Forecasts for a lagging economy and low

airline earnings call for low levels of commercial aircraft bookings in 1987 and 1991, as the highly cyclical nature of demand again impacts the industry. Finally, current budgetary and political conditions are most likely setting the stage for significant reductions in military spending. These would be likely to impact the development of missile systems (with military aircraft and fighter planes being relatively secure), which are at present a major component of California's industry.

The most critical impact of a downturn within the industry will be its effect upon employment within the state. Many Californian's don't need to be told about the employment consequences of cutbacks in military spending. During the 1970s, California and especially Los Angeles County experienced post-Vietnam reductions in aerospace production. Los Angeles County lost 6.9% of its aerospace employment between 1972 and 1976. In 1977 the area felt a sudden shock at the cancellation of the B-1 bomber. At that time, the Department of Defense's Office of Economic Adjustment estimated that under worst case assumptions, the multiplier effect in terms of job losses due to the closing would be 2.46 (meaning a loss of 2.46 jobs in related industries for every direct aerospace job lost).

This scenario would be even more drastic if defense cutbacks were to hit during weak periods in the commercial aircraft industry. Even given that commercial production of completed aircraft is less and less a major part of the state's overall activity within the industry, low demand will impact heavily upon those firms still involved in manufacturing parts for Boeing as well as in-state producers.

The state's recent experience with the Sergeant York programs illustrates how California firms can be affected by cuts in defense spending on an individual program basis, even during periods of strong military demand. The Department of Defense's multiplier of 2.46 can be applied to potential aerospace job losses to obtain rough estimates of the employment impact of the cancellation of various programs. For example, the loss of 1900 aerospace jobs due to cancellation of the Sergeant York antiaircraft gun could result in a total estimated job loss of 6,574 jobs. Under a

scenario in which military spending is reduced significantly total elimination of the MX program (16,000 California aerospace jobs) could lead to a total loss of 55,360 jobs. Alternatively, given June 1985 employment levels of 226,400, an across-the-board cutback of 6.9% in total aerospace employment (similar to that experienced in the post-Vietnam period) could result in a total job loss of 54,050.

These estimates are obviously very rough projections of the potential impact of a defense slowdown. It may be that the political impacts of job losses of this magnitude may in some cases be enough to prevent total cancellation of major programs. However, the important point is that an industry that is increasingly dependent upon military and other government projects will be even more susceptible to employment losses of this type.

Furthermore, the result of increasing concentration in military-related production will be to produce an industry that is increasingly unable to compete effectively, by reinforcing existing bureaucratic structures and management cultures. Larger aerospace firms will be unable to diversify into nonmilitary production when defense spending drops off. Furthermore, concentration on sophisticated military systems with no or limited commercial applications (e.g., stealth technology) may inhibit other needed innovation at a time when California's competitiveness is especially dependent on its ability to develop new production processes and products.

What can California do to minimize the effects that increasing competition and the volatility of military and commercial demand have upon employment within the state? The state's overall strategy should be to maintain its existing share of aerospace employment while attempting to diversify into commercially-oriented segments of the industry where growth is taking place. Actions in the four following areas will be important in achieving this overall goal:

(1) Maintaining the technological and human resource superiority that is a direct result of nationally prominent universities and research centers. This requires continuing investment by the state, as a means to maintain the technological edge which has in the past been the primary reason for the states dominance in the industry.

(2) Presenting a strong lobbying force on national issues affecting the California aerospace industry. The most important policy issues here are not those relating to individual weapon systems, which may save jobs in the short run but contribute to more vulnerable employment and competitive ability over the long term. Instead, key issues to be addressed are trade policy (especially as it relates to access to overseas markets) and space policy. The latter is important because space technology is one area which presents new opportunities to California's aerospace industry. Prospects for growth are not limited to the concept of space commercialization (use of space technology by private firms). Over the next 50-100 years, an entire space infrastructure will be built. Not only does this present a potentially huge area of growth for California, it may also be that much of this development is accomplished through private markets, or at least more competitive government programs. To the extent to which future federal policies regarding the management of its space program allow for increased privatization of space, California can benefit from a decreased dependence on government contracts as well as growth within the industry. In addition to attempting to influence federal policy relating to space, the state's most important actions in capturing this new growth would be to maintain its edge in space technology and to assist in addressing the factors of high risk and up-front cost that space firms--especially newer ones--face.

(3) Promoting diversification within the industry. As is true of diversification within an economy as a whole, expanding California's aerospace industry to include a wider range of products can help to insulate it from employment losses due to defense cutbacks or recessions in the airline industry. To achieve this goal, California should promote the entrance of more entrepreneurial and innovative aerospace firms, especially those producing for commercial markets. Because of incentives to avoid risk that the largest aerospace companies face, entrepreneurs are most likely to be found among smaller subcontractors, either those facing employment losses or those in new areas of opportunity, such as the commercialization of space. At the present time, there are a large number of emerging aerospace-related spin-offs in Southern California. These firms represent an important opportunity for stabilizing the state's aerospace industry, but they face substantial barriers to success. In addition to the potential problems with a lack of information regarding markets or difficulties in obtaining financing, new aerospace firms face capital and product- and technology-development costs far above those faced by firms in other industries. Therefore, assistance in the form of incubator facilities, market-related information, and flexible licensing or other arrangements (which can allow these entrepreneurial firms access to the equipment or technologies that national facilities--such as the Jet Propulsion Lab--or larger firms cannot use to produce successfully for commercial markets) are especially important to emerging firms in the aerospace industry.

(4) Providing assistance for firms or workers wishing to move into related industries. There may also be potential areas for new growth in other high technology areas in which aerospace workers or entire firms could be successful. Recent studies of the demand for high technology workers showed considerable competition between the aerospace and electronics industries for skilled workers (both professional and technical), even to the extent that a lack of skilled workers once threatened the growth of the state's electronics industry. In times of reductions in military spending or slow demand for civil aircraft, facilitating the transfer of aerospace workers into industries where their technical skills can be applied will be an important part of any adjustment program. However, even in the absence of the immediate need for these types of services, assistance in developing information about potential markets and in obtaining financing are means by which the state could play a role in assisting firms that wish to diversify into high-technology areas outside of the aerospace industry.

A more specific discussion of the above policies and/or programs--as they fit in with a more comprehensive state strategy on competitiveness--is set forth in the final section of this report. The recommendations above fit well with programs that could address the needs of many of California's industries. Within the context of the aerospace industry, this approach will allow the state to maintain its current employment base, while shifting toward firms that operate in a more competitive environment that is less dependent on federal spending and decision-making.

VII CALIFORNIA'S FINANCIAL SERVICE INDUSTRY

Introduction

California's financial services industry, a major employer in the state, is large and complex. Although the industry has been undergoing a significant transformation in recent years, it will continue to be an important component of the state's economy and a major asset because of its payment role in consumer, commercial, and real estate finance. California regulatory policies are more flexible than most other states in enabling response of the market place to the needs of industry during its life-cycle. While the industry has prospered and contributed to the health of the California economy through its financing, it has also suffered from (and adapted to) the changes in the state, national, and international economy. Competition resulting from deregulation (national and state), as well as national and global economic trends have reduced the size and altered the composition of the financial industry work force. California's financial service industry plays a critical role in financing industrial competitiveness.

A recent SRI study found that the financial services industry comprised over 22 different sectors. For the purposes of this analysis, however, the financial services industry will be defined as including only depository institutions and their employees. Of the over 7,500 finance-related businesses in California, this analysis will exclude the 2,000 securities dealers, over 1,000 insurance agents, 2,300 finance companies, and related service firms. However, as the distinctions between segments dwindle or disappear because of deregulation and competition, many of the observations made for depository institutions extend to cover more of the overall industry.

Important Trends in California's Financial Service Industry

Four important trends that influence the future structure of the California financial services market and the role it plays in the California economy are discussed here.

First, federal and state deregulation has opened up this market and will increase sources of competition for consumer and commercial clients in the state--with or without interstate banking. California commercial banks can expect to claim a lower share of the overall market in the state in the future. Money center banks outside of California, as well as foreign-owned banks, will increasingly be able to serve California through traditional and nonbank products, such as credit cards, insurance, and brokerage services.

California consumers are reported to be less loyal to state institutions than consumers in smaller states and will turn to providers whose credit criteria are more generous than those of California banks. Furthermore, while California commercial banks have an extensive branching system, which gives them local access to customers, this is also a significant cost not experienced by out-of-state banks, or smaller foreign-owned banks in the state. This means that there will be pressures on California banks to close marginal branch offices, reduce workforce, and increase marketing of services beyond those of traditional banking to include brokerage, real estate, insurance, data processing, and consulting.

Savings and loans are now empowered to compete against traditional commercial banks. This will not reduce the California share of the consumer market, but will increase the spread of market share within the state. Although many savings and loans are financially troubled, they are generally improving their financial stability.

Foreign-owned banks, particularly the Japanese, are becoming a significant factor in the California market. Almost 20% of assets are now owned by overseas banks. While control over where investment of deposits are made is not currently an issue, the profits are going overseas--not unlike the other instances of foreign manufacturing in the United States.

Because deregulation has opened up competition in a wide variety of new financial service markets, banks may need to increase staff in areas that include skills not characteristic of current branch personnel. As a result there may be displacement of existing staff, but a gradual increase of staff in back-office financial services. Banks already face significant difficulties in recruiting adequately trained personnel. This will pose a continued problem in the future.

Second, technology is enabling creation of a less labor-intensive and less geographically concentrated banking system. Today, most employment is concentrated in higher density population centers. Computer, cable, and telephone-based home banking and growth of related back office financial service transactions will put more pressure on bank branches to reduce staff--although most banks say this is not going to occur rapidly. Furthermore, because provision of banking services is no longer confined to local geographic markets, employment is likely to be concentrated in lower cost labor markets within the state, where financial service centers can be cost effectively located, and some shift is likely to out-of-state financial service centers. As recent evidence in the financial services industry shows, financial service companies can easily contract services to out-of-state or even overseas centers that can make transactions by satellite communication.

Third, independent from the issue of the competitive position of California banks in the state market, is the growth of foreign-owned banks. There is little doubt that such banks are designed to improve the ability of overseas firms to do business in the United States. The high concentration of their deposits in the banks' headquarters, which are usually in major markets and ports of entry, suggests that these banks are intended to facilitate foreign exports, and particularly, to assist the financing of U.S. based manufacturing, suppliers, and buyers.

The source of value-added in the financial sector is primarily in the process of providing services to end users, and in the profit from loans and investments. The health of the California consumer and commercial segments of the economy will determine the demand for financial services. The source of value added to product (i.e., a financial service) will shift in the future. There will be more reliance on electronic technology for transactions, and a major shift in employment from face-to-face customer service to back-office transactions and management. In reality, new products will be where California's value added will come from, not traditional banking services.

Finally, California' financial service industry--including those segments not discussed here (venture finance and investment banking) have played a critical role in enabling industry to respond to changing competitive factors. It is here that state policy has played one of its more effective roles--although more could be done--in helping the marketplace work.

Structure and Trends in California's Financial Services Industry

California's depository institutions include commercial banks (which make business, industrial and consumer loans), savings and loans (which primarily make home loans and some other real estate loans), and credit unions (which make a wide range of consumer loans).

Size of the Industry

In 1984, California's commercial banking sector included over 440 companies with 5,100 offices (Findlay Reports for California Banks). California's share of commercial banks was 3.0% in 1984.

In 1976, there were 18 foreign-owned banks in California. Crocker bank, purchased in 1985 by Midland Bank of England, brings the current total of foreign-controlled banks to 29. Foreign-controlled banks had $32.2 billion in total assets and $24.8 billion in deposits in 1984. Of California's

foreign-owned banks, nine are Japanese, three British, three Canadian, three Philippine, two Mexican, and two Korean; France, Italy, Hong Kong, Denmark, and India each have one. Ten of these banks have more than 50% of their deposits at their headquarters offices; eight place at least 50% of their funds in commercial and industrial loans.

In 1984, California's savings and loan (S&L) sector included 202 institutions and 3,625 offices. The number of companies has declined since 1976, but California's share of the total has risen to 6.0% (from 3.9% in 1976), reflecting a concentration in ownership. California has a higher percentage of publicly held S&Ls than the national average, which leads to more stockholder pressures for higher short-term returns.

An increasing number of California S&Ls have expanded into other states. Seven California S&Ls had a total of 410 out-of-state branches in ten states in 1984, up from 302 branches in nine states in 1982. The expansion provides California S&Ls with access to new deposits, which they can place wherever they earn the best return. Out-of-state branches can thus improve financial performance if the new owners can turn around the troubled S&Ls they purchase. Most S&Ls have been highly selective in their acquisitions.

There were 1,188 credit unions in California with 1,300 offices in 1984, a decrease of 467 credit unions from 1978. California's share of the nation's credit unions declined to 6.5% in 1984. The reduction reflects Californians' eager adoption of the bank credit card for frequent, small, consumer loans.

Employment in Depository Institutions

Employment in California banks has largely followed growth in population centers. California commercial bank employment began to decrease in 1981 after significant growth from 1970. In 1984, California banks employed approximately 190,000 workers (less than 13% of the nation's total), but they have lost about 5,000 workers a year since the 1981 peak of 200,600.

California has a larger share of S&L employment and a smaller share of credit union employment. Employment in California S&Ls has grown consistently over the past 15 years, reaching about 70,000 workers in 1984 or almost 22% of the national total. Nationally, S&Ls employed 106,000 people in 1970, when California's share of the total was 14%. California credit unions employed about 10,000 persons in 1984, or 11.8% of total U.S. credit union employment.

Assets

In 1984, California commercial banks had $231.5 billion in assets for domestic offices and a total of $278.1 billion for both domestic and foreign offices (Findlay Reports for California Banks). This reflects fairly steady growth over the past 15 years. Foreign assets have represented from 20% to 30% of California bank domestic assets since 1976--around 10% above the national average, which has grown from 15% to 25% since 1976.

California's banks currently hold 10.8% of total U.S. domestic assets and 11.4% of combined domestic and foreign assets. California's share peaked in 1981 with a 12.0% share of domestic assets and 12.9% of combined assets. However, a look at a purely artificial measure--bank assets per capita in the four largest banking states in 1981--shows a somewhat different picture:

New York	$15,593
Illinois	10,842
Texas	9,054
California	8,240.

California does not have the same per capita level of bank assets as the other three most important banking states. In part, this reflects the importance of California's S&Ls.

California S&Ls had $252.1 billion in assets in 1984, up from $120.5 billion in 1980. California S&L assets grew 20% from 1983 to 1984. California's S&L share of the nation's S&L assets was 13.6% in 1970 and has risen to 25.7% of total U.S. assets today.

California credit unions had $15.2 billion in assets in 1984, up from $10.7 billion in 1980. The California share of U.S. credit union assets has continuously decreased since 1979 when it was 15.9%; today, California credit unions hold 12.9% of the U.S. total. This represents another case where California has been an early adopter of a trend that later spreads nationwide.

Deposits

California commercial banks had $193.2 billion in domestic deposits and $239.7 billion in domestic and foreign deposits in 1984 (Findlay Reports for California Banks). Foreign deposits were 40% of total domestic deposits in 1976, and have decreased since 1979 (to 25%). (The difference made by IRAs has not yet been reflected in the data.) California's share of deposits U.S. commercial bank peaked in 1981 and has since declined to 11.6% of domestic deposits and 12.1% of combined domestic and foreign deposits. This contrasts strongly with the pattern in S&Ls. California S&L deposits were $171 billion in 1984, up from $89.7 billion in 1980. California's share of U.S. S&L deposits is currently 23.6%. California credit unions held $14.4 billion in deposits in 1984. California's share of total U.S. credit union deposits is currently 13.2%, a continued decrease from the 1980 high of 15.4%. Table 25 provides a summary profile of California's depository segment of the financial services industries.

Measures of Performance

Four measures of the financial performance and productivity of California's financial services industries are provided here. These are:

- Total assets per employee
- Gross profits
- Gross profits per employee
- Gross profits as a percent of total assets.

Table 25

PROFILE OF CALIFORNIA'S DEPOSITORY SEGMENT
OF THE FINANCIAL SERVICES INDUSTRY

	1970		1976		1982		1984	
	Number or Amount	Percent of National	Number or Amount	Percent of National	Number of Amount	Percent of National	Number or Amount	Percent of National
Commercial Banks								
Companies (No.)	144	1.1%	210	1.5%	360	2.5%	440	3.0%
Offices (No.)	3,062	8.6%	3,783	8.2%	4,904	9.0	5,100	9.2
Total assets ($ billion)								
Domestic	58.6	10.2	108.7	10.7	223.1	11.9	231.5	10.8
Domestic and foreign	--	--	144.1	12.2	275.5	12.6	278.1	11.4
Employees (No.)	106,700	11.1	151,200	12.0	200,800	13.3	190,000	12.7
Gross Profits ($ billion)	2.2	9.8	9.8	11.6	10.7	12.0	11.2 (1983)	11.6 (1983)
Savings and Loans								
Companies (No.)	222	3.9%	164	3.4	171	4.5%	202	6.0%
Offices (No.)	896	9.0	2,068	12.4	3,241	19.4	3,625	17.3
Total assets ($ billion)	32.7	18.6	69.1	17.6	153.4	21.7	252.1	27.9
Total deposits ($ billion)	25.0	17.1	57.1	17.3	108.7	19.2	171.0	23.6
Employees (No.)	15,300	14.4	27,900	15.0	49,200	17.8	70,000	21.8
Gross profits ($ billion)	0.6	20.0	1.6	20.0	0.1	7.1	33.3 (1983)	23.9 (1983)
Credit Unions								
Entities (No.)	--	--	1,655 (1978)	7.5	1,300	6.5	1,188	6.5
Total assets ($ billion)	--	--	9.6	15.7	12.6	15.2	15.2	12.9
Total deposits ($)	--	--	--	15.2	--	15.1	--	13.2
Employees (No.)	--	--	--	--	--	--	10,000	11.8

Total Assets Per Employee

Total assets per employee are a measure of potential. California commercial banks had an estimated $1.46 million in total assets per employee in 1984. In contrast, commercial banks nationally held $1.63 million in total assets per employee in 1984. The lower amount for California reflects in part the tendency to employ more people.

California S&Ls had $3.6 million in assets per employee in 1984, well above the national figure of $2.82 million. California S&Ls currently have 128% of the U.S. average in assets per employee, but the level has fluctuated slightly from year to year.

California credit unions had $1.5 million in assets per employee in 1984, above the national figure of $1.22 million.

Gross Profits

In 1983, the most recent year for which data are available, California banks had gross profits of $11.2 billion, up from $8.9 billion in 1980. California bank gross profits were 11.6% of the national total in 1983. Gross profits for California banks as a share of the national total peaked in 1979 at 12.8% and have decreased every year since.

In 1983, California S&L gross profits were $3.3 billion, down from $3.5 billion in 1980. In 1981 California S&L had losses of $0.2 billion, but in 1982 the recovery produced gross profits of $0.1 billion. California S&Ls had a 23.9% share of national S&L gross profits in 1983, down from their 1980 peak but far above their 7.1% share in 1982.

Gross Profits per Employee

Gross profits per employee are a measure of productivity that is of increasing concern during this period of financial industry restructuring. California commercial banks generated $57,000 in gross profits per employee in 1983 for domestic and foreign offices, up from $46,000 per employee in 1980. This 1983 level is slightly below the national figure of $60,000 per employee for domestic and foreign offices, just as California's 1980 level of $46,000 was slightly below the national figure of $48,000 per employee. This difference reflects the large number of branch banks in California.

The gross profits per employee of California banks have declined from 105% of the national average in 1978 to 89% in 1983. To some extent, this decline reflects declines in profits resulting from market shifts but it cannot be dismissed as solely resulting from profit declines. California banks have had difficulty in restructuring their work force to meet today's needs.

California S&Ls generated $55,000 in gross profits per employee in 1983, down from the 1980 figure, but far better than the $2,000 per employee in 1982. The 1983 California figure was well above the national S&L level ($45,000 per employee).

Gross Profits As a Percent of Total Assets

The gross profits of California commercial banks were 4% of total assets in 1983, up from 3.7% in 1980 but below the national average of 4.1% California S&L gross profits were 1.7% of total assets in 1983, down from 1980 but well above 1981 and 1982 and above the national average (1.7% vs 1.5%).

Analysis of Internal and External Forces

The U.S. financial services industry has been undergoing a significant set of changes. These changes have been driven primarily by a combination of national and state regulatory shifts, national and international economic forces, and shifts in management strategies within financial institutions. For the purposes of this analysis, commercial banking and S&Ls are discussed separately. Table 26 provides a summary of forces affecting the financial services industry in California.

External Forces

Federal and State Policy

The environment in which financial services industries conduct their business was dramatically changed with the passage of the Depository Institutions Deregulation and Monetary Control Act of 1980. The law introduced new competitive forces into the depository institutions market. It enabled financial institutions to offer more services, to charge more competitive prices on their services, and to enter into new financial services markets. Generally, commercial banks were able to market more aggressively to business and consumers by offering new services and paying higher interest rates on deposits than in the past.

The principal outcome of this law, however, has been to place a greater squeeze on the profitability of banks--particularly smaller ones. Yet, the number of applications for new banks has increased considerably; California has had an increase of over 128 banks since 1981. The pressures of competition have also resulted in a trend toward acquisition and merger. However, the trend is held back by the remaining interstate branching laws and regulatory constraints on growth of existing banks in California. California banks could expand in the state if acquisition is deregulated before interstate banking becomes possible.

Table 26

SUMMARY OF FORCES AFFECTING FINANCE

External	
Trade	Growth of the Pacific Basin markets provides an opportunity for California's expansion as a financial center for the Pacific region.
Business Cycle	High interest rates and inflation have increased competition for deposits and the cost of providing financial products.
Federal Policies	Deregulation has blurred the lines among financial institutions and affected the cost of funds and services to customers. Interstate banking will have a major effect on the number and size of firms within the industry.
Changing Markets	Changing demographics and increasing sophisitication among consumers have changed the demand for financial services.
Internal	
Technology	Introduction of electronic funds transfer, including ATMs, has affected the types of services that consumers demand, location of bank offices, human resource needs within the industry, and cost of transactions. California banks have led in the adoption of these new technologies.
Human Resources	Increase in demand for workers with ability to handle complex data processing activities. Fewer tellers needed and more consumer service representatives with ability to communicate sophisticated knowledge of services to customers
Financial Capital	Higher interest rates exacerbate the difficulty that small banks have in obtaining low cost sources of funds.
Management	Increased competition in a deregulated environment requires more innovation, enterpreneurial management with greater attention to product differentiation, marketing, quality of services and attention to customer need.

Deregulation has increased the ability of banks to generate revenues from other than interest. The number of revenue-bearing services has increased greatly and now contribute almost 50% of all bank revenues. Since California deregulated the state banking services environment (AB 3192 and AB 3469), banks have formed investment companies that can underwrite, distribute, and sell any type of securities. These laws also permit banks to perform a mix of traditional banking and S&L services, including becoming real estate developers. S&Ls are now permitted to make agricultural, business, corporate, and commercial loans along with their traditional personal, family, and household loans. However, there are limits on the percent of assets that can be used for these new loans.

Bank deregulation has produced more new services by larger banks in fields such as securities brokerage, discount brokerage, real estate equity, insurance brokerage, real estate brokerage, mutual funds, and non-full-payout leasing. Over the mid-term, banks expect to expand into data processing, securities underwriting, futures brokerage, management consulting, and travel agency services. Longer-term entry into telecommunications and insurance underwriting is foreseen by some banks. Regional and midsize banks are expected to follow a similar pattern, although the spectrum of their activities will be less broad in the short run; community banks will be able to offer only a small range of such services. The attraction of these new service areas is fees ranging from 12% for equipment leasing to for management consulting 37%, and to 64% for securities underwriting.

Interstate banking laws remain the principal barrier to complete fluidity of competition nationally. However, the reality is that banks are already competing within each state. For example, Citicorp has a million credit-card holders in California, and sells a variety of insurance products through direct marketing. Also, money market funds do not need to be based in the state to operate in California. The Bank of America holding company has over 400 offices in 40 states; Citicorp has 450 offices in 40 states; First Interstate Bank has 550 offices in 13 states; Manufacturers Hanover has 480 offices in 30 states; Chase Manhattan has 22 offices in 15 states.

These offices are for loan production and are legal if the offices do not take deposits. Overall, the issue of interstate banking is more a question of making competition more overt than it is one of enabling new competition. The capacity to cross borders is confined mostly to the larger banks.

Larger money center banks (New York, Chicago) perceive the California market as ripe for interstate banking because the California market is so dominated by the big five banks. Their view is that they can offer more competitive services because the existing banks are inefficient. In fact, California's extensive branch-oriented commercial banking system is both an advantage and a disadvantage in the new competitive market. Branches provide a direct marketing and distribution advantage, but they also create a large overhead and need for extensive revenue generation. California's commercial banking industry is less productive per employee because of the extensive branching system with its larger number of nonrevenue employees. Banks are now closing branches and reducing their workforce to meet the changing market conditions.

The legislation that enabled S&Ls to enter more traditional and nontraditional banking services has had an important effect on the performance of California's S&L industry. S&Ls have been slower than banks to adapt to new competitive pressures, and have had a number of problems in entering markets they were not equipped to compete in. In addition, many S&Ls diversified into (or were created to enter) specific market niches, such as development financing, with some negative consequences.

Changing Markets

The health of California's commercial banking and S&L industry has been heavily affected by the economy, and by the past investment decisions of the commercial and savings and loan industry. The larger commercial banks, in particular, have been hurt by their concentration of international loans, by loans to the now-volatile agricultural industry, and by fluctuations and uncertainty in real estate.

Crocker Bank, for example, has suffered from over $2 billion in nonperforming loans--many to international clients. As they were in serious trouble, their primary stockholder, Midland Bank of England, bought them out completely, making Crocker the largest foreign-controlled bank in California. Bank of America, which has also been troubled by foreign loan performance, is now suffering from a large number of nonperforming agricultural loans. They entered the farm lending market during the late 1970s, when agricultural real estate values and promising export markets provided a seemingly sound basis for lending. Bank of America has had to take some extreme measures to recover from its portfolio difficulties, including closing branches and laying off workers for the first time. However, some of these steps also served the purpose of general improvements in competitiveness.

Foreign-owned banks are highly interested in expanding in the California market both because of the consumer market and role the state plays as a gateway to trans-Pacific trading. They now control 18.7% of the total assets held by California banks (if Crocker is included). This level is even higher if non-California deposits are excluded from the total. The California market is an important gateway for imports, and a source of deposits for financing commercial and industrial loans for trading companies from the Pacific Basin and Europe.

Foreign-owned banks take a long-term view of their development and growth in California. Nonetheless, they are leveraging their stockholders' investments at a growing rate through careful acquisitions of California commercial banks. There is little threat to the California capital market from foreign-owned banks, however. The reason for this is that in order to maintain deposits commercial banks must serve the local customer base. Every $20 million in commercial and industrial loans usually requires $1 million in compensating deposit balances from borrowers. The real issue may be whether or not California banks are assisting California companies in entering the Pacific Basin markets, or whether they are merely helping new foreign owned firms enter the U.S. market. This is clearly a complicated issue, less related to the ability of banks and firms to compete than to the purposes for which they do business.

There is no doubt that foreign banks intend to capitalize on California's strong consumer market. Japanese banks, in fact, have a market strategy that has involved accepting lower profit in the short run to establish their market position in the longer run. They pick a market niche, sell their product at a low cost, and penetrate the broader market over time, as they do in other sectors. Japanese banks are specializing in working with state and local governments in industrial revenue bond finance. They have also been actively involved in providing stand-by letters of credit to back bank obligations of municipal governments.

The larger context of Japanese banking is the strategic rationale of having available in the United States credit capability for those Japanese firms that are or will be manufacturing here or warehousing inventory--whether they are producers, suppliers or buyers of Japanese products. The reason for this stems from the social role played by banks in Japan. The "Zaibatsu" structure of interlocking ownership and industrial collaboration among Japanese firms motivates banks to locate abroad so that they can provide both credit and related services to their firms as they penetrate new markets. Banks such as Mitsui, Mitsubishi, Sanwa, Sumitomo, are all part of this network of Japanese banks and industry. Acquiring California banks is important because it enables more effective sales and production in California high-technology and consumer product markets.

While having banks in target country markets is not essential to trade and manufacturing, it is convenient. The importance of concentrating U.S. deposits in the U.S. headquarters of foreign owned banks is that a deposit base enables a foreign business to more easily establish letters of credit and make trade arrangements. In general, companies like to be close to the market they are entering and, once there, tend to use banks that are familiar with their business and credit needs. Thus, the deposit concentration in foreign-owned banks suggests the creation of a U.S. platform for business finance in the leading economic communities of the California market (e.g., San Francisco, Los Angeles).

Japan has made a significant commitment to enabling its trade to expand internationally. Japan is the second largest international banking nation. Among the industrialized countries, by far the most important nationality groups were the U.S. banks, with a share of 28% (or $615 billion in 1984) of total reported assets, and the Japanese banks with a market share of 23.5% (or $514 billion in 1984). In fact, the Japanese are very close to equalling the U.S. banks position internationally.

Having California banks expand into overseas markets will be important to competitiveness. However, this is not easy. While the United States maintains a generally open-market policy on acquisition of banks, other nations are only now beginning to open up. Pacific Basin nations, however, where California industries should be well positioned to do business, are not uniformly open. Singapore, Hong Kong, Thailand, and the Philipines are open, while Korea, China, Taiwan, Indonesia, and particularly Japan are not.

Ideally, global reciprocity in banking would be desirable, but the ideal condition does not now exist. California businesses cannot do much to improve the openness of these markets, other than by using indirect approaches, such as having nonbank operations and trade services, or forming joint partnerships with overseas companies in these countries. California government has limited options here as well.

U.S. national policy will be the ultimate source of efforts to change overseas practices. The current policies on international banking are covered by the Bank Holding Act of 1970, as amended, and the International Banking Act. However, while there are currently no state restrictions on international banking, California could consider--as it examines interstate banking in 1986--the possibilty of requiring reciprocity in banking practices in nations that wish to acquire California banks. The legal complications of this type of policy would be numerous, and might be considered beyond the purview of the state because such a policy could restrict international trade, which is, fundamentally, a national policy domain.

The S&L industry has been the most affected by deregulation and the larger market shifts. Their traditional portfolio of long-term loans at fixed rates and regulatory constraints on interest paid did not permit them to become competitive during the period when interest rates rose and clients shifted their deposits from passbook savings to accounts bearing higher interest. Once they were able to enter new markets, few S&Ls could move rapidly to compete with banks, or other financial industry service firms.

Deregulation--nationally and within California--permitted more competitive strategies. One attractive strategy for S&Ls was to invest in real estate development. Some real estate developers bought small S&Ls and used deposit brokers to find more depositors. The deposits were then used to finance real estate development. Unfortunately, several of these development-bank S&Ls found their net worth wiped out when one or more projects failed. This problem has also hurt other S&Ls diversifying into the commercial real estate field.

The need to compete pushed S&Ls to offer higher interest rates and to devise new types of loans to offset them, such as the variable rate and adjustable interest loan. However, the volatility of interest rates over time places an unusual stress on consumers--particularly the negative amortization type of loan. As a result, S&Ls are concerned about the potential for future loan defaults as well as potential cash shortages if interest rates decline significantly.

Federal regulators have taken over or ordered new management for several California S&Ls in the past year. All S&Ls face higher insurance premiums for deposits insured by the S&L system. Foreclosures have gone up 600%; reserves are down to $3 per $100 of liabilities and many S&Ls have found their net worth cut in half. Profit has dropped 75%. About 20% of California S&Ls generate almost 95% of S&L profits. Unless the structure of the system changes, high FSLIC insurance costs are likely to continue and to be directly passed to consumers. While there is some pressure to return the S&L system to its original home loan focus, and away from becoming "second class" commercial banks, the issue is not likely to be resolved in the near term. California S&Ls, while facing some continuing difficulties in competing, are improving their position.

Internal Factors

Technology

Technology is playing an increasingly important role in reshaping commercial banking and will begin to affect the S&Ls more in the near future. Electronic funds transfer (EFT) mechanisms, such as automatic teller machines (ATMs), debit cards, smart credit cards (cards with microprocessors on them) videotex (home banking and sales), smart credit cards, as well as expert systems (within banks) all will affect both ability to acquire deposits and to make transactions more efficiently. These technologies also affect users--both consumers and merchants.

Bank of America took a first step toward electronic funds transfer when it sponsored the development of an automated check reader in the 1950s. Electronic funds transfer mechanisms began to permit rapid debiting and crediting of accounts within and between banks over 10 years ago. Since that time, the emergence of ATMs has extended the electronic funds transfer mechanism to the consumer. The availability of ATMs has significantly reduced the need for in-branch staffing and for new branches, although banks claim it will not lead to reductions in employment. While used primarily by commercial banks, ATMs are now being used by an increasing number of S&Ls. Clearly, the availability of an ATM has become an important competitive tool for all banks because it increases customer access at locations and times not otherwise feasible. Even small banks are now installing ATMs to remain competitive. For larger banks, ATMs help expand interestate banking-type transactions, through national agreements to network by banking groups. A Bank of America customer can make some transactions in New York as easily as in California. ATMs thus give more of an advantage to larger banks than to smaller banks.

Debit cards, which substitute for check writing are now being test marketed by several banks. In August of 1983, California's big five banks announced the formation of an electronic network to permit merchants to accept debit cards at the sales counter. Debit cards help merchants by

lowering accounts receivable (there is no float on debited funds) reducing transaction costs (including interbank transfers) and reducing exposure to fraud (bad checks are avoided and fraudulent credit cards cannot be used, although the problem of stolen cards remains).

"Smart cards" will be entering the market within the next few years as well and may be part of the debit card product made available to consumers. Smart cards are credit cards with microprocessors built in. They can store information, calculate transactions, and authorize purchases, as well as improve credit card security. Smart cards are being test marketed in Europe and in some U.S. areas.

Videotex is a computer-based system for carrying out sales transactions that is expected to increase in availability over the next 5 years as more TV cable systems offer two-way operation. However, competition between satellite dish communications and cable systems may slow this process somewhat. Individuals will be able to subscribe to cable connections with computerized transaction systems and will be able to review products and conclude sales, including paying bills and making related bank transactions. Home banking and sales of related financial service products, such as insurance in the home will be feasible as a result of this technology. Several of the large banks in California are test marketing home banking at the present time. Telephone banking is already available in most California consumer markets. Simpler than computer home banking, but relatively similar, telephone banking permits consumers to pay bills by punching in the numbers on a touch-tone telephone.

The impact of the increasing range of electronic transactions on competitiveness and employment in the California depository institutions sector is not known. The number of employees required for traditional transactions (e.g., tellers) is likely to diminish. The number of more skilled employees required to manage operating systems is likely to increase. There is no way to determine how (or if) the long-term growth in electronically based marketing (through computers and television) will affect employment in telemarketing and customer service. Currently,

substantially reduced employment does not appear to be a likely consequence--but growth in employment does not appear likely either, for this area.

Expert systems--artificial intelligence based computer software--that reduce the level of skill needed for completing a wide range of financial transactions are now being experimented with in banks. Software firms specializing in the development of computerized systems to enable more efficient management of the range of banking transactions--from accounting to more complex securities trading--are increasing in number. Most large banks are planning for the integration of expert systems as part of their efforts to control costs of transactions and improve efficiency and productivity of workers. It is too early to estimate the impact of expert systems on the future of California banking or banking in general. However, the chance to make at-home comparisons of services offered by different banks would be expected to increase competitive pressures.

In general, the prospects for moving toward a "paperless society" remain good, but the reality is still several years off. Most financial services firms are struggling to incorporate computerized systems into their service and internal management. Recently, federal suits have been brought against securities firms as a result of both misuse and mismanagement of the rapidly growing and highly complex financial services data management systems. As the banking industry becomes more diversified, the prospects for serious problems in data management appear likely--with concomitant risks for consumers as well as depository institutions.

Human Resources

Human resources issues are particularly important to California commercial banks as they attempt to maintain their competitive position in the state and in the broadening financial services market.

California commercial banks have more employees than the national average because of the extensive statewide branching system, which requires headquarters employees not engaged in banking. While California has 6% of banking companies it has 12.7% of employees. As a result, California bank financial performance and productivity are slightly below the national average. Since 1981, the number of employees has been decreasing by about 5,000 workers annually; the reduction can be expected to continue for at least one more year and perhaps up to three more years. Bank of America has let go over 7,000 workers since 1982 and Crocker has dropped 2,000; other large banks have followed. Some of the loss in employees may be at least partly offset by hiring for the new financial services banks are offering. However, there are no data on how much (or whether) prior layoffs have been offset by growth in new financial services.

A critical issue in commercial banking is how successful they can be in shifting existing employees to emerging service areas, such as real estate brokerage, securities, insurance, management consulting and data processing. Fundamental to maintaining employment is upgrading basic reading, writing, and communications skills of employees. This is a serious problem at the subsupervisory level. California's banking employees include a significant number of Hispanic and Asian workers. An SRI study of three banks showed a range of 25% to 72% Hispanic and Asian.

The causes of low skill levels relate to low salaries, recruitment practices (referral), screening and selection processes, lack of incentives, and limited training opportunities. The problem is made worse by supervisory difficulties with employees from different cultural backgrounds. The Bank of America is using the California Worker Employment Training program (CWETA) to retrain employees in-house and thus avoid layoffs. This is a creative approach to sharing the cost for maintaining employment (the bank contributes to the state unemployment insurance fund, but has rarely discharged employees until recently). However, the overall problem is so large as to require far more. A consortium of banks in the San Francisco Bay Area is now examining how they can work more effectively with community colleges to develop needed curricula and programs for retraining and skills upgrading.

Ultimately, there may be a risk to California's employment in the banking industry from competitive sources of labor. Technology has enabled service providers in any location to offer financial services. Back-office services, in particular, are now being moved from money center communities to low cost, high quality, labor markets, such as Salt Lake City and Phoenix.

Firms specializing in back-office services, such as State Street Bank, in Boston, can contract with large institutions, such as pension funds, for which they manage transactions, manage cash flow, reconcile accounts, and the like. Out-of-state providers may be as far away as Luxembourg or the Barbados and may compete to offer financial services to large and small California banks. Thus, telecommunications and competitive labor pricing and skills might, in the long run, lead banks to more cost-effective procurement strategies that would reduce bank employment in California.

Management

Management innovation has become a necessity for commercial banks as well as for S&Ls. Banks have been more adept than S&Ls in responding to new markets. S&Ls have been characterized as slow and poorly managed.

Competitive Assessment

Management of the larger banks is trying to sort out the pressing problems created by poor investment decisions and the shifts in the national economy over the past 4 years. Most smaller banks have done reasonably well, keeping to a market that was far more local and less volatile. However, even smaller banks have made errors of judgment in their rush to compete. Several have experienced losses as a result of great expectations from entering new markets, such as real estate investment and data processing. Overall, commercial banking in California is still a growing market and has good prospects, provided there is no worsening in the problems of the larger banks (particularly those with large international holdings), and the few troubled, smaller, commercial banks.

The number of troubled S&Ls in California is increasing. While the business was "heaven on earth" in the 1960s and 1970s, S&Ls were ill-equipped to deal with the changes in the economy and in regulation that came in the 1980s. California's S&Ls have recovered from the dramatic collapse of 1981-1982, although there are 5% fewer S&Ls than before. The decrease came largely through an ongoing process of merger and acquisition. However, the number of firms has increased since 1982, and the number of offices has continued to climb. There has been a 300% increase in the number of S&L offices since 1970. Neither the decrease in the number of California S&Ls nor the increase in the number of offices has reached the national average, however. California had 3.9% of the nation's S&Ls in 1970 and in 1984.

California's larger S&Ls have moved aggressively into out-of-state aquisitions. Seven California S&Ls had 410 out-of-state branches in 1984. Companies such as Home Savings and American Savings have been able to acquire selected (troubled) S&Ls in Ohio, Missouri, Florida, Texas, and Arizona, avoiding the more insolvent companies that are now plaguing some state governments.

Even when the industry has been struggling, California S&Ls were doing better than the national average. This is largely due to the fact that more California S&Ls are publicly held, rather than being mutual associations. California S&Ls had 23.9% of the nation's gross profits in 1983, below the 1980 peak of 37.6% but good considering the hard times. Gross profits as a percent of assets were 113% of the nation's average in 1983, and have usually been 6% to 18% above the national average for the past 15 years.

Credit unions, while a small part of the depository institutions in California, have good potential for expansion because of their employee- and association-related market contacts. Credit unions have decreased in number and lost 1% of market share nationally over the past decade. Deposits have grown to $14.4 billion, which is 13.2% of the national total. Per employee assets have been higher than the national average.

There is extensive competition in the California's commercial banking industry, as shown by the many new banks being started. So far, this new competition has had little effect on consumer costs. Several large banks are experiencing significant difficulties which are being slowly worked out (part of Crocker's nonperforming loans have been taken off its hands by the parent British holding company; similarly Bank of America has been selling assets and working out problem loans). The full impact of international, agricultural, and real estate loan problems on the industry has yet to be determined. (For example, Mexico's recent earthquake will have some mid-range effects that have yet to show up.)

New technologies will help California banks remain competitive, if labor costs and turnover can be managed. However, banks will have to be even more aggressive in new service areas, as well as the traditional ones, if they are to retain their market share against out-of-state firms.

Foreign-controlled banks are playing a greater and greater role in the state. This may be inevitable, and may be a fundamental element of the globalization of the economy. Foreign controlled banks want to increase exports into the United States, as well as to generate profits. Can California banks be said to be doing the same abroad? Their investments overseas are expanding, but not for financing entry of U.S. firms into new markets as much as for direct local loan placement.

Interstate banking, or its unofficial equivalent, also seems inevitable. As interstate banking become a reality, either by default or through regulatory reform, the state may want to institute a policy that requires at least a portion of net new deposits to be invested within the state as a strategy to maintain capital in California.

Finally, if California commercial banks are to remain competitive and improve performance, significant new investments in human resources are critical. Without these, difficulties in operating efficiencies may be significant enough to force banks to subcontract services out of state to providers with lower cost, higher quality labor. This implies a need for

continued state involvement with the financial services industry in education and retraining initiatives.

The S&L industry nationally and within the state is still undergoing a process of adjustment and shakeout to the changing financial services market. California's S&Ls, overall, are doing better than those in the rest of the country. The larger question is the overall viability of the S&L business in the United States. Will it have to return to specializing in home mortgages or will S&Ls become second-class commercial banks? These issues, layered on top of the generally less sophisticated management style of S&Ls, will make successful performance increasingly difficult for the state's industry.

Credit unions may be a suprise factor in the financial services industry in California. Credit unions affiliated with affluent and expanding employment areas (such as the professional segment of Silicon Valley) are expanding and have a strong base for competition in consumer credit, home improvement loans, and auto loans. They might be expected to show some growth, but will still be small relative to the overall financial services industry in the state.

Financing California Enterprise

The health and adaptiveness of California's financial service industry plays a broad and important role in the competitiveness of the rest of the state's industry. This role concerns, primarily, the commercial finance segment of commercial banking, but it also includes industries not discussed earlier, including venture capital finance and investment banking. The importance of the role of California's financial services industry is described below, followed by a review of innovations in finance where banks--as a result of deregulation and more competitive finance industry environment--are likely to play an even greater role in the future.

Industries within regions continually evolve through different stages of development: emerging, expanding, transforming. Each stage brings with it a different set of financial needs, such as increased investment in R&D for the computer industry and new investment in capital improvements for basic manufacturing.

The high financial requirements often occur at a time when the perceived risk levels of the industry are high or potential returns are constrained. Although any industry can obtain capital if it can pay the interest required or sacrifice the equity needed, it may have difficulty doing either when it is in the emerging or transforming stage.

The Emerging Stage

During the emerging stage, when no revenues are being generated but substantial costs (both long- and short-term) are being incurred, industry viability is still uncertain. Companies in this stage have limited or no access to traditional financing. California industries at this stage of the life-cycle include biotechnology, robotics, medical technology, advanced materials and some specialty steel producers.

Company funds for emerging industries typically are obtained from the entrepreneur's own sources, from venture capital providers, or from government support programs. High-risk providers, such as venture capitalists, impose restrictive conditions and demand high rates of return for their investment; the entrepreneur must give up a substantial equity position and submit to close monitoring and control.

The Expanding Stage

By the time an industry moves into the expanding stage, it has shown early signs of long-term viability and has started to generate revenues. Typically, the expanding stage begins with unsustainably rapid rates of growth in sales, which later taper off to more moderate rates of long-term growth. Expanding industries in the high-growth phase include the software segment of the information services industry, aerospace, and tourism.

Rapid growth shifts a group of high-risk start-up ventures toward becoming a large, established, maturing, low-risk industry. At first, the expanding industry is supported by second-tier financing from venture capital providers, by trade credit, and by finance companies whose close monitoring and heavily collateralized loans are well suited to both high growth and relatively risky financing. Investment funds and investment bankers enter into the expanding stage as well, with private placements to selected investors and with initial public offerings of stock. As growth becomes more reliable, the industry becomes a mainstream user of capital from traditional sources such as banks and money markets.

The Transforming Stage

The transforming stage of the industry life-cycle introduces great uncertainty into the industry's financial requirements. Markets become saturated, competition intensifies, margins become thin, and the industry casts about for ways to survive. During this stage, companies follow one of three strategies: acceptance of decline and failure; dematuration and consolidation into a tighter, more focused industry; or transformation into a different industry.

Very few firms simply roll over and die. The vast majority respond to adversity with renewed energy and a burst of resourcefulness. Companies that choose to demature continue to serve the same markets but make massive changes in their internal structure, stripping away excess capacity,

modernizing production, upgrading product lines, and taking other actions that allow them to emerge as tightly focused, competitive industries. California industries that seem to be following the dematuring strategy include motor vehicles (NUMMI), "big" steel (i.e., the Fontana plant), major appliances, and agriculture.

The second survival strategy is transformation. Transforming companies diversify into new markets and new businesses, divest themselves of unproductive lines of business, use extensive R&D to create new products and new processes, invest heavily in conversion of plant and equipment as well as training of the labor force, and acquire needed expertise and technology through joint ventures and acquisitions. Industrial machinery (especially robotics) and health services are two industries undergoing transformation.

Constraints on Capital Markets

U.S. businesses obtained between $500 billion and $600 billion in financing in 1984. When loans to governments, households, and financial firms are added, the estimate of financing obtained in 1984 amounts to several trillion dollars.

The amount of capital ultimately available to California is virtually unlimited. The key issue, as in any region, is access to capital. California's access to capital is a function of five critical factors:

- Risk--Access is influenced by how the investor perceives the credit risk, duration of exposure to that risk, and liquidity of the proposed investment.
- Return--This is what the investor or lender perceives as the dollar amount or percentage of profit that the investment must generate.
- Channels of access--These are the means the company employs to obtain capital. Some have direct access to capital markets and investors using company contacts or brokers; others have mediated access using banks, finance companies, investment companies, insurance companies, or investment funds. Access may be constrained by regulations or by lack of an efficient channel.
- Information--The investor and borrower both need to be familiar with the company, markets, competing channels of access, and methods in order for the financial transaction to be completed.

- Attitudes--The willingness of investors to place funds depends in part on how the MidAmerican region is perceived as a whole, how the industry is viewed, and the type of investment.

A wide variety of capital providers serve California. These include intermediary institutions (banks, thrifts, finance companies, insurance companies, investment funds), brokers ("deal makers" of various kinds who arrange transactions), and direct investors or lenders (who risk their own funds).

Capital providers concentrate on specific lines of business lending, investment, or brokerage. Without exception, however, all providers place funds based on their assessment of individual company situations; none will risk funds solely on the basis of industrywide or regional aggregate information. Programs to augment an industry's capital access must, therefore, enhance the individual company's ability to manipulate one or more of the five components identified above.

Even today, when most financial services companies are expanding into each other's traditional lines of business, each capital provider tends to concentrate in certain financial markets according to the risk characteristics and the tenure (duration) of their investments and loans.

Obtaining Capital to Meet California's Needs

Traditional forms of financing are increasingly inadequate, and financial innovations are needed. Fortunately, the U.S. financial community is in the most creative and innovative period of its history. The financial industry in California has exhibited surprising creativity, and the capital-hungry industries themselves are becoming increasingly sophisticated and innovative.

Capital availability for California can be provided through public and private innovations aimed at overcoming barriers to access as described below.

Risk Reduction

Risks can be reduced by decreasing the credit or investment risk, increasing liquidity, or reducing the duration of investment exposure. Sometimes ameliorating investors' perceptions of risk is enough to increase access. Possible instruments for risk reduction include third-party guarantees, loan insurance, subordinated debt, loan pooling, securitization (which can include pooling and revenue pass-throughs), and loan loss reserve funds. These instruments can be developed by the government or by the financial sector. California does provide some of these forms of risk reduction, including loan guarantees.

Enhancing Return on Investment

Returns to the investor or lender can be enhanced through revenue increases, cost decreases, tax advantages, or approaches that increase the certainty (or reduce the volatility) of returns.

Enhancement of return can involve several forms of direct government participation. These might include: regulatory reforms in banking laws, such as removing usury limits and eliminating prohibitions against compensation through equity-like cash payments (equity kickers); tax incentives that increase return by reducing tax rates on capital gains; and provision of "linked" government deposits to banks, which would provide the institutions with a source of capital to back increased lending for specific uses. California is one of few states that permit the use of equity participation agreements among state chartered banks. As a result, some banks, such as Wells Fargo, have targeted loans with equity components as a major product development area.

Return on investment can also be enhanced by financial institutions through innovative lending or investment practices such as leveraging loans or investments by selling participations to other lenders at lower rates, negotiating equity participation in loans (i.e., accepting cash or stock

warrants in return for lower interest and longer terms), and various forms of flexible interest rate structures (interest rate swaps, interest rate futures, and use of various ceilings, floors, front-end fees, deferred income, and performance-linked repayment approaches).

Improving Channels of Access

Relationships with financial institutions are often the key to acquiring needed finance. Innovation in access channels is just beginning. Industry and government can work with clients to shape financial instruments more creatively, mixing different sources and terms to meet client needs.

In some cases, the government can have a strong role in this area of innovation. Federal and state government loan programs frequently provide partial or complete financing help to leverage private debt. State-sponsored venture capital funds, financed either by general revenues or by bonds, and capital from state employee retirement/pension funds are being used to increase the availability of capital in more than 20 states. States are increasingly working through privately managed venture funds as well as running their own enterprises. However, California has such a strong venture capital industry (i.e., a sufficient amount of venture financing targeted to investments in the state) that this type of policy may not be necessary, at this time.

Governments are also enabling and sponsoring new financial intermediaries, such as development finance companies, that take public and private capital and leverage the funds by making mixed debt and equity placements. Portions of these investments are often guaranteed and resold (through the SBA program, for example). California was the first state to enable formation of Business Industrial Development Companies (BIDCOs) to perform this function. California legislation has served as a general model for other states.

Governments can also provide tax relief to businesses to improve their cash flow (reduction of income tax, property tax abatement, and tax holidays).

In the private sector, the channels of access within a region are being increased through the organization of private venture capital funds that have a primarily local or state focus (e.g., Cleveland's Primus Fund, Inc.). Joint ventures, R&D limited partnerships, and employee-owned cooperatives are becoming more common means of addressing the need for access to capital at certain stages in industry development.

Improved channels of access can help California firms at all developmental stages. Government loans and mixed public-private funding are particularly attractive for dematuring industries, such as agriculture, industrial machinery, and smaller chemical producers. State or private venture funds are essential to increasing the supply of capital for start-ups in new industries such as software and biotechnology. However, venture funds for leveraged buyouts are also essential to financing major shifts in direction among mature, transforming industries, such as steel and heavy equipment. For industries that need higher levels of R&D, financing instruments such as R&D partnerships (often sponsored by industry members themselves) provide a direct means of facilitating adaptation to economic forces. In the larger industries, including steel and heavy equipment, joint ventures are now becoming fundamental methods of financing innovations in plant modernization and product line expansion. Partners, however, are increasingly being found offshore, rather than in the United States.

Using Improved Information

California industries can improve their access to capital by acquiring (and having investors or lenders be able to acquire) appropriate, timely, and accurate information. Sources for needed information can include services developed by states--either in-house or under contract with an outside provider--such as financial counseling, loan preparation, investment

packaging and brokering, and initial stock issue underwriting. California is active in some phases of business loan preparation. In some instances government may find that "incubators" that provide a continuum of business services and information for start-up firms can reduce financial needs and improve survival rates in emerging industries. Venture finance companies are increasingly in the "incubation" business, helping first to finance new firms with venture capital and then to nurture them through their early development. Technology centers, sponsored by states, universities, and sometimes businesses alone, are becoming a popular means of helping companies gain access to information on technology and markets.

Information on capital markets is always important, but it is most critical to emerging California enterprises that are uncertain what financial sources are appropriate for them. For emerging industries--both those just starting out and those passing into the first- or second-tier venture financing stage--finding both interested investors and help in business planning is very important. This is true even for some firms with venture financing, such as new participants in software, biotechnology, robotics, and health services. Such firms have often given up significant equity to gain initial financing and, as a result, have difficulty in finding sources for their next level of debt or equity.

Information, however, can be equally critical to mature, midsized industries that require levels of capital beyond what their traditional lenders can provide. Assistance in finding investors--for equity investments or mergers and acquisitions--might be critical to completing the process of transformation in industries such as industrial machinery or specialty chemicals.

Mobilizing Capital Markets

The capital needed to finance the continuing transformation of the California economy is available in the global capital market. The problem is mobilizing both suppliers and users of capital to consider new approaches to meeting the finance needs.

In part, the successful transformation of the banking and securities industries into an integrated financial services sector (as discussed earlier) will be measured by their response to changing demands for capital. However, the current economic and competitive climate has, at least temporarily, made financial institutions far more conscious of risk, profit margins, and short-term returns on investment. As a result, despite growing competition in financial services and increasing pressures to transform, the industry may not take the initiative in exploring alternative approaches to financing industrial development. The innovative financial techniques described in this report constitute a menu of options that can be used, under the right circumstances, to improve capital access. There is clearly a basis for collaboration among the public sector, private industry, and the financial community to encourage use of these approaches, but the shared interests of industry, federal and state governments, and the capital markets need to be better articulated.

State Role in California Industry Finance

Regulatory tools and targeted investments are potent public-sector tools for increasing access to capital. Despite recent federal regulatory changes (such as the Garn-St. Germain Act), U.S. commercial banks still operate under laws that deter them from using new approaches in lending to and investing in business. In Japan, on the other hand, banks and government play a critical supportive role in industry as partners in investment and change.

States are increasingly recognizing how state policy can enable financial markets to serve the needs of industry. Until recently, however, state government has traditionally focused on direct provision of financing to industries in need of assistance. In these programs, funds from the state general fund or from bond issues are used to provide direct loans or loan guarantees. At best, such programs can provide only limited resources to industries in need of assistance.

In recent years, states have started to recognize that they can respond directly to the constraints on capital markets by helping lenders and investors to reduce risks, increase return, improve channels of access, enhance information, and change investor attitudes toward investment. Accordingly, they are addressing capital market constraints by redefining their financial industry regulatory policies and industry finance programs. This appears to the most appropriate form for California as well.

States that make direct subsidies are concentrating their subsidies more often on R&D tax credits and new capital tax credits and on incentives related to job generation by new firms. Clearly, subsidies of bank lending, through linked-deposits programs, for example, are useful in targeting subsidies to specific industries that are in particular difficulty. But these approaches, in the end, are only temporary measures that must be complemented by larger reforms in industry finance.

Subsidies of industry cannot replace improving the efficiency of the capital market. Increased efficiency, ultimately, is a consequence of providing better market information, carefully modified financial industry regulations (interstate banking), creation of new financial instruments, and strategic incentives of public funds such as pension investments. Achieving this will require increased collaboration among industry, government, and capital markets. While California is ahead of most states in terms of introduction of innovations in regulation, productive changes are still needed and can be accomplished only if all three sectors have a shared agenda.

VIII COMPETITIVENESS STRATEGY FOR CALIFORNIA

The Basics

To compete in the global economy, California must "out-produce, out-smart, and out-sell" its competitors. This requires a rededication to manufacturing innovation, human resources quality, and marketing expertise. Each of the key export industries in California faces competitive threats that can be overcome. While external factors such as the value of the dollar, trade practices and federal policies are clearly critical to determining the ability of California industries to compete, regaining California's competitive edge through value-added production is clearly within California's own hands--its enterprises, its workers, its government. Regaining that edge will require concerted action by all sectors. This strategy outlines a set of steps that can be taken now by the private and public sectors in California to help regain competitiveness by focusing on three basic areas:

- Competing through value-added production
- Enhancing worker productivity
- Expanding markets.

While foreign trade, the value of the dollar, and interest rates are clearly shaped by national and international forces, our competitiveness analysis clearly shows that major steps can be taken at the state level to address the root problems of declining competitiveness. Increasing productivity through investments in technology and human resources and finding new markets are important actions that can and should be taken by the private and public sector at the state level to address each industry's needs. (See Table 27.)

Table 27

SUMMARY OF ACTIONS NEEDED FOR KEY CALIFORNIA INDUSTRIES

Industry	Element: Value added production	Element: Worker productivity	Element: Expanded markets
Agriculture	Value added products	New management skills	FOREIGN MARKETS
High tech Manufacturing	PROCESS TECHNOLOGY	Engineering skills	New markets
Basic Manufacturing	FLEXIBLE MANUFACTURING AND DESIGN	Skills retraining	Import substitution
Aerospace	Process technology	Engineering skills	COMMERCIAL MARKETS
Finance	Automation technology	Skills retraining	PACIFIC BASIN MARKETS

Note: Capital letters indicate priority actions for each industry.

The focus at the state level should be on building the capacity to compete through innovation and investment in the basic ingredients for competitiveness--advanced technology applied to manufacturing, innovative management, and a skilled and flexible workforce. These are key factors of production that can be enhanced at the state level. Because it is impossible to know with certainty what will be the growth industries of the future, state-level actions should focus less on targeting specific industries for assistance and more on providing support for the basic building blocks--advanced manufacturing, worker productivity, and expanded markets that cut across industries.

While financing is critical for each industry and is essential for investment in advanced manufacturing, worker productivity, and expanded markets, our competitiveness analysis indicated that increasing the supply of capital was not a problem which the state government itself should focus on as a priority. This is an area where federal policy will shape the overall cost of capital relative to foreign competitors, and the private sector in California can and should take the lead. As indicated in the analysis of the financial industry (Section VII) the focus of the state should be on increasing the efficiency by which financial institutions respond to industry needs

Applying Technology for Value Added Production

The first step is making a commitment to excellence in manufacturing. This requires a renewed focus on the application of process technologies in production of higher-value-added products. California has several existing advantages in this area that can be maximized. Advanced manufacturing technologies bring the economies of full-scale automation to short production runs through the use of "smart" machines and robots that can be reprogrammed quickly and inexpensively to do new tasks. (Over 75% of all parts made in the United States today are produced in batches of 50 or fewer.) The key advanced production system will be computer-integrated manufacturing (CIM) and California with its lead in computers, artificial

intelligence, and software is in a prime position to become a center for the development of increasingly sophisticated CIM. (An example of this potential is the recent joint venture between Measurex, a $160 million Silicon Valley software firm, and Ford Motor Company to develop a software system to link Ford's current "islands of automation" on the factory floor.)

The leadership in moving toward new horizons in advanced manufacturing must clearly reside with the private sector. Business must make the investments and strategic decisions necessary to develop and adopt new manufacturing process technologies. To capture the real opportunity in flexible manufacturing and computer-integrated manufacturing systems, California will need to move aggressively because others have targeted this same opportunity, including Japan and states of the industrial Midwest (e.g., Michigan).

The state government can make critical investments to help stimulate this development building on its current strengths through the state's universities. Working in partnership with the private sector, the state can help build the necessary technology infrastructure or capacity that can help the private sector move ahead in this area. California has the opportunity to draw on its existing strengths in its universities and federal laboratories in making manufacturing technology more accessible to industry. Possible steps include the following:

- Create Centers for Manufacturing Competitiveness as university/industry consortium partnerships to provide applied technology for industries in the development and adoption of new manufacturing/process technologies. Models of jointly funded technology centers have already been developed with the University of California in areas of microelectronics (MICRO at UC Berkeley) and magnetic tape (UC San Diego). New emphasis is needed in the applications of technology to advanced manufacturing. For example, the Ben Franklin Partnership Program in Pennsylvania provides state matching grants for applied technology centers at state universities focused on such areas as robotics and computer aided design and manufacturing. Participating firms in private industry share in the funding and determine what applied research is conducted.

- Form Manufacturing Engineering Centers of Excellence at state universities that would provide interdisciplinary research and training in advanced manufacturing technologies. These centers would receive special state "center of excellence" grants awarded on a competitive basis to support engineering education and manufacturing engineering research. Such centers would serve two important functions: (1) increasing attention to manufacturing technologies, and (2) encouraging training and research in multidisciplinary problem solving focused on real industry problems. MIT has established a model program in this area, funded largely by private industry. The National Science Foundation has created a national program to help establish engineering centers at universities focusing on industrial needs.

- Develop a Manufacturing Extension Service that would provide on-site technology and management assistance to firms in the development and adoption of advanced manufacturing technologies. This could be developed in association with university engineering and business schools and related to Centers for Manufacturing Competitiveness and manufacturing engineering centers of excellence. Some states have begun to experiment with this concept, which is a logical outgrowth of the successful agricultural extension model. For example, Georgia has operated an industrial extension service through Georgia Tech which provides engineering and management assistance to small and medium-sized firms. Massachusetts is now developing an Industrial Service Program that would provide assistance to mature manufacturing firms by helping the firms to introduce new manufacturing technologies, identify new markets, or restructure.

- Establish Flexible Manufacturing Core Production facilities using state seed money on an initial demonstration basis that would provide common processing centers for several participating medium-sized and small firms. Shared flexible manufacturing facilities could run on a 24-hour basis, shifting production runs to meet individual firm requirements. These shared core facilities, operated on a joint lease basis, would promote economies of scale, increase adapability to changing consumer needs, and reduce entry cost for new product manufacture since a dedicated plant operating at partial capacity is no longer required. These facilities can prove especially important for aerospace subcontractors seeking new civilian markets, medium-sized high technology manufacturing firms, and basic manufacturing firms that need to share high cost production technology. The U.S. Department of Commerce is encouraging state initiatives in this area, and California's needs for increasing its flexible manufacturing capacity makes this state a logical site for demonstrations of this new concept.

These state-level activities would be aimed at developing capacity in manufacturing technologies and providing the networks for diffusion of these technologies through a variety of vehicles that build on the existing strengths of California's universities, federal laboratories, and private

firms. The state's role is to act primarily as a catalyst to help the private sector gain access to the most useful research and applications in advanced technology. Clearly, the process of adopting new manufacturing technologies must be industry-driven, based on the needs of individual firms to become more competitive. The state can, however, play an important role in helping firms gain access to what is available from public universities and federal facilities and in encouraging innovative joint action in this area.

Enhancing Worker Productivity

In addition to new technologies, the key to increasing manufacturing competitiveness is enhancing worker productivity and flexibility. In fact, investments in increasing flexibility in manufacturing must be complemented by investment in increasing skills and flexibility in the work force. Workers need new skills to operate and maintain new-technology equipment. The growth of new industries and the decline of older industries will require worker adaptability and retraining. Worker motivation and commitment will remain the cornerstone of productivity and thus efforts will be needed to ensure increased participation in the workplace. Therefore, an equal commitment to investments in human resources will be required to match the required investment in new technologies.

California industry faces a choice in how to compete based on its human resources. One approach is to focus on cutting human resource cost, the other approach is to increase human resource quality. Given the lower wage rates of our foreign competitors, competing through the the first approach will result in the loss of jobs and reduction in our standard of living. To compete and maintain our standard of living, California must focus on human resource quality, not simply cost. This requires investing in worker skills, (including communication, literacy, and numeracy skills) retraining employees for more complex tasks, and adopting new technologies in a way that allows workers to work creatively with machines to improve products and manufacturing processes.

Major steps are needed in the following key areas*:

- Education in basic skills--The need for a more adaptable workforce requires education in the "new basics" that include technical literacy. While firms will need to train workers for the specific skills required for the individual job, educational institutions will need to focus on a solid foundation of general skills. Much of the efforts currently under way in California that focus on education reform (e.g., SB 813) have begun to address this key issue. The business community, especially the California Roundtable, continue to give much attention to this concern, especially as it affects future competitiveness. The importance of basic skills for competitiveness need to be reinforced in future education reform efforts. In particular, state educational policy should focus on increasing the basic skills for the non-college-bound high school student as well as students in technical and vocational programs in both high schools and community colleges. Adult education needs to be expanded to provide the educationally disadvantaged with basic skills (including literacy training) that are required of entry-level high school graduates. These programs need not be integrated with industry specific training.

- Retraining and adjustment--Workers will be expected to acquire new skills as technologies change, and adapt to new jobs as industry requires change. A premium must be placed on worker adjustment to new assignments and new requirements both within and across firms. A commitment to retraining and adjustment assistance by both government and private firms is essential if the required level of adaptability is to be achieved. Programs such as the Job Training Partnership Act and the Employment Training Panel provide some assistance in this area, but much more clearly needs to be done. A more focused and intensive approach is needed that involves both of these key training programs as well as adult and vocational training provided by community colleges, working more closely with industry to meet retraining needs. Current training and retraining programs need to be reexamined in light of their ability to meet key competitiveness needs. In particular, the state needs a more comprehensive strategy for retraining which links the capacity of community colleges, the Employment Panel and other public institutions more closely with industry needs.

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* More detailed recommendations on education and training are provided in the report of the Human Resources Task Force for the Senate Select Committee on Long Range Policy Planning.

- Labor market matching--As rapid changes in industry and technologies create more structural employment change, more attention must be given to mechanisms that increase the efficiency of labor market matching. Both government and business need to invest in local labor market information sharing that will enhance the mobility of the workforce. Government employment programs, including the state employment service, need to provide assistance to workers in gaining job search skills. Efforts to create new labor market matching efforts in the Bay Area and Los Angeles need to be encouraged by the state as an important way to address a competitiveness issue.

- Employee incentives--Innovative management must place a strong emphasis on creating employee incentives for high quality performance and commitment. These include encouraging the adoption by the private sector of employment security policies that promote growing opportunity for employees to continue in employment in a firm, if they are willing to accept changes of assignment. Incentive stock options and employee stock ownership plans should be encouraged to reward individual employees and strengthen the link between pay and performance.

Linking investments in new manufacturing technologies and human resources skills is critical for moving toward higher-value-added production. These activities need to be planned in partnership with the private sector as part of California's overall strategic plan for the future.

Expanding Markets

Creating the capacity to produce more competitively is half the battle. Aggressively marketing value-added products is also required. Agriculture in California provides the important lessons--it is not enough to focus on production, it is also critical to promote new markets. Expanding trade is especially important for agriculture, aerospace, and high technology manufacturing. While the value of the dollar, trade practices, and federal policy clearly determine the overall shape of export markets (and California should be aggressive in making sure that its views on these issues are well known in Washington), much can be done at the state level to promote new markets and find profitable niches. At the same time, because California itself has become a major market that is served by industries outside the state, import substitution is an important stategy for

California. The rise of regional clusters or agglomerations provides an important opportunity in encouraging new linkages through import substitution. Key action steps include the following:

- Lobbying Washington on trade issues--The state interest in trade, especially with the rising Pacific Basin markets, is too critical to the state's economy to be left to Washington alone. California must make its presence known in Congress and in the Executive Branch to promote its interest in trade. This might be accomplished by creating a special California Trade Office in Washington

- Export promotion through state-sponsored trade missions, trade offices in key foreign countries, and finance assistance for medium and small businesses. While large firms may not need much state-level help, smaller firms can profit by assistance from the state--helping to provide information, making contacts, and providing some financial help. A major focus of export promotion should be California's comparative advantage as the "Gateway to the Pacific," targeting efforts toward the growing Pacific Basin markets. While California has become more active in this area through its new export financing legislation, activities of the World Trade Commission, and the California Economic Development Corporation's Pacific Basin Task Force, much more can be done to develop a focused state effort in this area. Opportunities may exist to join with some other Western states to jointly market products in the Pacific Basin.

- Import substitution through focused state efforts on a regional basis. Regional economic clusters create demands for support services and suppliers that are often met by firms outside the state. Publishing information on the types of services and suppliers needed by industries in the region can be an important service to new entrepreneurs. The state can also sponsor--in cooperation with regional private or public organizations--special studies of "backward linkages" between major producers and needed suppliers and "small business opportunities" based on profiles of small business in similar regional economies. Efforts under way in such areas as Southern California and Placer County to promote these types of import substitution opportunities need to be expanded to other regions of the state.

Building a Strategy

These three elements provide the basis for a competitiveness strategy for California. It addresses major factors influencing California's competitive advantage that are within the control of California itself and

can be built through a partnership between the public and private sector. Moving forward on this strategy requires several initial steps:

- Shared vision--Leaders in industries facing competitive threats and concerned state government leaders need to join together in formulating a shared vision of promoting competitiveness. Some possible elements for that shared vision have been suggested in this report.

- Action program--Using that shared vision as a base, leaders need to develop a specific action program that includes actions to be taken by both the private and public sectors. This action program should be developed through discussion and negotiations that include leaders from each sector.

- Ongoing competitiveness monitoring--Better mechanisms are needed to monitor trends in competitiveness on an ongoing basis and assess results of new initiatives.

- State capacity in competitiveness--The Legislature should take advantage of existing committees with jurisdiction over key areas related to competitiveness or, if necessary, consider creating one or more new committees to hold hearings, review proposals, and monitor developments in this area. Such committees could also analyze key legislation from the standpoint of its expected impact on competitiveness. The Administration should focus the activities of state agencies on this issue and assess the impact of all state actions in the area of competitiveness.

In summary, major attention should be focused on competitiveness as an issue critical to the future of the state; private leaders should be involved in the development of a major program in this area; and, where necessary, new public and private institutions should be established to give this issue the visibility that it deserves.

Most urgently, steps need to be take immediately to build a consensus among leaders from key industries facing competitive threats and state government leaders concerning the need for action. Consensus development should be stimulated through discussions across the state, focusing on what each sector can do to help promote manufacturing innovation, worker productivity, and expanding markets. Building a coalition for competitiveness in California that involves leaders from major industries is essential for moving ahead in this critical area.

INDUSTRIAL COMPETITIVENESS ROUNDTABLE

SRI International
September 19, 1985

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