

THE FUTURE OF BAY AREA JOBS

The Impact of Offshoring and Other Key Trends



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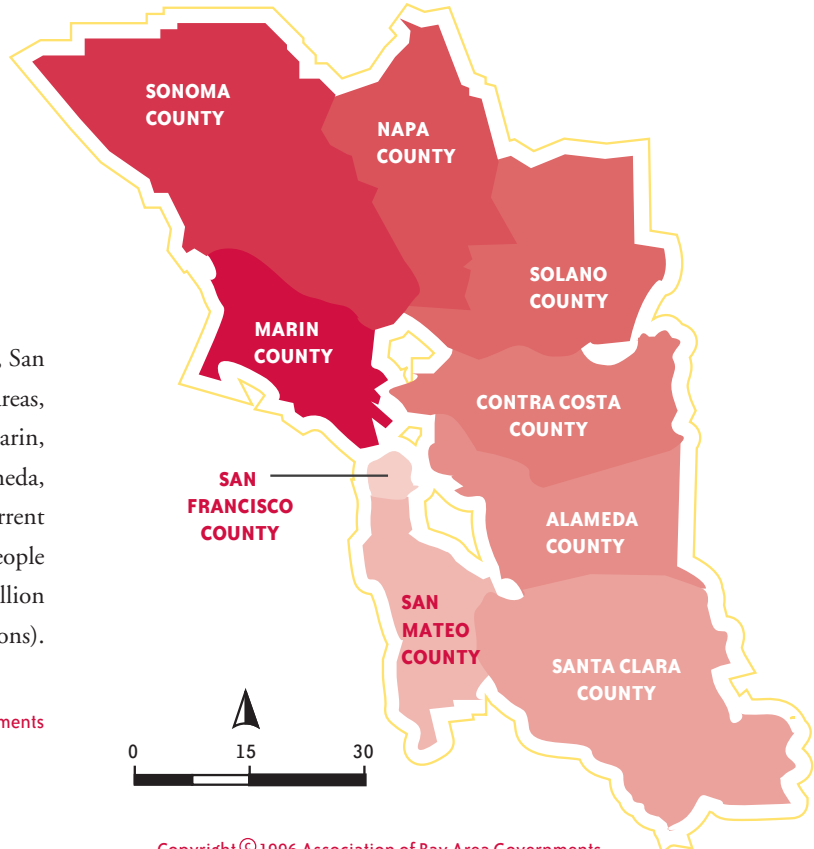
SELECTED BIBLIOGRAPHY

FIGURE 1

MAP OF THE BAY AREA

The Bay Area is comprised of the San Francisco, San Jose and Oakland metropolitan statistical areas, representing nine counties: San Francisco, Marin, Napa, Sonoma, Solano, Contra Costa, Alameda, Santa Clara and San Mateo. The region has a current population of approximately seven million people (6.8 million in the 2000 census, rising to 7.2 million in 2005 by ABAG 2003 projections).

Source: Association of Bay Area Governments



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INTRODUCTION

In the last two decades the Bay Area economy has seen jobs move out of the region to domestic and overseas locations, in search of lower costs and markets. Initially limited to manufacturing and assembly, the sophistication of the operations performed overseas has risen steadily and now includes computer programming, support and integration, and a range of other service and white-collar functions. Engineering and design, once performed almost exclusively in the United States and other developed economies, is also being done overseas by multinationals or by local companies contracted to them.

With some of the highest costs of doing business in the nation, Bay Area companies in particular have had major cost incentives to source and distribute their activities globally. Increasingly, however, other factors such as rising capabilities and growing market opportunities in other regions have provided additional motivation.

These factors, combined with a weak economy, have intensified interest in the media and among business, labor, government and community leaders in global offshoring and its impact on the domestic jobs base. Some strongly endorse offshoring as a strategy vital to competitiveness, while others are alarmed at the depth and speed of the changes that are occurring due to globalization and are proposing legislative restrictions.

By focusing only on offshoring, however, and ignoring key trends that affect jobs such as demographics and technology, the current debate lacks the balanced perspective needed to assess the many dynamics at work and the range of options available. Much of the debate is based on anecdotal information, without good empirical data. And little of the information that is available is specific to the Bay Area, which as one of the most globalized economies in the nation and the world's technology leader is at the center of the offshoring phenomenon.

With these considerations in mind, the Bay Area Economic Forum, Joint Venture: Silicon Valley Network, the Stanford Project on Regions of Innovation and Entrepreneurship and A.T. Kearney have joined to deliver an in-depth regional perspective on this issue. The objective of the partners and of this study is to help business and community leaders and state and regional policymakers understand the Bay Area's job market and how it is changing in response to key global and domestic trends. The model it provides is designed as a tool to anticipate structural shifts, both positive and negative, resulting from these trends. We believe that the analysis will provide the foundation for a broader and more balanced examination of what is happening to Bay Area jobs – and why. We also believe that the study approach and findings are applicable to other regions and have national implications.

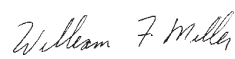
The best policies are proactive rather than reactive. Economic globalization is here to stay and will accelerate in the coming years. Managing it and the other key issues impacting California and the Bay Area's competitiveness and economic leadership will require strategic vision by business, government and community leaders alike.



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EXECUTIVE SUMMARY

This study has been prepared due to the intensifying debate on jobs and offshoring. In an election year, the debate is becoming particularly politicized. Bills to restrict offshoring have been introduced in as many as 37 state legislatures nationwide. In California, a dozen anti-offshoring bills have been drafted: some bar state services from using foreign call centers and other offshore resources, others restrict offshoring where sensitive information is handled, and still others require detailed disclosure of global sourcing. Increasingly, CEOs have been forced to defend their business decisions, as they argue for the importance of offshoring to business competitiveness and against protectionist measures.

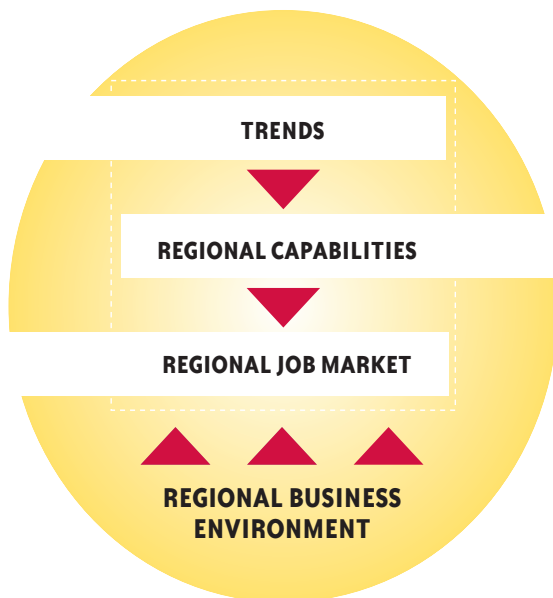
“It is vital for America that we maintain leadership in the industries of the 21st century – computer technology, space technology and biotechnology.... To lead in those industries, we have to think every day about our competitiveness.”

CARLY FIORINA, CEO,
HEWLETT PACKARD

Yet even as the debate heats up, there is a lack of perspective and little real data to help policymakers and the public understand how offshoring and other key drivers impact the job outlook in the region. To address that need, this study analyzed how offshoring and major trends are impacting the composition and future of jobs in the Bay Area. It offers a baseline profile of the job market – a close-up view of employment by industry, occupation and other variables. The findings are based on 120 interviews, analysis of 9,000 job listings in two leading Bay Area industries — semiconductor (including semiconductor equipment) and software — chosen to represent manufacturing and services, and an extensive review of secondary literature (*see appendix for details of the study methodology*). To understand the impact and changes to the job market, an analytical model was also developed based on four interacting components that will influence the future of nature of Bay Area jobs (see figure 2).

“The White House... supports [offshoring] of jobs — jobs going abroad — saying that that’s good for our country. Well, you tell that to the nine million Americans who are out of work.”

U.S. SENATOR
TOM DASCHLE



Source: A.T. Kearney analysis

FIGURE 2

ANALYTICAL FRAMEWORK

TRENDS: Long-term changes that have a significant impact on regional capabilities to support business

REGIONAL CAPABILITIES: A combination of regional workforce characteristics, experience and potential that contribute value to business

REGIONAL JOB MARKET: The profile, or structure and nature of employment across a region in terms of industry, occupation and company size, stage and growth

BUSINESS ENVIRONMENT: Local assets and resources that contribute to a location’s capabilities, including workforce availability, quality and cost of living, cost of doing business, infrastructure and policy environment.

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UNDERSTANDING OFFSHORING

Offshoring as a business strategy is not new; it is, however, broadening and accelerating. The offshoring of manufacturing has been underway for decades. What is new is the global competition for jobs in once insulated services, such as software, computer programming, business support functions (e.g., data management and processing) and applied R&D.

The Bay Area, as one of the nation's most globalized regional economies, is at the center of this phenomenon. Bay Area manufacturers earn almost 60% of their revenues in overseas markets and have been leaders in offshoring. 94% of Bay Area semiconductor and software companies interviewed for this study are using some offshore resources, compared to 66% among U.S. companies across eight industries in 2003 A.T. Kearney research. While high tech sectors appear the most affected, Bay Area biotechnology companies, financial institutions and other companies are also adopting offshore strategies. Venture capitalists are encouraging their portfolio companies to consider offshore options. These developments are affecting both the Bay Area's job market and how its companies are positioned for global competition.

The accelerating globalization of the job market is being driven by improvements in telecommunications, the entry of large developing countries into the global economy and growing capabilities in other countries to provide quality services and manufacturing and undertake increasingly advanced research and development. This rapid increase in capabilities to perform value-added activities in rising technology regions beyond Silicon Valley, from Beijing to Bangalore, and Munich to Jerusalem, is challenging U.S. and Bay Area companies to find new ways to collaborate, complement and compete with companies abroad. Rapid growth in markets outside the U.S., such as China and India, is also driving companies to locate activities and jobs closer to their customers. Companies are challenged to identify which functions

will move closest to the highest growth markets and which will stay in the area.

Offshoring, which is the global extension of corporate outsourcing, should not, however, be seen in isolation from the other key trends that enable it and are driving major job market changes.

TRENDS DRIVING JOB MARKET CHANGE

Five key trends – globalization, technology-driven improvements in productivity, the shift from a manufacturing to a service economy, business disintermediation (the modularization and segmentation of the value chain) and demographic shifts – are changing the character of the Bay Area's business capabilities and those in other regions around the globe. This is producing fundamental economic changes, including higher business productivity, the globalization of key segments of the workforce and increased job mobility.

KEY REGIONAL CAPABILITIES

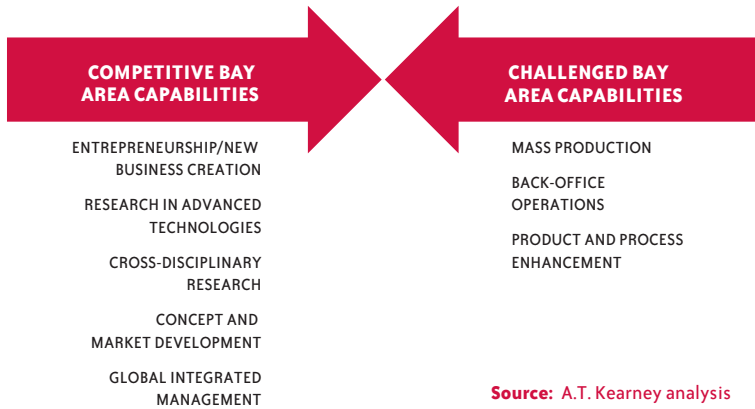
Companies choose to locate and invest in regions based on the competitiveness of the capabilities a region has to offer. This study found that the Bay Area is highly competitive in five key areas, and less competitive in three (see figure 3).

New business creation (entrepreneurship) and research in advanced technologies are well-recognized capabilities while cross-disciplinary research, concept and market development and global integrated management are less-recognized Bay Area strengths. The Bay Area is less competitive against other regions in the U.S. and overseas in three major areas: mass production (manufacturing), back-office (transactional and processing) operations and product enhancement in maturing industries. The reduced competitiveness in the latter is new, as the Bay Area is rapidly losing out

EXECUTIVE SUMMARY

FIGURE 3

BAY AREA CAPABILITIES



Source: A.T. Kearney analysis

to other regions in occupations associated with disciplined engineering and product development after the initial design stage.

Aligning these regional capabilities with the business lifecycle, it appears the Bay Area will remain a strong region in which to start a business, but will not capture the bulk of new jobs as companies expand. While not the case for every company and industry, nearly all the study interviews with businesses and investors strongly supported this view.

BUSINESS ENVIRONMENT VULNERABILITIES

Just as global, business and technology trends and regional capabilities can affect a region's job market, so does its business climate. The Bay Area's business environment - with its elevated cost of living, high cost of doing business and overburdened infrastructure - is particularly challenging for companies wanting to locate or expand here.

THE BAY AREA JOB MARKET - CURRENT AND FUTURE

CURRENT: The Bay Area job market is unique in many ways, and these characteristics are critical to an

understanding of the future employment outlook. More so than the U.S. as a whole, the Bay Area exhibits high volatility in job creation and destruction, due to its link with economic cycles, successive waves of technology innovation and high churn of new and exiting businesses. The boom-bust cycle of the past decade was felt far more dramatically in the Bay Area than in any other region.

The region has a high employment concentration in technology industries, with nine out of every 100 U.S. technology jobs located in the Bay Area. It has a larger proportion of employment in small businesses (77% of jobs are in establishments with fewer than 500 employees vs. 50% for the U.S.), which are the key engine for new job creation. Relative to the nation, more employment is concentrated in occupational clusters that are higher-paying and higher value-added (current Bay Area value-added per employee is 1.75 times U.S. levels).

FUTURE: Because of the region's job market and the major trends affecting it, a high level of both job creation and job destruction can be expected for the foreseeable future. Global trends will not affect all companies and occupations equally. Based on its baseline analysis and a focused look at two key industry clusters -semiconductor and software- the study finds that:

- With its strengths in entrepreneurship and cross-disciplinary research, the Bay Area will continue to incubate and grow new businesses, especially in leading edge technology areas such as information technology, biotechnology and nanotechnology.
- Small and new businesses will keep most (though not necessarily all) of their jobs local until their business processes and products mature.
- As Bay Area companies expand, they will increasingly create more jobs outside the region and relocate some existing jobs elsewhere, both domestically and overseas. However, large

EXECUTIVE SUMMARY

semiconductor and software companies are continuing to add as many as one in four jobs locally.

- The Bay Area will continue to be a leading innovation center; advanced, innovation-based research remains entrenched in the area, but R&D tied to product customization and development will increasingly go elsewhere, including other parts of the U.S.

With rapid economic and technological change, it is difficult to predict exactly which occupations will grow or shrink, or what new jobs will be created. Analysis at the occupational level, however, suggests areas where gains and losses can be expected (see figure 4).

IMPLICATIONS AND CONCLUSION

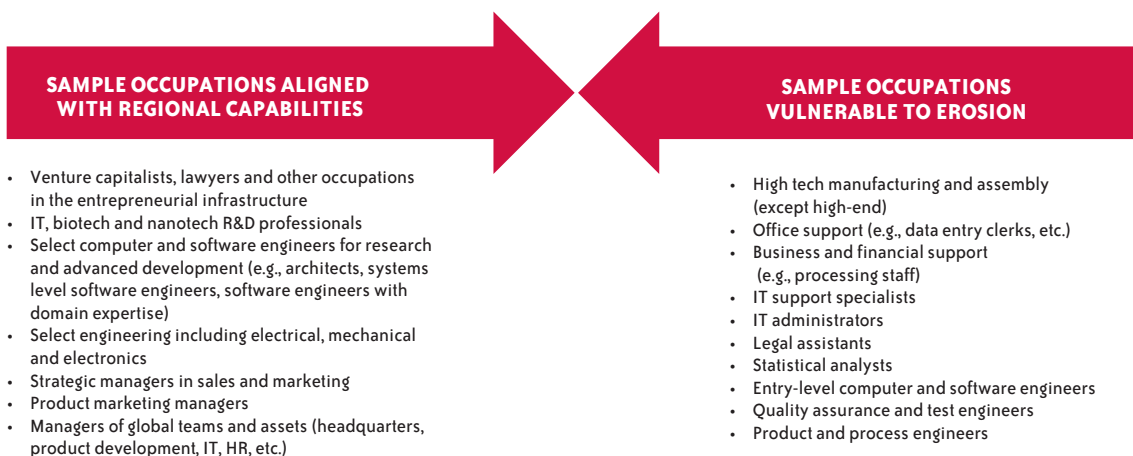
Offshoring is only one factor behind the continuing pattern of job creation and destruction in the Bay Area and appears to be less important than technological change and the outsourcing of jobs within the United States. The movement or creation of jobs overseas reflects the growth of global markets and the need for companies to be present there, and the globalization of the workforce. While there are gains and losses for the

Bay Area in these processes, they are unlikely to be reversed and, if anything, will spread. Attempts to prevent them will not be successful and are likely to come at considerable economic cost. Businesses and policymakers need to focus instead on the measures needed to strengthen the economic base of the region, the state and the nation in areas of competitive strength, and address those issues that are producing competitive weakness.

This effort will require creative and proactive, rather than reactive, strategies. For policymakers, it means maintaining strong investment in basic research. It also means investment in education, including the capacity for both high-end research and continuous job training and retraining, to ensure a competitive workforce that meets industry needs. Regional and state leaders must also address, as a priority, the economic climate issues that are hindering job creation and growth, including the lack of workforce housing, strained transportation and local and state policies that make California either a more desirable or less desirable place to create and grow a business. For their part, business leaders, as citizens of the community that have a long-term interest in a competitive workforce, should support transition programs for workers who lose their jobs, and invest in employee development programs to meet emerging needs.

FIGURE 4

ANTICIPATED JOB GAINS AND LOSSES



Source: A.T. Kearney analysis; some “vulnerable” back-office occupations are adapted from Bardhan, Ashok Deo; Kroll, Cynthia; “The New Wave of Outsourcing”, Fisher Center for Real Estate and Urban Economics, University of California, Berkeley, Fall 2003

UNDERSTANDING OFFSHORING

While offshoring is a hot topic in boardrooms and the press, the concept is not new. With extensive literature and media exposure, many of its key aspects are by now well known. Prior to detailing the study findings, this section takes stock of what is known, what's under debate and what's still unknown.

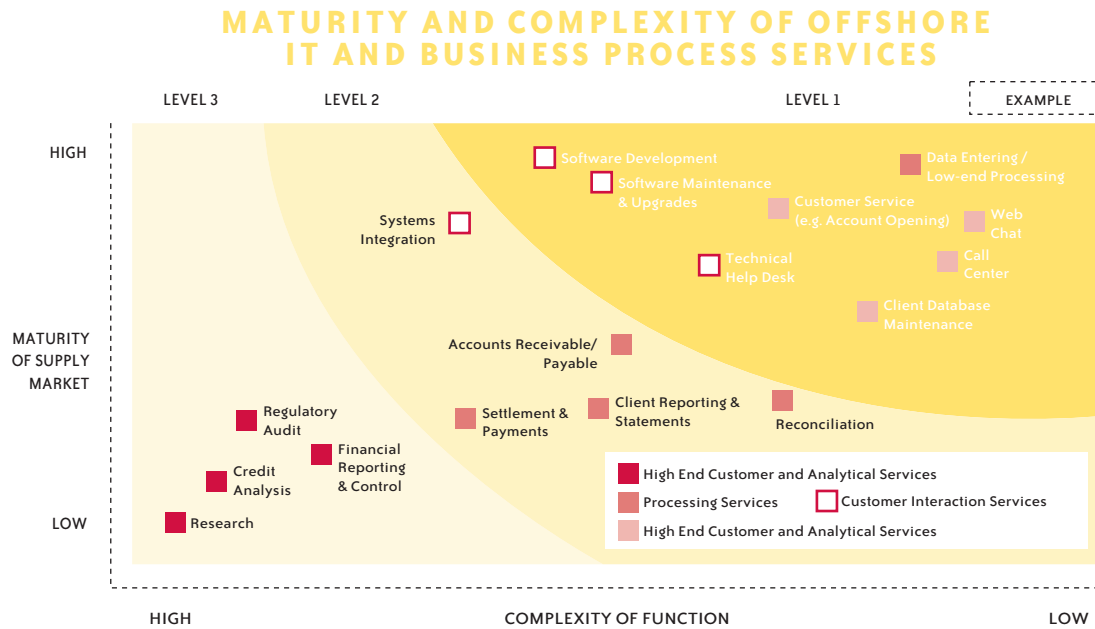
BUSINESS DRIVERS

Since the early 1960s, North American, European and more recently Japanese manufacturing have been shifting overseas, primarily to developing countries. While the first wave of offshoring was driven by manufacturing, its scope has broadened to include a wide range of administrative and service functions. Functions that are repetitive or process-based are increasingly likely to be performed overseas. More complex activities, such as product development, computer coding and software design, are also increasingly being performed abroad (see figure 5).

The acceleration of offshoring has resulted from the increasing business trend towards outsourcing as well as two major changes in the global economy. The first is the revolution in telecommunications brought about by the Internet and the worldwide expansion in telecommunications capacity in the later 1990s. With that infrastructure, the real-time cost of communicating data over large distances has dropped sharply, reducing or eliminating the barriers that once determined where information-related services could be performed. The second transformation is the entry by large parts of the developing world into the global economy. While countries that lack the infrastructure or governance structures to compete will continue to lag, others such as China and India are advancing rapidly. Southeast Asia and parts of Eastern Europe are also more globally engaged. Market based economic reforms are facilitating this process.

Steeply lower wage scales are the critical factor that allows these countries to compete head-to-head for jobs with more developed economies. Current estimates of the average wage differentials between India and the

FIGURE 5



Source: A.T. Kearney analysis

UNDERSTANDING OFFSHORING

U.S. show a factor of one to four, while Malaysian and Chinese wages range from one-tenth to one-fourth of U.S. labor costs. Fluctuations in skills and other factors drive variations in savings. An A.T. Kearney wage survey shows that a software programmer currently earns \$50-100/hour in the U.S., compared to \$20-30/hour in India.

productivity and capacity as major benefits of offshore activity; some executives interviewed for this study reported that they reinvest the savings from their offshore activity into capital investment, product development and other areas that increase their competitive advantage (see figure 6 for additional business drivers).

“Savings from outsourcing are contributing to our ability to do more product development; we’ve done more product development this year than in the prior two years.”

CIO,
TELECOMMUNICATIONS
COMPANY

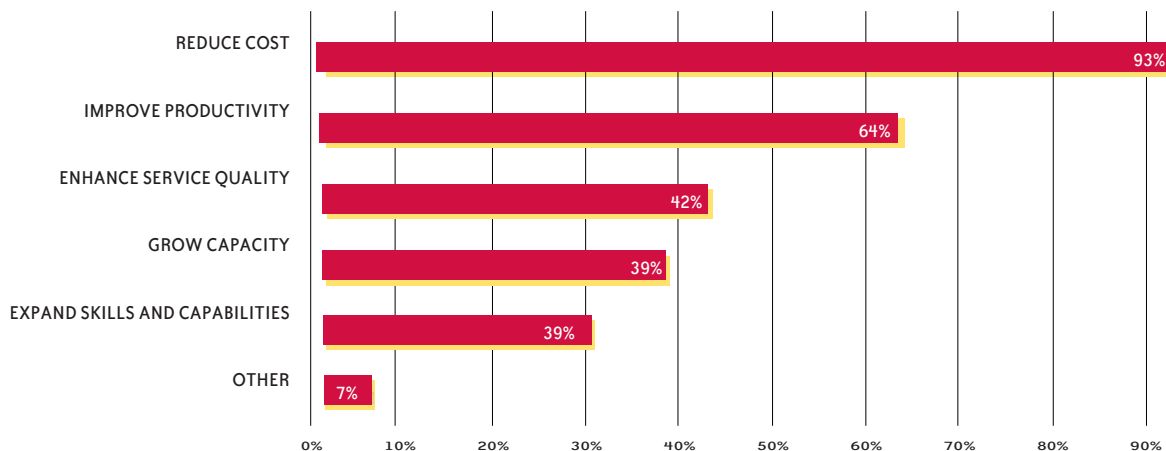
The availability of well-trained workforces in developing economies is a second key factor. According to the National Science Foundation, China currently produces nearly 200,000 bachelor graduates in engineering annually, and India 82,000, compared to 61,000 in the United States. The reasons companies are offshoring go well beyond labor costs and labor availability, however. Businesses cite improved

Growing export markets is another benefit attributed to offshoring, as increased purchasing power in host countries leads to more demand for U.S. products. For example, new call-center and programming jobs in India are contributing to the expansion of that nation’s middle class, which has estimated consumer spending power of \$420 billion.(1) These numbers translate into export opportunities for U.S. firms and for Bay Area companies in particular. Many of the fastest growing markets for Bay Area companies are in Asia, which also happens to be the current locus of much of the world’s offshoring activity.

As educational levels and the quality of manufacturing have risen abroad, so has overseas capability for sophisticated R&D. High-end (basic) research continues to be concentrated in developed nations

FIGURE 6

PRIMARY BUSINESS DRIVERS FOR MOVING OFFSHORE



Source: A.T. Kearney 2003 survey results and analysis

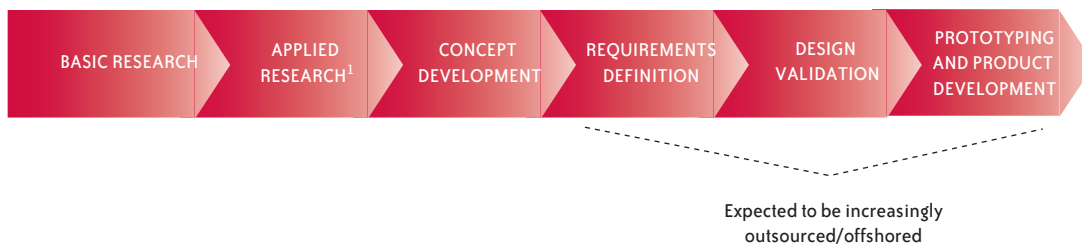
UNDERSTANDING OFFSHORING

such as the United States, Japan, Europe and Israel. However, companies in developing and emerging economies such as China, India, Southeast Asia and Eastern Europe are increasingly active in research related to product customization and development and are beginning to take on more sophisticated functions as well (see figure 7). Over 70 multinationals have recently established R&D facilities in India, including 100 of the Fortune 500 companies.(2)

Industry numbers provide evidence of the acceleration of offshoring for companies of all sizes. A.T. Kearney research shows that 66% of U.S. companies had offshore operations in 2003, and the number of large firms going offshore is expected to grow by 50% by the end of 2004. This report's interviews of semiconductor and software companies in the Bay Area finds that 94% are using offshore resources, 3% are exploring offshore strategies and the remaining 3% plan to offshore

FIGURE 7

RESEARCH AND DEVELOPMENT VALUE CHAIN



NOTE: (1) There is evidence that select parts of applied research are increasingly candidates for outsourcing and offshoring.

Source: A.T. Kearney analysis

ACCELERATION AND PENETRATION

Some Bay Area venture capital firms are now encouraging their clients to build offshore strategies into their business plans. For VC-supported companies, this strategy helps to conserve and extend scarce investment dollars. Most of the early-stage software companies interviewed were offshoring some portion of development. Some Bay Area biotechnology companies are also looking to move their clinical trials overseas, as a means to conserve investment funds, speed product development and move products more quickly to market. This offshore activity by early-stage companies represents a significant change from the past, when U.S. companies ventured abroad only after reaching a significant level of organizational maturity.

activities as their processes and products mature. Research for this study also found that over one third of the current job listings for large companies in the Bay Area's semiconductor and software industries are in overseas locations. Other A.T. Kearney research predicts that 8% of employment in the U.S. financial services industry – a significant sector for San Francisco and the Bay Area – will go offshore by 2008. As companies become more adept at overseeing offshore operations and as service providers specialized in offshoring gain more experience, the trend toward offshoring entire business processes is likely to accelerate.

UNDERSTANDING OFFSHORING

BEYOND THE COSTS AND BENEFITS TO BUSINESS

While the business drivers behind offshoring are widely recognized, its impact on regional and national economies is still being debated. Offshoring is not a zero-sum game: one job gained in India, China or Malaysia does not necessarily represent one job lost in the United States. But there is still little empirical data on its impacts and how they are distributed.

A number of recent studies suggest that offshoring can result in additional jobs and other regional economic benefits. For example, the Institute of International Economics finds that by manufacturing abroad, U.S. companies have been able to reduce the cost of computers and communications equipment by 10-30%, accelerating IT penetration into non-IT sectors and raising U.S. economic growth by .3% annually from 1995-2002. Similar gains are predicted from the overseas sourcing of software services. Global Insights estimates that every IT job lost due to offshoring will generate approximately two jobs in non-IT sectors in the U.S.. Other studies point to increased U.S. exports and lower consumer prices as other benefits created by offshoring.

Estimates of the number of jobs offshored vary widely. National estimates from Forrester Research, Goldman Sachs and Business Week fall in the 300,000 to 500,000 range while Economy.com's estimate reaches nearly a million jobs offshored since March 2001. All of these estimates need to be considered against the total number of jobs in the U.S. economy (130 million in the first quarter of 2004) and the cycles of normal job generation (2.2 million jobs created annually during a normal recovery). Most offshoring studies also fail to account for the number of domestic jobs created by foreign investment (the Bay Area, for example, benefits from more foreign investment in R&D that any other region or state in the country), and by foreign entities buying services from the U.S. (the U.S.

consistently maintains a positive balance in international services trade, with \$130 billion in exports and a \$53 billion surplus reported in 2003).

Still, the numbers of jobs expected to be offshored in the future are significant. Its growing dimensions raise important questions about the future structure of the job market, whether entire categories of U.S. jobs will disappear, what will happen to displaced workers and how the future numbers, pay and quality of U.S. jobs will be affected. These issues are still being debated and are unlikely to be resolved quickly.

OFFSHORING AND THE BAY AREA

The offshoring debate has rapidly worked its way down to the local level. Most of the data, where available, is still focused at the national level, leaving the unanswered question of how the future job market in the region will change. However, it is important to recognize that offshoring is *not* the only factor driving structural changes in the job market. To assess how the Bay Area job market is changing, it is critical to understand the underlying trends that affect the region's capabilities and competitiveness.

TRENDS DRIVING JOB MARKET CHANGE

Like companies elsewhere, Bay Area businesses are improving their productivity through technological and management innovation, and by sourcing goods and services wherever they can be most cost-effectively produced. This strategy contributes to their competitiveness and their ability to sustain profits and jobs. A key question for the Bay Area is: given an increasingly globalized economy, what kinds of jobs can be created and sustained here based on the region's competitive strengths (since jobs that are less economic to perform in the Bay Area are increasingly likely to go elsewhere)? To answer this question, this report identifies five key trends that are driving change in the global and regional job market:

GLOBALIZATION

Globalization is not new, but the trend has accelerated in recent years due to market-driven reforms abroad and the opening up of previously closed economies. Membership in free trade organizations has increased from 23 countries in 1948 (GATT) to 147 today (WTO). Restrictions on capital movement have been sharply reduced, and consumer and labor markets have opened up, with each reinforcing the other.

Technological advances have accelerated the globalization process. For example, companies now have unprecedented capabilities to exchange data (11,000 Gbps between the United States and India in 2001), and are benefiting from a dramatic decline in the cost of communications (costs in 2002 were approximately 1% of those in 1996).(3) These advances have facilitated the global distribution of business functions, particularly those that are dependent on information and data transfer.

The Bay Area is particularly affected because it is one of the most globalized regions in the country. Led by high technology, it is the nation's second largest exporting region, with Bay Area manufacturers deriving nearly 60% of their revenues from global sales. According to the Organization on International Investment, California (including the Bay Area) also

leads the nation in "in-sourced" jobs created by U.S. subsidiaries of foreign companies (over 700,000) and the number of in-sources jobs in manufacturing (nearly 200,000).(4)

TECHNOLOGY-DRIVEN PRODUCTIVITY

Recent decades have seen successive waves of innovation – from semiconductors to PCs to the Internet. Although business process improvements and other non-IT drivers contributed, technology is credited for over half

the surge in productivity in the late 1990s.(5) The trend has accelerated (productivity grew 4.4% in 2003 and 5.0% on 2002, the first back-to-back increase of greater than 4% since the Bureau of Labor Statistics began tracking in 1947) and can be expected to continue at a fast pace in the coming years.

This trend has had a profound impact on employment. The drive to increase

productivity spurs the demand for jobs related to the development of innovative, productivity-enhancing technologies, but also makes many jobs obsolete – from retail salespeople replaced by kiosks to entry-level designers replaced by automated design software. A recent Business Week report estimates that a one percentage point increase in productivity eliminates 1.3 million jobs, a greater number than any estimate of U.S. jobs offshored. Bay Area companies lead the world

"You've had a one-time-in-the-history-of-mankind event take place in the past decade. You almost instantaneously had half the world's population pulled into the world's free economic system. If you take China, India, Russia and other East European countries, that's about 3 billion people."

**CRAIG BARRETT,
CEO, INTEL**

TRENDS DRIVING JOB MARKET CHANGE

“Over the past two years, U.S. productivity in the non-farm business sector has grown at a 4.8% annual rate....This extraordinary surge of increased efficiency in our economy explains much more about the jobless recovery than offshoring, outsourcing or globalization does. Productivity probably explains about 98% or 99% of the job destruction over the last few years.”

ROBERT PARRY, FORMER PRESIDENT OF THE FEDERAL RESERVE BANK OF SAN FRANCISCO

shift from manufacturing to services in the global economy. The relative decline of manufacturing is evident not only in the United States and other advanced economies, but also in developing nations. Since 1995 more than 20 million factory jobs have disappeared globally; while the U.S. lost 11% of its manufacturing jobs, Japan lost 16%, Brazil 20% and

and other competing regions in productivity (see figure 8). Even during the recent downturn, Bay Area companies were able to maintain or increase their high productivity levels.

THE SHIFT FROM MANUFACTURING TO SERVICES

Recent decades have witnessed a major

China 15%. Despite the boom in foreign investment there, China has lost more manufacturing jobs than any other country.

Across industries, value is being tied less to physical and more to knowledge assets; at the same time, demand for knowledge workers has increased dramatically. In high technology sectors, this shift has occurred largely in the last 15 years: 1.5 million service jobs were added to the U.S. economy between 1987 and 2002, while manufacturing jobs declined by 150,000.(6)

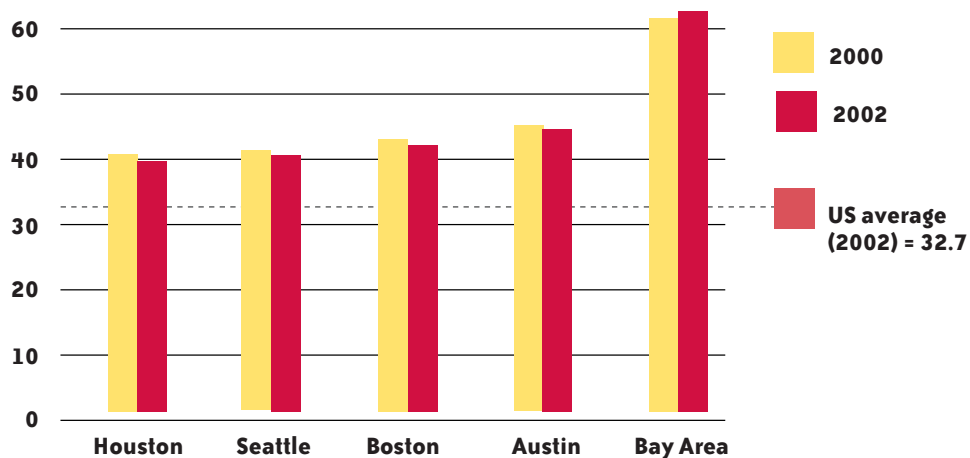
This shift resonates in the Bay Area, where the economy is heavily dependent on companies in high technology as well as manufacturing and service industries. Bay Area manufacturing industries contribute 17% to real regional GDP, and service industries contribute 29%, compared to 14% and 22% for the United States as a whole.

BUSINESS DISINTERMEDIATION

In 1937 economist Ronald Coase wrote, “As interaction costs decrease, the need for corporations to keep all functions in house is reduced.” For many years, companies in the Bay Area have lowered costs by employing local or domestic contract manufacturers, or

FIGURE 8

BAY AREA PRODUCTIVITY COMPARISON VS. COMPETING REGIONS (2000 & 2002) OUTPUT PER CAPITA (\$ THOUSANDS)



Source: Bay Area Economic Forum, January 2004

TRENDS DRIVING JOB MARKET CHANGE

developing alliances or joint ventures with overseas partners. As technological advances have now reduced interaction costs dramatically, companies are focusing more on their core capabilities and outsourcing activities that other companies can do better. This segmentation of the value chain, and the disaggregation of production into its modular components, is feeding the trend toward outsourcing.

The semiconductor industry is a good example. Once made up of many vertically integrated companies, the industry is now made up of many companies that either focus on a small set of core activities and outsource the remainder, or perform a key function in the value chain, serving other companies up or down the production chain.

mean for the Bay Area? The region is at the forefront of many of the changes that are now taking place. Whether the impact on Bay Area jobs is positive or negative will largely depend on its ability to remain competitive. An assessment of the Bay Area's competitive strengths and weaknesses is a necessary starting point for understanding the policy choices ahead.

DEMOGRAPHIC CHANGE

The retiring of the “baby boomer” generation over the next five to twenty years is expected to create a labor shortage in the United States. The 65-plus age group is expected to comprise 18% of the U.S. population in 2025 compared to 14% in China and 8% in India.⁽⁷⁾

Immigration has offset prior U.S. labor shortages, but in recent years has become more restrictive. Higher-skilled jobs may be affected by the reduction in H-1b visas (a non-immigrant classification for specialty-occupation employment); in 2004 the annual H-1b ceiling was reduced from 195,000 to 65,000. One mid-size Bay Area company reports that it has reduced the number of its H-1b visa workers by 30%. If local talent is scarce, increased restrictions on imported talent may push companies to create jobs elsewhere, tapping the growth of worker-age populations in countries such as China and India.

Together, these five trends are producing major shifts in global business dynamics: productivity has reached unprecedented levels, the market for workers is global, and jobs are increasingly mobile. What do these trends

KEY REGIONAL CAPABILITIES

BAY AREA COMPETITIVE STRENGTHS

Like companies, regions have core strengths and weaknesses that ultimately translate into areas that are more or less competitive. The Bay Area is no exception (see figure 3, page vii).

ENTREPRENEURSHIP AND NEW BUSINESS CREATION

More than any other region in the world, the Bay Area has an entrepreneurial spirit and culture that is supported by other ingredients necessary for the creation of new businesses.

RESEARCH IN ADVANCED TECHNOLOGIES

The region also hosts a powerful assembly of research institutions, both public and private, that make it a world leader in research in advanced technologies. The Bay Area leads the nation in the number and quality of its research centers. The Bay Area also boasts more foreign-owned R&D facilities than any other region, or even state, in the United States.(8) At 6% of employment, the region's proportion of innovation, research and development jobs to the overall job market is two and a half times that of the United States as a whole. No region so successfully turns breakthrough knowledge in science and technology into new products, processes and services.

CROSS-DISCIPLINARY RESEARCH

What is less often recognized is that Bay Area research institutions and companies are highly adept at working across industries and scientific disciplines. A host of interdisciplinary research centers such as Stanford's Bio-X, the Center for IT Research in the Interest of Society

(CITRIS) and the Center for Quantitative Biology (QB3) operate in the Bay Area. These institutions, and the region's five national laboratories and five research universities generate scientists, entrepreneurs and technologies that are ultimately reflected in new commercial technologies. The close proximity of leading companies in information technology, biotechnology and the emerging nanotechnology sector

in the Bay Area also serves to promote innovation and product development across disciplines and industries.

CONCEPT AND MARKET DEVELOPMENT

Bay Area companies have shown their ability to quickly commercialize and market new products and services – more effectively than almost anywhere in the world (see figure 9). The region has demonstrated a particular capability to take not only new technologies but also new concepts to market, as demonstrated by the success of Apple's iTunes, eBay's online auctions and Google's search engine.

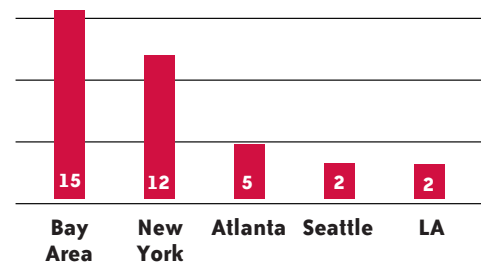
"The Bay Area's ability to create new businesses is unparalleled in the world...it is not something you can learn to do overnight. My view is that the Bay Area will be the best at it for a long time."

VINOD KHOSLA,
GENERAL PARTNER, KLEINER
PERKINS CAUFIELD & BYERS

FIGURE 9

NUMBER OF MOST RECOGNIZED BRANDS

By Headquarter Location in North America, (2003)



Source: "2003 Brand of the Year Results", Interbrand, 2003

KEY REGIONAL CAPABILITIES

FIGURE 10

HEWLETT PACKARD GLOBALLY DISTRIBUTED FUNCTIONS, PRINTER EXAMPLE



Source: A.T. Kearney analysis

GLOBAL INTEGRATED MANAGEMENT

Finally, an emerging Bay Area strength lies in the ability to manage and integrate business relationships across both company and country borders. With an extensive experience in outsourcing and deep experience in global markets, companies in this region are among the best when it comes to managing and coordinating globally distributed functions (see figure 10) and external relationships such as strategic alliances, contracts and joint ventures.

BAY AREA CHALLENGES

At the same time, there are several areas in which the Bay Area is increasingly less competitive and where jobs are vulnerable. With growing capabilities in other regions as well as overseas, businesses have more choices than in the past for where to locate business functions. Increasingly, their choice is outside the Bay Area.

One where the region's capabilities are comparatively weaker is manufacturing. While a significant amount of manufacturing still takes place in the Bay Area, it is increasingly under pressure from lower cost areas, both domestically and overseas. The Bay Area's high cost

"I'm not expecting the Bay Area to decline or go down, but it will no longer have a monopoly on capabilities. The region will find new business models; it is smart enough. Its companies and people will work with Israelis, Indians and Chinese; they will do higher value-added activities than they had done before. The model will become more of a cooperative distributed model, with different regions globally focused on what they do best."

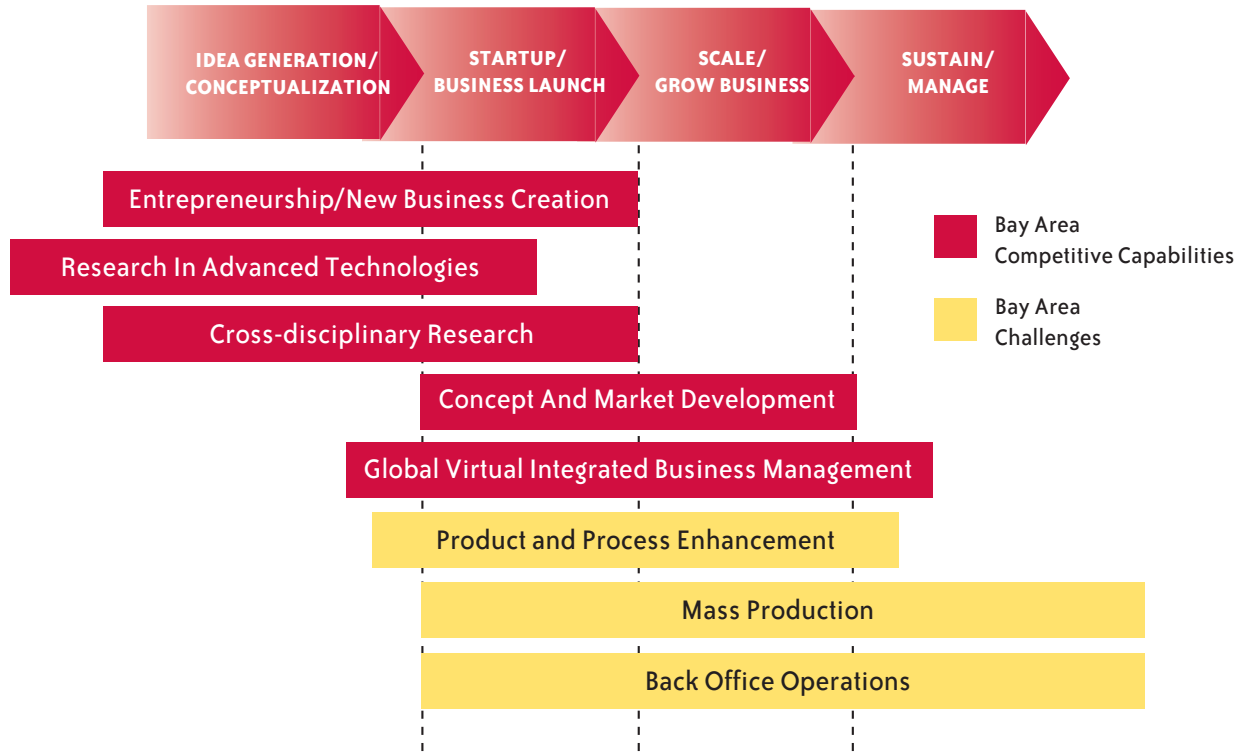
SRIDHAR MITTA, MANAGING DIRECTOR & CTO, E4E INC. AND FORMER BAY AREA ENTREPRENEUR

structure, when combined with the growing capacity elsewhere to perform a range of research, manufacturing and service functions, also raises concerns about the region's future ability to compete in product and process enhancement - after the early and more creative stages of product development. Part of this is related to

KEY REGIONAL CAPABILITIES

FIGURE 11

REGIONAL CAPABILITIES AND THE BUSINESS LIFECYCLE



Source: A.T. Kearney analysis

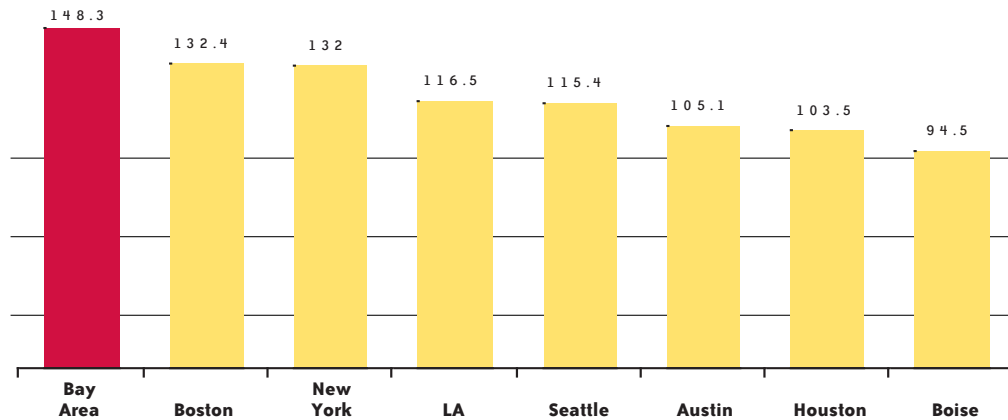
manufacturing: as more manufacturing is moved to lower cost areas, incremental product improvement processes may also be pulled to these locations. This is particularly the case when products are being developed or customized for global markets. For example, as Asia acquires process discipline and an increased capacity to perform advanced research, incremental product improvements are likely to be performed there as well.

Aligning these regional capabilities with the business lifecycle, it appears the Bay Area will remain a strong region in which to start a business, but will not capture the bulk of new jobs as companies expand. While not the case for every company and industry, nearly all the study interviews with businesses and investors strongly supported this view (see figure 11).

BUSINESS ENVIRONMENT VULNERABILITIES

FIGURE 12

COST OF LIVING INDEX COMPARISON, BAY AREA VS. OTHER REGIONS, (2002)



Source: Bay Area Economic Forum, January, 2004, Economy.com; Indexed to US average (100)

Another variable in any baseline analysis of the region's competitiveness is its business environment. Like technology, the quality of a region's business climate can impact job creation and destruction even more than offshoring or other global trends. This is an area where the Bay Area appears vulnerable.

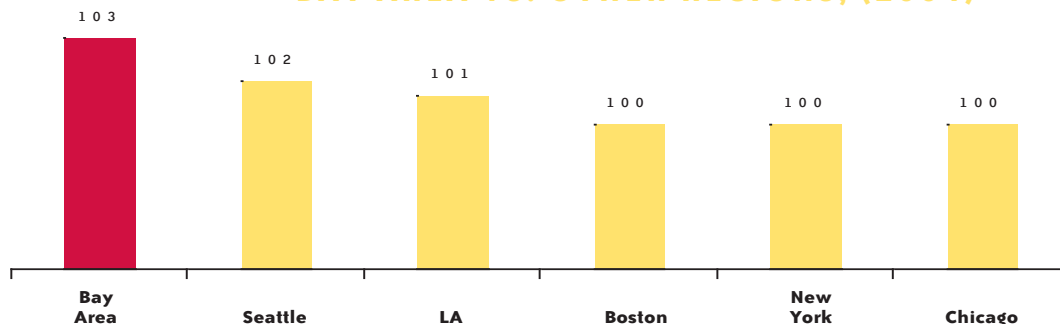
While the region has many strengths, a number of issues in its business environment inhibit present and future job creation. The region has the highest cost of living in the nation, well above the other cities and regions it competes with and nearly 50% above the national average (see figure 12). High housing costs, driven by inadequate supply, are the major culprit,

raising the amount that companies must pay to attract and retain their workforce. Government policies contribute to these costs: California's effective corporate tax (7.4%) exceeds not only the U.S. average (5.3%) but also that of states with comparable metropolitan regions. While improvements brought about by recent reforms are coming, California's workers compensation insurance costs are still the highest on the country. California's electricity costs are also the nation's highest.(8)

While the Bay Area still edges out other regions terms of quality of life – a factor important to attracting and retaining a creative workforce – its lead is diminishing (see figure 13).

FIGURE 13

QUALITY OF LIFE INDEX COMPARISON, BAY AREA VS. OTHER REGIONS, (2004)



Source: Mercer, Worldwide Quality of Life Survey, March 1, 2004, 39 variables, NY indexed to 100

THE BAY AREA JOB MARKET – CURRENT

To understand how the Bay Area’s job market is likely to evolve in the future, it is helpful first to understand its current employment base.

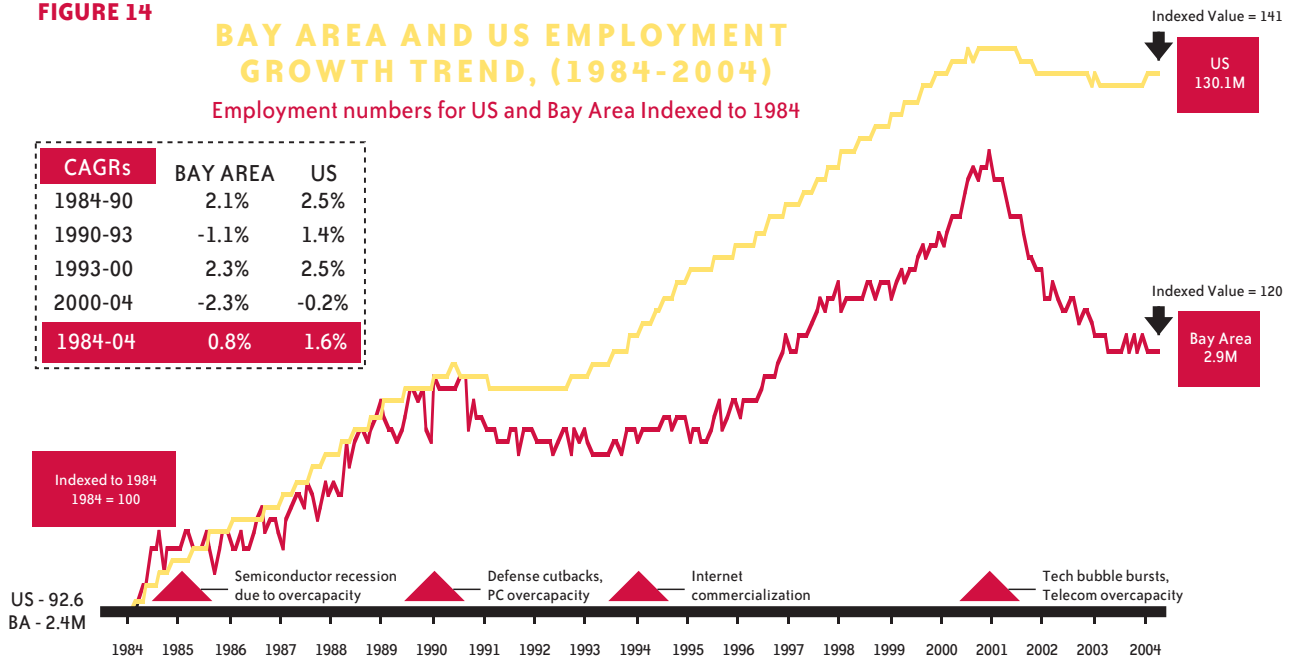
According to California’s Employment Development Department (EDD) approximately 2.9 million people are employed in the Bay Area. Employment levels in the

The Bay Area also hosts a diverse mix of technology and non-technology Fortune 1000 corporate headquarters; the number of Fortune 1000 companies is second only to the larger New York City metro area (see figure 15). Corporate offices account for 4% of the region’s employees, 1.7 times the national concentration.

FIGURE 14

BAY AREA AND US EMPLOYMENT GROWTH TREND, (1984-2004)

Employment numbers for US and Bay Area Indexed to 1984



Source: US Employment – US Department of Labor, Bureau of Labor Statistics; Bay Area Employment – California Employment Development Department, A.T. Kearney analysis

region are closely linked to economic cycles; the region’s swings appear to be more volatile than elsewhere in the nation, however, due to the leading role-played by technology and its successive cycles of innovation. The most recent and dramatic boom-bust in job creation and destruction was occasioned by the commercialization of the Internet (see figure 14).

EMPLOYMENT DISTRIBUTION BY INDUSTRY

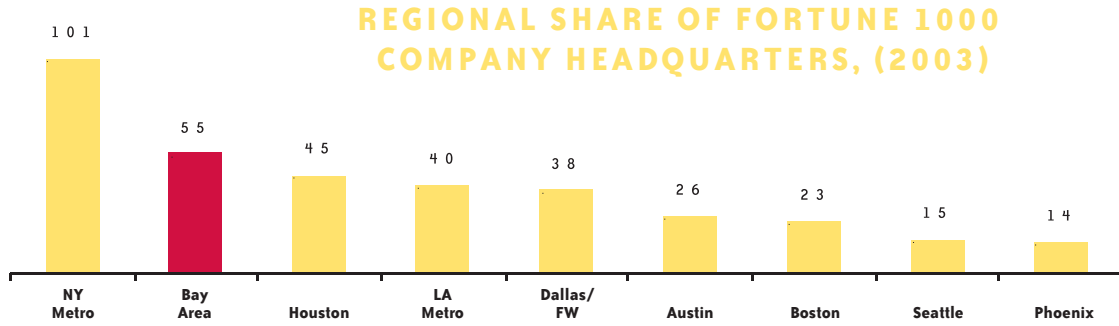
Although it is identified with technology, the Bay Area has a diversified economic base. Roughly 53% of its employment is in non-technology sectors, led by wholesale, retail, transportation and logistics, health and social services, hospitality, finance, insurance and real estate and resources, utilities and construction.

Despite its broad base, the region’s economy is clearly led by technology. The Bay Area has a higher employment concentration than the rest of the United States in nine industry clusters, comprising 23% of its employment base (see figure 16):

1. Biomedical
2. Computer and communications hardware manufacturing
3. Corporate offices
4. Creative services
5. Electronic component manufacturing
6. Innovation services
7. Other services
8. Semiconductor and semiconductor equipment manufacturing
9. Software

THE BAY AREA JOB MARKET – CURRENT

FIGURE 15



Source: 2003 Fortune 1000 list; A.T. Kearney Analysis

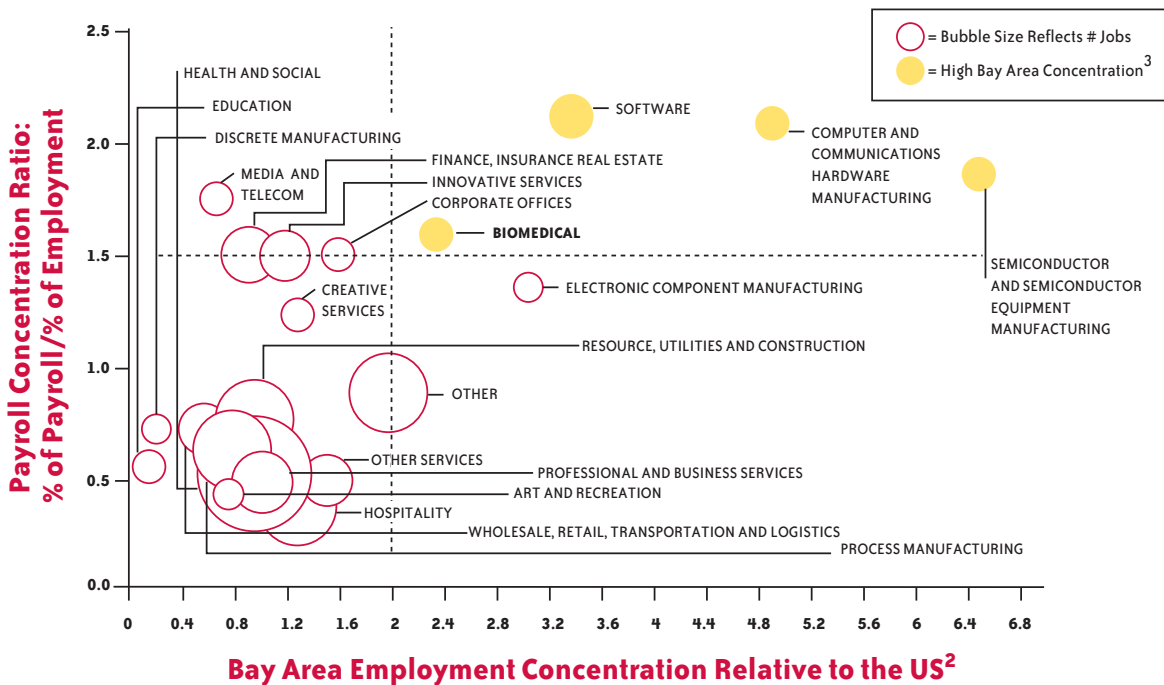
Areas of particular strength include computer hardware, enterprise software, Internet search and e-commerce, telecommunication and networking equipment, semiconductors and biomedical (which includes biotechnology). These sectors comprise 11% of employment and 22% of payroll in the Bay Area – 3.4 times the U.S. employment concentration in these

industries. Another way to look at it: nine out of every 100 high-technology industry employees in the United States are based in the Bay Area.

The Bay Area boasts 54% of all U.S. biotechnology companies (800 of 1,457 firms); its biomedical cluster (representing biotechnology and related industries)

FIGURE 16

BAY AREA INDUSTRY CLUSTERS¹ — BASELINE JOB PROFILE



Note: 1) Bay Area data reflects San Francisco, San Jose and Oakland MSAs
 2) Bay Area proportion of employment in industry cluster relative to that same industry cluster nationally
 3) High Bay Area concentration is defined as Payroll Concentration Ratio greater than 1.5 and Employee Concentration greater than 2
Source: US Department of Labor, Bureau of Labor Statistics National QCEW Survey Data, JVSJ and BAEF cluster definitions, A.T. Kearney analysis

THE BAY AREA JOB MARKET – CURRENT

accounts for 80,000 jobs, or 2.4% of employment and 4% of payroll in the region.(9) In IT, the Bay Area is home to leading global companies including Hewlett Packard, Intel, AMD, Sun Microsystems, Adobe and Apple, and is advanced research centers for IBM, Hitachi, Lockheed Martin, SRI and Microsoft among

“The Bay Area model is hard to replicate for other regions. It has what I would call “wealth momentum,” where concentration of capital leads to a culture in which venture capitalists are willing to

take on more risk.”
**RICK HILL, CEO,
 NOVELLUS**

others. Approximately 7% of the world’s nanotechnology companies are located here, second only to Germany with 9%.

EMPLOYMENT DISTRIBUTION BY COMPANY SIZE

The Bay Area has a high proportion of its employment in smaller companies; 77% of regional employees work for establishments with fewer

than 500 employees, compared to 50% for the United States as a whole. And compared to other parts of the United States, many of the Bay Area’s small companies are in higher value-added industries.

In the late 1990s the Bay Area led all regions of the country with the largest number of fast-growing private companies. While small company growth suffered during the recent recession, the region will continue to be a dynamic incubator of small businesses. It consistently attracts more venture capital than any

other region in the nation; after a hiatus of several years, investment by venture capital is growing again, providing renewed support for entrepreneurs and start-ups (see figure 17).

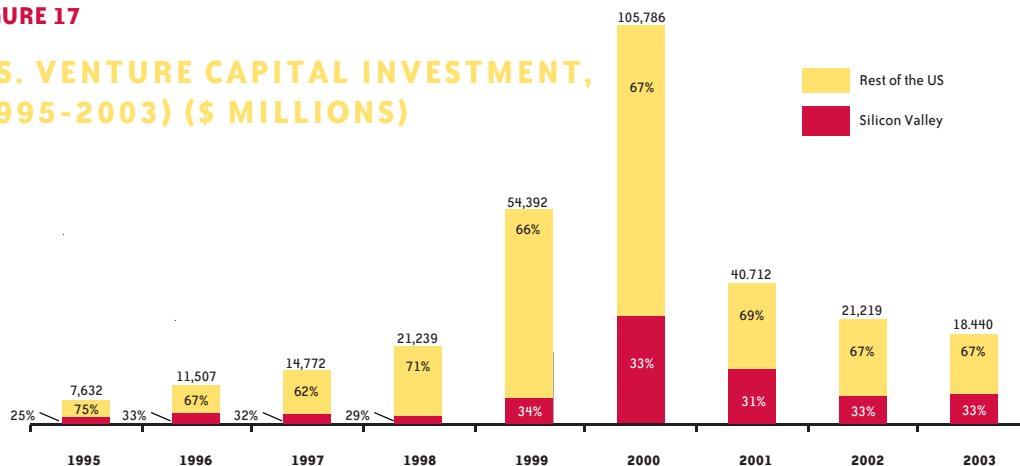
New business creation will also give rise to business failures, relocations and acquisitions. This cycle produces the high employment churn in the region. Over a 20-year period, only three of the top 40 Silicon Valley companies by revenue – Hewlett Packard, National Semiconductor and Intel – remain; the others have either failed, relocated, or were replaced by other companies, many of which did not previously exist.

KEY OCCUPATIONS

Roughly 64% of the region’s employment base is in medium-wage occupations – those with an average salary from \$39,000 to \$55,000. These include jobs in administration, education, health and human services, and technical production. Compared to the rest of the nation, however, Bay Area employment is weighted toward higher paying occupations (see figure 18).

Occupations in four higher value-added areas – innovation R&D, headquarters, professional services and creative services – account for 18% of employment, or 1.7 times the national level, with the margin in value-added per employee widening in the last two decades (see figure 19). Projections indicate that in 2004 the Bay Area’s value-added per employee will be \$145,000, of 1.75 times the U.S. average.

FIGURE 17
U.S. VENTURE CAPITAL INVESTMENT, (1995-2003) (\$ MILLIONS)

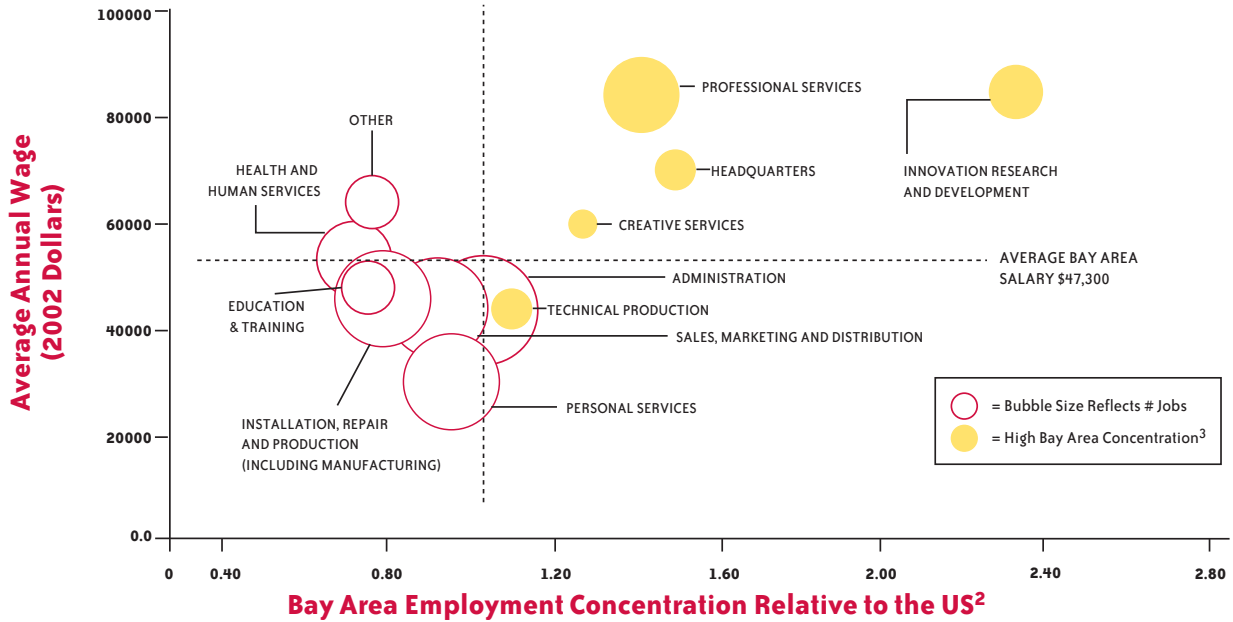


Source: PricewaterhouseCoopers/Thomson Venture Economics/National Venture Capital Association MoneyTree™ Survey.

THE BAY AREA JOB MARKET – CURRENT

FIGURE 18

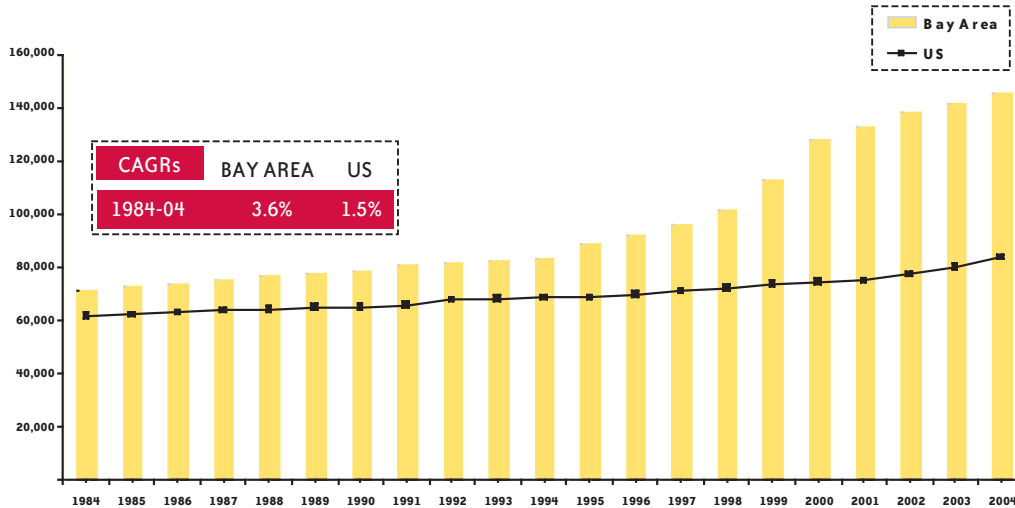
BAY AREA OCCUPATIONAL CLUSTERS¹ — BASELINE JOB PROFILE



Note: 1) Bay Area data reflects San Francisco, San Jose and Oakland MSAs
 2) Bay Area proportion of employment in occupational cluster relative to that same occupational cluster nationally
 3) High Bay Area concentration is defined as Payroll Concentration Ratio greater than 1.5 and Employee Concentration greater than 2.
Source: US Department of Labor, Bureau of Labor Statistics OES Survey Data, JVSJ cluster definitions based on the 2004 Index, A.T. Kearney analysis

FIGURE 19

BAY AREA VALUE ADDED PER EMPLOYEE¹ VS. US², (1984-2004) (US \$ THOUSANDS)



Note: 1) Value added per employee = GMP divided by the number of Bay Area employees; 2) US Value added per employee = GDP divided by the number of US employees
Source: Employment Data: Bay Area data from California Employment Development Department (EDD) and national data from U.S. Department of Labor, Bureau of Labor Statistics (BLS)

THE BAY AREA JOB MARKET – FUTURE

The assessment of regional strengths and weaknesses, when combined with the broader trends affecting job market change, gives a clearer picture of how these external factors will ultimately impact Bay Area employment. This part of the analysis examines the likely impacts from three perspectives: company size and maturity, job occupations and functions and two key sectors, (semiconductors and software).

JOB IMPACT BY COMPANY SIZE AND MATURITY

The Bay Area continues to offer a conducive environment for small company development. Companies founded in the Bay Area, particularly in their early stages of growth, typically keep the majority of their workforce local, until key business processes reach maturity or their first products or services are launched.

NEW AND SMALL BUSINESSES GROW MOST JOBS LOCALLY

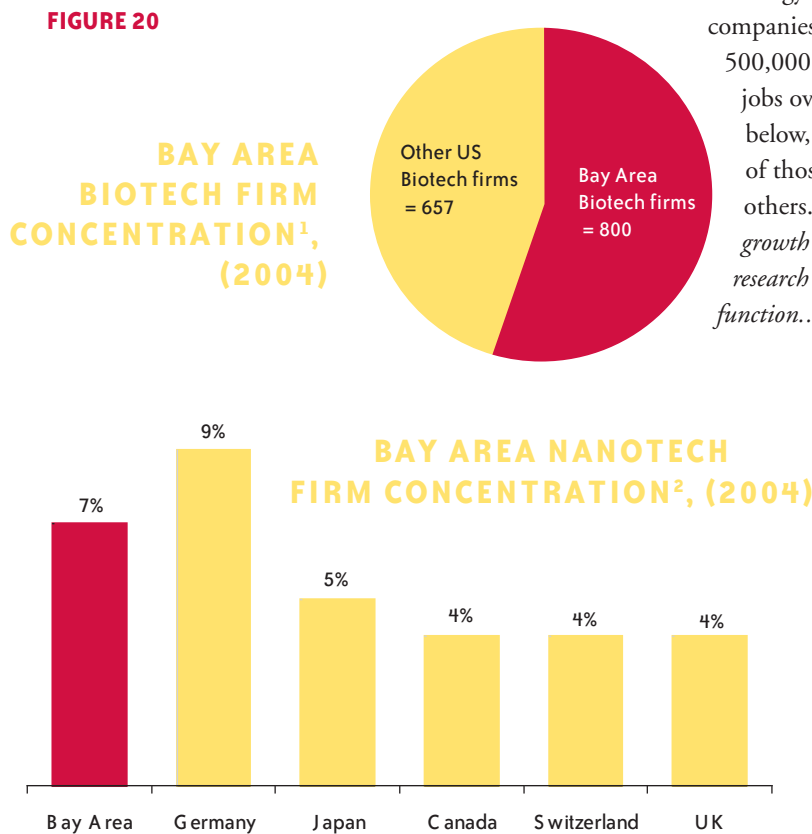
Despite the allure of outsourcing and offshoring, the findings of this report suggest that most small Bay Area companies realize far more benefit from locating their activities in one place, especially if that place is host to a good talent pool and to many companies across their value and supply chain. This tendency is good news for the region, since small businesses have historically been the largest source of new job creation. The Bay Area is well positioned to continue growing small businesses and lead the next wave of innovation, possibly around the fields of information technology, biotechnology and nanotechnology, or their convergence (see figure 20).

Annual job growth in biotechnology, for example, is expected to average 5-9% over the next 10 years. If the Bay Area leads an innovation wave in infotechnology, biotechnology and nanotechnology, Bay Area-based

companies may add as many as 150,000 to 500,000 biotech and nanotechnology-related jobs over the next 10 to 15 years. As suggested below, the region can capture a large number of those jobs, but will have to compete for others. *“In the biotech industry, the main job growth in the Bay Area will come from the research and product development function....almost 60% of jobs will be in these*

areas; About another 10 to 15% will be in regulatory functions, 10 to 15% in business functions, and 10% everywhere else,” explains Matt Gardner,

President of BayBio. With laboratories at its South San Francisco headquarters, for example, Genentech is likely to generate more R&D jobs locally. Some expansion in manufacturing is taking place locally (Vacaville), but also offshore (Spain). According to the California Healthcare Institute, more than a quarter of California’s biomedical companies – including both biotechnology and medical device



Source: 1) “Impact of Biotechnology to California”, Biotechnology Industry Organization, June 2004 2) Nano Investor News, March 2004

THE BAY AREA JOB MARKET – FUTURE

firms – plan to manufacture outside the state in the next two years. Overseas, Bay Area biotech companies are beginning to manufacture in China, Singapore, Ireland, Wales and other lower cost locations. Biotech venture capitalists also mention talent shortages as a driver for growth outside the region; for example pharmaceutical talent needed for later stage product development is more readily available on the East Coast.

AS COMPANIES GROW, THEY TEND TO CREATE MORE JOBS OUTSIDE THE REGION

As the biotech case illustrates, expanding companies expect to locate a larger proportion of new jobs outside the region. In most cases this is due to costs, while in others it is to access talent pools or move research or manufacturing functions closer to their target markets. At what point do growing companies tend to begin creating significant numbers of jobs outside the local area? On average, when a firm has 100 to 200 employees. This point divides the start-up, early stage from the expansion phase, where processes are defined, products and services are launched and the company is ready to enter new markets. Martin Kenney, UC Davis Professor and Senior Project Director, UC Berkeley Roundtable on the International Economy, believes, *“In the early stages, the activity will all be in the region; once you start to go over 100 employees, more of that growth is likely to end up in China and India.”*

While interview data suggests that the preponderance of small business jobs will remain local, they are not immune to relocation pressures. One CEO of a small East Bay company interviewed for this study reported that after several years in operation he had recently moved 80 of his 100 jobs (all in manufacturing) to China because of its competitiveness in mass production and the fact that PC manufacturers who are his primary end customers have also moved their manufacturing there. Only his research staff, responsible for innovating and developing core technologies, remains in the Bay Area. Increased pressure from investors for early stage

companies to explore offshore strategies, as well as the recent development of companies that serve as middlemen to facilitate offshore activities, suggests that in the future more small and medium sized companies may consider the offshoring option.

MOST LARGE COMPANIES WILL GROW FASTER ELSEWHERE, BUT WILL CONTINUE TO CREATE JOBS IN THE BAY AREA

What holds for medium sized companies applies even more to large firms. Drivers for these companies include the need to be closer to new markets, and a desire to take advantage of other countries and regions’ competitive advantages (and avoid the Bay Area’s disadvantages). However, while larger companies are likely to generate most of their new jobs elsewhere, they should continue to be a source of new job creation within the Bay Area based on its distinct competitive strengths. Some Internet companies such as Yahoo, Google and eBay have built substantial workforces in the region prior to expanding elsewhere; only recently has Google set up facilities in Ireland to support its expansion in Europe.

JOB IMPACT BY FUNCTION AND OCCUPATION

Job creation and destruction is a continuous process, particularly in the Bay Area with its innovation-driven cycles. The global trends identified in this report will not affect all functions and occupations. Many service-related functions and occupations that require physical proximity or personal contact will not be affected by offshoring or the key trends identified in this report. Interview data and projections based on a review of current job listings suggest that for those functions and occupations that are affected, some will experience growth and others are vulnerable to decline.

THE BAY AREA JOB MARKET – FUTURE

FUNCTIONS:

Interviews revealed a number of areas in the value chain where the region can expect either job creation or job erosion:

- 1 Research, marketing and headquarters functions, which are aligned with the region's strengths, are expected to experience job creation and growth. (10)
- 2 Manufacturing and administrative functions, where the Bay Area is less competitive, are vulnerable to continued job erosion. This erosion is already occurring and will continue across industries. For example, in the financial services industry, up to 8% of employment, largely in back office and transactional/process functions, may be offshored in the next five years, according to a 2003 A.T. Kearney national survey of financial services executives.
- 3 Design and development functions are expected to be increasingly distributed as they are moved closer to manufacturing facilities and customers.

While the location of activities and jobs away from headquarters is usually practiced by expanding companies with mature business processes, emerging industries are not immune from

relocation pressures. As indicated above, some biotech functions, such as

manufacturing, routine clinical trials, testing and administrative operations, are being sent outside of the Bay Area and offshore. R&D is more resistant to offshoring, given the complex lab work involved and the need for collaboration with regional partners, but is not entirely secure. The offshoring of R&D may become a larger issue in the future as other countries (such as Singapore) are making major investments in biomedical research facilities to attract up-and-coming researchers.

“I don’t see new occupations being created, but the requirements for existing occupations are being expanded, namely the ability to manage remote teams and to bring a multicultural/multicountry experience to an organization. In the technology sector there is very big demand for this type of experience, and almost every search we have done in the past 12 months has been for an executive with some multinational expertise – even for those positions that historically would have been focused almost exclusively locally, such as vice presidents of engineering and marketing. For CEO roles today, an understanding of and experience in the global economy is a must.”

**TONY SCOTT, MANAGING PARTNER,
CHAMPIONSCOTT PARTNERS**

FIGURE 21

SAMPLE OCCUPATIONS ALIGNED WITH REGIONAL CAPABILITIES

Bay Area Competitive Strengths	Sample Occupations Aligned with Regional Capabilities
New Business Creation and Entrepreneurship	Venture capitalists, lawyers and other occupations in the entrepreneurial infrastructure
Research In Advanced Technologies AND Cross-disciplinary Research	IT, biotech and nanotech R&D professionals Select computer and software engineers for research and advanced development (e.g., architects, systems level software engineers, software engineers with domain expertise) Select engineering including electrical, mechanical and electronics
Concept And Market Development	Strategic managers in sales and marketing Product marketing managers
Global Integrated Management	Managers of global teams and assets (headquarters, product development, IT, HR, etc.)

Source: A.T. Kearney analysis

THE BAY AREA JOB MARKET – FUTURE

OCCUPATIONS:

The Bay Area can expect to see growth in specific occupations that are aligned with its core strengths, but job erosion in occupations where it is competitively weaker (see sidebar for highlights for each occupational cluster). Areas of likely growth include (see figure 21).

Growth in jobs specifically aligned with regional capabilities is in turn expected to contribute to additional job growth in locally-based support services such as health care and human services (e.g., nurses and pharmacists) and personal services (restaurant workers, entertainers).

Job erosion can be expected in occupations that are aligned with the Bay Area’s weaker capabilities (see figure 22).

Other potential areas for job erosion or exit from the region are those jobs that are easily commoditized (e.g., medical support professions such as diagnostic support services and medical transcription) or automated (e.g., retail sales people replaced by kiosks).

FIGURE 22

SAMPLE OCCUPATIONS VULNERABLE TO EROSION

Bay Area Challenges	Sample Occupations Vulnerable to Erosion
Mass Production	High tech manufacturing and assembly (except high-end)
Back-office Operations	Office support (e.g., data entry clerks, etc.)
	Business and financial support (e.g., processing staff)
	IT support specialists
	IT administrators
	Legal assistants
Product And Process Enhancement	Statistical analysts
	Entry-level computer and software engineers
	Quality assurance and test engineers
	Product and process engineers

Source: A.T. Kearney analysis; “Vulnerable” back-office occupations are adapted from Bardhan, Ashok Deo; Kroll, Cynthia; “The New Wave of Outsourcing”, Fisher Center for Real Estate and Urban Economics, University of California, Berkeley, Fall 2003

A TALE OF TWO INDUSTRIES: SEMICONDUCTOR AND SOFTWARE

These findings are supported by an in-depth examination of two industry clusters that are bellwethers for the Bay Area's economy, semiconductors (including semiconductor equipment) and software, that reflect key trends in both manufacturing and services.

JOB GENERATION BY NEW AND SMALL BUSINESSES

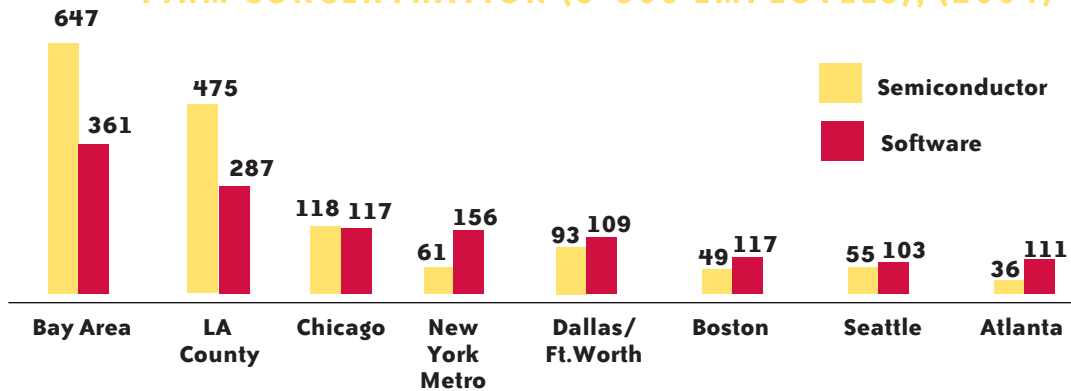
The Bay Area remains the preferred location for the creation of new semiconductor and software businesses in the United States (see figure 23). Increased automation of the design process is driving a convergence of these industries, playing to Bay Area strengths and fueling growth in segments of the software industry such as electronic design automation.

In contrast, many software companies in their early growth stages have already located some part of their workforce elsewhere (see figure 25). *“For software companies, you may at most need 70-100 people locally. All others can be located where you have more competitive prices for talent,”* says Ben Smith, CEO, Spoke Software. In practice, some software start-ups are following that rule. A late-stage start-up with 108 employees in the Bay Area and 32 sales, service and support employees outside the region is now considering moving some of its legacy development activity to China and India.

One potential explanation for the early-stage differences between semiconductors and software is that more companies within the semiconductor value

FIGURE 23

BAY AREA SEMICONDUCTOR AND SOFTWARE FIRM CONCENTRATION (5-500 EMPLOYEES), (2004)



Source: Hoover's Dun & Bradstreet Company Database; A.T. Kearney analysis

JOB CREATION ELSEWHERE AS COMPANIES GROW

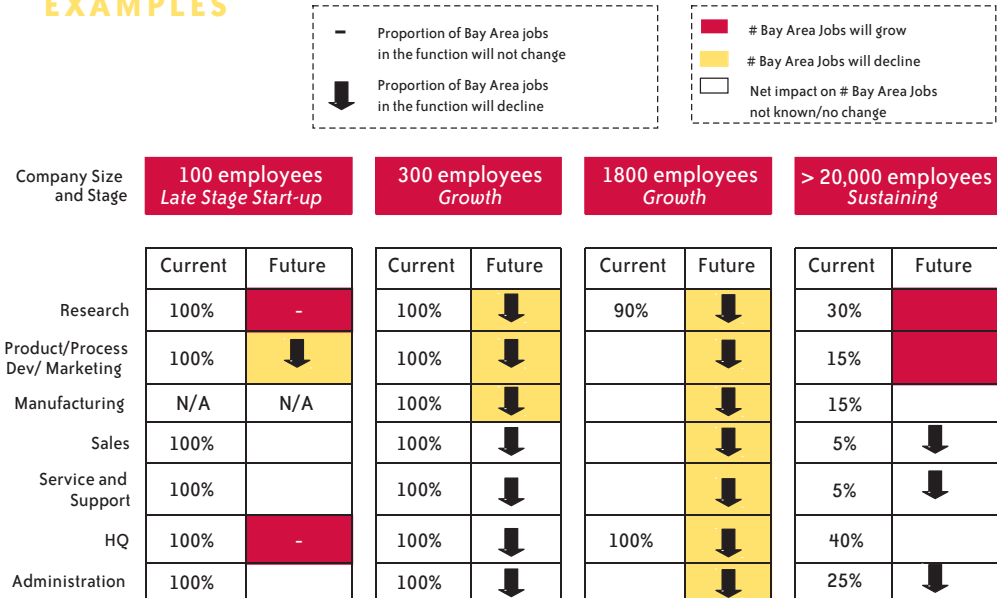
Interviews with executives show that semiconductor and software companies differ slightly in their early-stage job profiles, with semiconductor companies maintaining a larger presence in the Bay Area in their early stages (see figure 24). Two of the smaller semiconductor companies profiled (100 employees and 300 employees) have 100% of their staff in the Bay Area.

chain (i.e., not single function design houses) have higher requirements for human capital and therefore a higher pivot point in terms of how many jobs are needed locally before extra-regional growth occurs. For software firms and semiconductor design houses that point may be at the 200 to 300 employee range, while some of the more complex semiconductor companies of 300 employees or more still perform most functions in-house or onshore. For many semiconductor companies the offshoring of manufacturing is already a given (many design houses use fabrication facilities in

A TALE OF TWO INDUSTRIES: SEMICONDUCTORS AND SOFTWARE

FIGURE 24

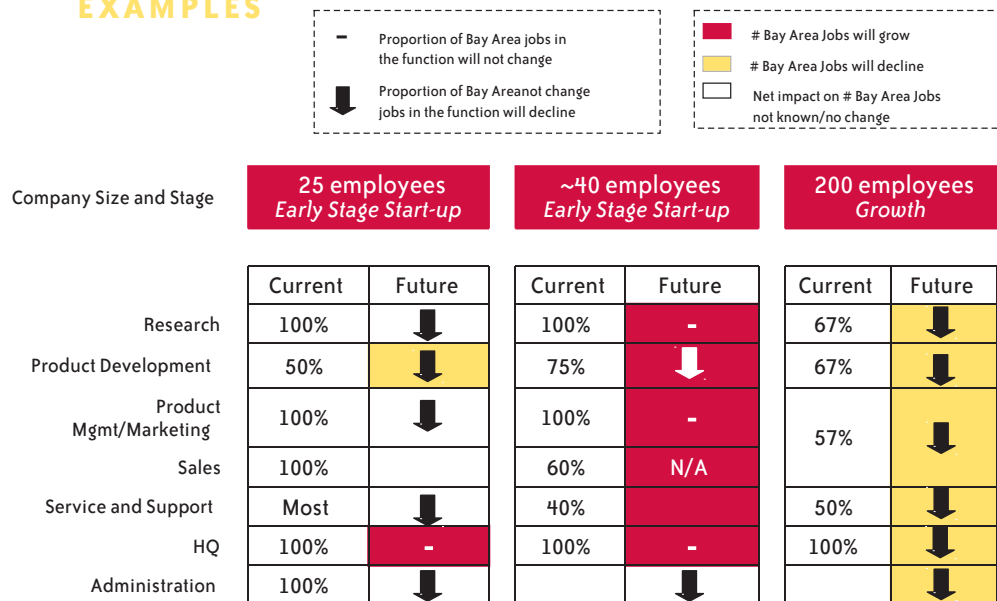
SEMICONDUCTOR COMPANY EXAMPLES



Source: Interviews, A.T. Kearney analysis

FIGURE 25

SOFTWARE COMPANY EXAMPLES



Source: Interviews, A.T. Kearney analysis

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“We will double in size in the next few years, and we expect half our workforce will be outside of the Bay Area. Our fully loaded cost for an R&D employee here is \$150-200K, and it’s only 25% of that in Shanghai. The main drivers for our globalization plans are cost and proximity to the customer, but we also see some pressure on quality and availability of talent here.”

**JOHN MCSORLEY, VP,
HUMAN RESOURCES,
NVIDIA**

from an analysis of current job listings, adding quantitative data to the perspectives gained from the company interviews (for further explanation, see appendix on study methodology). These figures show that, at least in the near term, one in four of the new jobs created by large Bay Area semiconductor and software companies will be local. Of the jobs created outside the region, the listings are both onshore (38%) and offshore (35%).

Taiwan and China for manufacturing, while others in more specialized markets use facilities in Germany or other locations).

LARGE COMPANY JOB LOCATION

Evidence that large companies will grow jobs here but are creating more jobs elsewhere comes

KEY FUNCTIONS AND OCCUPATIONS

THE OUTSOURCING AND OFFSHORING OF MANUFACTURING IS CONTRIBUTING TO THE DEPARTURE OF OTHER FUNCTIONS

Views are mixed as to whether the location of manufacturing pulls other functions with it. However, there is some evidence that design may follow manufacturing— in the notebook PC, microwave and semiconductor industries. An immediate concern is the shift of R&D to other regions such as China (where \$10 billion has been invested in chip ventures in the last three years), and its potential impact on the Bay Area’s continued leadership in innovation. This message was highlighted in a recent report by the President’s Council of Advisers on Science and Technology: *“Other nations are catching up to our leadership [in innovation and technology]. They are increasingly replicating our basic innovation platforms, rather than merely manufacturing commoditized products on a global basis....Other countries are moving swiftly to co-locate R&D centers of excellence next to the manufacturing plants they attract.”*

RESEARCH REMAINS A CORE BAY AREA STRENGTH, BUT OTHER U.S. REGIONS ARE GAINING

Where research jobs are being shifted outside the region, it is primarily by larger companies; for smaller companies, most research needs to remain at headquarters. Chris Rowen, CEO, Tensilica, explains, *“We get an enormous productivity boost out of working in one room. When you move something offshore, you must have a structured, modular engineering process. That tends to occur only in companies with a very stable innovation pattern. Where there is deep innovation in the interaction, then it’s crazy to push offshore.”* When research jobs are created outside the Bay Area, most are located in the United States (see figure 26).

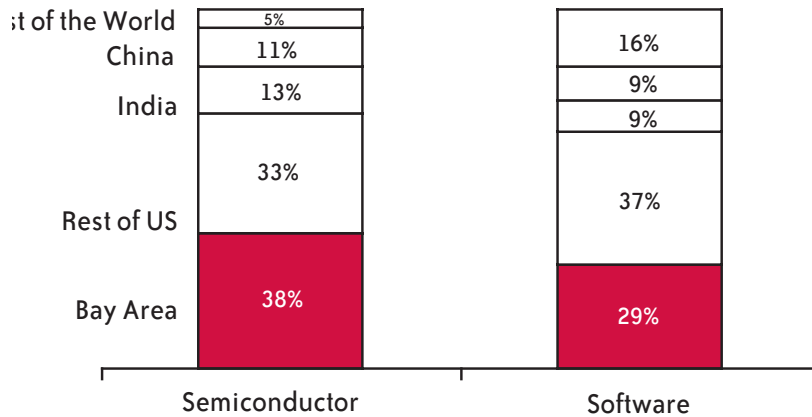
“We are trying to push out of here because we have a hard time retaining young people. A software engineer here wants to be paid \$120K, compared to \$15K for our new hires in Malaysia, who have lots of experience. As our software goes to maintenance mode, more development will be offshore. Three years from now, when most of our work is done, there’s not much to keep us from moving. The issue is people cost.”

**EXECUTIVE, MID-SIZE
SOFTWARE COMPANY**

A TALE OF TWO INDUSTRIES: SEMICONDUCTORS AND SOFTWARE

FIGURE 26

RESEARCH JOB LISTING ANALYSIS FOR LARGE BAY AREA BASED EMPLOYERS



Source: A.T. Kearney job listings analysis of large Bay Area-based Semiconductor and Software companies

“Software architecture will remain in the U.S. for now. In India and China, the skill level is good for projects requiring one to five years of software development experience, but there is not enough talent yet for offshore software architecture.”

M.R. RANGASWAMI,
CO-FOUNDER,
SAND HILL GROUP

There is growing demand within the Bay Area for software architects and engineers at the systems level; these jobs, however, account for a smaller share of industry employment than applications level positions.

RESEARCH PERFORMED OVERSEAS IS LOWER LEVEL, BUT IS GAINING IN SOPHISTICATION

While a small number of large firms perform advanced (basic) research in multiple overseas locations, most work performed abroad is still applied research, related more to product development and customization for local markets than to baseline innovation (see figure 7, page 3). Two current barriers to more advanced research being performed overseas are quality and

concern with the adequacy of intellectual property protection. With foreign government investment and the return of many trained scientists from the U.S. to their home countries, however, overseas capabilities can be expected to increase.

INDUSTRY-SPECIFIC TRENDS ARE DRIVING BOTH GROWTH AND LOSS IN DESIGN AND DEVELOPMENT JOBS

As a result of semiconductor and software industry convergence, demand for software professionals with domain expertise could increase. However, demand for entry-level design-engineer jobs is likely to decline over time; the push to increase automation and productivity, and the desire to locate design closer to target markets, will continue to affect this profession. *“Our software function went from 150 to 50 employees, purely based on the use of productivity tools and systems we deployed.”* Steve Newberry, President and COO, Lam Research.

Though chip design will grow overseas, particularly in Asia, chip innovation will still be driven from the Bay Area (see figure 27).

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“In design, Taiwan is making progress, but the U.S. is ahead because design requires multidisciplinary collaboration and idea generation.”

CHINTAY SHIH, FORMER HEAD OF THE INDUSTRIAL TECHNOLOGY RESEARCH INSTITUTE, TAIWAN

Both the semiconductor and software industries are outsourcing product development. In software, development is the most common function outsourced or sent offshore, primarily due to the modularity of applications and interfaces, a trend

confirmed by venture capitalists. Some companies have had more successful experiences with offshoring than others. *“We had some development offshored initially, but we weren’t happy with the results and brought it back in-house and on-shore.”* said Ben Smith, CEO, Spoke Software.

The first development jobs to go offshore are typically quality-assurance and testing engineers. In the job listings research performed for this report, more than 80% of the listings for both industries were outside the Bay Area, with 42% of job listings at other U.S. locations, and 16% in China and India (combined). Application-level software developers and engineer

positions are also migrating to other locations, primarily India (which accounted for 60% of large company listings).

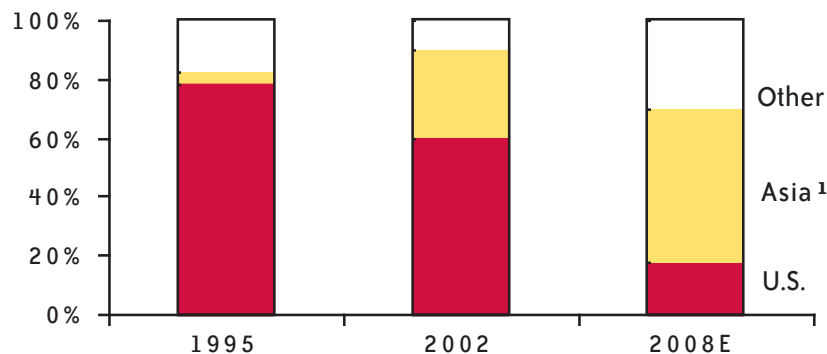
Some observers have expressed concern that the loss of development positions will lead to a loss of Bay Area leadership. For example, Dirk Michels, Partner, Kirkpatrick & Lockhart says, *“Products are being conceived in the Bay Area, developed and manufactured in other countries, and then marketed here. The trend poses a big problem because young graduates in IT and biotech need some experience to become successful. If the offshoring goes on, I am concerned that entry level positions to train tomorrow’s architects and innovators are not available locally.”* While a concern, it was also clear through the interviews that not all development jobs will be offshored, and architects do not necessarily come from the developer pool.

“Design is moving, but innovation remains here. None of the top ten Taiwanese design firms are doing innovation. All are doing designs based on known chips and products.”

DAN BREZNITZ, MIT

FIGURE 27

SHARE IN GLOBAL PRODUCTION OF CHIP DESIGN, (1995 TO 2008E) (%)¹



Note: (1) Asia includes (Taiwan, S. Korea, India, China, Singapore and Malaysia).

Source: iSupplie Report on Kdesign, March 2000. Cited by Dieter Ernst, University of Honolulu, April 2004

A TALE OF TWO INDUSTRIES: SEMICONDUCTORS AND SOFTWARE

SOME SEMICONDUCTOR MANUFACTURING PRESENCE IS EXPECTED TO REMAIN IN THE BAY AREA

Many of the semiconductor companies interviewed for this report say they will keep high-end assembly in-house; some, such as Lam Research, outsource manufacturing but primarily to local suppliers. *“A lot of our contract manufacturing is done in the Bay Area as opposed to overseas (about 95% is in the U.S., and 75% of that remains in the Bay Area), and the primary driver for concentrating our manufacturing in the Bay Area is local relationships; the learning loops are sped up dramatically,”* explains Newberry. A locally-headquartered contract manufacturer executive explained that much of the manufacturing performed for local companies stays in the Bay Area when high-end operations are involved and when speed of development is essential.

MARKETING POSITIONS WILL GROW

Marketing is one of the Bay Area’s strengths, a fact recognized by foreign as well as local companies. Research for this report found that nearly half the job listings for these positions at large Bay Area software companies were local. Many marketing positions for foreign semiconductor companies will also be located in the Bay Area. *“Taiwanese semiconductor companies locate their marketing functions in the bay Area because the U.S. is the most important market for their products and services. It is also the place where ideas and product definitions are generated,”* said Shih.

IMPACT BY INDUSTRY

The semiconductor and semiconductor-equipment industry cluster is expected to lose jobs. Because this industry is cyclical, the upswing will likely create jobs; however, 70 percent of the new jobs for large companies are being created outside the region. While

there are some expected areas of growth, net loss of jobs in the industry is expected due to increases in productivity and outsourcing. Manufacturing functions, related to the Bay Area’s weaker capabilities, will likely continue to lose jobs to lower cost regions—both offshore and onshore. The net effect is estimated to be a 1.7% loss of jobs annually from 2003 to 2008 in the Bay Area according to Economy.com and analysis of the study interview data.

The software cluster is expected to gain jobs. Global and industry trends point to solid growth for this industry and for software occupations on the whole. Job creation and growth will likely more than offset jobs moved offshore in this industry cluster. Estimates indicate that software industry employment may grow at 4.8% annually from 2003 to 2008 in the Bay Area. These estimates were derived from Economy.com forecasts, and adjusted based on the study’s interview data.

Other regional industry clusters are also expected to grow. Although this study focused on just two prominent Bay Area clusters, other similar impacts are apparent in other sectors, from financial services to biomedical. At the industry level, the Association of Bay Area Government expects every industry cluster to generate net job growth over the next few years except for technical production (high-tech manufacturing). Net job creation in the Bay Area economy can be expected to support growth in services jobs, with some areas already experiencing a shortage of workers. This is consistent with overall study findings of the impact of trends, capabilities and business environment on the regional job market.

“The semiconductor industry is changing fundamentally, and there are diminishing returns in simply improving a specific chip. Competition is now focused on functionality at the system level and cost. This means you have to focus on ensuring that 1) your chip works well within the entire system, and 2) your manufacturing processes are efficient. Both these require domain expertise that are best found in the Bay Area.”

LACKY SHAH, BUSINESS DEVELOPMENT, TRANSMETA

IMPLICATIONS AND CONCLUSION

Just as the debate over offshoring is polarized, this study found contrasting views of the future of jobs in the Bay Area. On the one hand, there was inherent optimism that the region will always bounce back, and that the region's leadership in technology and innovation and the jobs they create is secure. Given the rapid development of capabilities and talent in competing regions, however, this is not assured. The other, more pessimistic, view was that a large number of Bay Area jobs are at risk of going offshore and will actually leave, leading to high unemployment and a hollowed out economy. This is also unlikely, given the evidence that companies continue to find great value in Bay Area capabilities and are continuing to produce world-leading innovation and technology here.

The more likely path is somewhere in between, with moderate job growth driven by the continued creation of new businesses in existing and emerging technology clusters, and in a wide range of services. New job creation should compensate for or outweigh job destruction. This implies a continuation of the current job profile, with a diversified industry base led by technology, strength in high value-added occupations, job creation by new and small businesses, and a continuing base of mid-wage occupations.

More than any other regional economy in the nation, the Bay Area has been characterized by high levels of both job creation and job destruction. Driven by change and innovation, the resulting flexibility is one of its greatest strengths. The region currently benefits from a number of competitive advantages – entrepreneurship, research in advanced technologies, cross-disciplinary research, concept and market development, and global integrated management, as well as disadvantages - in mass production, back-office operation, and product and process enhancement. Instead of looking at the jobs lost to offshoring in isolation, community, state and regional leaders need to consider why jobs are or are not being created in the Bay Area. The assessment of competitive capabilities and weaknesses in this report provides that perspective.

Plotting an economic strategy that will guide the Bay Area through these structural changes is a shared

responsibility of business, policy and community leaders. As national and global labor competition increase and jobs become mobile, the region's *workforce* must change in pace, adapting to new demands and the need for value-added skills. For many Bay Area employees, standing still is not an option. *Business* decisions will continue to be shaped by competitive considerations, with global and regional capabilities driving job-location decisions; but businesses retain the responsibility to invest in and support their workforce. *Policymakers* need to focus on the strengths and weaknesses that shape the region's changing job market and direct their strategy and investment decisions accordingly.

Offshoring is only one factor behind the continuing pattern of job creation and destruction in the Bay Area, and appears to be relatively less important than technological change and the outsourcing of jobs within the United States. Globalization raises questions of both competition and cooperation, as economies and companies not only compete for jobs but also build alliances for mutual benefit. The movement or creation of jobs overseas reflects the growth of global markets and the need for companies to be present there, and the globalization of the workforce through increased business disintermediation, innovations in telecommunications and the entry of large and small developing countries into the global economy. While there are both gains and losses for the U.S. and the Bay Area in these processes, they are unlikely to be reversed and, if anything, will continue to expand. Attempts to prevent them will not be successful, and are likely to come at considerable economic cost.

Government, business and community leaders instead must focus on the measures needed to strengthen the region's economic base in areas of competitive strength that will drive job creation, address the issues that are producing competitive weakness and manage the transition in areas that are seeing structural job loss. The Bay Area's competitive strengths are compelling, and if invested in and promoted effectively, can provide growth and quality jobs for years to come.

IMPLICATIONS AND CONCLUSION

In the policy arena, decision makers must avoid taking measures that will impair the competitiveness of Bay Area businesses or their access to global markets and human and capital resources. Instead, policies and investment should be directed toward helping the region, its businesses and its workforce to compete on a national and global basis by strengthening its capabilities. This means:

- At the federal level, maintain strong investment in basic research, in both health and physical sciences. Keep the door open to foreign scholars, students and other highly educated immigrants and visitors; and
- At the state level, strengthen investment in the University of California, California State University and Community College systems, including the capacity for both advanced research and continuous job training and retraining, to ensure a competitive workforce that meets industry needs; and
- At the state and regional level, address the priority issues of housing supply, overburdened infrastructure and other business environment issues that hurt the region's competitiveness and its ability to attract and sustain a high quality workforce.

Businesses leaders, for their part, can continue their historic role as community citizens by investing in their workforce through employee development programs to meet emerging needs; by investing in productivity improvements that will support the creation of competitive domestic jobs; and by supporting policies that aid the transition of displaced workers. In the long-term, businesses stand to benefit from a more competitive regional workforce.

The Bay Area is at a crossroads. Despite strong business capabilities, its economic leadership is under pressure from a variety of directions, of which offshoring is only one. The accelerating globalization

of the job market presents major challenges, as well as opportunities; they must be dealt with creatively and not reflexively. But many of the challenges the Bay Area faces are not new. They come not from overseas, but from decisions and policies at home. These are the issues of investment, education, housing and infrastructure that will make the California and Bay Area economies either competitive or vulnerable to domestic and overseas competitors, and on which the region's current and future job creation will depend.

APPENDIX

NOTES

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2. Uchitelle, Louis, (October 2003). *A Missing Statistic: U.S. Jobs that Went Overseas*, New York Times.
3. Stanford Project on Regions of Innovation and Entrepreneurship, (2003). *SPRIE Year in Review 2003*.
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6. Bardhan, Ashok Deo, Jaffee, Dwight M. and Kroll, Cynthia A., (2004) *Globalization and a High-Tech Economy: California, the United States and Beyond*.
7. U.S. Bureau of the Census, International Database, 2000 population data.
8. Bay Area Economic Forum, (January 2004). *Downturn and Recovery: Restoring Prosperity: Bay Area Economic Profile*.
9. Based on study analysis of the latest available 2002 EDD data; widely cited California Healthcare Institute estimate based on 2000 data is 96,000 jobs.
10. Headquarter functions include executives, investor relations, legal affairs, and corporate marketing and communications.

EXPECTED JOB GAINS AND LOSSES BY OCCUPATIONAL CLUSTER

Interview findings on occupations were combined with findings from the job listings analysis and secondary research from EDD forecasts. At the occupational level, some clusters are expected to experience net job growth while others experience net decline (see figure 28).

FIGURE 28

POTENTIAL IMPACT ON FUTURE BAY AREA JOB GROWTH BY OCCUPATIONAL CLUSTER

Occupational Cluster	Current % of Bay Area Employment	Bay Area Job Growth
Administration	19.3%	–
Sales, Marketing & Distribution	18.1%	+
Technical Production & Installation, Repair and Production	15.1%	–
Personal Services	14.6%	+
Professional Services	8.3%	–
Health and Human Services	6.6%	+
Innovation R&D • Research Occupations • Product Development Occupations	5.6%	+
Education and Training	4.9%	–
Headquarters	2.4%	+
Creative Services	1.6%	+

Source: Interviews, A.T. Kearney Cluster Analysis, EDD Occupational Forecasts from 2001-2008; A.T. Kearney analysis

APPENDIX

INNOVATION R&D. The Bay Area continues to remain strong in advanced (basic) R&D and concept development, but other regions, both nationally and globally are becoming increasingly sophisticated in their capabilities (see figure 7, page 3):

- Some applied research jobs, which relate to commercial development, are moving to less costly regions or closer to customers—more onshore than offshore—to take advantage of lower costs and proximity to customers and markets.
- Positions in concept development are expected to grow regionally, taking advantage of Bay Area capabilities.
- Entry-level design positions will erode as increased automation of design leads to obsolescence, and shifting mass-production pulls design to lower-cost locales.
- Workers focused on transactional or modular product development and administrative activities will feel the affects of outsourcing—both onshore and offshore—as businesses become more focused on core capabilities.
- Based on the growing dispersion of research activities (particularly non-core IP), managers skilled in leading global teams will be in demand across many sectors as globalization accelerates. These functions align closely with the region's strengths in research, its ability to take concepts to market, and to manage globally.
- Emerging industries, such as biomedical, will add research jobs fastest.

SALES, MARKETING AND DISTRIBUTION. Based on interviews and analysis of job listings, sales jobs will grow outside of the Bay Area as companies expand into new markets. Strategic and management positions in sales and marketing, such as marketing directors and product marketing managers, are expected to grow in the Bay Area. Sales and retail positions for companies with customers concentrated in the Bay will grow as the business climate improves. According to EDD, retail sales positions are expected to increase roughly 2 percent per year.

HEADQUARTERS. Based on interviews, CEOs and executives with global, cross-cultural and virtual business management experience will increase in number, which is consistent with EDD growth projections of 1.4 percent annually. Senior legal and finance positions are on the rise, particularly in response to increased regulatory requirements. Public-relations specialists are expected to increase at a rate of 2.4 percent annually according to EDD. Junior-level headquarters' functions across industries may be relocated to other locations as companies grow.

PROFESSIONAL SERVICES. In-house service and support teams are increasingly being reduced as companies rely on third-parties. Many lower-skill service positions have been automated (e.g., some customer support has moved online) or moved to low-cost locations. In-house transactional and processing activities are increasingly contracted to business process outsourcing (BPO) firms. Skilled managers of outsourced services will be in high demand as outsourcing increases.

ADMINISTRATION. Administrative positions have increasingly been automated, and remaining transactional and processing activities have moved out of headquarters or outsourced. For example, larger companies have increasingly complex HR needs, and senior and strategic positions are in greater demand as companies shift HR focus from transactional to strategic activities. However, HR numbers will be smaller overall (e.g., one large company interviewed plans to reduce its HR staff by half even as it expects to double its workforce over three years).

TECHNICAL PRODUCTION AND INSTALLATION, REPAIR AND PRODUCTION. Product and process-improvement engineers are increasingly hired closer to manufacturing sites. Most regional high-tech manufacturing positions (except high-end assembly) should continue to decrease, as mass production is one of the Bay Area's weaker capabilities. For example, EDD estimates electrical and electronic-equipment assemblers will decrease 2 percent annually. In some forecasts, high-tech manufacturing may experience a small rise with the economic recovery, but over the long-term should expect continued erosion.

HEALTH AND HUMAN SERVICES. No profession is expected to decline in the health and human services cluster, a key support service cluster already experiencing shortages. Overall, EDD estimates indicate 2 percent annual growth. For pharmacists, EDD growth is 2.7 percent annually. For pharmacy technicians, EDD growth is 3.3 percent annually. For family and general practitioners, EDD growth is 1.5 percent annually.

CREATIVE SERVICES. News analysts, reporters and correspondents are expected to decline by 0.4 percent according to EDD. Entertainment-focused professionals are expected to increase in the Bay Area. For example, according to EDD, musicians and singers will grow 2.3 percent annually and other entertainers, performers, sports and related workers will grow 1.8 percent annually.

APPENDIX

PERSONAL SERVICES. Restaurant workers, child-care workers and personal- and home-care aides are expected to grow at 1 to 3 percent annually, based on EDD forecasts. The study findings agree with these growth forecasts because personal services are likely to benefit from growth in the high-value occupations addressed in the study.

EDUCATION AND TRAINING. According to EDD, K-12 teaching jobs are expected to decline in the next three years due to budgetary pressures, which is slightly less optimistic than the overall education and training field, which will grow at rate of 1.7 percent annually. University teaching positions are estimated to increase by up to 2 percent annually, including computer science, mathematics, engineering, biological science, nursing, business, law and health specialties.

STUDY METHODOLOGY

The analytical framework that served as the foundation of the study focused on four key components: trends, capabilities, business environment and the regional job market (see figure 2, page v for diagram and definitions).

Primary data was collected in three parts:

PROFILE OF REGIONAL JOB MARKET. Industry and occupational cluster studies for the entire region were performed to generate a profile of regional employment. Industry cluster definitions were adapted from two study partners: the Bay Area Economic Forum and Joint Venture: Silicon Valley Network, distinguishing high value clusters not yet defined for the Bay Area. Occupational cluster definitions are consistent with those in Joint Venture's 2004 Index. Two focus industries were selected for an in-depth analysis from the baseline profile: the semiconductor and semiconductor-equipment manufacturing industry; and the software industry, including software publishers and software services. These two industry clusters were chosen due to their importance within the Bay Area economy, and their reflection of both the manufacturing and service sectors.

INTERVIEWS. From March to June 2004, nearly 120 interviews were conducted, with approximately half in business and industry. Of these, 38 were company interviews, and a high proportion of executives interviewed were from the study's focus industries —15 semiconductor and 16 software executives. Emerging-industry companies and business process outsourcing providers were also included, albeit with a much smaller sample size. Interviews were also conducted with executives of venture-capital and employment-search firms, industry groups and professional associations to gauge more general sentiment.

The remaining half of the interviews were with academics and economists, government agency representatives and other subject matter experts —representing a broad spectrum of local and global expertise.

Interviews with executives began with a general inquiry, to identify the trends affecting the interviewees and where they believed jobs would be located over the next three to five years. The interviews also attempted to gauge the current —and expected— distribution of employees by function and geography. Interviews largely focused on outsourcing and offshoring, but also covered key trends (e.g., productivity and changes in the industry). Interviews with academics and subject matter experts were more focused on individual expertise.

JOB-LISTINGS ANALYSIS. In April 2004, nearly 9,000 online jobs listings were taken from the websites of large companies (annual revenues exceeding U.S.\$500 million) from the two focus clusters. The classifications were based on industry experience, job description and calls to the companies. The final analysis showed where jobs were being created around the world by functional area. However, there are some limitations to this method:

- Executive job searches are generally performed offline, meaning that headquarter positions are understated. However, as executive positions tend to be few, the discrepancy is likely minimal.
- Jobs-listing data reflects a snapshot in time, and should be repeated in future studies to allow a time-series comparison.
- Wide variations in job titles results in a small margin of error in the classifications.

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SECONDARY DATA

An extensive review of existing research was conducted, beginning with prior research by all four study partners. These studies included joint studies on economic clusters, reports on offshoring and outsourcing and regional trends (*see selected bibliography*).

STAKEHOLDER REVIEW

A review board, composed of a cross-section of Bay Area interests, offered input and reviewed the study prior to publication. Representatives from the sponsoring organizations and many subject matter experts also offered detailed feedback (*see acknowledgments*).

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