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Analysis of the California Innovation Corridor

new economy strategies



making the complex simple

California Innovation Corridor Project Overview

Implementation of the Advanced Technical Assistance provided to the California Innovation Corridor (CIC) under a Department of Labor WIRED grant

Overview:

This project aims to develop a market-driven economic development model that will guide policymaking on innovation, entrepreneurship, technology transfer and commercialization. We have outlined the following steps for the project:

1. **A Working Definition of Innovation:** Develop consensus with CIC on a definition of innovation that is flexible, creative, and can be acted upon.
2. **Regional Benchmark Selection:** NES, in conjunction with CIC, will select 6 regions on which to conduct detailed case studies.
3. **Regional Case Study Composition:** Each regional case study will consider a number of factors, including assets, programs, policies and obstacles.
4. **CIC Innovation Gap Analysis:** What programs, assets or best practices can the California Innovation Corridor adopt from other regions?
5. **Regional Innovation Model:** Provide data and strategic guidance for a working model of a robust innovation ecosystem based upon case study work.

Overview of the California Innovation Corridor's Innovation Infrastructure

Basic Statistics

Population:

California— 36.8 million

CIC—26.2 million

Per Capita Income:

U.S.— \$24,529

California— \$25,321

CIC— \$25,564

Unemployment:

U.S.— 5.5%

California— 6.2%

CIC— 5.6%

Key Assets

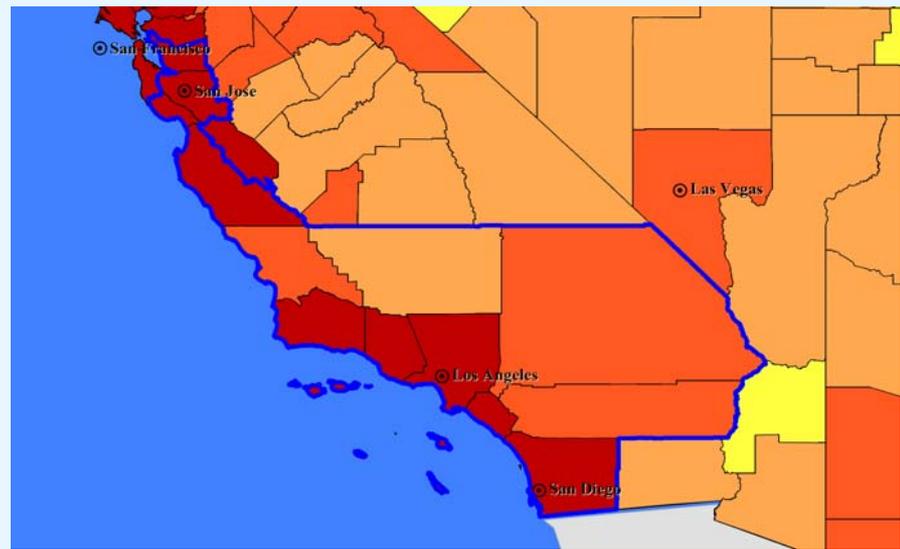
Global Recognition: California is recognized around the world as a center of innovation, and the CIC captures most of its core capacity. It boasts a vibrant and experienced entrepreneurial community, high quality university systems, and high degree of available capital due to an active venture capital market. In addition, a strong presence of successful innovative firms (with subsequent spin-outs and management talent) and a large local market make California an ideal location for the development of new and converging technologies.

Industry Base: A multitude of high-tech companies are located in the CIC region, including Cisco Systems, Intel, Hewlett Packard, and Sun Microsystems. The CIC also hosts the majority of California's 2,500 biomedical companies including Amgen and Genentech, and leading companies in renewable energy such as Nanosolar, Inc. and SunTechnics. Finally, particularly in the Los Angeles, there is a strong presence of top Aerospace companies such as Boeing (Space Systems) and Northrop Grumman (headquarters in L.A. and Integrated Systems facility in El Segundo).

Workforce: The CIC region boasts a large and diverse workforce, ranging from less skilled manufacturers to highly skilled scientists and engineers. In 2006, 31.1% of the population had a college degree, and about 60% of the population over 25 had some college experience. The region hosts several large industry clusters including Energy, Advanced Manufacturing, Biomedical, IT, and Aerospace, which each employ between 400,000 and 500,000 people. Healthcare is the largest cluster, employing about 785,000 in the CIC region.

Innovation Base: CIC has a broad base of research assets that provide a solid foundation for innovation. It is home to hundreds of college and university campuses, including several top research universities. The University of California system is one of the largest in the country, educating over 200,000 students at ten campuses throughout the state. It includes leading research universities such as UC-Berkeley, UC-Los Angeles, and UC-San Diego. Top private universities in the area include Stanford and the California Institute of Technology. Universities host or partner with research institutes in a variety of fields and include the Lawrence Berkeley National Laboratory (biology, nanoscience, and energy systems), the California Institute of Technology's Jet Propulsion Laboratory (spacecraft design and robotics), and the UC-San Francisco Institute for Regeneration Medicine (stem cell research). In addition, research in industries such as Aerospace are supported by military installations in the area like Edwards Air Force Base, which hosts and research and manufacturing facility, and the Los Angeles Air Force Base, home to the Space and Missile Systems Center. Finally, private industry enhances the research infrastructure as many of the leading companies have located their R&D divisions in the area. Facilities include HP Labs, the premier R&D engine for Hewlett Packard, with facilities in Palo Alto as well as the Johnson & Johnson Pharmaceutical Research & Development, L.L.C., which is become a leading biotechnology center. Also located in the area is the a leading research and development unit for the Lockheed Martin Aeronautics division known as "Skunk Works."

Income Levels in California Innovation Corridor (Darker regions indicate higher average household income)



Key Economic Development Strategies and Programs

Statewide Programs

Multidisciplinary

California Institutes for Science and Innovation are four institutes located at University of California campuses that leverage public-private partnerships in research areas critical to sustaining California's growth. Combined, these four institutes receive over a billion dollars for research in the following fields: biomedical, bioengineering, nanotechnology, telecommunications, and information technology.

UC Discovery Grants are a three-way partnership between the University of California system, the state of California, and industry sponsors. Projects are financed by the state of California through research funds and tax credits, and these funds are matched by California-based companies, who in turn are given the opportunity to partner with UC scientists and students and obtain access to UC laboratories and resources. Areas of focus include biotechnology, communications and networking, digital media, IT for life sciences, microelectronics, and electronics manufacturing and new materials.

Governor's Research and Innovation Initiative was announced in 2006, and it will provide almost \$95 million in funding for research in key innovation sectors including cleantech, biotech, and nanotech. Among the programs it supports are the Helios Project, which seeks to find new carbon-neutral sources of energy, and the UC-Berkeley's selection as a site of the BP-sponsored \$500 million Energy Biosciences Institute, which will position California as a world leader in clean energy research. This initiative also provides \$5 million toward the University of California's bid to build a \$200 million Petascale Supercomputer.

California Teach Program seeks to increase the number of qualified math and science teachers for K-12 education in California. Sponsored by the State of California and 18 private businesses including Boeing, HP, and Amgen, this program seeks to quadruple the number of certified math and science teachers produced by the UC system by 2010 from 250 to 1,000. Elements of this program include financial incentives for participants (including loan forgiveness) and paid internship opportunities to facilitate entry into the teaching workforce.

Aerospace

California Space Grant Foundation facilitates and manages learning opportunities for K-12, college, and continuing education students. This includes a mentor program for students and research professionals as well as numerous scholarship and fellowship opportunities for Aerospace field work.

California Space Education and Workforce Institute, Inc. works closely with the California Space Authority to stimulate awareness and understanding of the California space enterprise and its accompanying research needs. It also works to attract, integrate, and retain a robust California space workforce. The Institute is currently assembling an inventory of all STEM (Science Technology, Engineering, and Mathematics) education programs within California.

Biomedical

Biological Technologies Initiative was started in 1997 to enhance biotechnology education and training. The initiative is led by six training centers who oversee training at local community colleges and partner with biotechnology firms, local schools, universities, public agencies and associations.

Proposition 71—Stem Cell Initiative establishes the California Institute for Regenerative Medicine to regulate stem cell research in the state of California and provide funding, through grants and loans, for stem cell research. The initiative provides up to \$3 billion in funding over the next ten years. Funding has been used for a variety of stem-cell related grant programs including the establishment of a stem cell research fellowship training program.

Nanotechnology

Nanoelectronics Research Initiative is led by the Semiconductor Industry Association, which seeks to accelerate research in nanotechnology for the benefit semiconductor industry. It partners with research centers across the U.S. including the Western Institute of Nanoelectronics at UCLA (which partners with three UC schools and Stanford). This initiative also funds NSF research centers such as the Materials Research Laboratory at UC-Santa Barbara

Renewable Energy

The Green Wave Initiative involves the two major California pension funds (CalPERS and CalSTERS). In 2004, they combined to allocated \$450 million dollars to private equity firms for investment in renewable energy companies. Both funds are expected to have all of this capital invested by the end of 2006. The sheer magnitude of this commitment will provide a significant boost to the renewable energy sector.

Public Interest Energy Research (PIER) Program, managed by the California Energy Commission, supports energy research and development through issuing up to \$62 million dollars in awards annually. PIER partners with San Diego State University to issue awards to promising proof-of-concept energy research.

Renewable Resource Trust Fund is funded with \$135 million annually from the three California investor-owned utilities via a public goods surcharge on electricity use. This money is distributed to a variety of existing, new, and emerging renewable generation technologies including biomass, wind, geothermal, small hydro, PV and thermal solar, and fuel cells.

Innovation Infrastructure

Public-Private Partnerships

There are a variety of public-private partnerships throughout the state that encourage the development of technology-based business, supporting a wide range of entrepreneurs and emerging companies. Through these partnerships, companies are granted access to technical and business service providers and information about federal funding opportunities and technology assistance programs. In addition, many of these partnerships help facilitate technology transfer between government laboratories and small companies, and they also provide networking opportunities to link small firms with larger firms in related industries. Partnerships can occur in many forms, including strategic alliances, technology funds, research institutes/research centers, and technology transfer programs. They can also be multidisciplinary in nature or they may focus on specific sectors, both well-established and emerging sectors. In addition, there are several partnerships that focus on converging technologies such as biotechnology, information technology and nanotechnology. In all forms, public-private partnerships are essential for promoting collaboration and the efficient use of resources.

Business Incubators

The CIC region contains several business incubators that support start-up and early stage high-tech companies. They offer a variety of support services including business consulting, mentoring, and access to networking opportunities. In addition, business incubators play a large role in helping companies obtain funding from angel and venture capital investors. While many incubators support start-up companies in all fields, there are several with a specific focus such as environmental technologies, space technologies, or international business.

Technology Funds

Technology funds are typically public revolving loan funds that help finance small businesses efforts to raise working capital and accelerate growth. There are a variety of technology funds throughout the state, financed by city or county governments. Currently, many of these funds are focused on emerging technologies and renewable resources.

Regional Trade Associations

The CIC is home to a variety of regional trade associations and industry associations. They are active in fields ranging from biotechnology and bio-agriculture to construction to computer science. Many of these organizations are involved in promoting business and legislative issues, and educating the general public about the use of certain technologies. In addition, most trade associations provide support services for member companies including financial and marketing assistance as well as numerous networking opportunities.

Venture Capital Networks

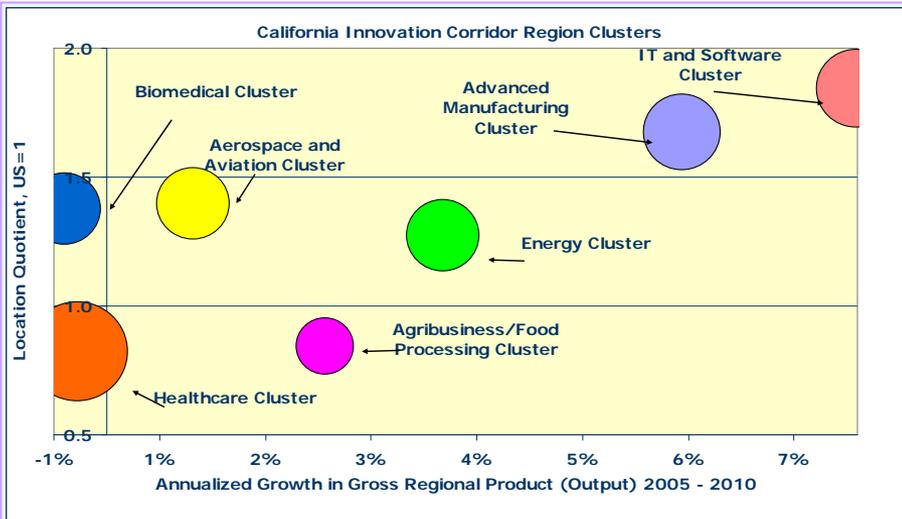
California has always had success in attracting venture capital, and this is partly due to its venture capital networks throughout the state that link entrepreneurs with sources for knowledge and capital. Most provide a variety of forums that bring together entrepreneurs, business leaders, technology specialists, and angel investors. Many also offer workshops in topics such as business plan creation, IP protection, and raising VC funds. In addition, several venture capital networks publish funding guides for start-up, emerging, and growing businesses searching for funding or funding advisors.

Technology Transfer

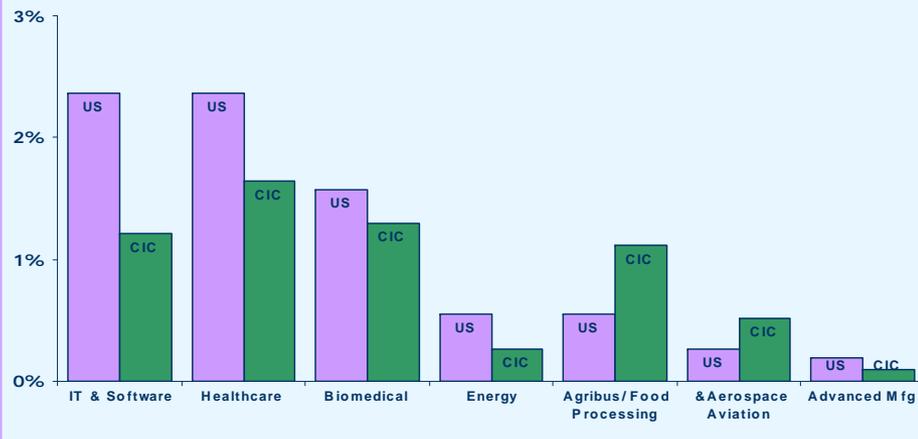
Technology transfer primarily occurs at the technology transfer departments at national laboratories and universities. California universities are among the top in the nation in measures of tech transfer. In a 2006 tech transfer ranking by the Milken Institute based on patents, licensing income, and start-ups, three of the top four universities in the country were in California. MIT was first, followed by the University of California system, California Institute of Technology, and Stanford University. The UC system was also the most successful university in the country in licensing income, averaging about \$100 million annually from 1997 to 2003. Stanford was second with \$50 million, followed by MIT with \$33 million.

California universities are also among the top in the world in terms of patenting. Three UC schools (Berkeley, San Francisco, and San Diego) and Stanford were in the top ten universities in the world in biotechnology patents issued from 2000 to 2004, with UCSF tied for first with 219 patents. All 10 UC schools ranked in the top 100.

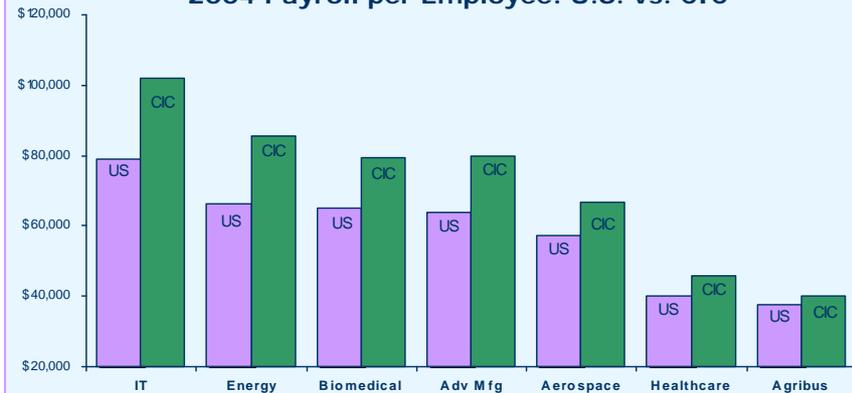
Industry Summary



2005-2010 Annualized Cluster Employment Growth Rates: U.S. vs. CIC



2004 Payroll per Employee: U.S. vs. CIC

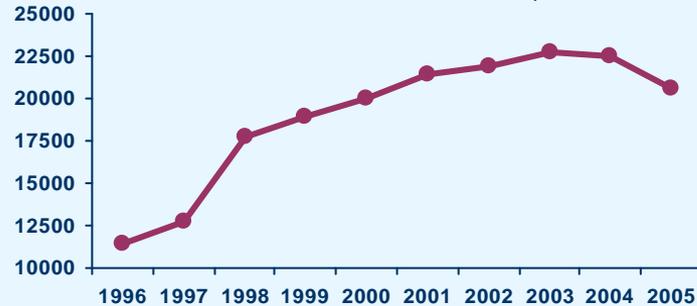


➤ **Industry Overview:** The California Innovation Corridor is home to a number strong industries. Five of the seven clusters examined have a location quotient greater than one, which indicates an employment concentration that is above the national average. The five industries are Biomedical, Aerospace, Advanced Manufacturing, Energy, and IT. The region's strongest cluster is IT, which has the highest location quotient at nearly 2 and leads the region in growth, with annual projected output growth of over 7% from 2005 to 2010. Advanced Manufacturing is also well positioned, with a location quotient above 1.5 and projected growth of around 6%.

➤ **Employment Growth:** CIC is not projected to keep pace with the national employment growth levels in the majority of clusters. Two exceptions are Agribusiness/Food processing and Aerospace, with projected growth rates of 1% and 0.5%, respectively. Highest employment growth is predicted in Healthcare, followed by IT and Biomedical. However, the region still trails the nation in all three clusters. Advanced Manufacturing is predicted to have the least growth, with relatively stagnant employment levels through 2010.

➤ **Average Wages:** CIC has extremely competitive wages, as measured by payroll per employee. It leads the nation across all industries, with average wages ranging from just over \$100,000 in IT to about \$40,000 in Agribusiness. Energy, Biomedical, and Advanced Manufacturing also have relatively high wages that average around \$80,000. The largest wage gap occurs in IT, where CIC leads the national average by about \$20,000.

Breakdown of Patents Issued in CIC, 1996-2005



➤ The number of patents issued in the CIC region has steadily increased over the past ten years. The apparent drop-off in 2004 may be attributed to the time required to approve patents at the USPTO. Data and observations point to a slow-down in patent approval, which may result in fewer patents granted in some parts of the country.

➤ Nearly all of the top patent assignees are high-tech companies such as Advanced Micro-Devices Inc. and Hewlett-Packard. The University of California is the only non-business entity that has generated a significant number of patents, over 2,700 from 1996 to 2005. The presence of two Aerospace-related companies, Raytheon and Northrop Grumman, reflects the strong Aerospace background in the region.

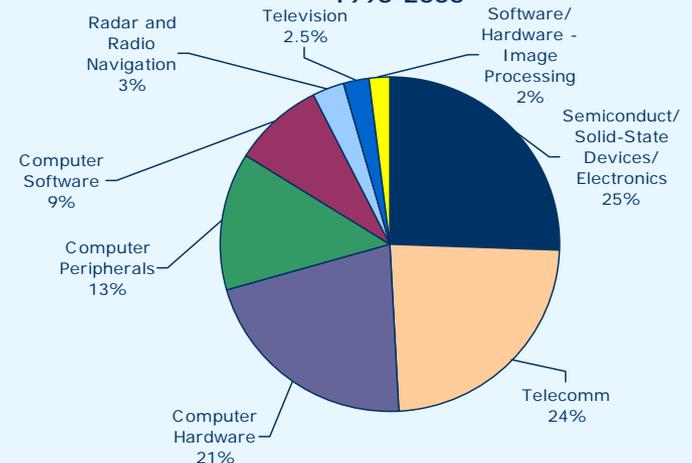
| Top Patent Assignees, 1996-2005 | Patent Count | % of Total |
|--------------------------------------|--------------|------------|
| Advanced Micro Devices Inc | 4,252 | 3.1% |
| International Business Machines Corp | 3,828 | 2.8% |
| Hewlett-Packard Co | 3,486 | 2.5% |
| Sun Microsystems Inc | 3,086 | 2.2% |
| Applied Materials Inc. | 2,920 | 2.1% |
| University of California | 2,704 | 2.0% |
| Intel Corporation | 2,441 | 1.8% |
| Raytheon Co. | 2,157 | 1.6% |
| Sony Corp | 2,015 | 1.5% |
| Northrop Grumman Corp | 1,794 | 1.3% |
| LSI Logic Corp. | 1,666 | 1.2% |

| Technology Sector | US | US Share | CA | CA Share | CIC | CIC Share |
|------------------------|----------------|----------|----------------|----------|----------------|-----------|
| Advanced Materials | 58,215 | 7.2% | 5,841 | 3.2% | 4,703 | 3.0% |
| Aerospace & Defense | 9,281 | 1.1% | 1,836 | 1.0% | 1,635 | 1.1% |
| Energy | 27,415 | 3.4% | 3,999 | 2.2% | 3,222 | 2.1% |
| Environmental | 10,402 | 1.3% | 1,566 | 0.9% | 1,224 | 0.8% |
| Industrial Processes | 18,166 | 2.2% | 2,375 | 1.3% | 1,936 | 1.3% |
| Information Technology | 266,417 | 32.9% | 89,680 | 48.5% | 77,806 | 50.4% |
| Life Science/Health | 146,348 | 18.1% | 38,147 | 20.6% | 29,847 | 19.3% |
| Logistics | 8,011 | 1.0% | 1,269 | 0.7% | 1,003 | 0.6% |
| Miscellaneous | 52,665 | 6.5% | 8,558 | 4.6% | 6,935 | 4.5% |
| All | 810,421 | | 185,062 | | 154,532 | |

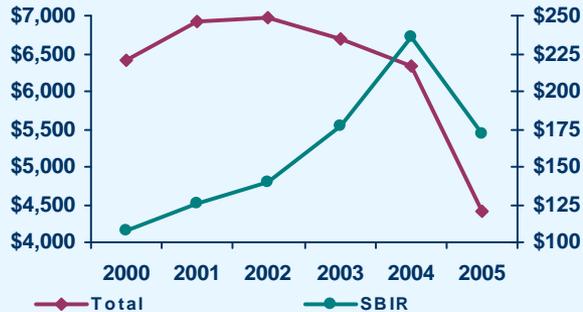
➤ As a reflection of the multitude of high-tech firms in California, both the state of California and the CIC have relatively large share of patents issued in IT compared to the national average. Both regions maintain a share of about 50%, which is significantly greater than the national average of 33%.

➤ Within IT, the largest sub-category of patents is Semiconductors/ Solid State Devices, followed by Telecommunications and Computer Hardware.

Breakdown of Patents Issued in CIC in IT, 1996-2005



Federal R&D Funding Trends (USD Millions)



➤ In the CIC, total federal funding had been decreasing gradually since 2002 and there was a sharp reduction in funding after 2004. In contrast, SBIR funding had been increasing steadily during that time until a sharp drop-off after 2004. SBIR funding in 2005 represented just under 4% of total federal funding in the CIC.

➤ There have been several changes in the major sources of federal funding provided to CIC from 2000 to 2005. Although the Department of Defense was the top contributor in both years, it reduced funding by about 25% in that five year period. NASA, the second largest contributor in 2000, reduced its funding by about 60% during that time. On the other hand, science and engineering focused agencies such as NSF and HHS have increased their funding during this period. HHS is currently the second largest provider of federal funding in the region.

Top Funding Agencies, 2000 (USD Millions)

| | |
|------|---------|
| DOD | 2,057.9 |
| NASA | 1,861.6 |
| HHS | 1,190.7 |
| DOE | 635.2 |
| NSF | 350.9 |
| DVA | 140.7 |
| DOC | 64.6 |
| DOT | 49.8 |
| DED | 26.0 |

Top Funding Agencies, 2005 (USD Millions)

| | |
|------|---------|
| DOD | 1,539.9 |
| HHS | 1,255.2 |
| NASA | 602.7 |
| DOE | 445.3 |
| NSF | 403.3 |
| DOT | 56.3 |
| DOC | 47.1 |
| USDA | 15.6 |
| DED | 15.5 |

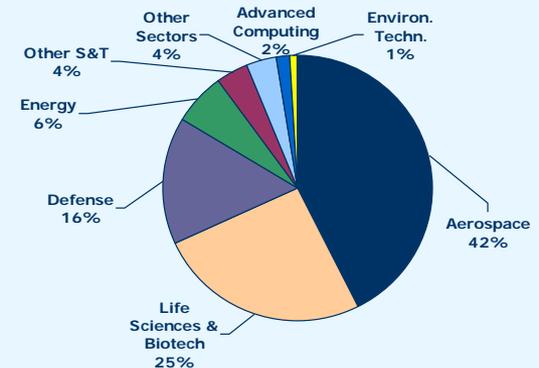
Top Recipient Counties, 2000-2005 (USD Millions)

| | |
|-------------|----------|
| L.A. | 16,504.8 |
| San Diego | 6,332.1 |
| Alameda | 4,779.7 |
| Santa Clara | 4,651.1 |
| Orange | 3,378.5 |

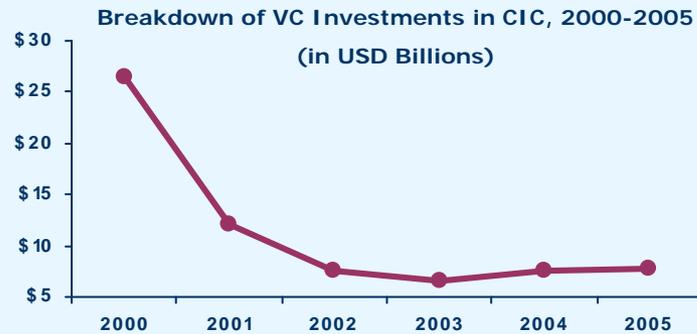
➤ Los Angeles County was the top recipient county of federal funding during this five year period, with a large portion of the funding given to UCLA. San Diego was the second large recipient, followed by Alameda, Santa Clara, and Orange Counties.

➤ The Aerospace sector is the largest focus of federal funding in the region, as expected, given the large spread of Aerospace and Defense contractors and military research facilities in the region. This is followed by Life/Sciences and Biotech. Interestingly enough, despite the region's presence on environmental technologies, this sector received just 1% of federal funding in the region from 2000 to 2005, which has led to a greater reliance on state and private funding for renewable energy and other clean technology initiatives.

Breakdown of federal funding in CIC by sector, 2000-2005



Venture Capital



- In the CIC, total venture capital funding decreased sharply from 2000 to 2002 and it has remained around \$7 billion since then.
- The strong presence of high-tech companies and the rich innovation culture in the Silicon Valley contributes to Santa Clara's position as the top county in VC investment. With more than \$37 billion between 2000 and 2005, this county has nearly four times more investment than the next highest county, Alameda, which had \$9.5 billion. San Diego County is third with \$8.1 billion and Los Angeles is fourth with \$7.9 billion.

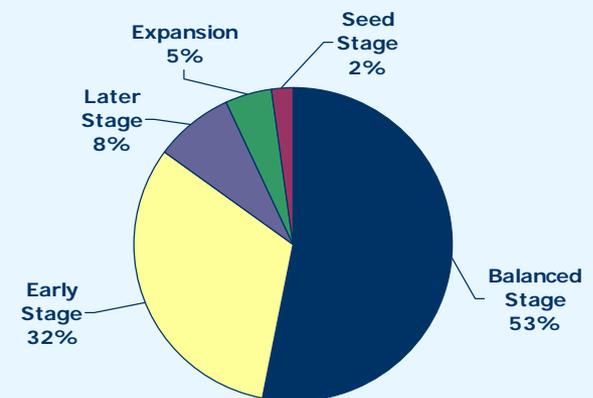
| Top Counties in VC Investment, 2000-2005 (USD Billions) | |
|--|------|
| Santa Clara | 37.1 |
| Alameda | 9.5 |
| San Diego | 8.1 |
| Los Angeles | 7.9 |
| Orange | 4.3 |
| Santa Barbara | 0.6 |
| Santa Cruz | 0.3 |

VC Investment by Technology Sector, 2000-2005 (USD Billions)

| | |
|----------------------------------|-------------|
| Computer Related | 22.6 |
| Communications and Media | 18.2 |
| Semiconductors/Other Electronics | 11.3 |
| Medical/Health/Life Science | 7.0 |
| Non-High-Technology | 4.6 |
| Biotechnology | 4.4 |
| Total | 68.0 |

- VC Investments in the Computer-Related ventures represented the largest sub-category of investments, with \$22.6 billion in investments from 2000 to 2005., and this is closely followed by Communications and Media with \$18.2 million. Life Science and Biotechnology are less represented areas of venture capital, possibly because large portions of federal funding are serving to assist in research, commercialization, and start-up company efforts in these areas.
- A large portion of the venture capital investment is occurring in the relatively early development stages in start-up companies. More than half of all investments are made at the balanced stage and about one-third of all investments are made at the early stage.

Breakdown of Investment stage in CIC, 2000-2005



Source: Thomson Financial's VentureXpert, WITS for WIRED



www.InnovateCalifornia.net



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new economy strategies



making the complex simple