Internet Based Services Cluster in Silicon Valley
FINAL REPORT (PED-329: MICROECONOMICS OF COMPETITIVENESS)
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Disclosures:
(1) No team member has had any special or nonpublic access to information about the country or cluster that was utilized
(2) No team members traveled to California during the project period
Section 1 – Overview of the United States Economy

Despite sluggish economic performance in recent years due to the financial crisis, the United States remains the world’s largest economy with a nominal GDP of $14.7 trillion, which accounts for 20% of the world’s gross domestic product (EIU, 2010). In 2010, the economy grew by 2.9% driven mostly by consumption, which represented 70% of the economy (Kowalski, 2011).

The United States’ economy has evolved from one largely driven by the manufacturing sector to a service-based economy. For instance, during the 1940s manufacturing accounted for 38% of the economy, in contrast to 10% for services. Today, 79.6% of real GDP is generated by services (EIU, 2010). The clusters growing most rapidly include service clusters like business services, financial services, hospitality, and tourism (ISC, 2010).

Overview of US Business Environment: The National Diamond

The United States has proven to be one of the world’s most competitive economies given its sophisticated demand base, strong institutional environment, and emphasis on innovation. However, several of the factors that have contributed to the US’s competitive advantage are showing worrying signs. Indeed, although economic growth in the United States has rebounded since the 2008 contraction, its business fundamentals remain troubling.

The Global Competitiveness Index reflects a steady drop in US rankings, which fell to number four in 2010, down from first place and second place in 2008 and 2009 respectively. Currently, the US trails behind Switzerland, Sweden, and Singapore in descending order. This decline has been triggered by the recent financial crisis that exposed fissures in the US economy including unsustainable growth fueled by increasing leverage (standing at $14 trillion, 97% of GDP), and large current account deficits of approximately 4% of GDP, down from levels as high as ~6% of GDP in 2005. Furthermore, large
budget deficits of 8-10% of GDP between 2009-2011 have led to a weakening dollar and have sent tremors through capital markets on the country’s weakening financial position (Lauricella, 2011).

**Factor Conditions**
The United States has some of the world’s best higher education institutions, which have enabled an ample supply of qualified scientists, engineers, and managers. According to the Global Competitiveness Index, the US ranks 9th in institutions for higher learning. Additionally, the nation’s general infrastructure, which ranks 15th in the Global Competitive Index, helps foster competitiveness by making a variety of products easily available to consumers. The quality of the nation’s ports and roads also makes the movement of goods less costly. Troubling, however, is the dismal quality of the primary education system, ranked 34th by the same index. Based on 2009 PISA rankings, the US may face difficulties in producing future leaders in science and technology. The 2009 PISA rankings place the US at 31st in math and 23rd in science, far behind other leading countries like Japan (8th and 9th, respectively), Korea (4th and 6th), and Singapore (2nd and 4th).

**Demand Conditions**
The United States ranks 8th on business sophistication in the Global Competitiveness Index and 1st in market size. These rankings are based on the large market present in the US as evidenced by private consumption levels in 2010 totaling $10.4 trillion, and the sophistication of buyers given the high regulatory environment that establishes stringent standards for products and services. Unfortunately, demand conditions may suffer given projected low economic growth as consumers move away from discretionary goods (EIU, 2010). Government consumption will also likely decrease given the large national budget deficit.

**Context for Firm Strategy and Rivalry**
The US economy continues to be one of the most innovate economies with very strong university-industry research collaboration (ranked 1st by World Bank Doing Business Report) and very high
patents per capita (ranked 3rd in WB DBR). However, there are concerns about the US’s weakening position in R&D and lackluster performance in math and science education. While the country’s spending as a percent of GDP has risen to 2.82% in 2010 from 2.79% in 2008, this spending is lower than other leading countries (i.e. Japan at 3.28% of GDP). In fact, other regions are outspending the US, which has led to a drop in the US share of total global R&D spending down to 34.8% in 2010, in contrast to regions like Asia where it has increased from 32.0% in 2008 to 34.6% in 2010. Additionally, an inadequate rate of investment in science and technology will hinder the US’s ability to continue fostering entrepreneurship (Porter, 2008).

Despite these obstacles, the US remains a key business cradle and ranks 5th in the world for doing business according to World Bank rankings. Specifically the US is bolstered by its investor protection (ranked 5th globally in the GCI), a broad based availability of credit (ranked 6th), and ease of starting a business (ranked 9th). Additionally, the US has very strong intellectual property protection (ranked 1st in the GCI) and regulatory environment, supported by laws including the Sherman Antitrust Act of 1890, Clayton Act 1914, Robinson-Patman Act 1936 and the Celler-Kefauver Act 1950. This legal framework supports the US’s strong commitment to competition and free market values. Indeed, “America has been the country with the strongest commitment to competition and free markets [and] this belief has driven the remarkable level of restructuring, renewal, and productivity growth in the US” (Porter, 2008). Lastly, the country’s decentralized economic policy makes each state more efficient at responding and addressing its own local economic challenges, making the overall economy more competitive (Porter, 2008).

**Related and Supporting Industries**

As previously mentioned, the US has benefited historically from the high quality of its research and technological institutions, and strong university-industry research collaboration (ranked 1st by World Bank Doing Business Report). Additionally, the US has one of the deepest and most efficient capital
markets in the world, particularly for risk capital (Porter, 2008). For instance, the country ranks 13th on the GCI for venture capital availability. Although the decentralized economic policy makes local economies more attuned and responsive to their particular needs, this has also translated in a lack of federal support on regional cluster development that may hinder future growth. As Professor Porter describes, the federal government has created programs that “are not designed to support regional clusters, nor do they send money where it will have the greatest impact in each region” (Porter, 2008).

**Section 2 - Overview of California’s Economy**

**California Economic Analysis**

**Economic Overview**

California is the world’s eighth largest economy with a population of more than 38 million people. Its 2010 Gross State Product (GSP) of ~$1.85 trillion accounts for ~13% of the US economy. California’s merchandise exports in 2010 totaled $142.3 billion (GOED, 2010) and its access to the Pacific and strategic geographic location makes it a prominent global trade hub. Total trade in California as a percentage of GDP stands at 21.3% in 2009 vs. 18.3% for the overall US economy. California also receives the most FDI from all the US states at $130B in FDI in 2009 (CalChamber, 2010).

California has a diversified economy and is a major exporter of computer and electronics, transportation equipment, non-electrical machinery, chemicals, and various agricultural products (Exhibit I). The state is a magnet for talent from around the world and has a very diverse population in terms of race and ethnicity, which tends to stimulate its potential for innovation and economic growth (Exhibit II). It also has a strong endowment of natural resources that not only makes it a top agricultural producer (Central Valley produces 8% of the nation’s agricultural output on less than 1% of farmland) (USGS, 2008), but also a key tourist destination. California’s natural beauty, biodiversity, and wildlife, make it a prime tourist destination (CTTT, 2011).
The state has a number of defined world-class clusters that are major contributors to its economy. The IT cluster in Silicon Valley is a prime example. Others include the entertainment cluster in Los Angeles, winemaking cluster in Northern California, biotech cluster in San Diego, agricultural cluster in the Central Valley, and the business services cluster in San Francisco.

The California Business Environment through the Diamond Framework

▶ Factor Conditions

California has outstanding access to high quality business inputs that play a significant role in the state’s competitiveness nationally and beyond (see Exhibit V).

- Human Resources:

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<th>Strengths (+)</th>
<th>Weaknesses (-)</th>
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<td>California boasts qualified and abundant human capital. The state is home to ~1 million high-tech workers, representing more than one-sixth of all high-tech workers in the US.</td>
<td>California has a relatively high cost of living (ranked 48th out of 50 in the US) (Cohn, 2010), which has led to a significant outflow of skilled workers to states like Nevada, Oregon, and Texas. Such states have benefited from this outflow and have been able to form competitive clusters in many areas in which California has historically held leading positions (e.g., IT, biotech, business services, etc.).</td>
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<td>According to U.S. News rankings, six of the top twenty engineering schools (e.g., Stanford University, UC Berkeley and CalTech) and two of the top five design schools (e.g., Art Center College of Design, Pasadena &amp; California College of the Arts) are located in California. Those institutions, as well as top business schools (e.g., Stanford GSB, Haas School of Business, UCLA, USC, etc.), produce highly qualified professionals who take leading positions in the state’s economy.</td>
<td>California is known for excessive costs of recruiting and retaining qualified personnel, which has a negative effect on the willingness of established businesses to invest in the state and on new businesses to establish a meaningful presence there. The state also possesses one of the highest employee churn rates in the country.</td>
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| The state’s access to qualified human capital is also fueled by a large inflow of foreigners who move to California drawn by its high standard of living and strong demand for specialized skills (e.g., software engineering, financial and business services, etc.). The state’s diverse and international population contributes to its reputation for innovation and productivity (e.g., California boasts 15

- The state is prone to natural disasters including earthquakes (e.g., San Andreas Faultline), and wild fires (Southern California).
- The state’s land access to the Mexican border can be viewed positively and negatively. While California takes advantage of trade opportunities with Mexico and South America, serious issues like illegal
- Access to Capital: California has unrivalled access to capital from a variety of sources such as federal programs, commercial lending, access to financial markets, and various forms of venture capital. In 2010, California companies received $11.2 billion of VC funding as part of 1,142 deals, representing ~41% of total VC dollars and 47% of all VC deals in the US (PWC, 2010). The top sectors receiving VC in the state are as follows: Internet, healthcare, mobile & telecommunications, software, and energy.

- Physical Infrastructure: The state has an extensive road network that totals to more than 15,000 miles of highways and freeways (GOED, 2010). California’s access to the Pacific, its proximity to the Panama Canal and the sheer size of its economy makes it a prominent trade hub and home to thousands of logistics and trade services companies. The state’s 12 cargo airports and 11 cargo seaports enable huge exports (e.g., California’s merchandise exports in 2010 amounted to $142.3 billion, a 16% increase from 2009) (GOED, 2010). Domestic and international trading activities are also complemented by the existence of 18 foreign trade zones and 42 enterprise zones in the state. Recently, there has been a growing concern about the state’s aging infrastructure, exacerbated by chronic state budget deficits, as well as the global financial downturn. California’s infrastructure investment needs are estimated at $500 billion over the next 20 years (PIC, 2009) and those cannot be financed through GO bonds.

- Scientific and Technological Infrastructure: California has long been home to the best-in-class scientific and technological infrastructure. California is home to 3 out of 10 NASA centers in the US. It also hosts 40 federal research laboratories and is the epicenter of hi-tech innovation in the nation. As previously mentioned, major research institutions like Stanford, Berkeley, and CalTech have had vast impact on attracting and further developing prime talent from around the
world. Lastly, the network effects resulting from the high concentration of technology companies, as well as state initiatives such as Innovation Hub (iHub) started in 2010, contribute to the continuous evolution of the scientific environment that results in the effective utilization of the underlying infrastructure.

- Efficient Access to Natural Endowments: California’s access to natural resources makes it a top agricultural producer. Its natural beauty, biodiversity, wildlife, and prime tourist destinations attracted 12.5M international travelers and 322M domestic person-stays in 2009 (CTT, 20110). Direct travel spending in California amounted to $95.1B in 2010. Lastly, the state has significant natural resources such as oil, wind, water resources, hydropower, and solar energy, to name a few.

- Demand Conditions

California is the world’s 8th largest economy with a population of more than 38M people. Four of the top twenty most educated cities in the US (San Francisco, San Diego, Oakland, and San Jose), as well as the two cities with highest household income (San Jose and San Francisco) are located in the state and are home to demanding and sophisticated consumers with high appreciation of innovation. The state has strong safety and quality regulations and enforcement mechanisms. Its environmental standards are the highest in the world (GOED, 2010), which has actually resulted in it driving away a number of businesses (e.g., oil refineries). The state also has a dedicated Department of Consumer Affairs that strictly enforces consumer protection laws, including local initiatives (e.g., Tanner Consumer Protection Act, protection from abusive debt collection practices, etc.). Given, California’s leading position in terms of innovation (Silicon Valley, San Diego biotech cluster, etc.) and popular culture (e.g., Hollywood), the state tends to experience periods of exuberance and bubbles.

- Context for Firm Strategy and Rivalry
California’s overall ranking in terms of attractiveness to businesses is rather poor (32nd place out of 50) (CNBC, 2010). Some of the areas in which the state has particularly poor ranking against the 50 states are cost of living (49th place), business friendliness (49th place), cost of business (48th place), education (31st place), and workforce (31st place). Furthermore, California’s firms are thwarted by rising unionization in the state, which inevitably leads to higher wages and benefits. In 2010, California was rated the worst state to do business for a fifth consecutive year as part of the Chief Executive’s Annual that collects opinions from 600+ CEOs (Donlon, 2011). The state has seen many companies relocate important parts of their businesses to other states and/or internationally due to the overly burdensome regulatory environment. The state currently has one of the highest unemployment levels out of any state (12.5% as of Dec. 2010 vs. 9.4% in the US).

Despite these shortcomings, California ranks first among US states in terms of technology and innovation. The number of patents issued in the state, which currently stands at 15 patents per 10,000 people, far exceeds the US average of 6.8. The state’s 24% R&D tax credit to businesses provides a powerful incentive for investment in new processes and products alike. In fact, California ranks higher in terms of R&D spending as a percentage of GDP than powerhouses like Japan, US, South Korea, Germany and France. Firms in the state, especially in the hi-tech sectors, engage in fierce competition over attracting talented workers, which places California among the top ten states in terms of wages. Given the tremendous output that the state has in terms of creative and innovative content, as well as technology patents, its firms have a strong commitment to IP protection and are supported by the state.

**Related and Supporting Industries**

The sheer size of California’s economy gives rise to the great diversity of industries and the opportunities its citizens have for transitioning between those. The state is home to leading IT, financial sector, and business services companies, as well as to powerful supporting industries such as law, consulting, and alternative investing (VC, PE, hedge funds, etc.). The venture capital industry has
played a key role in nurturing nascent companies with ambitious ideas, which have spurred new industries.

In spite of the robust network of related and supporting industries that exist in California, the state lacks inexpensive business development frameworks like business incubators, which allow for the emergence of businesses that are not necessarily part of the latest entrepreneurial vogue. Federal R&D funding to the state has also declined over time, leading to a greater need for self-reliance of enterprises. Lastly, the high level of fluidity between related industries in the state results in a high propensity for structural shifts, which creates volatility that is exacerbated by economic recessions and other adverse effects on the economy.

**Institutions for Collaboration**

California has an elaborate network of institutions that promote collaboration between a variety of industries and economic initiatives that we have separated into three groups: academic institutions, special interest groups, and state initiatives.

**Key Academic Institutions:** As previously mentioned, the state is home to a number of prestigious universities that have close ties with the private sector and conduct research in some of the most innovative fields of technology. Prime examples are Stanford University, CalTech, and the UC System. Many of the world’s most successful technology companies originated at these institutions and those ties are maintained and expanded through links related to recruiting, specialized research-funding, joint ventures, close ties with the venture capital community, and technology transfer programs.

**Key Special Interest Groups:** There are many organizations that promote collaboration and economic development within the state. The California Chamber of Commerce is the largest such group with more than 16,000 members, which helps businesses navigate federal and state commercial regulation and plays a major role in promoting trade and investment activities. Another prominent organization
with a similar mandate is the California Association for Local Economic Development (CALED), which aims to help its members deliver “economic development services to their communities and business clients” (CALED, 2011). The state is also home to a myriad of foreign trade offices, centers for international trade development, trade associations, industry associations (entertainment, building, lodging, solar energy, etc.), and other regional initiatives (e.g., California Stewardship Network, an initiative between eleven state regions to develop solutions to key economic, environmental, and community challenges).

**Key State Initiatives:** California’s government has pursued a number of statewide initiatives over the years to promote collaboration and economic growth. For example, the California’s Enterprise Zone program was established in 1984 with the goal of stimulating business investment in depressed areas of the state and creating new job opportunities. Today the California legislation allows for 42 Enterprise Zones (CAEX, 2011) In 1988, the California Legislature unanimously approved the formation of the California Council on Science and Technology. The organization, led by representatives from academic institutions and the business community, is designed to “offer expert advice to the state government and to recommend solutions to science and technology-related policy issues” (CCST, 2011). Given California’s prominent trade position, the state has pursued a number of programs that stimulate exports and domestic and international commerce. Furthermore, the state has made strong efforts in attracting FDI through its International Trade Promotion Program, which provides market research, technical assistance, networking with investors, and financial and logistics assistance to businesses. In 2005, Governor Schwarzenegger’s administration established the California Economic Development Partnership to coordinate the state government’s economic development activities. Governor Brown followed up on this initiative and launched the Governor’s Office of Economic Development (GoED) in 2010, thus establishing a “one-stop shop and consolidating the state’s fragmented economic development resources to cater to California businesses
needs” (GOED, 2011). As part of the GoED structure, the State also launched the Innovation Hub (iHub) initiative in 2010. Its goal is to “improve the state's national and global competitiveness by stimulating partnerships, economic development, and job creation around specific research clusters through state-designated iHubs. The iHubs will leverage assets including research parks, technology incubators, universities, and federal laboratories to provide an innovation platform for startup companies, economic development organizations, business groups, and venture capitalists” (GOED, 2011).

**Summary of Key State Challenges and Recommendations**

- **Challenge: Poor Governance and Fiscal Health**

  California's deficit is the largest of any of the 50 US states in absolute dollar terms (Baltimore, 2011). The administration identifies a $25.4 billion budget problem, which consists of an $8.2 billion deficit that would remain at the end of 2010-11 absent additional budgetary action, as well as an estimated $17.2 billion gap between current-law revenues and expenditures in 2011-12 (LAOCA, 2010). Reasons for the budget shortfall include: the state’s inability to achieve previous budget solutions in several program areas; the expiration of various one-time and temporary budget solutions approved in recent years; and California’s failure to obtain significant additional federal funding for key programs.

- **Recommendations: Bridge the Gap**

  - California must relax the super majority rule for local revenue measures in order to unlock significant funding sources for essential infrastructure and public services that are presently funded through additional borrowing.
  
  - The state should also simplify its tax code, work to close loopholes, expand its tax base, and adopt popular taxes. We recommend that the state adopt most of the steps proposed by the California Tax Reform Association (CTRA, 2011), which include: Enacting an oil severance/production tax
(expected to generate $1 billion +) – California currently taxes oil at 60c per barrel, while other states and countries tax $6+ per barrel; Terminating the election of the single sales factor (expected to generate $850 million to $1 billion) – presently California allows multi-state corporations annual selection of the formula they use to report their taxable income, which results in significant manipulations of their taxable income and lower revenues to the state; adopting a statute to change how commercial property is assessed (expected to generate billions) – California is the only state that assesses commercial property based on a “change of ownership” rather than on market value basis; and increase sin taxes on cigarettes and alcohol (expected to generate $1-2 billion).

- California must curb the initiative process (e.g., Proposition 13), which has placed tremendous pressure on the state’s resources. This process has become almost “extortionary” and mostly serves special interest groups, which have a complete disregard for the fact that new public services have to be paid for and that lower taxes do not meet this need.

**Recommendations: Unlock Value In Infrastructure**

- The above-mentioned recommendations are meant to unlock significant revenue sources that could fund essential new infrastructure (e.g., California’s infrastructure investment needs are estimated at $500 billion over the next 20 years (PPIC, 2009)) and maintenance. We also recommend the implementation of user fees for key assets such as road systems and parks, as well as onto important resources such as gas and water to promote responsible consumption.

- We also recommend the pursuit of public-private partnerships in key areas such as transportation, utilities, and correctional facilities to leverage the private sector’s resources and expertise.

**Challenge: Poor K-12 Education**

The quality of the state’s public education is a key concern. A survey conducted by the California Business for Education Excellence (CBEE) found that California’s constituents identify significant
problems in the education system including an inefficient allocation of school resources; an “achievement gap” between students of different socioeconomic backgrounds; weak accountability and performance measurement standards; and a decreasing number of engineering graduates in the state.

► Recommendations: Accountability and Reform

We believe CA must make overall student assessment test scores and grade-level performance available and understandable to the public so that parents can make informed decisions about their children’s education:

- Implement teacher performance measurement systems in K-12.
- Give parents clear options for when their local school is chronically low-performing, including easy-to-access tutoring services for their children, transfers to another school, and charter school options.
- Establish a strategy plan for those low performing schools that includes providing additional funds for those schools that raise achievement as an incentive for improvement.

Quality of education is critical to the state’s long-term prospects. While the above-mentioned recommendations related to curbing future initiatives and increasing funding sources would have a positive effect on the state’s K-12 system, a comprehensive education reform is long overdue:

- Repeal Proposition 111, which has added an extraordinary level of complexity to the management and funding of the K-12 system and retain Proposition 98, which represents a simplified regulatory framework that protects education funding by imposing a “floor” to annual funding allocations.
- Reform the governance of the system in order to implement clear checks and balances, while preserving the decentralized nature of the system in order to allow for the local flexibility needed
to deal with external factors such as rising percentage of Hispanic pupils (e.g., Southern California).

- Promote the development of low-cost bilingual online modules and initiatives at universities that cover K-12 levels. This would allow for customized education delivery, leverage of significant knowledge base in the state, and flexibility in terms of remaining employed while studying. This initiative may be leveraged to address the growing concern around the rising percentage of under-educated Hispanics who could get additional out-of-the-classroom instruction.

**Section 3 - Assessment of Silicon Valley IBS Cluster**

**Cluster Description**

For the purposes of this project, the Internet Based Services cluster was determined by looking at companies whose “business model was fundamentally dependent on the Internet, regardless of the company’s primary industry category” (PWC Report). Using this definition, we distilled the cluster into five specific sub-clusters: Media & Entertainment, E-Commerce, Search and Content, Social Media, and Cloud Services (Software as a Service). Some of these clusters have long been a structural component of the Internet’s evolution such as Search & Content (i.e. Yahoo, Google), while other sub-clusters like Media & Entertainment (i.e. YouTube, Netflix) and E-commerce (i.e. E-bay, Amazon) resulted from disruptive moves and shifting paradigms in existing business models. Social Media (i.e. Facebook, LinkedIn) on the other hand originated from the evolution of IBS and Cloud Services (i.e. VM Ware, Sun), and emerged as enterprises migrated back-end and operations to a resilient and more cost efficient online environment.

**Development of the IBS Cluster in Silicon Valley**

The history of the IBS cluster must be understood through the evolution of Silicon Valley. From the early 1900’s through the 1950’s, Silicon Valley was primarily driven by military spending, specifically
through defense needs for WWI/WWII and the impending Cold War. The strong presence of the US Navy in California prompted research and development on technologies like the radar and the radio, thus establishing early foundations of a hardware cluster (Blank, 2008).

However, it wasn’t until the founding of Stanford’s Industrial Park in 1951 (the world’s first tech-oriented office park) that Silicon Valley as we know it began. Stanford’s role as a research and development anchor cannot be underestimated and companies like Hewlett-Packard, Varian Associates, General Electric, and Eastman Kodak owe large part of their success to the University’s guidance and support. Furthermore the presence of supporting institutions like XEROX’s Palo Alto Research Center (PARC) established in 1970 strengthened the bedrocks for innovation by championing key early developments like object-oriented programming and graphical user interfaces. PARC’s thought leadership has been pivotal throughout Silicon Valley’s history with developments like HTTP and IPv6 (standards that govern and design how the Internet functions) that have offered the cluster a leading position in emerging technologies like the Internet (Xerox, 2011).

At a federal level, the passage of the Small Business Investment Act in 1958 allowed for the licensing of private "Small Business Investment Companies" (SBICs) enabling the financing and management of start-ups and evolving to the venture capital industry. This was later complemented in 1978 by the "prudent man” exclusion in the 1978 Employee Retirement Income Security Act, which allowed corporate pension funds to access alternative investments thus boosting the importance and strength behind venture capital as an asset class.

Fueled by a growing venture capital community and solid technical foundations, every decade after the 1960s saw a major technological wave that shaped Silicon Valley through knowledge spillovers and labor mobility. This enabled the cluster to build on itself and capitalize on rising technological cycles. The first major development occurred with the shift away from transistors toward integrated circuits and semiconductors, which ultimately resulted in the development of the
microprocessor. Having significantly reduced the size and cost of computers, companies like Apple Computers began marketing personal computers to the mass markets in the 1970s. This decade saw growth led by the availability of capital, innovation, and the rise of a highly skilled workforce with an estimated 100,000 new manufacturing jobs added during this period. PCs proliferated during the 1980s and the need for content gave rise to a new software industry, which marked the initial transition from hardware to software that has continued since the 1990s. As the Internet began to establish a stronghold (greatly furthered by PARC’s efforts) skilled software programmers began looking at the web as a new source of growth, leading to the creation of online companies like Yahoo (’94) and Google (’98) and sparking a gold rush that culminated in the Dot Com bubble at the turn of the Millennium. The IBS cluster was effectively born during this period as brick and mortar concepts were taken online and new business models were developed leveraging the market power and connectivity of the web. Ten years later Silicon Valley’s IBS is the strongest Internet cluster in the world and home to the most admired and coveted online companies including Google, Facebook, Zynga, and Twitter among others (Morgan Stanley, 2009).

▶ Performance of California IT Cluster at Large

The IT Cluster is a vital part of California’s economy and ranks as the 8th cluster in employment (185,000 employees). At a national level, the California IT cluster is the largest cluster with approximately 19% of the total US IT employment followed by Texas and Washington, both of which are significantly behind with only 9% and 7.5% of the national share respectively. Unfortunately, however, California also ranks first in job losses with a 2.5% annual decline between 1998-2008. At a more granular level, these losses are primarily coming from the San Jose – Sunny Vale – Santa Clara MSA (6% of national employment, down 5.8% annually between 1998-2008), which fall within the Silicon Valley footprint. While the Silicon Valley cluster still has a very high location quotient (7.69 vs. Seattle at 5.2 and Austin at 2.1), its underlying fundamentals are troubling.
The Silicon Valley IT cluster can be broken down into six different sub-clusters: Electronic components and Assemblies (ranked 1st nationally), Software (ranked 1st), Communications Services (ranked 8th), Peripherals (ranked 8th), Computers (ranked 11th), and Fiber Optic Cables (ranked 13th). Each of these sub-clusters, with the exception of telecommunications, has been decreasing in number of establishments (between 1998 and 2008) led largely by a decline of software establishments (down to 762 in ‘08 from 1,223 in ’98). As mentioned earlier, the employment numbers are also dropping overall. The main culprit for the decrease has been Electronic Components and Assembly accounting for 58% of all job losses, while Software and Telecom have slightly offset this through marginal gains (ISC, 2011). After controlling for Electronic Components, the sub-cluster picture remains concerning given decreasing establishments and stagnant employment levels. Furthermore, the presence of a technology cluster today does not guarantee a technology cluster tomorrow without healthy indicators for growth.

Performance of the IBS Cluster Within the California IT Cluster

We see a more optimistic outlook when looking at growth prospects and entrepreneurial activity within the IBS cluster specifically. The total US investment dollars flowing into national Internet-based startups have recuperated to pre-bubble levels and remain steady at 17% of total US VC investments. However, within Silicon Valley, Internet ventures represent 38% (more than double the national level) of total VC investments in dollar terms. Internet investment has been an important growth driver behind Silicon Valley VC investments, which have increased substantially from 24% in ’95 (PWC, 2010).

Established Silicon Valley IBS cluster companies are performing well. While the SV150 (the top 150 publicly traded companies based out of Silicon Valley) has had lacking performance with YoY declines of 5.8% in sales, a decrease in employment of 5.6% and a slight dip in productivity per employee (down 0.20% YoY), the Internet sector is one of three sectors (along with
Computers/Peripherals and Biomedical) that partially offset these losses. IBS companies generated sales gains of 4.7% (vs. index 5.8% decline) and an increase in employee productivity of 4.7% (vs. -0.20% index decline) per employee. While employment decreased slightly by 0.80% (vs. index decline of 5.6%) it was likely due to conservative behavior as the ’08 slump continued to reverberate, and not related to weakening fundamentals. The index also reflects the structural shifts in Silicon Valley away from manufacturing and toward up-and-coming sectors like Biomedical (Mercury News, 2010). We can thus conclude from the information reviewed that the established IBS cluster is performing well, and the healthy levels of VC investment flowing into this cluster are indicative of strong prospects for future growth despite SV’s overall IT cluster performance previously discussed.

The IBS Cluster through the Diamond Framework

The Internet has become a global tool that is no longer limited to national boundaries as Internet penetration and computer literacy increase globally. In fact, there are competing clusters across the world ranging from developing countries like India and Ukraine, to more developed countries like Germany, Singapore, and Japan. Each of these clusters provides differentiated offers ranging across low cost offshore services to premium specialized software solutions. Silicon Valley also faces significant rivalry at a national level from clusters dotted across the US including Boston and NYC in the east coast, Chicago and Austin in the central US, and Seattle in its neighboring vicinity. However, none of these competing clusters offers the unique density, diversity, and virtuous entrepreneurial cycle that we see in Silicon Valley (see Exhibit V and Exhibit VI).

Factor Conditions

Silicon Valley has a privileged geography within California with access to the San Francisco metropolitan area. This brings with it the many benefits of agglomeration effects of a world-class urban environment and generates an attractive setting for the abundant MNCs (and their employees)
choosing to establish operations in the area. The presence of Stanford University in Palo Alto serves as a hub for the interchange of ideas, talent, and the permanence of networks through affinity groups and formal organizations like alumni chapters. Silicon Valley has higher levels of educational attainment relative to the rest of the state: Hispanics (14% vs. CA average of 10%), Black (28% vs. 21%), White (51% vs. 39%), Asian (57% vs. 48%). However the area is plagued by high unemployment, fast growing minorities groups with low levels of educational attainment (particularly Hispanics), and decreasing quality of life driven by high costs of living and pronounced congestion due to urban sprawl (SV Index, 2011).

- Demand Conditions

Silicon Valley has strong and sophisticated demand at a B2B and B2C level. The cluster is home to leading IT companies and also host to a plethora of regional offices from tech-related MNCs from around the world. These companies seek cutting edge technologies that can offer a competitive advantage, and many are themselves pioneers in their particular sector, which generates a sophisticated and bleeding-edge demand environment. From a B2C perspective, California is the most populous state (ranked 1st nationally) with wealthy consumers (CA ranked 7th in the country with average wages of $48k, 13% higher than the national average) (ISC, 2011) that are tech-savvy (29.2M internet users resulting in 80% penetration, and 16.6M Facebook users; Forbes ranked the Francisco – Oakland – Fremont as the 4th most wired area in the US, and the San Jose – Sunnyvale – Santa Clara area as the 11th most wired) and accustomed to being early adopters of both new business models and online technologies. This avant-garde behavior is a legacy of the gold rush period during which San Francisco became a cradle for creativity (along with unorthodox risqué behavior brought by transient gold seeking populations), and baron robbers of the era showered the region with modern marvels including the first cable cars and first country air-mail service among others. The larger US population also provides healthy Internet penetration, computer literacy, and widespread use of e-commerce. This
offers Silicon Valley IBS companies a robust and profitable local market that allows them to prototype and scale quickly, thereby making Silicon Valley a bellwether of global technologies and a trendsetter in online technologies.

► Context for Firm Strategy and Rivalry

Though Silicon Valley remains a key location for businesses and startups, it has become an increasingly expensive and cumbersome area for doing business. Silicon Valley faces considerable challenges in financing its future given that housing markets continue to struggle (a key source of tax revenues), consumer spending remains low, and unemployment persists (SV Index, 2011). This has created fiscal weaknesses at a time of ballooning employee health care costs and pension fund obligations. In response, Silicon Valley has had to choose between cutting personnel, stemming services and infrastructure spending, or increasing taxes. This has impacted the business environment with high corporate taxes, an increased local tax burden, and the 48th and 49th worst doing business and business friendliness ranking respectively (DeVol, 2011). Furthermore, the growing presence of well-funded companies has made it increasingly difficult for small up-and-coming companies to acquire talent, and has crowded out entrepreneurs through the availability of attractive employment packages.

► Related and Supporting Industries

Diversity is a key factor behind the cluster’s RSI. From the numerous top education institutions, to the diversity of its population, Silicon Valley possesses a melting pot of expertise. Specifically, Silicon Valley’s related clusters are highly diverse in nature with high location quotients, which means they are highly concentrated and possess deep labor pools. Key related clusters like education and knowledge creation, analytical instruments, medical devices, biopharmaceuticals, and defense all exhibit above average employment levels relative to their overall share of US employment. Despite strong levels of competition among firms in SV, they collaborate (“coopetition”) in terms of sharing
information and technologies and engage in a variety of joint ventures. This sharing of resources, infrastructure, and social capital generates powerful network effects among individual firms. Employee churn, one of the highest in the country, also presents one of the cluster’s hidden strengths. The internal shifts, generated as employees leave from one company to the other in search of the next big opportunity, generate a comingling of networks and the cross pollination of ideas that gives Silicon Valley its explosive innovation.

**Challenges Facing the IBS Cluster**

- **Challenge: Cost of Doing Business**

  Among US states with IBS clusters, California is in poor shape for attracting new businesses. The state nearly ranks last on other important metrics including the cost of doing business, the cost of living, and business friendliness. This demonstrates the delicate position of the IBS cluster in California and the severity of the problem. Despite ranking first in “Access to Capital” and “Technology and Innovation,” this is not sufficient to keep start-ups present in the state. The IBS cluster contains a high number of startups and entrepreneurs might face significant costs when starting up their companies and little or no revenues in the first years of operation. Therefore, the cost of doing business and cost of living are key for the IBS cluster.

- **Recommendation: Support the Startup Environment**

  - Create state level initiatives to reduce the cost of doing business. In a cluster like IBS, the importance of start-ups is decisive and it is necessary to make ensure that entrepreneurs have the financial capacity and resources (i.e. human capital & financing) to do business in California. In order to reduce the cost of doing business and provide new sources of capital and know-how we propose that the state:

    - Create tech hubs for space rental and efficient sharing of resources. IHUB is a right step in this direction and must be followed through.
Create business incubators to diversify from traditional capital venture model, and provide with a center were entrepreneurs can efficiently share capabilities and resources.

Promote existing SME programs:

- Expand and promote the Small Business Technology Transfer Initiative
- Promote the Small Business Innovation Research Program
- Promote the Small Business Investment Company Program

**Challenge: Uncertainty of Future Regulation**

New regulations could eventually have a significant impact on the IBS cluster. Among the regulations that could affect the IBS cluster directly we identified Net Neutrality Regulation as a pressing issue.

- “Net neutrality” is the principle that all Internet traffic should be treated equally (Whitt, 2010). Net neutrality advocates have established different definitions of network neutrality. According to the Guide to Net Neutrality for Google Users: “Net neutrality is about equal access to the Internet...the broadband carriers should not be permitted to use their market power to discriminate against competing applications, content or to control activity online” (Whitt, 2010). Groups like SaveTheInternet.com defend net neutrality: “Net Neutrality means no discrimination. Net Neutrality prevents Internet providers from blocking, speeding up, or slowing down Web content based on its source, ownership or destination.... freedom of expression” (SavetheInternet.com, 2011). Among the Proponents of net neutrality there are consumer advocates, online companies, and some technology companies (i.e. Amazon, eBay, Yahoo!, Vonage, and Microsoft). Proponents argue that Net Neutrality allows IBS providers to control their own content, to provide a free and open technology, and that it does not place newer online companies at a disadvantage and avoids slow innovation in online services. On the other hand among the opponents of Net Neutrality there are hardware companies and members of the cable and telecommunications
industries that argue that net neutrality is a violation of the property rights. IBS providers such as YouTube, MySpace and blogs are put at risk by net neutrality, not to mention the impact on small nascent online startups that wouldn’t be able to compete for access relative to large established companies. A limit on the availability of bandwidth would significantly endanger innovation (Whitt, 2010).

**Recommendations: Increase Lobbying Efforts and Focus on Startup Impact of Net Neutrality**

- Create net neutrality working/advocacy group for lobbying and education purposes in order to prevent any future regulation that could significantly affect the competitiveness of IBS companies in the world and specifically against those IBS companies in other clusters around the world.

**Challenge: Lack of Future Labor Talent, and Immigration**

Having a well-educated pool of human capital is one of the most important requirements for supporting a healthy IBS cluster, as well as any other related Science and Technology clusters. Human capital represents the source of technological innovation in the knowledge-based economy. Creating a concentrated presence of human capital facilitates economic growth in the region (Gottlieb, 2011). Bachelor’s level education represents the first step on the advanced learning required for a knowledge-based economy. The percentage of adults with a bachelor’s degree is closely associated with variations in per capita income (DeVol, 2011). With a score of 60.67, California ranks 13th on the 2010 Human Capital Investment Composite Index (Milken, 2011). While California shows strengths in R&D and risk capital, human capital is yet another area that is critical to the high-tech industry in order to create sustainable economic growth. However, California ranked 45th in recent bachelor degrees awarded in science or engineering (Milken, 2011) (1.85 science and engineering degrees per 1,000 civilian workers vs. the US average of 2.62). This creates a disadvantage as other states with better-educated science and engineering workforces expand their high-tech industries (Milken, 2011). The Office of the Governor estimates a shortfall of almost 40,000 engineers by 2014, and that California will need
approximately 20,000 to 24,000 additional engineers educated in California to begin meeting the growing engineering needs of both the private and public sectors over the next decade.

Amassing a well-educated pool of human capital can be accomplished either by providing an adequate educational system for state residents or importing talent from outside. All states engage in both approaches to varying degrees (Milken, 2011). For this reason, it is important to consider the effect that current immigration policies are having over the IBS cluster in California.

Immigrants are a vital part of the Silicon Valley and the IBS community. From 1980 to 2005, 144 companies were created by foreigners and founded by venture capital that employ today over 400,000 people. In addition, the founders of Google, Yahoo!, Intel, eBay, Sun, Nvidia and Juniper Networks among others are foreigners. However, immigration laws in the state are restrictive and discourage immigrants. According to the National Association of Venture Capital 40% of companies who use H-1B visas said the lack of H-1B visas has negatively impacted their competitiveness globally, 37% of companies said the lack of H-1B visas had delayed projects at their corporations, and 33% of companies said the lack of H-1B visas had influenced their company’s decision to place more personnel in facilities abroad.

Recommendation: Bolster Science & Tech Graduates

It is necessary to promote science and technology at both undergraduate and graduate levels through scholarships and private-public partnerships. In particular we recommend:

- Promote higher education among the rapidly growing Hispanic population.
- UC system international marketing campaign to attract foreign students.
- Stem cost increases in UC education system, which has significantly increased during the last years.
Chase Funding: there must be a private-public effort to increase lobbying efforts for R&D funding to compete with other states transitioning into technology-based economies (CA currently ranks 15th in NSF funding). This could support increased grants in education.

**Recommendation: Stem the Brain Drain**

It is extremely important that California stops the outflow of technical workforce by attracting new industries that offer new openings in different industries within the same sector. In order to do so the public and private sector should create a strategic plan to:

- Ensure that a diversity of companies/industries to foster innovation.
- Diversify the state economy to mitigate volatile tech swings.
- It is also critical to support the Startup Visa initiative for foreign entrepreneurs. As mentioned previously, the IBS cluster is highly dependent on foreign talent to create new firms making an increased visa quota for high-skilled science and technology professionals paramount.

**Other General Recommendations: Promote IBS**

We believe that the IBS Cluster needs to better leverage California’s government given its position as the largest tech buyer through e-government initiatives. The following initiatives could strengthen such efforts:

- Work to make state government more efficient while also reducing business costs.
- Create economic feedback loops by channeling funds through CA companies.
- Promote online medical records and online-based education.
Appendix

Exhibit I. CA Trade

**California International Exports, 2009**

- Canada: $14 Billion
- Mexico: $17 Billion
- Latin America: $5 Billion
- Europe: $20 Billion
- Other: $10 Billion
- Asia: $46 Billion

Source: National Governor’s Association Meeting, California Competitiveness: State and Cluster Economic Performance

Exhibit II. CA Demographics

**California’s Ethnic Diversity, 2008**

- White (Non-Hispanic)
- Hispanic
- African American
- Others

Source: National Governor’s Association Meeting, California Competitiveness: State and Cluster Economic Performance

Exhibit III. CA Cluster Portfolio

**Long Term State Patenting Performance, 1999 – 2009**

Source: National Governor’s Association Meeting, California Competitiveness: State and Cluster Economic Performance
Exhibit IV. CA Diamond Analysis

California Diamond Analysis

**Strengths (+)**

**Factor Conditions / Inputs**
- World's 8th largest economy
- Strong higher education and research institutions
- Home to the top 50 gateways - direct Pacific Rim access
- High quality of life (weather/gEOGRAPHY)
- Home to ~1 million high-tech workers; more than one-sixth of all U.S. high-tech workers reside in California
- Diverse and international population

**Demand Conditions**
- High income demand
- Strong historical and continued ties to the US Defense Department in terms of R&D funding
- Sophisticated demand with appreciation for innovation

**Related & Supporting Industries**
- Leading IT Companies, Financial Sector and Business Services companies
- Ample risk capital to support entrepreneurs
- Powerful supporting industries such as law, consulting, and finance (VC)
- Diversity of industries allows for labor flexibility

**Context for Firm Strategy & Rivalry**
- Quick access to new information and new technologies
- Active institutions for collaboration
- Sharing of resources, infrastructure, and social capital
- Attracts the most FDI from all states
- One of the top 5 states in the area of science and technology

**Government**
- Offers 24 percent R&D tax credit to businesses
- 40 federal laboratories
- Home to three out of the ten NASA centers in the US

**Weaknesses (-)**

- Relatively high cost of living
- High cost of doing business
- Excessive costs of recruiting and retaining qualified personnel
- Natural disasters (earthquakes, fires, etc.)
- (+/-) Land access to Mexican border
- California tends to have bubbles given Silicon Valley and Hollywood

- Lack of business incubators
- Decline in federal R&D funding
- High propensity for structural shifts within industries

- Recently rated by 600 CEOs as the worst state to do business for the fifth year in a row
- Highest state unemployment level (12.5%) as of Dec. 2010 vs. 9.4% in the US
- High and rising degree of unionization

Sources: 2010 Chief Executive magazine annual survey; California Competitiveness: State and Cluster Economic Performance presentation by Prof. Michael E. Porter, Team
Exhibit V. IBS Cluster Diamond Analysis

Factor (Input) Conditions
- Strong R&D, both in industry and institutions
- Top tier higher education (top engineering, business, and design schools)
- Abundant private capital availability
- High labor mobility
- High level of competitiveness and inherent entrepreneurial culture
- Natural hazards (earthquakes, fires, etc)
- High traffic congestion in SV and aging infrastructure
- High unemployment and growing Latino undereducated population

Context for Strategy and Rivalry
- Leading companies on a global scale
- Sharing of resources, infrastructure and social capital
- Efficient access to new information and new technologies
- Speed of market entry is critical to success
- High employee churn
- Relatively high cost of living
- High cost of doing business
- Restrictive immigration policies and climbing cost of education

Demand Conditions
- Sophisticated mass market consumers
- Most sophisticated companies demanding top technology and innovation (SV as bellwether)
- Wealthy pop. / high Internet / mobile
- High density of cluster / concentration

Related and Supporting Industries
- Diversification of leading hardware and software companies
- Mobile telecommunications companies
- Wide presence of VCs allows high specialization and competitiveness
- Sophistication of venture capital cluster
- Agglomeration enables network effects
- Collaborative competition
- Supplier and employee pooling
- Easier to establish in an emerging cluster
- Low value activities typically offshore
- MNCs take away talent/concepts out of SV

Exhibit VI. IBS Cluster Map

The IBS Cluster

Entrepreneurial Spirit Virtuous Cycle

Business Services (1)
- Legal Services (patents, IP protection)
- Financial Services (2)
- Consulting Services (1)
- Marketing Services (1)

Institutions for Collaboration
- GOED
- SBIR
- SBA
- JSVSTN

Qualified and Abundant Human Capital
- Cost & Quality of Life
  - Real Estate Cluster (1)
  - Entertainment Cluster (1)
  - Hospitality Cluster (1)
- Premier & Abundant Education
  - Engineering Schools
  - Design Schools
  - Business Schools
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