



**BAY AREA
ECONOMIC
FORUM**

*A Partnership of the Association
of Bay Area Governments
and the Bay Area Council*

THE FORUM REPORTS

*A series of
discussions
on vital issues
concerning the
Bay Area*

Volume Five Number One

*Technology
Start-Ups and
the Dynamics
of Silicon Valley*

THE FORUM REPORTS

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Panel Discussion

Bay Area Economic Forum
Joint Venture: Silicon Valley Network
Public Policy Institute of California
Winter 2005

Technology Start-Ups and the Dynamics of Silicon Valley

The Bay Area's economy is often identified with technology, and the dynamism of Silicon Valley. With the nation's largest concentration of information technology and biotechnology companies, and its largest pool of venture capital, the region has generated extraordinary, if cyclical, growth that for decades has led technology innovation.

Reflecting its entrepreneurial profile, the Bay Area is home to a large proportion of small businesses. Many of these start-ups have failed, been acquired or merged. Others, such as Sun and Google™, are now industry leaders. This success in innovation and business creation has led other regions throughout the world to emulate Silicon Valley's model.

Silicon Valley's economy suffered heavily from the collapse that followed the technology boom of the late 1990s. Competition from other technology regions has also increased. Yet the infrastructure and dynamics that have made the Bay Area one of the most productive regions on earth remain in place. After a difficult 2001–03, entrepreneurs are re-emerging, business is gaining momentum, and venture capital is back.

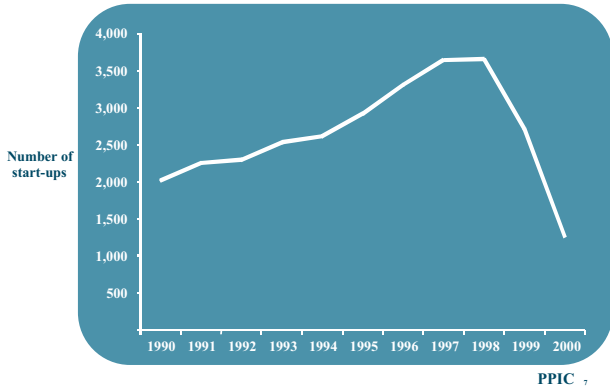
In many ways the world of 2005 is different from 2000. It is both more competitive and more resource-constrained. The Bay Area's leadership in technology and innovation is intact, but subject to challenge. To discuss the dynamics of Silicon Valley, the role of start-ups and the challenges they face, a number of leading analysts, economists and entrepreneurs were assembled by the Bay Area Economic Forum, Joint Venture: Silicon Valley Network and the Public Policy Institute of California (PPIC). Dr. Junfu Zhang, Research Fellow with PPIC and the author of a recent report on High-Tech Start-Ups and Industry Dynamics in Silicon Valley, led off the discussion.

Junfu Zhang

Silicon Valley has been and will continue to be a major driver of our State economy, and looking at its past successes, we don't really understand or know much about how we did it.

Fig. 1

Many Firms Founded Each Year in SV



This is a very dynamic region. Doug Henton repeatedly points out that there were waves of innovation from the early years, from defense to semiconductors, personal computers, and the Internet, so it has been evolving all the time. You often hear people talk about Silicon Valley as a habitat, an ecosystem. We need to study firms in the Valley through their birth, growth, death and migration. If we look at this group as a population, and use a demographic approach this will help us to better understand what's going on.

I'll start with job creation by new firms. Figure 1 shows the number of technology firms founded in Silicon Valley each year from 1990 to 2000. Over those years, a total of over 29,000 technology firms were founded. The trend peaked in 1998, which was long before we really felt the recession.

Fig. 2

Despite Failure of Some, Many Others Survive

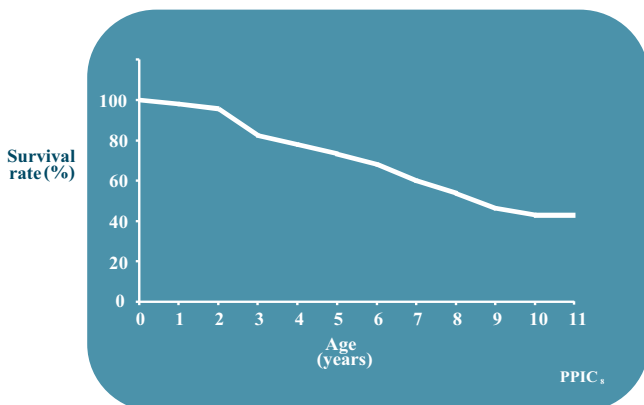


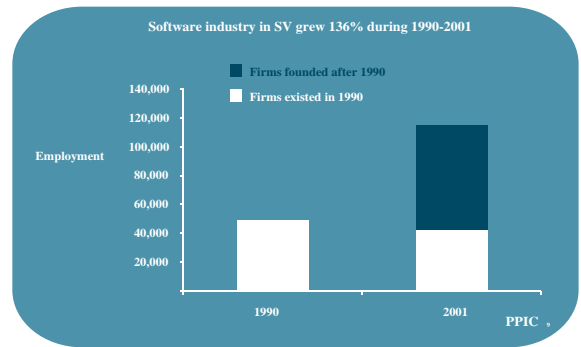
Figure 2 shows the survival rate of technology firms. Of course not all of them survived, but at age ten, more than 40% of them were still alive. This is a fairly high survival rate.

These firms created jobs. Here I am using the software industry as an example (Fig 3). Look at the left bar, which is total employment in software in 1990. The right bar shows total employment in 2001. The top part of the right bar, is total employment in software by firms founded after 1990. This means that if we didn't have new firms founded during the 90's, total employment would actually be lower in 2001. Instead the industry more than doubled its size over this period, growing about 136%. This shows the importance of new firms. I have a table in my larger report, which shows a similar story for almost every industry in the Valley.

Figure 4 is something I created using venture capital data. I've looked at each venture-backed start-up, its founding date, and also the closing date of its first round of venture capital finance. I wanted to look at the average timespan between those two dates. The average age of venture-backed start-ups in Silicon Valley at the closing date of the first round is 11.5 months. In the Bay Area, the average is 11.9 months, but if you look at the

Fig. 3

Start-Ups Create Jobs



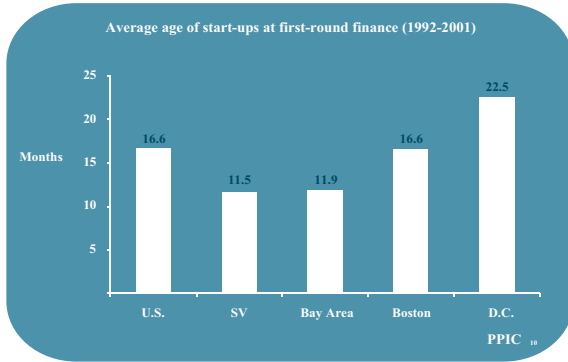
Boston area, it is 16.6 months, the same as the U.S. average. In DC, it takes even longer for start-ups to get venture capital.

Why do we care about this? Remember that in the high-tech sector, a year means a lifetime. If you have your business plan and can get money quickly, you gain first-mover advantages. I repeated this exercise within each high-tech industry, and found that in each industry, Silicon Valley has the same advantage. Silicon Valley firms always have quicker access to venture capital. In Figure 5 the right bar is Silicon Valley: it's shorter, which means the average age to VC is shorter here. Why is that? Perhaps because we have the world's largest venture capital sector here, and we know that

venture capital firms tend to invest in start-ups close by so that they can monitor them. Or as some have argued, maybe we have a special culture: people here are willing to take risks. I don't have a definite answer, but this is also good for the Valley.

Fig. 4

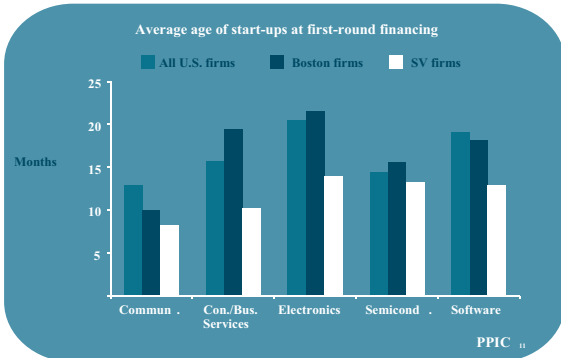
Venture-Backed Firms in Valley Got Venture Capital Quickly



Let's move on to firm-level spin-offs. What is a spin-off? If I worked for HP, I could start my own firm, and that would be called a spin-off from HP. Why do we care about spin-offs? Here in Silicon Valley we have a high-velocity labor market. That means people move frequently, they change jobs, they move from one firm to another, they move from an established firm to a start-up, and this is good because it facilitates technology and knowledge transfer. And this economy is based on knowledge.

Fig. 5

Silicon Valley's Quick Access to VC Appears in Every High-Tech Industry



I know the background of many start-up founders, and checked to see if they used to worked for HP, or Sun Microsystems, or another big firm. Then I compared

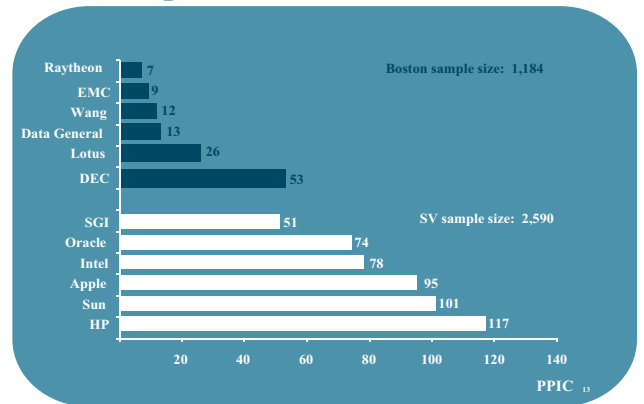
Silicon Valley with the Boston area, and the results are striking. Raytheon is the biggest employer in the Boston area's high-tech sector. It employs over 15,000 people. But over the period from 1990 to 2001, only 7 people from there founded start-ups.

Then, look at HP; it is the biggest employer in Silicon Valley, and it has 117 spin-offs. EMC is a big name in Boston, and was founded earlier than Sun Microsystems; it has 9 start-up founders, and Sun has 101. Successful firms here have employees leaving to start their own businesses. I don't have Netscape in the figures, but Netscape already has close to 30 former employees starting venture-backed start-ups in Silicon Valley. Netscape is gone, but there are many Netscape children.

The next point is about firm migration, and I want to spend more time on this because it has been a hot issue. Recently, we have heard politicians and business leaders talking about how the business climate is so bad that firms are leaving. But very few people have numbers to

Fig. 6

Silicon Valley Has More Firm-Level Spin-Offs Than Boston



show whether that is true or not. We do see more firms moving out of Silicon Valley than moving in. Some high-tech firms are more likely to move than nanotech firms, for example. Those moving out tend to be older firms—those coming in tend to be younger firms. Figure 7 shows the top ten destination states for firms moving out of Silicon Valley.

What can we learn from this? When they do move out, they are very likely to stay inside of California (Fig.8). It is not so common for firms to move to other states. Actually, they are very likely to end up somewhere in the Bay Area. When they move out they tend to go to San Francisco, Hayward, Burlingame and Pleasanton. It seems to be a natural and dynamic process that firms are founded here, and as they grow bigger they tend to move to nearby cities. There are some firms moving out of

Silicon Valley to other states, but we also see firms moving into Silicon Valley from other states. Let's look at the net effect on the labor market over these ten-years. Every year, net job loss by firm migration is less than .2% of total employment. This is negligible. I'm not denying that we are losing jobs, but the number is tiny, and we shouldn't spend too much time on it. Instead, we should focus on firm death. This is the bigger reason we have a high unemployment rate.

We have been in a recession, and Silicon Valley always walks out of a recession on two legs. First, if the macro economy is in good shape, that's good for us because consumers and companies want to buy our products and services. Right now, the macro economy is getting better. So we should focus on the second driver: Silicon Valley firms have to create new demand by creating new products through innovation, and that's something they are very good at. State and local governments can help by improving the situation in housing and transportation, but at least, if you don't help, do no harm, because this is a good ecosystem.

Another point is that we should focus on firm creation. Jobs are created through firm creation. To create new firms we need talented people; we need knowledge. This is a knowledge-based economy and we need people who have and create knowledge. So what do we look at? The Bay Area has great universities, and we need to continue to support them. We should also keep our door open to foreign talent, which has been a major contributor to the Valley.

Randolph

Let me introduce our other panelists:

Chuck Erickson is a long-time executive with over 35-years of experience in technology management, and is currently the managing director of a software business cluster in San Jose. He has held positions on corporate and management teams, start-ups and turn-around companies, focused on software and hardware development.

Brian Frenzel is an angel investor, founder and advisor to biomedical and high-technology companies, and serves on boards of directors and management advisory boards for a number of private companies in the pharmaceutical, medical device and biotech sectors. He is going to make sure that we're not just talking about IT. Bruce Taragin has 15-years of experience in venture capital; he's also an entrepreneur, technology investment banker and corporate attorney, currently with Blumberg Capital. Bruce is going to bring the venture capital perspective to our conversation.

And taking us back up to the 10,000-foot level, we have Doug Henton. Doug is founder of Collaborative Economics, a nationally recognized economic consulting firm that looks at business, government, industry and education, particularly here in Silicon Valley.

Chuck Erickson

Let me tell you what I see from the standpoint of companies starting up at the software business cluster and incubator in San Jose. We have succeeded in creating about 85 new companies that

Fig. 7

When Moving Out of SV, Firms Are Likely to Stay in California

Top 10 Destination States (1991-2001)

High-Tech Sector			Non-Tech Sector		
Destination	# of Firms	# of Employees	Destination	# of Firms	# of Employees
California	1,126	12,700	California	2,631	27,750
Texas	34	1,570	Oregon	56	275
Nevada	32	354	Arizona	47	348
Oregon	30	355	Nevada	40	547
Colorado	21	1,404	Washington	39	146
Washington	21	187	Texas	36	1,941
Massachusetts	20	932	Colorado	33	2,075
Arizona	20	208	Florida	24	303
Florida	19	1,944	Illinois	20	612
New York	18	1,272	Utah	18	229

PPIC⁶

Fig. 8

In Fact, They Are Most Likely to Move into Nearby Cities

Top 10 Destination Cities (1991-2001)

High-Tech Sector			Non-Tech Sector		
Destination	# of Firms	# of Employees	Destination	# of Firms	# of Employees
San Francisco	148	1,744	Hayward	286	3,414
Hayward	88	1,211	Burlingame	219	2,968
Burlingame	84	871	SF	205	2,312
Pleasanton	75	1,097	Pleasanton	131	2,998
Santa Cruz	34	207	Livermore	78	1,360
San Ramon	28	129	Santa Cruz	73	354
Oakland	27	411	San Leandro	62	498
South SF	26	650	Oakland	55	490
Livermore	21	209	South SF	49	828
San Diego	16	542	Sacramento	43	544

PPIC⁶



are still alive and around in one form or another. Companies merge and acquire, so it's sometimes difficult to track this exactly. The city's analysis says we've created about 2,500 new jobs through this process in San Jose.

It's a great job working with start-up entrepreneurs in Silicon Valley. We went through a really bad time as everybody else did from the middle of 2000; the last half of 2001 was a disaster for most companies that were trying to get started. Many had to radically alter their plans for growth to survive, and we saw almost no new companies coming in. The implosion drove the entrepreneurs underground for a while. I'm a little biased, but I think we actually watched many opportunists being driven out of the market so that the true entrepreneurs could come back.

As we moved out of 2001 into 2002, it was still pretty glum. But we've discovered that the disease of entrepreneurship has not been cured: it is still there, it is still rampant, and it is contagious. So I am very optimistic that we will find the right kinds of solutions and the right kinds of new enterprises, and we will watch Silicon Valley grow and come back. We are not going to see the silliness that we saw at the end of the last decade; but we are going to see some really solid entrepreneurs.

In recent years, the focus has changed from trying to grab a bunch of venture capital money, to how do I finance this thing by selling product or finding development partners. By the beginning of 2003, we started to see a resurgence of the old entrepreneurial spirit. We got a lot of people coming in who were very serious about getting companies started, and we have been seeing a steady increase in the number of entrepreneurs coming into the software business cluster. At this point now we are admitting about one new company a month.

Brian Frenzel

I guess I'm the token biotech guy in a bunch of high-tech people. My role in the habitat that Junfu described is that of a mid-wife for small biotech companies, primarily in the therapeutic and drug delivery area.

Many in the high-tech sector may not realize that the Bay Area is the principal center in the country for biomedical companies of all kinds, particularly start-ups—about 500 or so. That represents about one-third of

that type of company in the U.S. In fact, we are twice as large as the number two area, which is Boston. When you look back at how that happened, it was very surprising because the locus of government spending is Washington, DC, and the highest concentration of academic research is in Boston.

So, how did we end up being twice as large? I think it does start with our academic excellence in the greater Bay Area. We have five major research universities: Stanford, UC San Francisco, UC Berkeley, UC Davis and UC Santa Cruz. We have three medical schools in the biomedical field: it is very important to have researchers on the cellular and molecular level, as well as patients coming into the hospitals. Our Vet school at UC Davis is also of critical importance. If you take an historical perspective, this is analogous to the sorts of

"We have great universities, and we need to continue to support them. We should also keep our door open to foreign talent, which has been a major contributor to the Valley."

examples Junfu cited, with HP and other high-tech companies being a seed for everything that came from it.

In the case of biomedical, the first company of note was

Syntex, now Roche Biological, which for many years was the largest West Coast pharmaceutical company. I worked there in the early '80s, and asked one of the founders, "Why did you move to the Bay Area from Mexico," which was their original home. The answer was related to a university. Carl Djerassi was working at Stanford, and was a very important contributor to Syntex; he was one of the co-inventors of the technology that resulted in the birth control pill. This was a nice area, and people coming up to see Carl got to know the Bay Area. That's how Syntex ended up here.

The next major company on the list is Genentech, and Genentech came out of Stanford and UC San Francisco, with the invention of recombinant DNA by Herbert Boyer, and help from venture capital. That spawned 500 or more biomedical companies.

It is really a combination of the academic excellence, entrepreneurial spirit, and venture capital that has been available and continues to be available here, which has gotten us to where we are. We do see a fair amount of outflow, and there is tremendous competition. New Zealand, Australia, Alberta, and all of the countries in Europe are looking to create their own biomedical capability similar to what we have here, and we are vulnerable because technology moves quickly, from one place to the other. But if we can maintain those pillars of

our success, particularly centered around the quality of the research that gets done in the major research institutions, and if that technology is available (and I think we can do a better job of this) to companies that want to license it, we can continue to maintain our two-times lead over the next biggest place, and multiple-times lead over everywhere else in the world. So, it's very analogous to other high technology, but I think perhaps driven a little bit more by the research and university side of it.

Bruce Taragin

We are a classic early stage venture fund focused on IT security, software infrastructure and technology-enabled services.

With the likes of Intel, Sun and Cisco in Silicon Valley, leading universities like Stanford and Cal, the unique entrepreneurial spirit that thrives here in the Valley, and billions of dollars in venture capital, you have a terrific recipe here for success.

Maybe it's actually a bad thing that so many companies that started in Silicon Valley were funded so quickly, because of the excess of dollars that were chasing deals. Many of them should never have been funded, but a lot has changed since March 2000.

Overall, I agree with Dr. Zhang's point that we just need to stay the course. There are wonderful things happening here in Silicon Valley that will unquestionably continue to happen. I believe that the most important thing to focus on is firm creation, while minimizing the attrition of firms leaving California.

From the perspective as an early stage investor, what we find most challenging is the lack of other early stage investors right now to syndicate and co-invest with. Early stage venture capital is a very "hands on", intense endeavor where the investor needs to spend time with each portfolio company, trying to enhance the management team, make customer introductions to accelerate sales and business development, strategize with team members on positioning, and of course keep the start-up capitalized.

Venture capitalists, have grown their funds tenfold, and are forcing more capital into companies. A lot of start-ups now are raising \$10, 20, 30 million dollars in their first round of funding rather than the traditional \$3, \$5 or \$6 million dollars. We're seeing some retraction in the industry. In recent years, there was a negative amount of cash raised by venture funds because some were actually giving back capital they had raised because their funds

had gotten too large and they didn't feel they could effectively deploy those dollars. But what we need to see are more early stage venture funds going back to basics. It's about investing small amounts into deep technology companies, and actively assisting entrepreneurs to help them flourish.

On a macroeconomic level, inflation has been relatively low, the stock market has been positive, and we've seen an increase lately in early stage venture capital activity. In the last few years, a lot of CIOs, as a result of trying to cut their budgets to maintain profitability, have reduced spending on IT; now the only way they can improve their productivity is through technology adoption and acquisition. To do that, they either need to buy existing technologies, which is fortunate for us as early stage investors, or become more productive with technology. Most CIOs you talk to say, "You buy what you can, you build what you must." So, I think we're going to see a renewed trend over the next few years of both increased IT spending and acquisitions (but not really the bottom-feeding we've seen over the last few years).

Doug Henton

Over the last nine years we have worked with Joint Venture Silicon Valley to do the *Index of Silicon Valley*.

Several years ago, a number of us participated in a project at Stanford, which resulted in a book called *The Silicon Valley Edge*. It drew on twelve practitioners who were doing start-ups, and twelve academics who looked at what made Silicon Valley tick. That's where this concept emerged of an ecosystem. Basically, Silicon Valley is a habitat. It's made up of not only the entrepreneurs, but of all the necessary support systems—the venture capitalists, the lawyers, the accountants, and the networks.

Look back over 30 years and you see an interesting phenomenon. We have been through at least four cycles; what just happened to us is not new. It happened with World War II and the Korean War, and NASA putting a man on the moon. The federal government decided to spend a lot of money on technology, we benefited, and so did Boston and a few other areas. What the government needed was integrated circuits, and to get small things in tiny capsules.

We didn't really have commercial buyers for integrated circuits until the 1960s, and that ended after the Vietnam War, when the defense industry was cut back. Then we had a massive recession in California in 1969 and 1970. We had engineers driving taxicabs, and the small venture community here disappeared. People said Silicon Valley

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was dead. What do you think happened? The integrated circuit was commercialized, and the semiconductor industry grew from the ashes. Companies began to grow, because they learned that you could use the integrated circuit in other applications, such as calculators. Then it essentially took off.

Companies broke off from the original Fairchild and became Intel, AMD and National Semiconductor. We had this giant explosion and a reporter from a magazine called *Electronic News* named us Silicon Valley. Then guess what happened? The Japanese figured out how to make semiconductors. So in 1985, Intel almost went out of business; twenty thousand workers were laid off. Why? Because the so-called high-tech product had become a commodity.

So what did Intel do? Andy Grove took a big leap; he moved out of the memory chip business altogether and said we're going to cede that market and move to microprocessors, which are computers on a chip. They moved from there to create a platform, which allowed us to have personal computers. All those kids that hung out at the Home Brew Computer Club—Steve Jobs and others—couldn't have done what they did if it hadn't been for the microprocessor. In that period, over 200 personal computer companies were founded. Everybody thought that was the future and we grew like crazy. And guess what happened? Personal computers became a commodity. Almost 90% of laptops are produced in Taiwan today. The personal computer is not a high tech product; it is plastic wrapped around chips. Software is what makes it work. So software was the next generation, and that led us to the Internet.

Everyone got excited about the Internet because they thought this was some brand new invention. It really wasn't; it was simply connecting what we already had, which was personal computers and networks. People got so excited they thought it was going to change the world. Essentially, 300 companies went out and got venture funding, and there was only room for a few. So we had a boom/bust. If you look at this, it is absolutely expected; it's like product life cycles. Joseph Schumpeter, the economist, told us this in 1912, when he coined the concept called "creative destruction." We are the essence here of creative destruction; that is how we live. It's a boom, bust, and build cycle.

Across this entire cycle we have added jobs. If you look back to the early 1990s, we added 350,000 jobs. And

then we lost 200,000 jobs – a net gain of 150,000 jobs over 10 years. Innovation does not move in a straight line. That is what we mean by a dynamic economy. Why does this happen? It's a phenomenon because entrepreneurs get excited, venture capitalists get excited, they all jump into the same marketplace, and only a few can succeed. Today we have eBay®, Amazon.com, Google™, and Yahoo!®. Electronic commerce has not gone away, we have more people using it than ever before.

The question on everyone's mind is what's next? Nobody really knows. But I have to tell you, innovation has not gone away. Will we move forward? The answer is yes. The question is what will it look like. A lot of us think it's going to be a convergence of new technologies, just like hardware, software and media came together to create the Internet. Maybe it will be information technology and biomedical coming together. That's already happening; there are over a hundred of these companies right now.

"There is tremendous competition. New Zealand, Australia, Alberta, and all of the countries in Europe are looking to create their own biomedical capability similar to what we have here, and we are vulnerable to that because technology moves quickly, from one place to the other."

The question that I have is this. Regis McKenna, has observed that, "We're really good at starting companies, but we're not so good at creating mid-size companies." If you look at the numbers they're quite startling. Twenty-nine thousand startups, but how many of them went from 10-20 people to 100? Not too many. When they get to a certain size they expand elsewhere. Is this inevitable? When Intel, HP, or Cisco get to that size they have to expand elsewhere. But we don't have the mid-sized companies;

it's hard for them to be here. Housing costs and labor costs are high. Education is a problem and talent is a problem. So the question is can we maintain the entire business life cycle. We need to ask is the balance of cost versus value working for us? Can people afford to live here, with a good quality-of-life and education? What drives us is talent, and are we going to have the right talent? These are the real questions facing us.

Will we continue to be an incubator? I think we will, but can we grow mid-sized companies? That's the question, and it's an open one that will determine the future of the Valley. It only will be answered by maintaining this habitat, which is going to require investing in all these areas. We can't be complacent, because other regions want what we have. I'll end with a great quote from Robert M. Metcalf, who was the founder of 3Com, and helped develop the Internet. He said, "Silicon Valley is the only region that is not trying to become Silicon Valley."

Q.

Focus for a moment on the problems of housing and transportation.

Henton

I'll separate the two. Transportation is related to population and recently we've had a loss of population, so you're feeling that transportation is not as congested as a few years ago. That may change if our population picks up again. Housing is a major problem.

"We are the essence here of creative destruction; that is how we live. It's a boom, bust, and build cycle."

Everyone knows that our housing costs are higher than most areas. The reason why housing is so important is that with limited supply and high costs we can't attract and maintain young talent. And if young engineers and talented people can't afford to live here, they'll go to Austin or some other place. If someone graduates from one of our universities, the first question in my mind is can they afford to live here? This is an absolutely critical issue. Our future depends on these factors as much as anything else, and at the moment, this is a competitive disadvantage. We may not ever solve it, in the sense that we will continue to have high housing costs. But we can do a lot more. In the end, this is all about attracting and retaining talent.

Q.

How do we know we're not Detroit?

Henton

Well, the reason we're not Detroit is that we are not a one-industry town. We have at least 7 or 8 industry clusters. What happened to Detroit, to some extent like Pittsburgh, is it became a one-industry town (in terms of the auto industry or steel industry). The dynamics of the computer industry, the software industry, the semiconductor industry and the biomedical industry are somewhat different and they're on slightly different cycles. For instance, the semiconductor industry is a cyclical industry, which is coming out of a deep trough. The personal computer industry has a different model. The biomedical industry is an emerging industry where we have had an early streak because of our research base. To the degree to which we lose competitiveness in all of these industries at the same time, we will end up as Detroit, but I don't see that happening.

Q.

Is outsourcing a good thing?

Zhang

I think outsourcing is a good thing, but is it good for us? When I do the cost-benefit analysis I find that the benefit

is scattered. It is shared by many, many people, so we don't feel it, but the cost is shared by the few people who lost their jobs. They have reason to get angry, but overall, it is a good thing. The market sends a signal that some people can do the job at a lower cost, and firms should respond to it.

The media is almost our only source of information. As a result, we tend to ignore the benefits from outsourcing. I was reading something recently about a small startup in Contra Costa County, called NeoIT. It was founded in 1999, and last year their sales growth was 193%. Guess what they do? Outsourcing consulting. Outsourcing has been going on for a long time, but many people who have lost their jobs don't have time to adjust or to acquire new skills. From that perspective the government should step in to help. But don't distort the market, because the market signal is something we really need.

Henton

This isn't the first time this has happened to Silicon Valley. There was a giant debate in the mid 1980s around competitiveness, particularly as a result of Japanese competition in the semiconductor and computer industries. People had the same questions and we had a lot of outsourcing going on—things moving offshore. There is a solution to that: it is first understanding business functions. Not all companies do the same thing, and some things will move offshore. The disk drive

"Will we continue to be an incubator? I think we will, but can we grow mid-sized companies? That's the question, and it's an open one that will determine the future of the Valley."

industry started to move offshore; we held on to the design. These industries change, and we have to understand that they're not static. It's absolutely critical to

retrain and prepare people for the new jobs and understand that it is this dynamic process. The overall issue is about creating opportunities everywhere—not just here. It's not a zero sum game.

In trade, it's about competitive advantage, and if we can create growth here we can also have growth in other countries. This is an interesting phenomenon. If other countries have wealth they can buy our products. We have to think that way. There was a recent study of manufacturing jobs worldwide. We're all concerned about losing two million manufacturing jobs in the U.S. But it turns out that the country that has lost the most

manufacturing job in the world is China. It's all about productivity. We all used to work on farms—now we produce more goods and have fewer people on farms. We have to understand that there is a fundamental shift going on in the world, but it's not because of some unfair game. It's because of the way the economy works, and we're going to have to learn to live with it. We came out of the competitive crisis of the 1980s ahead of the game because we learned how to compete.

Q.

Brian, you mentioned there's a problem with the Bay Area maintaining mid-size companies: we have a lot of start-ups, but mid-size companies are suffering because of affordability and other issues in the workforce. This seems to be a problem in the biotech sector; we get a lot of start-ups, but don't see that many biotech companies growing and expanding here beyond a certain stage. On the other hand, there has been a lot of movement by these companies toward San Diego. So what are you seeing in biotech? Are there specific issues that need to be addressed in that industry?

"The most important thing to focus on is firm creation, while minimizing the attrition of firms leaving California"

Frenzel

Growing companies is tough; next to starting a company it's the hardest thing to do. There are a number of reasons why companies tend to stop at a certain stage: they run out of steam, their technology doesn't take them far enough to become larger, and venture capitalists look to get out. My former company, Syntex, sold to Roche; it no longer exists. It would be one of the larger companies in the Bay Area if that hadn't happened. So there's a dynamic at work. We have several notable exceptions to that rule, such as Genentech and Chiron, so maybe it's just a natural selection process.

Zhang

Can I follow up? I'm writing a report now on biotech that includes a chapter on migration. One reason we don't have many mid-size firms or manufacturing plants is because many firms are still doing research or developing products. Another thing I want to stress is that competition from other states is fierce. In 2001, a biotech industry organization published a report in which they claimed that 41 states in this country have some sort of biotech initiative. They all want to recruit our firms and they all want to convince our firms to set up manufacturing plants there.

I was just reading a story about Genentech. In 1994, Genentech decided to build a new manufacturing plant and many states wanted it. Finally, our state government

responded and the new plant ended up in Vacaville. We gave a lot to Genentech in order to keep the plant here. So we have to come up with solutions to deal with the competition, not only from other states, but also from foreign countries.

Henton

One thing that strikes me is the survival rate for start-ups. It's hard; most firms that get started don't survive.

Erickson

That's right. In a typical start-up environment, approximately 80% of the firms that start don't make it.

Henton

So these Bay Area survival numbers [40%] are really quite high. It's not that firms are dying on the vine. This habitat is quite remarkable, in that once companies get started here, if you're in trouble you can get help. We have a network here of resources and support systems. Starting a company in Montana it wouldn't be the same.

Taragin

From the venture side, these companies are pretty small and tend to disappear or get gobbled up. So even when start-ups are being shut down, or lay off people, it doesn't compare to when Merrill Lynch or Sun or Cisco lays off 5,000 or 10,000 people. When a start-up shuts its doors and has only dozens of employees, it's relatively insignificant from a statistical perspective. Needless to say, it's traumatic to those involved.

Q.

Bruce, you mentioned a lack of capital, or maybe a market gap in the venture capital community, for smaller amounts to be invested in entrepreneurs. How do you see that being filled? Are venture capital companies going to move into that gap, or are angel investors going to pick it up?

Taragin

The shortcoming endemic to most angel investors is that they typically lack deep pockets and are not necessarily investing in your company as a full time endeavor. On the other hand, the venture capital community has been going through unprecedented change, both positive and negative in the last decade. From 1998 through 2001, approximately 700 VC firms in the United States raised and invested \$200 billion dollars in over 15,000 companies. A lot of the venture funds that back in 1995 were sub-\$100 million dollar funds, in 1999 and 2000 became \$500 million or \$1 billion dollar funds. Their business model has shifted over the last few years into one that is more leveraged buyout and private equity than early stage venture capital. As a result, one of the

biggest challenges we are finding, as a classic early stage venture fund, is finding other like-minded investors. We think there is tremendous opportunity to build investment syndicates so that we can initially seed a company and have enough financial resources to fund it through profitability.

Q.

How about the relationship between venture capital and life sciences?

Frenzel

Life sciences are on a completely different cycle. Whereas venture capital investing went down by a factor of seven after the boom, it was only a factor of three in life sciences, so we weren't as adversely affected. There has been a shift of money out of early stage to later stage companies, as venture capitalists tended to protect their existing investments instead of supporting new companies. Two things are really supporting life sciences now. One is a convergence of technology. The rate at which technological innovation is spawning new products in the life sciences is really amazing. The other is that government funding has increased. DARPA [Defense Advanced Research Projects Agency], NIH [National Institute of Health], and others are spending. So, life sciences have been a little better off than high tech, although we have suffered a similar sort of decline in early stage financing.

Q.

Dr. Zhang, I was intrigued by the contrast in your remarks between Washington, DC and Silicon Valley. It would appear that the nexus between business and universities is powerful here, whereas in Washington, DC it's business and government. The venture capital community also plays a less active role there than here. Brian, you said something about licensing of technologies by universities. Is there something more we need to know about the nexus of universities and business, to reinforce those points of leverage and ensure that this continues to work effectively?

Zhang

You're right. The model in DC is a little different. They have a lot of government contractors. They also have the NIH and John Hopkins University, but the culture is different. I graduated from John Hopkins, and I know the university did not spin off many entrepreneurs.

In the biotech sector, the universities play a very important role. More than 40% of venture backed biotech firms were founded by university professors. I looked at Nobel Prize winners in chemistry and

medicine from 1993 to this year, and found that fifteen of them have founded biotech firms.

Frenzel

In life sciences there's a virtuous circle between academia and the start-up company. The university professor invents a technology with NIH funding, publishes, establishes prominence, and then typically helps to found a company, either by leaving or becoming an advisor. The small company licenses that technology and then adds other licenses. They can go off and become giants like Genentech and Chiron did. The fly in the ointment has been that the licensing process has been very difficult from time to time, particularly in the UC system. It would behoove the State to make that process a little easier, to take more the view of salmon spawning: hopefully a few of them come back, as opposed to believing that every single invention is going to be a billion dollar molecule and Nobel Prize. We saw some movement in that direction at the behest of former Governor Gray Davis, and hopefully Governor Schwarzenegger will do the same. We need to have that sort of technology coming into companies to provide the genesis of ideas.

"Silicon Valley is the only region that is not trying to become Silicon Valley"

The other side of the virtuous circle is professors, particularly medical school professors, who want to see their technology benefit the world and can't do that in the context of an academic environment. You need to

get it into a commercial environment to see the product development. I think that cycle has been working relatively well, and that's one of my explanations for why the Bay Area has won. There are conflict-of-interest rules that university people have to live with, and I think people on the commercial side fully understand and respect them.

Henton

I agree with Junfu's point about the different culture between Silicon Valley and Washington DC. I think the best possible role for the federal government is to be a patient investor (and they have been an investor in biomedical research and IT over the years). It's an advantage being several thousand miles away here in Silicon Valley, where we can be entrepreneurial and not have them in our backyard. We have the best of both worlds, being involved with federal research yet being at arm's length in our entrepreneurial culture. But I don't think we should be afraid of federal funding. NIH is incredible; the pipeline has been impressive, and it's still there.

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Published by:
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