

## Whatever Happened to Silicon Valley Innovation?

**Short-term thinking and increasing risk aversion have stifled the tech center's spirit. But innovators still lurk there, if you look for them**

By [Steve Hamm](#)

Transmeta Corp. ([TMTA](#)) once embodied the Silicon Valley dream. Starting in 1995, the company raised more than \$300 million in a nervy bid to reinvent the market for chips powering portable computers. Yet Transmeta struggled in recent years, and the grand hopes officially ended on Nov. 17, when the Santa Clara (Calif.) company agreed to be acquired by a little-known rival. In the empty lobby of the company's headquarters shortly before the sale was announced, a note on the reception desk told visitors to call an extension and "ask for Mary Anne." Incoming and outgoing mail bins on the wall were both empty.

Meteoric rises and catastrophic collapses are the norm in Silicon Valley, of course. It's all part of the process of creative destruction that's one of the Valley's strengths. But for some tech industry veterans Transmeta's fall is a lesson in how dramatically things have changed in the information technology capital. Venture firms are shying away from the kind of large and risky bets they made in the 1990s, and some experts say a company like Transmeta could never get off the ground today. "If it takes more than \$100 million to get a company started, you probably can't get the returns VCs want," says Navin Chaddha, managing director of Mayfield Fund, which has backed standouts such as Compaq Computer and Genentech. The venture model for capital-intensive companies is "broken," he says.

Venture capitalists' taste for risk has changed for a number of reasons, including the difficulty of taking tech companies public or selling them for lucrative paydays. The result is that venture firms are putting much less money into tech startups than in the past, and the money they do invest goes into less expensive, less risky deals, including social networking startups such as Facebook, Twitter, Yelp, and Digg. These so-called Web 2.0 companies are creating exciting new forms of socialization, information sharing, and entertainment. But some of the Valley's old guard are skeptical they'll grow big and important enough to deliver sizable productivity gains for business and the nation or to produce an upswell in new core technologies. Today's startups "give us refinements, not breakthroughs," says Andy Grove, former chief executive of Intel ([INTC](#)).

## RESEARCH CUTBACKS

Startups and venture capital are just part of the issue. Federal funding of advanced computer science and electrical engineering research has dropped off sharply since the late 1990s, as has the number of Americans pursuing computer science degrees. And large technology companies are putting less emphasis on basic research in favor of development work with quicker payoffs. "We're off-balance. Everybody is thinking short-term," warns Judy Estrin, former chief technology officer at networking giant Cisco Systems ([CSCO](#)). She just came out with a book, *Closing the Innovation Gap*, that's a call to arms for the U.S. technology sector.

For more than 40 years, Silicon Valley has been the world's most prolific laboratory for information technology innovation. But Estrin, Grove, and others are growing concerned that the vitality of the Valley, and, indeed, that of the entire U.S. tech industry, is at risk. That could have huge consequences for the future of American productivity, job growth, and national competitiveness. These problems have been brewing for years, but they've been amplified by the economic downturn.

Many people in Silicon Valley disagree with the doom-and-gloom assessment. After all, Apple ([AAPL](#)) is reinventing the cell phone with its computer-like iPhone, while Google ([GOOG](#)) pioneers cloud computing and Intel pushes the envelope in microprocessor design.

But while those concerned about the direction of the nation's tech economy acknowledge those bright spots, they believe an overhaul is needed. They're calling for new tax incentives from government to encourage long-term investments in breakthrough technologies, a renewed commitment by large tech companies to basic science, a shift by venture capitalists to bolder bets, and grander ambitions on the part of entrepreneurs.

So is Silicon Valley losing its magic? Or is there another generation of breakthrough technologies that outsiders just don't know about? To find answers to those questions, I recently motored through the Bay Area. I talked to some of the industry's most prolific inventors and most successful company builders. I got an earful from advocates on all sides.

Andy Grove's modest title of senior adviser to Intel belies the monumental role he has played in the success of the company and Silicon Valley. He rose through the ranks at Intel to become chief executive and chairman. He's widely credited with saving the U.S. chip industry and Intel from the onslaught of the Japanese industrial machine in the 1980s. Grove adopted a motto: "Only the paranoid survive." Now 72 and retired, he thinks the Valley's techies don't worry enough.

Dressed in a gray sweater with a BlackBerry ([RIMM](#)) clipped to his belt, Grove greets me at the door of his small office above a travel agency in Los Altos. He launches directly into a diatribe against what he sees as the shortsightedness and shortage of ambition on the part of today's Valley-ites. He regrets that the U.S. ceded the market for computer batteries to Japan in the 1970s. Now it's way behind in the race to invent improved batteries for electric vehicles—something he thinks Silicon Valley companies should be working harder on.

What really infuriates him is the concept of the "exit strategy." That's when leaders of startup companies make plans to sell out to the highest bidder rather than trying to build important companies over a long period. "Intel never had an exit strategy," he tells me. "These days, people cobble something together. No capital. No technology. They measure eyeballs and sell advertising. Then they get rid of it. You can't build an empire out of this kind of concoction. You don't even try."

Grove doesn't name names. But his criticisms raise the question: Can any of today's startups measure up to the giants of the Valley? Can any become the next Intel, Cisco, Hewlett-Packard, Oracle ([ORCL](#)), Apple, or Google? It's hard for some to imagine. "These Web 2.0 companies are surfing on the old wave. They're not creating the next one," says analyst Navi Radjou of Forrester Research ([FORR](#)), which studies the tech market.

To get a different perspective on the latest crop of startups, I drove up Route 101 to the San Francisco headquarters of Digg, one of the most celebrated Web 2.0 outfits. Started four years ago by Kevin Rose, a University of Nevada at Las Vegas dropout who drifted to San Francisco at the tail end of the dot-com boom, Digg is at the forefront of the concept of crowdsourcing. People who come to its Web site rate the quality of news stories, pictures, and videos collected there. And when "Diggers" find stories they like on other Web sites, they click on a button to add those stories to Digg's lists. The site has more than 22 million users, and it's among the few startups that can still get venture capital funding, raising \$27.8 million in October. Rose says the key to Digg's success is staying nimble. "Things change in the shower in the morning," he says.

When I met Rose at Digg's converted industrial building, I didn't recognize him at first. I pictured the kid *BusinessWeek* put on its cover two years ago—with a baseball hat turned backwards and a goofy grin. Rose still looks young, but he's matured. His hair is clipped, and that day he wore designer glasses. The mood at Digg is a bit more serious these days, too. Growth in the number of monthly visitors to the Digg site has flattened, and Rose and his colleagues are hustling to add new features. While he concedes the company didn't do much technology innovating in its early years, he says that's changing. Digg hired Anton P. Kast, a former assistant professor of mathematics at the University of California at Berkeley, to assemble a small research team. Kast et al have produced software that links people with similar interests and makes recommendations to people based on their preferences. "This is not something you can build over a weekend," says Rose.

Companies such as Digg and Facebook are clearly just getting started. They have the potential to let people organize themselves and share information in powerful new ways. But it's hard to imagine Digg coming up with the kind of fundamental technology that changes the way business gets done or the way the economy operates.

There is some serious technology innovation going on in the Valley—just not a lot of it coming from startups. And that fact may prove an obstacle to truly transformative changes. One fountain of innovation, for example, is IBM's Almaden Research Center, perched high in the grassy hills of San Jose. Back in 1954 when the Santa Clara Valley was producing more prunes than microchips, IBM scientists invented a machine that would change the world of computing: the disk drive, a device for storing information electronically. The prototype in one of the hallways

at the lab is about the size of a MINI Cooper automobile. It could hold just two digital songs, if there had been such a thing at the time; its modern-day successor, Apple's iPod, can hold 30,000. The march of the miniaturization of electronics is the foundation of Silicon Valley innovation.

And the march goes on. A short walk from the car-size disk drive is the office of Don Eigler, one of IBM's top physicists. Eigler, 55, has white hair, but he wears it in a ponytail and is as energetic as a 25-year-old. Since Eigler joined the lab in 1986, he has produced one advance after another at the intersection of physics and electronics. For example, he was the first person to move a single atom.

## **THE BLEEDING EDGE**

These days, Eigler is working on harnessing the natural spin of electrons to overcome the limitations of the chip technology that has been in use since the 1960s. "My work is on the boundary between fundamental science and applied science. It won't hit the marketplace in a direct way for many years to come," Eigler explains. If and when it does, his work could place IBM at the forefront of the next big advance in microchips.

Exciting, yes. But the fact that much of the most promising tech work is being done at large companies like IBM may actually be a problem. Established companies are usually not the most capable of creating truly disruptive technologies. As management guru Clayton M. Christensen explained in his hallmark *Innovator's Dilemma*, established companies have a vested interest in selling what they already produce, and they're often reluctant to launch technologies that upset existing businesses. Scrappy upstarts are the ones who usually come up with breakthroughs, and they push established companies to new achievements.

That's certainly been true in the case of Microsoft. For much of the company's three decades in business, it primarily copied, packaged, and improved technologies invented by others. But prodded by Netscape in the mid-1990s and Google in the past few years, Microsoft has been forced to reinvent itself and its software. The company now invests heavily in basic computer science research and employs 1,000 PhDs in labs around the world—including one in Silicon Valley.

Microsoft's glass and stucco Silicon Valley lab is tucked away in Mountain View, just a stone's throw from Highway 101. I stopped in to visit Charles P. Thacker, one of the pioneers of PC computing. As a youngster at Xerox's famed Palo Alto Research Center in the 1970s, Thacker led the team that designed the first true personal computer, the Alto. This machine so impressed Apple's Steve Jobs that he modeled the Macintosh computer on it.

## **INNOVATION LAG**

At 65, Thacker is still a tinkerer at heart. These days he's developing a research computer, called BEE3, to experiment with the newest microprocessor technologies. Microsoft has to rethink its software so it can take full advantage of the way the new chips work. In an annex next to his office, Thacker shows me a BEE3 with the lid off, exposing complex circuits and wiring. He has a small fan mounted on the frame that blows air on the chips. A soldering gun sits nearby.

While Thacker's project could make computers much more productive, it's not a revolutionary concept. Still he says Microsoft researchers are working on a wide array of potential breakthrough technologies. "Don't think about what your computer does for you now," he says. "Think about what it doesn't do. It doesn't drive your car. It doesn't know anything about you. It can't adapt to you. You can't talk to your computer even in the simplest way." These are the capabilities he believes will come with the next advances in computing.

The threat to the U.S. is that these advances may come from overseas. Fundamental innovation is happening in more places than ever before. In 2007, only seven American firms ranked among the top 25 U.S. patent recipients. Europe and Asia continue to lead the way in mobile communications. Japan is surging ahead in display and nanotechnology. And China and India are coming on strong in fundamental computer science research and software, respectively. "India and China are improving exponentially. We're flat. So we're falling behind," says Curtis R. Carlson, chief executive of SRI International, the Silicon Valley research lab-for-hire.

Executives at companies whose investments in basic research appear to be slipping insist they're as committed as ever. Hewlett-Packard's research budget has flattened in recent years, and its rank for patents received fell from No. 5 in 2006 to No. 10 in 2007. But Shane V. Robison, HP's chief technology and strategy officer, says the company is getting more bang for its buck now because it's concentrating on software innovations—which are less expensive to produce than chip advances. "A lot of people think if you're not doing microprocessor design, you're not doing information technology innovation," he says. "That's a goofy way to think about it."

The Valley faithful point out that the region has always gone through cycles of innovation, with lulls before the next big breakthrough. Google looked like just another search engine in its early days; perhaps another startup just getting going has the same potential to change the world. "I'm a Silicon Valley optimist," says John Hagel III, co-chairman of the Deloitte Center for Edge Innovation. "I think there's an incredible amount of opportunity to be created out of the technologies that are already in play."

New technologies may also end up eclipsing the old. Semiconductors, for example, laid the foundation for technology improvements in the past, but there may be more important advancements elsewhere in the future. Ken Lawler, a Valley partner with the venture capital firm Battery Ventures, points to new developments in biotech, solar power, and other green technologies. "Innovation is still alive and well," he says. "It's in new areas."

One day during my journey, I stop into the offices of Numenta, above a bookstore in Menlo Park. The startup has one of the most ambitious goals imaginable: building computers that work like the brain. Numenta represents classic Silicon Valley game-changing ambition—no surprise, perhaps, considering that one of the founders is Jeff Hawkins. He's a serial inventor who produced the first tablet computer, GridPad; the first successful handheld computer, PalmPilot; and the first successful smartphone, Treo.

Hawkins and his Numenta programmers study the inner workings of the brain and then replicate them with some of the most complex mathematical algorithms ever devised. Yet it's not venture capitalists who are funding this effort: Hawkins, a sandy-haired 51-year-old, is financing

Numenta largely with his own savings. "The work we're doing is technically very hard. It would be very difficult to get it funded in the typical Silicon Valley way," he tells me.

There's a minitrend emerging in the Valley: Some of yesterday's inventors are resurfacing with bold ideas, which, like Hawkins, they're funding themselves. But there's a limit to how much self-funded entrepreneurs can do.

So, after my journey through the Bay Area and dozens of interviews, I drew several conclusions: Breakthrough innovation is going on at a handful of large companies and a few small ones. But there are also legitimate concerns about the Valley's long-term prospects. IBM and Intel will keep producing important chip advances. Microsoft and Google will race each other to come out with cutting-edge Net technologies. And Apple seems likely to produce more hit products. But unless entrepreneurs and venture capitalists refocus on more ambitious tech projects—even though they take more time and money to incubate—the Valley's and the tech industry's contribution to the national economy is likely to wane.

The world economic meltdown might actually have some positive effects. In times of crisis people sometimes set off in bold new directions. This shock might prompt action on the tech front from the federal government. The America Competes Act, which was passed by Congress in 2007 but was never funded, called for increased money for university research, improvements in math and science education, and corporate R&D tax incentives. Tech leaders say now is the time to act. "We have chosen not to compete," says Intel Chairman Craig R. Barrett. "You cut off your future if you don't invest."

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### **Sustaining Innovation**

America is suffering from a critical innovation deficit, says Judy Estrin, author of *Closing the Innovation Gap*. Estrin, former chief technology officer at Cisco ([CSCO](#)) and an adviser to President-elect Barack Obama, says U.S. companies—and the investors who fund them—have become too focused on short-term results. They need to do more to create "sustainable innovation," she says.

To read a chapter from Estrin's book, go to <http://bx.businessweek.com/innovation-economics/reference/>

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