

# **The Development of the Silicon Valley**

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## **Introduction**

The technology boom and the development of the Silicon Valley began with the establishment of Stanford University in Palo Alto, California. The founding of the university set in action the course of events that have led to what people know today as the Silicon Valley. The Silicon Valley is a region in the San Francisco Bay Area, which includes the County of Santa Clara. It is known for its technological advancements – it is home to some of the world's leading computer and computer-related companies, including Intel Corporation, Hewlett-Packard, IBM, Yahoo!, Google, and many more. It has attracted many people from all over the world, seeking opportunities to make themselves rich through start-ups or even just searching for a high-tech job at a larger, more stable company. It has made headlines, renowned for its achievements and riches. When Governor Leland Stanford established Stanford University in the late 1800s, he left a legacy of scientific and technological discoveries and advancements. All of these new ideas led to the founding of new high-tech companies, many of which became successful, multi-billion dollar businesses and are still flourishing and competitive today. Without Governor Stanford and his university, California, especially the Bay Area, would not be the same. The founding of Stanford University played a major role in molding the Silicon Valley into what it is today.

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## **Stanford University and the Silicon Valley**

Leland Stanford, the founder of Leland Stanford Junior University, was born in New York in 1824. He later moved to Wisconsin, looking for better prospects, but when a fire destroyed his office and library, he moved again, this time to California. Stanford was an active citizen, joining the Republican Party. He was elected governor of California in 1861 and later a Senator in 1885. Stanford also led the effort to build a railroad in the west. On March 13, 1884, Stanford's only child, son Leland Stanford, Jr., died of typhoid fever at the age of fifteen. Stanford and his wife decided to establish a university to act as a memorial for Leland Stanford, Jr. In 1891, after six years of preparation, Governor Leland Stanford and his wife, Jane Stanford, founded Leland Stanford Junior University. The University opened on October 1, 1891, with enrollment of 465 students the first semester.

The opening of the university provided an opportunity for higher education in the western United States. It drew many bright, hopeful students from the east, including innovative and creative young scientists who would eventually go on to found some of the Valley's most prominent companies. Stanford University helped set the foundation for the Silicon Valley through its science department. Unlike many other universities at the time, Stanford University provided and encouraged education in the sciences, rather than just focusing on the humanities. The university's comprehensive education prepared its students well for the growing world of technology. It is therefore not surprising that many Stanford graduates became so successful. They have helped create and shape the Silicon Valley.

One way Stanford University has shaped the Silicon Valley was by supporting research and inventions. In 1909, David Star Jordan, president of the university at the time, provided funding for Lee de Forest's research. In 1912, Lee de Forest invented the vacuum tube amplifier.

The vacuum tube amplifier, also known as an audion tube, could amplify an electric signal. This invention stimulated the use of electronics and paved the way for future technological developments, including the computer, the television, and the radio.

One of the people crucial to the development of the Silicon Valley was Professor Frederick Terman, who taught radio engineering at the university. Terman encouraged his students to stay in California and work in engineering companies or start such companies of their own instead of moving back to the east. In 1937, two of Terman's students, William Hewlett and David Packard, started a company in Palo Alto, where they manufactured their audio-oscillator. Their company became successful, starting with Walt Disney's purchase in 1939 of their audio-oscillator for use in the film *Fantasia*. Today, Hewlett-Packard is a multibillion dollar company, known for its printers and personal computers. In 2006, it was ranked eleventh in the "Fortune 500," an annual report ranking the nation's companies. During World War II, Professor Terman went to Washington, D.C., and met people in the government. As a result, he helped Stanford University as well as growing companies in the valley, bringing in government contracts for the institutions.

Professor Terman is known today as the "Father of Silicon Valley" for his contributions to the region. Without him, the Valley certainly would not be the same. In a time when many people felt compelled to move back east in order to find jobs, Professor Terman stayed in California and encouraged his students to do the same after graduation from Stanford. Through this, Terman helped the population of the Valley grow and kept many of the brightest young minds in the Valley, ensuring that successful companies would be born there in the future. Also, he inspired his students like Hewlett and Packard to found their own companies and supported their ideas.

Another successful duo in the Silicon Valley was Sigurd and Russel Varian, two brothers who worked in a laboratory in Stanford University. Stanford invested in the two scientists; the university gave them free lab use and money for supplies in return for a portion of the profits. The Varian brothers formed the company Varian Associates, with inventions such as microwave radiation. Stanford University shared their success, earning millions of dollars in royalties.

After World War II, Stanford University needed more money. Stanford's land, however, was forbidden to be sold. The solution was the establishment of the Stanford Industrial Park in 1951, where Stanford's land was leased out to various companies including General Electric, Eastman Kodak, and Varian Associates.

The initial purpose of creation of the Stanford Industrial Park was to earn money for the struggling university. However, the Stanford Industrial Park also ended up helping along the development of technology. By providing this land to the public, Stanford University promoted technology in the Silicon Valley, however indirectly. Many companies that rented the land for research eventually became very successful. The park provided vital resources the early companies needed: land for office and lab space. With this, the companies had the supplies needed to make breakthrough discoveries and design technology. Without Stanford's land, the Stanford Industrial Park would not have been possible.

## **The Development of the Computer**

Inventions such as the radio, the television, and the computer led to new industries in Santa Clara Valley. In 1955, Dr. William Shockley, a Stanford graduate student, started his own company, Shockley Transistor Corporation, in Palo Alto. He was one of the inventors of the transistor, a small device that sends electrical signals in order to control other electric devices. At first, his corporation was booming, receiving many contracts. However, an inside company disagreement was one of the factors that led to the end of Shockley's company in 1968. For the choice of semiconductor material to use in the production of transistors, Shockley chose the element germanium over silicon. The eight engineers who worked for him favored silicon over Shockley's choice of germanium. Those eight engineers, Gordon Moore, Eugene Kleiner, Victor Grinich, Jean Hoerni, Jay Last, C. Sheldon Roberts, and Robert Noyce, left Shockley Transistor Corporation in 1957 and founded Fairchild Semiconductor in Mountain View of Santa Clara County. The company was a subsidiary of the Fairchild Camera and Instrument Corporation.

Fairchild Semiconductor became successful after their discovery of how to mass-produce integrated circuits, minute electrical devices made of silicon. Fairchild Semiconductor was the first company to do this, and it soon became one of the largest companies in the state of California. Fairchild Semiconductor led to the foundation of many other Silicon Valley companies, including Intel, Philips Semiconductors, National Semiconductor, and Advanced Micro Devices (AMD).

One of the largest semiconductor companies in the Silicon Valley today is Intel Corporation, the name a contraction of Integrated Electronics, founded by Gordon Moore and Robert Noyce, who both left Fairchild Semiconductor after ten years of working there. A while later, Andy Grove, who had worked with Moore at Fairchild Semiconductor, left Fairchild as

well and joined Intel. Moore, Noyce, and Grove later became known as the “triumvirate” of Intel. The company produced chips, trying to put as many circuits on a silicon chip as possible. They produced dynamic random access memory (DRAM) chips. They continually improved their product, releasing the 1 k DRAM chip in 1970 and the 4 k DRAM in 1974. Intel also invented the 8088 CPU, a microprocessor, in 1973. Intel’s microprocessor was groundbreaking. It was the first microprocessor in the world, an integrated circuit, made on a silicon chip. These tiny chips became the foundations of the modern computer. From its first microprocessor, with only 2200 transistors, to today’s Intel Dual-Core Processor, containing over one billion transistors, Intel has led the global microprocessor revolution.

Stanford has produced many of the people who go on to found their own companies, such as William Shockley. Without Stanford, these people would not have the educational tools necessary for success. The companies that they founded may not be still flourishing today, but many of the companies were stepping-stones for the establishment of other companies, many of which are large corporations today, as shown through the previous example. Shockley Transistor fell apart soon after the departure of eight of Shockley’s engineers; however, the legacy continued through the companies that those eight people came to found. Companies that resulted from Shockley Transistor include, as illustrated above, Intel, AMD, and National Semiconductor.

The speed at which companies were improving their semiconductor chips increased competition between companies. By 1979, as many as sixteen companies, including Intel, were contending with each other in the manufacturing of the 16 k DRAM chip. Intel’s 8088 CPU chip depreciated in value; many companies produced the chip for lower prices, driving the value down. In 1975, the 8088 CPU cost \$110, while in 1980 the price was a low \$8 per chip. To stay

competitive, many companies invested money in research and development, which led the continual innovation in technology.

In 1975, the Homebrew Computer Club was founded in Menlo Park, California, which is near Santa Clara County. The purpose of the club was to research and to build home computers. Many of the members of the club eventually went on to found their own companies. Steve Wosniak, one of the founders of Apple Computer, Inc., was one of the founders of the Homebrew Computer Club. He built his own computer at home. He and his friend Steve Jobs founded Apple Computer in 1976. Apple Computer built computers, unveiling the Apple I in 1976 and the Apple II in 1977. Apple has since faced fierce competition from top companies such as Microsoft and IBM. In 1984, Apple launched the Macintosh, a computer, which had decent sales but was not popular enough. Apple has innovated itself even more since then. Today, Apple has a line of “i-products”: the iMac, a personal computer; the iPod, a digital audio player; and most recently, the iPhone, a high tech phone with new features. Slowly but surely, Apple has risen in the tech industry. It’s stock has risen quickly, from about \$6 a share in 2003 to over \$80 per share in January 2006.

Two other successful PC companies that emerged were International Business Corporation, better known as IBM, and Hewlett Packard, founded by William Hewlett and David Packard in Palo Alto. These companies, along with others, set the playing field for today’s PC industry.

## **Modern Silicon Valley: The Internet**

Today, the innovation of the Internet has caused many new companies to spring up in the Silicon Valley. Two of the largest now are Yahoo! and Google. They both have their roots in Stanford University.

The founders of Yahoo! were graduate students in Electrical Engineering at Stanford, on their way to getting their Ph.D.s. Their company started as only a hobby, in February of 1994. David Filo and Jerry Yang wanted to keep track of their interests on the Internet, making long lists of Internet links. They eventually organized their list into categories and subcategories. Their website, "Jerry and David's Guide to the World Wide Web," as it was first called, was very popular, receiving one million hits by fall 1994, less than a year after founding. In April 1995, Filo and Yang received an investment with which they founded their company Yahoo!, Inc., with headquarters in Sunnyvale, CA, in the Silicon Valley. Today, the company is one of the top in global Internet communications, commerce, and media. More than 345 million people around the world use Yahoo! services each month. Yahoo! provides services such as advertising, e-mail, and searching.

Similarly, the founders of Google were also students at Stanford University. Larry Page was a Ph.D. student at Stanford University. He and his friend Sergey Brin, also a Ph.D. student at Stanford, were working on a research project, which Page had started in January of 1996. They developed a new kind of search engine that used the relationships between different websites to search rather than using the number of times an expression appears on a site. Their beginnings were at Stanford; the original Google search engine was on a subdomain of Stanford University's website. Eventually, Page and Brin obtained their own domain, google.com, and founded a company, called Google Inc., headquartered in Palo Alto. Their search engine became extremely

popular among Internet users. Google started making money through advertisements. Today, Google is amazingly successful, its stock price topping \$500 per share in November of 2006.

The examples of Yahoo! and Google show the culture of the Silicon Valley today. This culture has resulted from the technology boom in the area. Yahoo! and Google started from humble beginnings, both founded by college students who did not expect their companies to become so huge and successful. The Silicon Valley has not only developed into a center of technology, but into a place that encourages innovation and new ideas, company startups and the American dream, the idea of making it rich. Yahoo! and Google embody all these ideals, the young entrepreneurs with new, innovative ideas, making their fortunes. This is what the Silicon Valley has become, a result of Stanford University and the people around it.

## **Conclusion**

Stanford University has proven to be a monumental influence in the Silicon Valley even today. Although tragic, the death of Governor Stanford's son Leland Jr. was a significant event in the history of California. Before Stanford University, the San Francisco Bay Area was not even close to technologically advanced. People who wanted to pursue a career in technology, much like the jobs in the Silicon Valley today, had to go back to the east coast of the U.S., where there was more opportunity in that field. With the establishment of Stanford University, the technological advancement in the west was set into action. The area quickly grew; countless Stanford graduates tried to start their own companies in the county. Stanford is still the home to many startups, some successful and some not, showing the university's continual support of the sciences. Without Stanford's support, companies like Yahoo! and Google might not have been formed, and especially not in the Silicon Valley area. However, because Stanford had set the technological stage and had made the area such a technological hotspot, the culture around the area today encourages small company startups.

The development of the microprocessor and the personal computer still leave a visible legacy today. The extreme growth of technology in the Silicon Valley has also drawn many companies that originated elsewhere over to Santa Clara County. The companies, whether headquartered in the Valley or elsewhere, have each contributed to today's Silicon Valley in Santa Clara County. Today, the Silicon Valley has established itself as one of the world's centers of technology. From the early 1900s, the population has grown immensely. Today, there are more companies, more cities, and more jobs. The competition is just as fierce, if not fiercer, and the technological advancements are breathtaking. But, without the humble beginnings of Leland Stanford's university, perhaps everything would be different.

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