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Martha L. Reiner
University of Richmond

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Recommended Citation

Reiner, Martha L. 1989. "The World War II Experience and the Leadership of Entrepreneurship and Venture Investing Around Stanford University." E.C.R.S.B. 89-5. Robins School of Business White Paper Series. University of Richmond, Richmond, Virginia.

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THE WORLD WAR II EXPERIENCE AND THE
LEADERSHIP OF ENTREPRENEURSHIP AND
VENTURE INVESTING AROUND STANFORD UNIVERSITY

Martha L. Reiner

1989-5

The World War II Experience
and the Leadership of Entrepreneurship and Venture Investing
around Stanford University

Martha L. Reiner
Assistant Professor of Management
Robins School of Business
The University of Richmond
Richmond, VA 23173
(804) 289-8575

submitted to the Entrepreneurship Division
Academy of Management Meetings, 1990

Note: Please forward this paper to the Management History Division if it is
outside the domain of the Entrepreneurship Division.

The World War II Experience
and the Leadership of Entrepreneurship and Venture Investing
around Stanford University

Dr. Frederick Terman¹ has been widely recognized as the "godfather of Silicon Valley" (Lowood, 1982). Terman, a Stanford University electrical engineering professor, managed Harvard University's Radio Research Laboratory during World War II and returned as Stanford's dean of engineering. His commitment to seeing California companies in science-based industries seize postwar opportunities to push ahead of their Eastern counterparts influenced the venture investing as well as the entrepreneurship that built a thriving high-technology industrial community around Stanford University. Terman's wartime experience shaped his postwar role as a leader of high-technology entrepreneurship. Wartime experiences similarly influenced individuals who invested in California ventures after the war. Environmental shifts during World War II also did much to foster the industrial community now known as Silicon Valley.

Post-War Opportunities for Technology Ventures in California

During World War II, the American West changed from almost an economic colony of the East into a region with a rapidly growing diversified economy. The development of service industries and advanced technology industries, particularly aerospace and electronics, in the West shot far ahead of their development in the East (Nash, 1985, pp. 3-36).

Wartime demographic shifts favored postwar entrepreneurship and venture investing in the West. Many veterans hoped to start businesses, and many of

¹ Terman died in 1982 at age 82.

the 800,000 veterans returning to California were expected to stay (Wendt, 1946, p. 9; Wendt, 1947, p. 43; Nash, 1985, pp. 37-41). Western population growth strengthened the marketing base for West Coast firms (Terman, 1947a, pp. 10-14). Per-capita savings grew more in the West than in the East (Monroe, 1946).

World War II accelerated the rise of scientific research in the West. In 1944, scientist Bernard Jaffe observed that "the center of gravity of scientific talent in the United States" had started to move west by the 1930s (Jaffe, 1944, p. 476). However, war mobilization brought in a vastly larger share of federal research funds--partly because war planners' decentralization strategy overrode traditional allocation methods that used advisory groups dominated by Eastern scientists (Nash, 1985, pp. 153-160). There was a sense that Western science was gaining influence--notably with the rise of Ernest O. Lawrence's radiation laboratory at the University of California, Berkeley, as well as science and engineering research at Stanford University and the California Institute of Technology. This sense of rising expectations made Western financiers less likely than Eastern financiers to grow skeptical about technology ventures' prospects and turn back to conventional ventures when the war ended.

There were many signs that federal money and federal planning had stimulated the West's wartime growth. About 90 percent of the investment capital that the West gained during the war was federal money (Nash, 1973, p. 49; Nash, 1985, pp. 17-36). Many government offices opened in San Francisco during the war; by the end of the war, only Washington, D.C., had more (Monroe, 1946, p. 52). West Coast financiers were less prone than Eastern financiers to feel threatened by state capitalism. Because of the West's wartime economic

advances, West Coast leaders were not worried about reversing industrial decline, as Eastern financiers were. Yet regional pride influenced the growth of venture investing on the West Coast as much as it did in the Northeast, where the promotion of venture investing was in part a response to industrial decline. Public and private leaders in California spoke, usually confidently, of the need to build on the wartime boost to industrial development. Many small businesses had closed and few had started during the war. The state's shipping and aircraft industries, which had grown rapidly during the war, declined just as rapidly after the war. Yet California policy makers had optimistic postwar scenarios.

California leaders sensed that the future of their state was tied to the future of small business, which traditionally had a strong role in the state economy. When San Francisco financier Edward Heller was nominated to the U.S. Surplus Property Board in 1944, California Attorney General Robert Kenny praised the board's mission to support small business and testified that Heller shared that mission. "It is particularly important in our region where we are growing, where we have not established industries," Kenny said. "We are particularly anxious to see carried out those phases of the bill which will prevent the disposition of surpluses from going to build up existing monopolies. . . ." (Kenny, 1944, p. 127). California policy makers were very conscious that the aftermath of the war could favor entrepreneurship in their state, according to Paul Wendt of the University of California at Berkeley's business school, who analyzed small businesses' financial prospects for the California Reconstruction and Reemployment Commission. State officials wanted to create "optimum conditions" for new businesses to form and operate profitably. Legislators even proposed a California Reconversion Finance

Corporation modelled loosely on the Reconstruction Finance Corporation in January 1946, although nothing came of this idea (Wendt, 1946, p. 9; Wendt, 1947, p. 43).

Continued federal support in the years just after World War II did much to foster the development of high-technology industry and new technology firms on the West Coast. In a November 1953 letter to Harold Laun, chairman of Television Shares Management Co., a mutual fund that Terman advised, Terman wrote that the end to increases in federal research and development funding "means that the lush period for starting new enterprises and learning to operate at government expense is over" (Terman, 1953). Terman referred to several key high-technology firms as "war babies" (Terman, 1954).

Post-War Venture Investing

On the West Coast, the innovation of organizing venture investing after World War II was only vaguely conscious--incremental and largely a response to venture investment opportunities more well defined and more abundant than those in the rest of the nation. Eastern pioneers in organized venture investing were implementing prewar proposals for institutional venture investing but building in features of traditional, personal venture investing. Western innovators, in contrast, revived traditional, individual venture investing but applied evaluation and monitoring techniques that institutional investors had developed.

West Coast financiers, unlike Eastern financiers, were relatively free of anxiety about postwar "reconversion" to a peacetime economy and unconcerned with proving the legitimacy of private capitalism. Yet the innovation of organized venture investing followed from the war experience in the West, as

it did in the East. Because the wartime shift of industry, population, and scientific research to the West advanced postwar opportunities for entrepreneurship, the enthusiasm about venture opportunities that arose just after the war was sustained on the West Coast much more than in the East (Griswold, 1950, pp. 599, 601; Fortune, 1950; Nash, 1973, pp. 48-53).

Despite the widespread awareness of outstanding postwar venture opportunities on the West Coast, most conventional financing sources were reluctant to deal with new ventures. Thirteen California investment banks surveyed in 1946 received 200 inquiries for securities issues of less than \$200,000 that year. They turned down 185 (because they were too venturesome, had inexperienced managers, or offered too little profit). They had financed five proposals and were still thinking about the remaining ten (Wendt, 1947, pp. 47-48).

In contrast, private investors were very interested in new ventures. Individuals associated with the ventures sold 63 of the 70 securities issues of less than \$300,000 for which notification letters were filed with the SEC; investment bankers underwrote the remaining seven. A dramatic increase in requests for permits from California's Commissioner of Corporations in 1946 also signalled a resurgence in local venture investing. Some reorganized their businesses as corporations because the federal excess profits tax on corporations was repealed, but many others formed new ventures and planned to sell stock within California (Wendt, 1946, p. 150; Wendt, 1947, pp. 48-49).

There were trends toward organization even in the revival of individualistic venture investing. At least two formal venture capital organizations formed in California in 1946.

A group of California and Eastern investors organized the Industrial

Capital Corporation with \$1 million in capital by June 1946. Their mission statement expressed the financial community's widespread desire to strengthen private capital, but it did not show the anxiety that Eastern financiers expressed. The "general objective" was "assisting the development of business on the West Coast by private financing." The organizers highlighted the special opportunities in "the expansion of industry and commerce on the Pacific Coast." As many did after the war, the organizers pointed to a gap in the existing institutions' arrangements for financing ventures, but they reassured the local financial community that their intent was to complement, not to displace. Industrial Capital Corp. would finance small and medium-sized businesses, with direct loans, debt purchases, equity purchases, or a combination of these methods. Its organizers would support as well as finance these businesses--"to act as financial and industrial counselors to management." However, they expressed little commitment to the ideal of independent venturing. Their organization was "equipped to negotiate consolidations or mergers, as well as participate in the outright acquisition of companies." They hinted to acquiring corporations when they added, "While in general the corporation proposes to act as a principal, it may also act as an agent on occasion. . . ." (Business Week, 1945, p. 22; Wendt, 1946, pp. 140-41; San Francisco Chronicle, 1946, 1947; History of the Greater San Francisco Bay Region, 1966).

A group of West Coast investors organized Pacific Coast Enterprises in San Francisco with \$2 million in capital before October 1946. This organization had a mission more focused than Industrial Capital Corp.'s; it would invest in small and new businesses in California. The directors--George Folsom, Louis Muller, Philip A. Fisher, Jacques Bergues, and Edward Hellman Heller--had

been involved in the "private financing" of California ventures for several years. Heller, for example, began to work with Lockheed in the 1930s, and he invested in Aircraft Accessories Corporation, a radar, radio, and hydraulics company that Randolph Walker, a Lockheed founder, organized the day that Pearl Harbor was bombed. Still, the founders were courageous to focus on small and new businesses, since their past success was not primarily with start-ups (Heller, 1944, p. 50; Walker, 1944, pp. 59-64; San Francisco Chronicle, 1945a, 1945b; Wendt, 1946, pp. 141; San Francisco News, 1946, p. 22; Fisher, 1957; San Francisco Chronicle, 1961; Johnson, 1984).

The two organizations' venture investing followed from wartime procurement. Marshall Kempner, president of Industrial Capital Corp., and Heller of Pacific Coast Enterprises had arranged financing for new military supply ventures while they served as military liaison officers with Federal Reserve banks--Kempner in San Francisco, Heller in Boston. Howse, an Industrial Capital Corp. director, had been an Army Air Force procurement officer and then administrator of the Surplus Property Board, which oversaw the transfer of government military production facilities to private industry. Heller served on the Surplus Property Board (San Francisco Chronicle, 1945b, 1946, 1947, 1961; Business Week, 1945). San Francisco, which had become a Western center for federal offices during the war, was a well-situated venture investing center in the era that began with reconversion and advanced when the Korean War and the Cold War brought contracts for sophisticated weapons.

These two organizations were clusters of individual venture investors rather than staffed venture capital management organizations like American Research and Development Corp., which was organized in Boston in 1946. Many founders of the two California organizations continued to play important

roles as individual venture investors.

Conditions were ripe for venture investing to grow after World War II, according to Henry A. McMicking, who with his brother Joseph formed McMicking & Co., one of the first San Francisco venture capital organizations, in 1947. "The country had gone through a tremendous depression and a tremendous war," McMicking said. "Nothing had been done. Youth were coming out of the war. We were all patriotic and interested in doing things. . . . We were shocked about the German scientific things like the magnetophone" McMicking, educated at Stanford, initially worked as a stockbroker after serving as a combat intelligence officer in the war. McMicking & Co. financed the growth of Ampex Corp., one of the first big successes in the 1950s high-technology stock boom (McMicking, 1987). Ampex's success in the public stock markets did much to encourage others to invest in new high-technology ventures.

The West Coast innovators did less to differentiate venture capital from conventional business finance by forming organizations than their Eastern counterparts did. They tended to do venture investing as individuals and often as a sideline to other work in the financial community. However, they did much to develop a distinctive style of venture investing--closely engaged, emphasizing people in evaluation, mutualistic.

Terman's Influence

Incremental and individual action at Stanford did at least as much to develop venture investing as did MIT and Harvard's efforts to create a venture capital institution by organizing American Research and Development Corp. in 1946. Stanford administrators did not work with leaders of San Francisco's financial community to create a specialized venture capital organization, as

the Boston area university administrators did. However, Stanford administrators were early activists in the struggle to change institutional investment guidelines that constrained venture investing. They also built institutions that would support the growth of technology firms in the surrounding community. In 1946 they created Stanford Research Institute, a comprehensive research organization. They developed sites for technology businesses on university land. They developed intellectual property policies that encouraged faculty to develop commercial applications for their research (Lowood, 1982; Adams, 1987).

The greatest stimulus to venture investing to come from Stanford was the personal involvement of Terman. Terman did much to develop the culture of the entrepreneur around Stanford University. This culture encouraged technology venturing and venture investing. Terman's ideas about personality, groups, and research management shaped the practices of both technology ventures and venture capital organizations. Terman also encouraged the growth of venture investing more directly. He advocated venture investing in speeches to many local organizations and referred technology venture founders to venture investors. Terman did not form a venture capital organization. Yet he became involved at the border of institutional finance and venture investing when he joined the technical advisory board of the Television Fund, a Chicago investment company, when it was organized in 1948 to invest in the emerging electronics industry.

When he returned to Stanford after World War II, Terman began to argue that California electronics companies should plan to advance relative to those in the East, although he acknowledged that it would not be easy. By the time Terman spoke at the West Coast Institute of Radio Engineers convention

in September 1947, he was consistently promoting a strategy to achieve this goal. There was "a group of sound electronic industries in the west . . . [a] nucleus on which to build for the future," Terman argued. He proposed a growth strategy focused on research rather than manufacturing strength. Eastern firms had the advantage when it came to mass production, but researchers liked California's climate and living environment. To implement this strategy, California firms needed to support basic research and pay competitive salaries (Terman, 1947a).

The experience of managing the Radio Research Laboratory during World War II had a dramatic influence on Terman's life. It gave him an exhilarating sense of accomplishment and new insights about managing research. He believed that the war experience would have a similarly dramatic influence on other lives and on trends in science and industry.

By acting on the assumption that the war experience would have a great, lasting influence, Terman reinforced this influence. He drew upon his experience managing wartime research to analyze postwar business and research strategies. With his postwar speeches, by evoking memories of the wartime sense of purpose, Terman motivated further achievements in technology. In the speeches he also perpetuated wartime enthusiasm about the promise of technology, which increased support for basic research and built financial and market support for technology ventures (Terman, 1946b, 1947b, 1952a).

Terman's war experience managing the Radio Research Laboratory was an idyllic equivalent of entrepreneurship. He faced little financial or bureaucratic control. "If in war a device becomes genuinely useful, then

the cost of development is of no significance and time is everything," he reflected in a 1946 speech to the National Association of Broadcasters. There was "[n]o one to check our results with" and "[n]o one to say that when we got our results they would be wanted," Terman said. "We just went ahead" (Terman, 1946a).

The culture of entrepreneurship that Terman promoted was focused on young entrepreneurs. Many public and private leaders were stressing the need to help young people achieve their potential after the war. When business leaders and public officials in their speeches worried about the younger generation's prospects for achievement, their main concerns were often with increasing industrial productivity, easing progressive taxation, and keeping returning veterans from growing restive. In contrast, Terman was concerned about the implications of a life cycle effect in research contributions. In his notes for one of many speeches that proposed bringing talented young people to the fore of research rather than constraining them in hierarchies, Terman cited studies showing that researchers were at their highest potential between the ages of 25 and 35, although he marked this passage "out" (Terman, 1946b).

Terman encouraged a mutualistic culture of entrepreneurship. He influenced not only the quantity and the quality of technology ventures but the mutuality of venturing in the area, according to venture capitalist William K. Bowes, now general partner of U.S. Venture Partners in Menlo Park. "Terman graduated Dave Packard and Bill Hewlett, saw what they gave back, and wanted to see that cycle repeat itself," said Bowes (Bowes, 1987). Terman's war experience also influenced this mutuality. A critical part of the war experience, Terman often reflected, was the extensive pooling of know-how for new manufacturing developments encouraged by the wartime values (Terman, 1946a). In the early

1950s, Terman observed that one lesson in the entrepreneurial process of the Bay Area electronics industry was that "mutual aid" as well as the ripple effect of creative pioneering activity was beneficial (Terman, 1952b).

Terman's beliefs about personality have been reflected in venture capitalists' approaches to evaluating deals. His beliefs in turn were likely influenced by his family background. He was the son of Lewis Terman, a Stanford education professor who developed the Stanford Binet personality test and devoted most of his career to studying individual giftedness and leadership (Lowood, 1982). An individual's personality traits were strong indicators of potential to succeed in research or entrepreneurship, in Terman's view. The character analysis in Terman's letters prefigures the personality analysis that venture capital organizations have used to evaluate entrepreneurs seeking financing. It is also possible that Terman influenced the conventional wisdom that a venture seeking financing should have an effective group, not simply one potentially great entrepreneur. The idea that groups are critical for developing technology appears in his writings. Terman believed that creative researchers must be monitored respectfully rather than meticulously (Terman, 1951a). Similarly, venture capitalists acknowledge that it is important to monitor a venture without alienating the entrepreneurs whose specialized knowledge often is the venture's most important asset. Venture capitalists could have developed these operating assumptions independently by trial and error. However, Terman dealt frequently with several who became key figures in the venture capital industry, and he expressed these ideas in public speeches that reached a wider group of venture investors.

The exhilarating experience of pushing technological developments during the war crisis changed Terman's ideas about settings in which researchers

could flourish. Before and during his service at the Radio Research Laboratory, Terman often encouraged promising engineers and scientists to stay in university research rather than move into industry. After he returned to Stanford, he was more encouraging to engineers and scientists who thought about starting ventures. He advised entrepreneurs about financial strategy (Llewelling, 1949), and he introduced them to investors (Dennis, 1987; McMicking, 1987) and established companies (Terman, 1949c).

Terman encouraged potential venture investors as well as potential entrepreneurs. He spoke about growth opportunities in the electronics industry to organizations like the Chambers of Commerce on the Peninsula, the Kiwanis Club, the Stanford Alumni, the Bond Club, and even the Bohemian Club, as well as to technical organizations like the Institute of Radio Engineers and the West Coast Electronics Manufacturers Association. By 1949, Terman included an industry analysis that highlighted the favorable opportunities for new, independent electronics ventures when he subtly promoted investment in local electronics firms (Terman, 1949b). The "[r]apid[ly] moving" electronics industry was "[s]o diverse that [there] cannot be monop[oly]," Terman told members of the Bohemian Club in 1951. Individuals could build highly profitable companies with very little start-up capital, he said (Terman, 1951b). In his entertaining talks about electronics discoveries and applications, Terman appealed for support of basic research generally and the proposed National Research Foundation and Stanford University's programs specifically (Terman, 1947a). Terman's speeches often had an explicit message that supporting engineering and science at Stanford combined civic duty and self-interest and an underlying message that investing in the young local companies developing new technologies did the same (Terman, 1949a).

Terman believed that there was a delicate balance between financing that promoted ventures' growth and financing that destroyed their independence and diverted them from their goals. A recurrent theme in his speeches during the late 1940s and early 1950s was the "very significant lesson" to be learned from the "checkered" history of Federal Telegraph Company, which operated in Palo Alto until it moved to New Jersey in 1931. Terman had worked for Federal one summer. Cyril Elwell, a Stanford graduate, bought patent rights for the Poulsen arc, raised money, and with help from San Francisco financier Beach Thompson organized Federal Telegraph to develop continuous wave radio transmission. The company provided wireless telephone service for the Navy during World War I (Terman, 1949d, 1951a; Norberg, 1976).

Part of the Federal Telegraph lesson was an inspiration for entrepreneurship. Although Federal Telegraph "left [the] West," it "left behind an influence" that was "never eradicated" (Terman, 1950b). Many ventures spun off from Federal Telegraph. For example, Terman said, Charles Litton's specialized glass blowing business began there. Jensen, who came to the United States to help develop the Poulsen Arc at Federal Telegraph, invented the dynamic loud speaker with Proudham. Jensen later left Magnavox, the company formed to produce the speaker, and organized the Jensen Company. Magnavox and Jensen "were originally local companies, locally financed," Terman stressed with some regret that they did not remain so (Terman, 1951a).

Another legacy of Federal Telegraph was a warning about mixing science and finance. "Unfortunately the Federal Telegraph Company and also some of our other earlier operations in this area were too much run by bankers and the financial people, whose interests were in the stock market rather than in creating a productive and sound company," Terman said in a 1951 speech to

the Institute of Radio Engineers in Palo Alto (Terman, 1951a).

Terman wanted to perpetuate these cautionary memories even though he considered the postwar group of West Coast electronics firms less susceptible to the problems that struck Federal Telegraph. In 1949, when he addressed the West Coast Electronics Manufacturers Association, Terman expressed his confidence in the staying power of Western electronics companies. Yet in doing so he evoked the negative memory: These firms were "sounder, more indigenous, better operated and financed" than Federal Telegraph, he said. Terman praised the local companies "built up and . . . financed from [their] own success" (Terman, 1949d). In his 1951 speech to the Institute of Radio Engineers in Palo Alto, Terman said that the community now had a group of "outstanding" companies of "moderate" size, "run with an idea of representing lifetime careers and not with the thought of making a quick profit in the stock market, or of blowing it up and selling out to somebody for as much as you can, and then letting him hold a bag" (Terman, 1951a).

Even when he spoke to financial organizations Terman argued that the concern with short-term profits tended to thwart scientific companies' goals. "Electronics is an industry that has seen more than its share of charlatans, and more than its share of promoters interested more in selling and manipulating stock than in building a sound enterprise," Terman told those attending the American Bankers Association's Pacific Coast Trust Conference in 1947. He spoke less harshly of the potential dangers of financiers' influence in this setting, but he included gory details of Federal Telegraph's history. The company's president "committed suicide only minutes before Federal officials broke into his room," Terman said. Later, the officer in control at the final receivership hearing testified "that he then had negligible holdings,

but had made over \$15,000,000 profit in dealings in the stock of the concern, which probably never had much over \$1,000,000 in actual physical assets" (Terman, 1947b).

At least one manager in American Trust Company, then one of California's three largest banks (Wendt, 1946, p. 91) thought that institutional investors could deal with emerging technologies. Francis Whitmer, an assistant vice president in the bank's trust department who served on the ABA trust conference program committee, invited Terman to speak. Whitmer had heard about Terman's wartime research from Hugh Jackson, dean of Stanford's business school, and believed that the conference audience would be interested in hearing Terman's ideas about "the impact of technological developments upon the long term economic interests of the country." "As you know from our business, we are professional trustees, and as such make investments in many enterprises," Whitmer wrote. "The developments of atomic energy and in the electronics field have been of great interest to all of us." A speech by Terman would fit the committee's goal of bringing "the latest and most informative discussion in the various fields we intend to cover." However, Whitmer must have taken the initiative to see that technology was one of these fields. There were no related speeches, and Terman's was sandwiched between one on "Trusts-- Their Economic Value" and another on "Costs and Charges" (Whitmer, 1947).

Terman felt a sense of loss that Eastern companies had dominated the early stages of the electronics industry's growth, when there had been prospects for much of that growth to occur in the West. If Federal Telegraph had been "properly managed," it "would logically occupy the place of the Radio Corporation of America," he suggested at the trust conference in 1947.

Part of Terman's solution was for the West Coast community of technology

companies to become more competitive by supporting research. "A national program of research is not only needed by the country as a whole, but the West must have its own special program if it is to realize its full industrial possibilities," Terman told the trust officers. "A parasitic industrial activity that depends upon imported plans, and second-hand ideas, cannot hope to be more than a vassal paying tribute to its host, and condemned to a permanently inferior competitive position" (Terman, 1947b).

At least partly due to Terman's efforts, the West Coast electronics industry exploited its postwar opportunity to advance relative to the Eastern industry. By 1950, Terman could observe, "West Coast electronics is growing faster than the East, and that is saying a lot." East Coast electronics firms had been dominant during World War II because General Electric, RCA, the government laboratories, MIT, and Harvard "were supplying the hard core of scientific support," Terman reflected. After the war, the West "gained enormously, and we hold our own with anyone" (Terman, 1950b).

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