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Master Degree in Telecommunication Engineering

EMERGING GATEWAYS FOR ITALIAN
HIGH TECH COMPANIES TO THE
SILICON VALLEY ENTREPRENEURIAL ECOSYSTEM

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*You got a fast car
I want a ticket to anywhere
Anyplace is better
Starting from zero got nothing to lose
You got a fast car
But is it fast enough so we can fly away*

*I remember we were driving, driving in your car
The speed so fast I felt like I was drunk
City lights lay out before us
And your arm felt nice wrapped 'round my shoulder
And I had a feeling that I belonged
And I had a feeling I could be someone, be someone, be someone*

From Fast Car, Trace Chapman

Dedicated to my parents

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Abstract

Italian high tech firms are currently undergoing a second revolution, incorporating economic development and searching for global expansion. Emerging realities as gateways, deal flow organizations and startups incubators allows Italian technology based SMEs to get access to the huge US market. Therefore Italian brain drain to the USA can be reversed as brain gain for Italy, through a technology – bridge between these two countries. Different forms of gateways and this new strategy are analyzed in this thesis.

Introduction

Silicon Valley is in the southern part of the San Francisco Bay Area in Northern California, United States. The term originally referred to the region's large number of silicon chip innovators and manufacturers, and later came to refer to all the high-tech businesses in the area; it is now generally used as a metonym for the American high-tech sector. Despite the development of other high-tech economic centers throughout the United States and the world, Silicon Valley continues to be the leading hub for high-tech innovation and development, accounting for 1/3 of all the venture capital investment in the United States. The region in fact is home to many of the world's largest technology companies including Apple, Google, Facebook, HP, Intel, Cisco, eBay, Adobe, Agilent, Oracle, Yahoo, Netflix, EA and one of the main NASA research center. Several studies have stressed that Silicon Valley success is mainly due to distinctive key factors that characterize this area: valuable research centers and universities – Stanford, UC Berkeley, UC San Francisco, Santa Clara University – whose innovative approach aims to create technology transfer and start up or spin offs from research projects; US government policy, sponsor of University research and particularly favorable for new business ventures; Venture

Capital firms that assure the deal flow to startups then the emerging of new innovative technologies; prestigious law firms, which provide another source for locating key personnel, finance contacts, as well as corporate and intellectual property legal services; a magnet for talent due to the result oriented merit system; social networking with collaborations among businesses, government, and non-profit organizations.

Over the years lots of Italian talented engineers and PHDs have been attracted from Silicon Valley entrepreneurial system and most of them moved there to open new innovative startups and promote high technologies. Therefore a large interest group has been created over years with the purpose of building a bridge and a social network between Silicon Valley and Italy. Italian Universities in fact are recognized all over the world as their high value preparation and quality, so that students and graduates even more started to go to Silicon Valley to explore a new entrepreneurial scenario favorable for the realization of new businesses. Lots of startups opened by Italians in Silicon Valley and Route 128 are today profitable companies and recognized research laboratories. This migration witnesses how Italian excellences need to migrate abroad to get success on new entrepreneurial ideas and innovative technologies.

M31, an Italian private incubator based in Padua, is now going to open a new startup in Santa Clara with the mission of creating a gateway to Italian technologies already supported in Italy. The plan vision of M31 parent company and US corporate is to create an entrepreneurial ecosystem, a group of non-competing companies, including start-ups, established companies and a coordination entity, which share the same vision, values, culture, strategy and business processes that decide to form an organization in order to explore economies of scale in business functions. More precisely the vision statement of M31 USA is the one of becoming a recognized player in promoting and developing new technology entrepreneurship among the young generations of – primarily – Italian engineers and researchers.

On the same wave of M31, in the USA and mainly in Silicon Valley, there are lots of Italian companies and deal flow

organizations operating business development services and cross cultural exchange between students and important local firms. All this has the breadth to create a connection between Italian technologies and the USA – Silicon Valley open business environment. Among these organizations, the most important in the Bay Area are BAIA – Business Association Italy America, SVIEC – Silicon Valley Italian Executive Council, then technology transfer accelerators as Fulbright BEST program, Face2Face, IGN – 1st Generation Network, IAG Italian Angels for Growth and Mind The Bridge, a non-profit organization that every year organizes one of the most important business plan competition for Italian startups in Silicon Valley.

This thesis has the purpose to study the entrepreneurial habitat of Silicon Valley and main differences to other American industrial clusters, as Route 128. Then through a deep analysis of Italian macroeconomics, American macroeconomics, Italy – America import export statistics and IPO, I have identified what Italy misses in its system to be competitive in high tech fields. Finally, as actively involved in the opening of M31 USA, I have reported and analyzed the case study of this private high tech incubator, became in few years an invaluable example of Italian quality. From this case study and the analysis of Italian excellences in the USA, it results that the Italian bridge existing between Silicon Valley and Italy is necessary today to promote new high tech SMEs. It is a new strategy not yet contemplated from the literature and operated from Italian startups to get access to a huge and innovative leading market. On this thesis I made a research activity to identify strengths and risks of this new business strategy.

1. How Silicon Valley came to be

During recent years the San Francisco Bay Area developed rather suddenly into one of the major centers of electronics research and industry in the United States. To those who knew the background it seemed a natural evolution in a region that has been the scene of radio and electronics pioneering since early in the Century.

– Frederick Terman, from preface in Morgan 1967

The rise of Silicon Valley has garnered worldwide attention because it seemed to offer the possibility that a region with no prior industrial history could make a direct leap to a leading-edge industrial economy. The idea that so much growth could occur in so short a time within such a small geographic area has encouraged the attention of entrepreneurs and government agencies for economic development.

Unfortunately, the full story of how the Silicon Valley came to be has not been told yet. Most accounts of the region's history begin in 1955, when William Shockley, who had co-invented the transistor at Bell Laboratories in 1947, founded Shockley Transistor Corporation in Palo Alto. The spinoff of Fairchild Semiconductor from Shockley Transistor and the "Fairchildren" that followed are widely believed to be the stimuli that set the Silicon Valley economic development in motion.

More careful researchers push the origin of Silicon Valley back further, to the formation of Hewlett Packard Company in 1938, and Varian Associates in 1948, within the incubator of Stanford University. The agglomeration of electronics companies around Stanford University is attributed, in this version of the Valley's genesis, to the vision of Frederick Terman, the dean of Stanford University's School of Engineering during World War II, and to the influx of military financed research and development that he brought to the area (Saxenian 1985). Born in June 7, 1900 in English Indiana, Terman is widely

credited with being the father of Silicon Valley. He completed an undergraduate degree in chemistry and master degree in electrical engineering at Stanford University. After having earned a ScD in electrical engineering from MIT in 1924, he returned to Stanford University as a member of the engineering faculty. Terman's students at Stanford included Oswald Garrison Villard, Jr., William Hewlett and David Packard. He encouraged his students to form their own companies and personally invested in many of them, resulting in firms such as Litton Industries and Hewlett-Packard. During World War II, Terman directed a staff of more than 850 at the Radio Research Laboratory at Harvard University. After the war Terman returned to Stanford and was appointed dean of the School of Engineering. In 1951 he spearheaded the creation of Stanford Industrial Park (now Stanford Research Park), whereby the University leased portions of its land to high-tech firms. Companies such as Varian Associates, Hewlett-Packard, Eastman Kodak, General Electric, and Lockheed Corporation moved into Stanford Industrial Park and made the mid-Peninsula area into a hotbed of innovation which eventually became known as Silicon Valley. He served as Provost at Stanford from 1955 to 1965. During his tenure, Terman greatly expanded the science, statistics and engineering departments in order to win more research grants from the Department of Defense. These grants, in addition to the funds that the patented research generated, helped to catapult Stanford into the ranks of the world's first class educational institutions, as well as spurring the growth of Silicon Valley.

Looking back on his creation in his declining years, Frederick Terman reflected, *“When we set out to create a community of technical scholars in Silicon Valley, there wasn't much here and the rest of the world looked awfully big. Now a lot of the rest of the world is here.”*

On the other hand Martin Kenney on his work *“Understanding Silicon Valley: the anatomy of an entrepreneurial region”*, appoints that there has been a vibrant electronics industry in the San Francisco Bay Area since the earliest days of experimentation and innovation in the fields of radio, television, and military electronics. Martin wants to focus on the fact that the Silicon Valley economic growth took a long time to build up

momentum, and was very related and structured by place and historical context acquiring path dependent characteristics that continue to influence outcomes far into the future. He says that the characteristics of early Bay Area electronics companies closely match the structure of industrial organization so widely hailed in Silicon Valley today, albeit on a much smaller scale. *“A leading role for local venture capital; a close relationship between local industry and the major research universities of the area; a product mix with a focus on electronic components, production equipment, advanced communications, instrumentation, and military electronics; an unusually high level of inter-firm cooperation; a tolerance for spinoffs; and keen awareness of the region as existing largely outside the purview of the large, ponderous, bureaucratic electronics firms and financial institutions of the East Coast – all of these well know characteristics of Silicon Valley were much in evidence from 1910 through 1940 as they have been from the 1960s onward. In the jargon of the valley, it seems that the key characteristics of Bay Area electronics, set in place so long ago, have proved to be readily "scalable" as the industry has grown in the region”.*

1.1 Origin of the name

“Hoefler was having a hard time coming up with a good title for his series so he asked Ralph Vaerst, then president of Ion Equipment, for a suggestion. Vaerst gave him the idea of somehow using Silicon Valley because he had often heard people on the east coast refer to it that way. Hoefler, unaware of how well the name would stick, agreed with Vaerst and named his series “Silicon Valley USA”, which was more than likely the first time the name was used in print.”

– Digital Equipment Corporation, 1996

The term Silicon Valley was invented in the mid 1970s. Naturally, the local residents had names for their region prior to this newfangled name, such as "Santa Clara Valley" and "Valley

of Heart's Delight," and still use them. The term Silicon Valley overlaps several of the pre-existing names for this region including parts of the South Bay and Peninsula. Because the electronics industry is considered somewhat prestigious, nearby communities often redefine the term Silicon Valley to include them. Some of these communities were mostly farmland when the term was invented, so it was pretty natural that the term didn't originally include them, but they might reasonably be considered part of the Silicon Valley now.

The term Silicon Valley was coined by Ralph Vaerst, a Central California entrepreneur. Its first published use is credited to Don Hoefler, a friend of Vaerst's, who used the phrase as the title of a series of articles in the weekly trade newspaper Electronic News. The series, entitled "Silicon Valley USA," began in the paper's issue dated January 11, 1971. Valley refers to the Santa Clara Valley, located at the southern end of San Francisco Bay, while Silicon refers to the high concentration of companies involved in the semiconductor (silicon is used to create most semiconductors commercially) and computer industries that were concentrated in the area. These firms slowly replaced the orchards which gave the area its initial nickname, the Valley of Heart's Delight.

1.2 History

"Perhaps the strongest thread that runs through the Valley's past and present is the drive to "play" with novel technology, which, when bolstered by an advanced engineering degree and channeled by astute management, has done much to create the industrial powerhouse we see in the Valley today."

Timothy J. Sturgeon, Massachusetts Institute of Technology,
SV Globalization

Silicon Valley, located around Santa Clara and San Jose, California, is the home of many key U.S. corporations that specialize in advanced electronic and information technologies.

First called "Silicon Valley" in 1971 by a local newsletter writer, Donald C. Hoefler, the "Valley" became the center of newly developing technologies that revolutionized computers, telecommunications, manufacturing procedures, warfare, and even U.S. society itself. The name came to symbolize a type of high-risk business characterized by rapid success or failure, extensive job mobility, and informal behavior, traits thought by some to be the wave of the future. The location of such high-tech research, development, and manufacturing in a formerly agricultural area – once known as the "prune capital of America" – grew mainly from its proximity to Stanford University nearby Palo Alto. Stanford University, a research-oriented institution with active departments in engineering and electronics, decided in 1951 to establish a "research park", a place where companies could build facilities and conduct research in cooperation with the university, the first such enterprise in the country.

One of the main player in the growth process of the Silicon Valley was William Shockley, an English-born physicist who worked on early concepts of the transistor at Bell Laboratories before World War II and who went on to become the director of Bell's Transistor Physics Research Group. His entrepreneurial aspirations did not find satisfaction in the larger corporation and he became a visiting professor at the California Institute of Technology in 1954. After returning to California Institute of Technology for a short while, Shockley moved to Mountain View, California in 1956, and founded Shockley Semiconductor Laboratory. Unlike many other researchers who used germanium as the semiconductor material, Shockley believed that silicon was the better material for making transistors. Shockley intended to replace the current transistor with a new three-element design (today known as the Shockley diode), but the design was considerably more difficult to build than the "simple" transistor. In 1957, Shockley decided to end research on the silicon transistor. As a result, eight engineers left the company to form Fairchild Semiconductor. In 1968 Robert Noyce, Gordon Moore, and Andrew Grove left Fairchild Semiconductor and definitely established Intel. Their departure established a pattern of job mobility that came to characterize careers in Silicon Valley in particular and in the electronics

companies in general, with employees shunning ties of corporate loyalty in favor of personal fulfillment and financial reward. Another Fairchild employee, W. J. Sanders III, founded Advanced Micro Devices soon thereafter Intel was started. In the early 1970s one survey found forty-one companies in Silicon Valley headed by former Fairchild employees. This pattern continued into the 1980s with such companies as National Semiconductor, Atari, Apple Computer, LSI Logic, and Cypress Semiconductor having all or part of their origins in Silicon Valley.

On the other hand, during the 1940s and 1950s, Frederick Terman, as Stanford's dean of engineering, encouraged faculty and graduates to start their own companies. He is credited with nurturing Hewlett-Packard, Varian Associates, and other high-tech firms, until what would become Silicon Valley grew up around the Stanford campus. Terman is often called "*the father of Silicon Valley*". Then during 1955-85, solid state technology research and development at Stanford University followed three waves of industrial innovation made possible by support from private corporations, mainly Bell Telephone Laboratories, Shockley Semiconductor, Fairchild Semiconductor, and Xerox PARC. In 1969 the Stanford Research Institute operated one of the four original nodes that comprised ARPANET, predecessor to the Internet.

One of the most important key of the Silicon Valley's success was the silicon-based integrated circuit, the microprocessor or the microcomputer, among further high technologies developed. The silicon integrated circuit elected the valley to be the worldwide site of electronic innovation for over four decades, sustained by about a quarter of a million information technology workers. Anyway there have been some other important roots that led to the Silicon Valley leading position, for example the roots in radio and military technology. In fact the San Francisco Bay Area had long been a major site of U.S. Navy research and technology. In 1909, Charles Herrold started the first radio station in the United States with regularly scheduled programming in San Jose. Later that year, Stanford University graduate Cyril Elwell purchased the U.S. patents for Poulsen arc radio transmission technology and founded the

Federal Telegraph Corporation (FTC) in Palo Alto. Over the next decade, the FTC created the world's first global radio communication system, and signed a contract with the U.S. Navy in 1912. In 1933, Air Base Sunnyvale, California, was commissioned by the United States Government for use as a Naval Air Station (NAS) to house the airship USS Macon in Hangar One. The station was renamed NAS Moffett Field, and between 1933 and 1947, US Navy blimps were based here. A number of technology firms had set up shop in the area around Moffett to serve the Navy. Sometime later NACA (the National Advisory Committee for Aeronautics, forerunner of NASA) took over portions of Moffett for aeronautics research. One most principal actor on developing the Silicon Valley was for sure the Stanford Industrial Park. After Terman found venture capital for civilian technology start-ups and one of the major success stories of Silicon Valley had begun, Hewlett-Packard, in 1954, Stanford created the Honors Cooperative Program to allow full-time employees of the companies to pursue graduate degrees from the University on a part-time basis. The initial companies signed five-year agreements in which they would pay double the tuition for each student in order to cover the costs. Hewlett-Packard has become the largest personal computer manufacturer in the world, and transformed the home printing market when it released the first ink jet printer in 1984. In addition, the tenancy of Eastman Kodak and General Electric made Stanford Industrial Park a center of technology in the mid-1990s. By the early 1970s there were many semiconductor companies in the area, computer firms using their devices, and programming and service companies serving both. Industrial space was plentiful and housing was still inexpensive. The growth was fueled by the emergence of the venture capital industry on Sand Hill Road, beginning with Kleiner Perkins in 1972; the availability of venture capital exploded after the successful \$1.3 billion IPO of Apple Computer in December 1980.

To many observers California became the central location to the success and, later, the problems of Silicon Valley. The popular image of California, with its promise of individual and professional renewal, played a part, as did the cultural

climate of the 1960s, which criticized large organizations for suppressing personal expression. The moderate climate of Silicon Valley combined with talented people from California universities and a largely nonunion workforce, attracted investors and corporations alike. Publicity about Silicon Valley in the 1970s generated discussion about new opportunities for U.S. industry, especially in electronics. In this respect the Valley represented a significant change in American society: a shift in political and economic power from the older industrialized Northeast and Midwest to the Pacific Coast. The rise of Silicon Valley occurred at a time when major changes in financial markets and the availability of capital were affecting many established electronics companies.

During the 1950s and early 1960s, much of the valley relied on military contracts, but this dependence declined as commercial and then personal markets for computers emerged. Investors hoping for a very high rate of return increasingly were willing to risk supporting the new electronics companies even though as many as 25 percent of them failed within a few years. Demand for capital increased as the size of electronic components, such as memory chips, decreased. Hand in hand with smaller components which developed the need for more sophisticated and costly technologies in manufacturing. By the late 1980s companies estimated that they needed as much as \$1 billion to establish a manufacturing facility for the latest generation of Semiconductors. Observers of investment practices and corporate strategies began to worry that this reliance on venture capital had created a pattern in U.S. business that stressed short-term profits rather than longer-term concerns about product development and competition from foreign corporations. As a consequence of Silicon Valley's success and the boost it gave to California's image and economy, such states as Oregon, Michigan, Texas, Colorado, New York, and Minnesota started to promote advanced electronic firms. In the 1990s, however, companies in Silicon Valley remained the major indicator of the health of the industry.

Products such as memory and logic chips, micro-processors, and custom-made circuits are expensive to manufacture, subject to price-cutting in the market, and have a

short product life (sometimes two years or less) before the next generation appears. Their sale depends on the health of important segments of U.S. industry, including computers, telecommunications systems, automobiles, and military contractors. Silicon Valley and its counterparts elsewhere in the United States thus are subject to cycles of boom and bust. The latter occurred in 1984–1986, when many of the valley's companies found themselves with surplus products after a drop in the U.S. personal computer market. Companies had to lay off workers and some went out of business.

Foreign competition, especially from Japan, caused perhaps the greatest problems for Silicon Valley. Business and political leaders debated whether or not trade policy needed to defend the interests of U.S. electronics firms more aggressively and whether U.S. companies should receive government funding to make them more competitive in the international market. Silicon Valley had begun to worry about Japanese competition by the late 1970s. In 1981, U.S. companies controlled 51.4 percent of the world's semiconductor market; Japan's share was 35.5 percent. Within seven years the figures had virtually reversed themselves, with Japan at 51 percent and the United States 36.5 percent. U.S. companies charged their Japanese counterparts with dumping semiconductors onto the U.S. market at low prices to undercut U.S. manufacturers while Japan kept much of its home market closed. The Semiconductor Industry Association, which represented many companies in Silicon Valley, urged bilateral agreements to open Japan's market. The first of these was signed in 1986, and a second followed in 1992. By the early 1990s it appeared that U.S. industry had started to recover some of the ground lost to Japan.

A boom cycle began in the mid-1990s with the emergence of the Internet and Electronic Commerce, sending technology stocks and leading to the rapid rise of new businesses in the software and electronics industries. Although semiconductors are still a major component of the area's economy, Silicon Valley has been most famous in recent years for innovations in software and Internet services. Silicon Valley has significantly influenced computer operating systems, software, and user interfaces. Using money from NASA and the

U.S. Air Force, Doug Engelbart invented the mouse and hypertext-based collaboration tools in the mid-1960s, while at Stanford Research Institute (now SRI International). When Engelbart's Augmentation Research Center declined in influence due to personal conflicts and the loss of government funding, Xerox hired some of Engelbart's best researchers. In turn, in the 1970s and 1980s, Xerox's Palo Alto Research Center (PARC) played a pivotal role in object-oriented programming, graphical user interfaces (GUIs), Ethernet, PostScript, and laser printers. While Xerox marketed equipment using its technologies, for the most part its technologies flourished elsewhere. The diaspora of Xerox inventions led directly to 3Com and Adobe Systems, and indirectly to Cisco, Apple Computer and Microsoft. Apple's Macintosh GUI was mainly the result of Steve Jobs's visit to PARC and the subsequent hiring of key personnel. Cisco's impetus stemmed from the need to route a variety of protocols over Stanford's campus Ethernet.

Moreover, although Stanford University provides the historical basis for high-technology growth in the South Bay, and remains at the center of high-technology academic research in Silicon Valley, San Jose State University has emerged as the largest supplier of working engineers to high-technology companies in the region. In this light, SJSU engineering, business and computer science graduates often are viewed as the workhorses that power Silicon Valley from day to day. Former SJSU students and SJSU alumni also have founded or co-founded a number of important high-technology firms, many of which were integral to the commercial growth and development of the region. Included among those companies founded or co-founded by former SJSU students and SJSU alumni are Intel Corporation, Oracle Corporation, Quantum Corporation, Seagate Technology, and Atmel Corporation. SJSU alumni also have risen to the level of CEO and/or senior vice president at numerous high-technology firms in the region including ROLM Corporation, Cisco Systems, IBM, Google and Solectron Corporation. Additionally, Ray Dolby and Charles Ginsburg are two Silicon Valley luminaries with close ties to San Jose State.

Several factors reduced the tempt of Silicon Valley as the center of the electronics and computer industry, but among them new technologies, the ascent of successful electronic-component manufacturing elsewhere in the United States, and foreign competition. Silicon Valley remained a center of research, development, and manufacturing in the electronics industry, however the rise of the Internet-based "dot.coms" of the mid-and late 1990s invigorated the area's symbolic function as a frontier of industrial and social. In fact Silicon Valley is generally considered to have been the center of the dot-com bubble which started from the mid-1990s and collapsed after the NASDAQ stock market began to decline dramatically in April 2000. During the bubble era, real estate prices reached unprecedented levels. For a brief time, Sand Hill Road was home to the most expensive commercial real estate in the world, and the booming economy resulted in severe traffic congestion. Even after the dot-com crash, Silicon Valley continues to maintain its status as one of the top research and development centers in the world. A 2006 Wall Street Journal story found that 13 of the 20 most inventive towns in America were in California, and 10 of those were in Silicon Valley. San Jose led the list with 3,867 utility patents filed in 2005, and number two was Sunnyvale, at 1,881 utility patents.

According to a 2008- study by AeA in 2006 Silicon Valley has the highest concentration of high-tech workers of any metropolitan area, with 285.9 out of every 1,000 private-sector workers. Silicon Valley has the highest average high-tech salary at \$144,800. The region is the biggest high-tech manufacturing center in the United States. The unemployment rate of the region was 9.4% in January 2009, up from 7.8% in the previous month. On June 24th, 2008, on the American Markey Watch newspaper appeared an article stating that Silicon Valley, New York and Washington are still the country's top centers for high-tech employment. Benjamin Pimentel, a MarketWatch reporter based in San Francisco, wrote: *"Combined with San Francisco and Oakland, the wider Bay Area, long known as the world's tech mecca and home to such pioneers as Intel Corp., Google and Oracle Corp., topped the Big Apple with more than 386,000 workers. In terms of concentration, San Jose/Silicon Valley was on top with roughly*

285.9 of every 1,000 private-sector tech workers. Boulder was No. 2, with 230.5, followed by Huntsville, with 188.5, and Durham, with 155.9. The Riverside-San Bernardino area in Southern California posted the biggest growth in tech employment from 2005 to 2006, with an 11.5% increase, followed by Durham, at 8.4%, and Salt Lake City, with 7.2%. Tech workers in the San Jose/Silicon Valley area were the highest-paid, with an average annual salary of \$144,800, followed by San Francisco, at \$118,500, and Austin, Texas, at \$100,500. San Jose/Silicon Valley also was the dominant area for technology manufacturing, the report said”.

2. The Silicon Valley edge: innovation and entrepreneurship

In Silicon Valley a myriad of forums bring together individuals from different firms and industry of private sectors, and from financial, educational, and training institutions. These gathering, both formal and informal, enable individuals – often determined competitors – to discuss common problems, debate solutions, and define the shared identities that enable an industrial community to transcend the interests of independent firms. Only such an industrial community can create and recreate regional advantage in today's competitive global economy.

– Annalee Saxenian, from “Regional advantage: culture and competition in Silicon Valley and Route 128”

Silicon Valley has many stories – brilliant entrepreneurs turned billionaires – that are often lucky and sometimes fall in the managing of new companies. On January 1, 1939, two classmates at Stanford University launched from a one-car garage in Palo Alto an electronic measuring device company. Six decades later their company, Hewlett-Packard, led the Valley in revenues, with \$47.1 billion in 1999. In April 1994, another pair of Stanford students worked during their spare time to build “Yet Another Hierarchical Officious Oracle”. Today their firm is called simply Yahoo! and is one of the leading edge web search engine, with a market capitalization of \$70 billion. In March 1996 Larry Page and Sergey Brin, Ph.D. students at Stanford, were working on a research project regarding the Stanford Digital Library Project (SDLP). The SDLP's goal was “to develop the enabling technologies for a single, integrated and universal digital library.” Convinced that the pages with the most links to them from other highly relevant Web pages must be the most relevant pages associated with the search, Page and Brin tested their thesis as part of their studies, and laid the foundation for the first and leading search engine actually existing, Google, which in 2009 has reported \$21.651 billion of revenues.

These are only some legendary examples that describe the Silicon Valley's growth during the last half of the twentieth century. A short review of the main firms based in the Valley shows that for every significant innovation in information technology, a company born and grown in Silicon Valley is a leader: for example integrated circuits (National Semiconductor, Intel, Advanced Micro Devices), 3D graphics (Silicon Graphics), personal computers (Apple), workstations (HP, Sun Microsystems), database software (Oracle), network computing (3Com, Cisco Systems). Moreover in the latest Internet boom, Silicon Valley played a central role on this business: examples of this extension are Netscape, Excite@Home, eBay.

Thousands of high technology companies are headquartered in Silicon Valley. Fortune 1000 is a reference to a list maintained by the American business magazine Fortune. The list is of the 1000 largest American companies, ranked on revenues alone. Among the most notables companies based in the Silicon Valley, the following are in the Fortune 1000:

- Adobe Systems
- Advanced Micro Devices (AMD)
- Agilent Technologies
- Apple Inc.
- Applied Materials
- Business Objects (acquired by SAP)
- Cisco Systems
- eBay
- Google
- Hewlett-Packard
- Intel
- Intuit
- Juniper Networks
- LSI Logic
- National Semiconductor
- NetApp
- Nvidia
- Oracle Corporation
- SanDisk
- Sanmina-SCI

- Sun Microsystems (acquired by Oracle Corporation)
- Symantec
- Yahoo!

Additional notable companies headquartered (or with a significant presence) in Silicon Valley include (some defunct or subsumed):

- 3Com (headquartered in Marlborough, Massachusetts)
- Actel
- Actuate Corporation
- Adaptec
- Aeria Games and Entertainment
- Amazon.com's A9.com
- Amazon.com's Lab126.com
- Amdahl
- Ampex
- Antibody Solutions
- Aricent
- Asus
- Atari
- Atmel
- Broadcom
- BEA Systems (acquired by Oracle Corporation)
- Cypress Semiconductor
- Electronic Arts
- EMC Corporation (headquartered in Hopkinton, Massachusetts)
- Facebook
- Fairchild Semiconductor
- Force10
- Foundry Networks
- Fujitsu (headquartered in Tokyo, Japan)
- Hitachi Global Storage Technologies
- IBM Almaden Research Center
- IDEO
- Logitech
- LynuxWorks
- Maxtor (now part of Seagate)
- McAfee

- Memorex (acquired by Imation and moved to Cerritos, California)
- Micron Technology (headquartered in Boise, Idaho)
- Microsoft (headquartered in Redmond, Washington)
- Mozilla Corporation
- Nokia (headquartered in Espoo, Finland)
- Netflix
- Netscape (acquired by AOL)
- NeXT Computer, Inc. (acquired by Apple)
- Ning
- NXP Semiconductors
- Opera Software (headquartered in Oslo, Norway)
- OPPO
- Palm, Inc.
- PalmSource, Inc. (acquired by ACCESS)
- PayPal (now part of eBay)
- Philips Lumileds Lighting Company
- PlayPhone
- Rambus
- ROBLOX
- RSA (acquired by EMC)
- Redback Networks (acquired by Ericsson)
- SAP AG (headquartered in Walldorf, Germany)
- Siemens (headquartered in Berlin and Munich, Germany)
- Silicon Graphics (now defunct)
- Silicon Image
- Solectron (acquired by Flextronics)
- Sony
- Sony Ericsson
- SRI International
- SunPower
- Tesla Motors
- TWiT
- Tellme Networks (acquired by Microsoft)
- TiVo
- VA Software (Slashdot)
- WebEx (acquired by Cisco Systems)
- Western Digital
- VeriSign

- Veritas Software (acquired by Symantec)
- VMware (acquired by EMC)
- Xilinx
- YouTube (acquired by Google)
- Zoran Corporation

Silicon Valley is also home to the high-tech superstore retail chain Fry's Electronics. Moreover Silicon Valley hosts also notable government facilities:

- Moffett Federal Airfield
- NASA Ames Research Center
- Onizuka Air Force Station

Finally, as already highlighted before, some of the top class American Universities are also based in the Valley:

- San José State University
- Stanford University
- Santa Clara University
- University of California, Berkeley Extension
- University of California, Santa Cruz Extension
- Carnegie Mellon Silicon Valley
- Golden Gate University Silicon Valley Campus
- Silicon Valley University
- University of Phoenix San Jose Campus
- University of San Francisco South Bay Campus
- University of Silicon Valley Law School
- Menlo College
- De Anza College

Then this is the Valley's strength: despite rising costs in land and labor, increasing global competition and periodic downturn and upturn in business environment, Silicon Valley has sustained its leading position in information technologies by consistently fostering entrepreneurship. Silicon Valley's territory specializes in developing start-up companies. The region's story is not primarily about advances in science or breakthroughs in technology, although some important ones have occurred here. An incomplete list includes, in electronics, the invention of the klystron vacuum tube by the Varian

brothers; in silicon, the invention of the planar method of making transistors and the co-invention of the integrated circuit at Fairchild Semiconductor, as well as the invention of the microprocessor by Intel engineers. In computers, Douglas Engelbart proposed the concept of the computer for personal productivity in 1968 at SRI International; Xerox PARC has a stellar record of breakthroughs, including the graphical user interface; Apple produced the first successful microcomputer; IBM's Almaden laboratory invented the random-access method of magnetic disk storage and relational databases; and researchers at Stanford and the University of California at Berkeley made important advances in RISC architecture and relational databases. So Valley's strengths are built on such noteworthy foundations. But many fundamental technologies, including the transistor, packet switching, the World Wide Web and browser technology, occurred elsewhere. What sets Silicon Valley apart is the presence of companies created in the region that develop market and exploit the technologies discovered. Then the Silicon Valley key success is mainly related to the development of technology and its market applications by firms – especially by start-ups. The result is that new companies focused on new technologies for new wealth creation.

2.1 How does Silicon Valley work?

Like a natural habitat for flora and fauna, the habitat of Silicon Valley is one in which all the resources high-tech entrepreneurial firms need to survive and thrive have grown organically over time.

Di Chong-Moon Lee, “The Silicon Valley edge: a habitat for innovation and entrepreneurship”

After having depicted this extremely proactive scenario it comes natural to ask why here and not somewhere else. Di Chong-Moon Lee on his book entitled “*The Silicon Valley edge: a habitat for*

innovation and entrepreneurship” asserts that there is no sufficient subject to answer the compelling question. Then his book argues that the Valley’s sustaining edge arises from factors that go also beyond any individual or single company. Rather, the Silicon Valley edge lies on an entire environment, or, as Di Chong–Moon Lee calls it, a habitat honed for innovation and entrepreneurship. This habitat has developed endogenously over time, co–evolving with generation after generation of new firms and new technologies. As Michael Porter puts it, “*enduring competitive advantages in a global economy lie increasingly in local things – knowledge, relationships, motivation – that distant rivals cannot match*”, Porter 1998. Silicon Valley is a fundamental example of a region leveraging the advantages accrued from local clusters in knowledge, relationships and networks.

Like Detroit and Route 128, Silicon Valley is characterized by a distinctive collection of people. Firms and institutions dedicated to a region’s high–tech industry and startup activities. In fact the Valley’s focus on the intersection of innovation and entrepreneurship is evidenced by the many specialized institutions and individuals dedicated to helping startup bring new products or services to market. These include universities and research centers, specialist supplier, and local services – from chip and software designers, to angel investors and venture capitalists and commercial banks; from patent and venture lawyer to marketing and communication firms, headhunters, accountants. All these people have a lot of overlapping associations. They may have been colleagues at an established firm, or share university, having been fellow classmate at Stanford. They may share an ethnic identity and belong to a group such as The Indus Entrepreneurs or Monte Jade or BAIA, Business Association Italy America based in San Francisco. They may share a professional identity as microprocessor designers, financial specialists or lawyers. Or having the same investors, such as the Band of Angels, may link them. Some associations are formal, as university or law firm; some other are informal and have short life, for example famously, in the mid–1970s, the Homebrew Computing Club, a collection of mavericks including Steve Jobs and Steve Wozniak, co–founder of Apple Computer, with an interest in

making more user-friendly, cheaper computers. The result of these associations is a vast network composed of many smaller networks of contributor to the Valley's process for innovation and entrepreneurship.

Networking is one of the prevailing business activities in Silicon Valley, and this concentration of productive relationships built over time the rich accumulation of shared conversations, projects and agreements. The prevailing business philosophy of Silicon Valley promotes openness, learning, sharing of information and the co-evolution of ideas, flexibility and mutual feedback, then fast response to opportunity and challenge. AnnaLee Saxenian, in her book *Regional Advantage: culture and competition in Silicon Valley and Route 128*, described the Silicon Valley as a “*regional network-based industrial system that promotes collective learning and flexible adjustment among specialist producers of a complex of related technologies.*”

2.2 Silicon Valley features

Social forces here co-operate with economic: there are often strong friendships between employers and employed: but neither side likes to feel that in case of any disagreeable incident happening between them, they must go on rubbing against one another.

Principles of Economics, Book Four: The Agents of Production: Land, Labour, and Capital and Organization, by Alfred Marshall, 1890

Within the Silicon Valley habitat it is possible to identify some crucial features that make the Valley's prosperous business working. Again Di Chong-Moon Lee on his book “*The Silicon Valley edge: a habitat for innovation and entrepreneurship*”, suggests ten main characteristics necessary, but not sufficient, for understanding the Valle's model for innovation and entrepreneurship. Anyway other innovative and entrepreneurial

worldwide communities have developed these characteristics to varying degrees. But they are particularly well developed here. Marc Andreessen, founder of Netscape, summarized the subject this way: “*Silicon Valley has people, the venture capital, the infrastructure, and the creative energy to turn ideas into successful business. Many places try to imitate the Valley, but none of them comes close*”. From Joint Venture: Silicon Valley 1998.

Di Chong–Moon Lee listed on his book the following ten features that well describe the Silicon Valley habitat:

- *Favorable rules of the game*: The American national system is composed of laws, regulations, and conventions for securities, taxes, accounting, corporate governance, immigration, research and development, and other. The American system is very favorable for new startup and new business ventures than are the system of other countries. These rules do not explain Silicon Valley’s unique position but they have had fundamental importance to promote American firms leadership of the IT industry and they have been a necessary condition for the Silicon Valley’s growth.
- *Knowledge intensity*: Silicon Valley is an amalgam of ideas, new products and services, business models. Entrepreneurs, people in established firms, students at universities, venture capitalists have encouraged these activities. In particular this region counts the highest flow rate of ideas about information technologies of any place in the world.
- *High–quality and mobile work force*: The Valley is a magnet for talent. Many engineers, scientists and entrepreneurs have been educated in Silicon Valley and skills are continuously advanced. Role of universities is very important and, because merit is rewarded and the rewards can be large, many talented people came here from all over the world. Moreover the Valley labor force is also unusually mobile, resulting in a market that matches the needs of both individuals and firms, in a rapid and continuous process of recycling people. This

mobility and elasticity of the work force contributes to collective learning, as tacit knowledge is conveyed and shared when professionals move from one company to another. The result is that the region gains knowledge and people find carriers opportunities that maximize their contributions.

- *Results-oriented meritocracy:* Talent and ability is the engine of the Silicon Valley habitat. Entrepreneurs in the Valley vary widely in age and style, but they share a common talent of raw ability. The region is very merit oriented and this system based on results removes obstacles for immigrant entrepreneurs. Examples are notable members of Intel, Andrew Grove from Hungary, of Sun, Vinod Khosla from India, Yahoo!, Jerry Yang from Taiwan and many others. In addition large groups of immigrant entrepreneurs build connections to high-tech centers in their home countries giving Valley access to skills, technologies, network, and market in other place of the world.
- *A climate that rewards risk-taking and tolerates failure:* A distinctive and quite unique feature of Silicon Valley is the business environment that enforce and encourage risk-taking and tolerates failure. In the Silicon Valley financiers usually see failure as a learning experience. This tolerance is also enforced by bankruptcy laws in California that limit liability to invested capital and do not permit creditors to reach beyond the company. On the other hand, limited partnerships for venture capital firms remove strong liability barriers for them to participate in risk high-tech ventures. All this makes the Silicon Valley the culture of independence, networking, egalitarian, meritocratic and equal a model per excellence.
- *Open business environment:* Although companies in Silicon Valley strongly compete, there is also a common attitude that all can gain from sharing knowledge that is not secret. This is in contrast with most business models that characterize other countries. In Silicon Valley there

is instead the common belief that some secrets are more valuable when shared between communities. This is the base of open standards, which develop and produce several applications or products using other's platforms or products, then providing a significant feedback for the original platform.

- *Universities and research institutes that interact with industry:* Universities and research institutions are so rich source of advanced research that are seen as a powerful advantage for high-tech companies. More important for the Silicon Valley is that people interact effectively with industry during the academic studies. In the information technology Stanford University has had a dominant role as a source of ideas and people with lots of creativity.
- *Collaborations among business, government, and non-profit organizations:* In addition to universities and industry, in Silicon Valley there are lot of trade associations, labor councils, and service organizations that over the years have built a community. These organizations are financed and largely led by those in private sector, beside with public sector. They include also non-profit association as “*Joint Venture: Silicon Valley Network*”, that recently has started to produce an annual “*Index of Silicon Valley*” that benchmarks the region's status on economic, educational, health, and quality life factors. It mainly aims to link the benchmark to a forward-looking policy in order to control the long-term sustainability of the region.
- *High quality of life:* The landscape beauty of the Bay Area, the proximity to open spaces and the attractive city of San Francisco has also been major attraction for foreigner entrepreneurs. More over leading universities, opportunities for innovation and higher wages have encouraged this up level life style. However it is necessary to underline also that recently frustrating highway congestion, high housing prices and “24/7” pace of work have led some people to a less enthusiastic view of life in the Valley.

- *A specialized business infrastructure:* What makes more distinctive Silicon Valley's habitat is its assortment of support services for new high-tech businesses. These mainly include venture capitalists and bankers, lawyers, headhunters, accountants, consultants and others specialists.

3. The role of US government in Silicon Valley

The capacity to foster clusters of innovation, an effective use of university resources, the supporting infrastructure, the culture of a willingness to accept risk as well as the venture capital programs are catalysts for the economic development at Silicon Valley.

The dynamic economic engine at Silicon Valley and US Government programmes in financing innovations, Jarunee Wonglimpiyarat, Boston University 2006

Policy makers around the world are anxious to find tools that will help their regions emulate the success of Silicon Valley and create new centers of innovation and high technology. Unfortunately the structure of Silicon Valley and the various components of successful high-tech regions are related to empirical effectiveness of activist policy interventions. The list of potential policies is huge and cannot be examined in one article. Anyway there are two most common policy approaches intended to generate regional technology growth: some regions create public venture capital funds – direct government subsidies for small high-tech firms – to stimulate entrepreneurship. Other regions, or sometime the same region, build science parks to lure high-tech firms.

These approaches remain popular around the world. The International Association of Science Parks currently has members in 49 countries outside the United States. While some parks remain quite small, others represent significant investments. Hong Kong, for example, is spending more than \$2 billion in developing research and technology park (Cheng 1999). Malaysia recently opened a planned high-tech region, Cyberjana. Public venture capital funds, meanwhile, have been established in several Asian countries, while European Union nations are increasingly turning toward direct subsidies of small high-tech firms.

The United States witnessed large growth in both science parks and public venture capital in the 1980s. The U.S. federal government does not operate a public venture capital program per se, although many U.S. states do. The largest single federal program funding small high tech firms in the U.S. is the Small Business Innovation Research (SBIR). This program awards more than \$ 1 billion a year in contributing for small firms for R&D leading. But SBIR is not intended for regional development and some states believe that SBIR can be a key development tool. Anyway it is interesting to analyze how these funds have had an impact on regional economic growth. Meanwhile, the United States have seen an sudden increase in the number of research parks – 16 in 1980 and 135 by 1998 –, according to the American Association of University Related Research Parks. Again it is instructive to see the regional impact of these science parks.

3.1 Porter's cluster-based model

Competitive advantage grows out of value a firm is able to create for its buyers that exceeds the firm's cost of creating it. Value is what buyers are willing to pay, and superior value stems from offering lower prices than competitors for equivalent benefits or providing unique benefits that more than offset a higher price.

Michael Porter, Competitive Advantage, 1985

The study of high-technology clusters started with Michael Porter's "Competitive Advantage" in 1985. Porter, the most influential management analyst of Harvard Business School who is frequently cited in a conceptual thinking of "competitive advantage", argues that the cluster of collaborating businesses helps in the rapid dissemination of innovations. The cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by

commonalities and complementarities (Porter, 1990, 2001). Porter has identified four attributes that characterize a cluster: 1. Factor conditions, 2. Demand conditions, 3. Context for firm strategy and rivalry, 4. Related and supporting industries. These are believed to be self-reinforcing and they catalyze the process of continuous innovations. Porter's Diamond Model provides a structure for understanding collaboration and networking between the government sector and the industry sector in the form of 'clusters' (Porter, 1990, 2001).

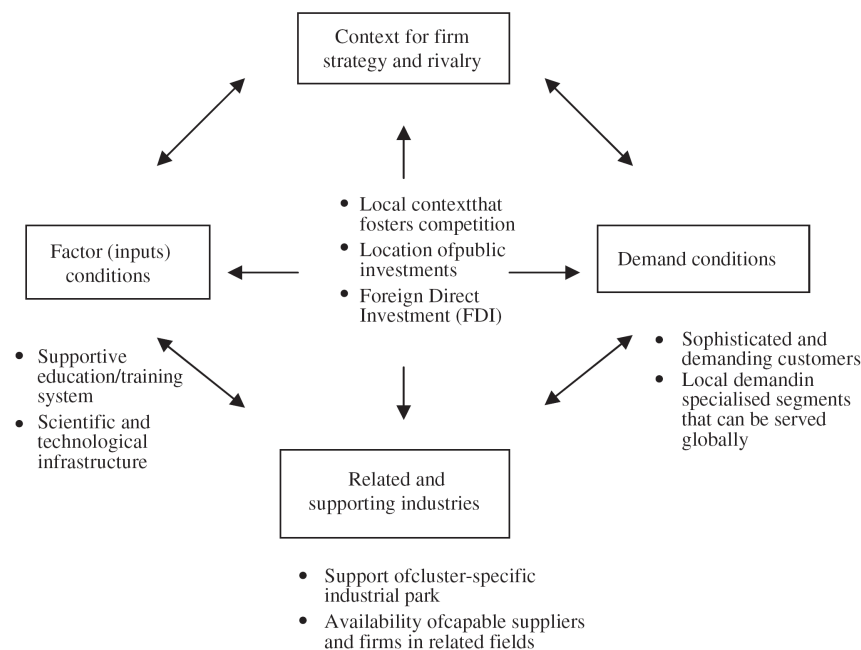


Fig. 1: Porter's Competitive Diamond Model: determinants of regional productivity. Source: Porter (1990, 2001).

The cluster-based policies make possible innovation and support trans-disciplinary research networks among academics and entrepreneurs through information and knowledge exchange. Clusters are a practical means of linking research to marketable innovations.

VC is a high-risk, potentially high-return investment to support business creation and growth. It is a source of funds that typically finance new and rapidly growing companies through equity participation (Bygrave and Timmons, 1992;

Gompers and Lerner, 2001). Porter with his 'industrial cluster' concept explains the role of VC investments to complete the commercialization of innovation (Porter, 1990). Additionally Porter argues that cluster supports competition by increasing the productivity of companies within the cluster. The structure of VC financing generally comprises the stage of financing, ex post refinancing and exit monitoring (IPO, acquisitions, new financing, failure) in order to achieve high-efficiency ventures (Gompers, 1998; Marx, 1998; Cornelli and Yosha, 2001; Schmidt, 2002). The importance of VC financing in the development of a geographical concentration is the regional capacity to create economic advantages. In other words, the VC investment plays a vital role in creating exceptional economic growth. A useful policy is to assist firms at early stage of development by using risk capital then providing a possibility to economic change. Anyway VC markets are influenced also by many factors including a country's legal and institutional structure, size and liquidity of the stock market, investor complexity and ability to supply VC finance to entrepreneurial firms (Cumming et al., 2005).

3.3 The development of Silicon Valley

Silicon Valley dense industrial networks; knowledge intensity; community dynamics among business, governments and other sectors; high-quality labour markets and the supply of VC encourage entrepreneurship and experimentation.

Saxenian, 1994; Miller, 1999

Silicon Valley is the world's most dynamic economic region as it is a habitat for innovation and entrepreneurship. Located on the San Francisco peninsula, California's Silicon Valley is the largest concentration of VC in the world whereby it receives the greatest amount of investments. The development of US Silicon Valley has shown that clusters are an effective economic development model. The entrepreneurial group worked closely

with Stanford University and the industry with the support of VC finance since the early days. After World War II, the development of Silicon Valley was mainly due to the set up of Science Parks as centers of high technology and they worked strongly with universities. Throughout the history Silicon Valley has witnessed a transformation of its economy and the result is a high value entrepreneurialism and VC finance.

The US government has launched several policy initiatives to fill the gaps in VC financing. For example, the Bayh–Dole Act of 1980 and the Federal Technology Transfer Act of 1986 facilitate the commercialization of early–stage technology. Also, the US government promotes the VC industry and entrepreneurial innovation through tax policy: in fact it applies lowering tax rates on capital gains. Here below Table 1 lists the major US government programs in financing innovations according to the stages of innovation development. Table 2 presents the details of the major programs providing loans, expertise and assistance to technology–oriented businesses.

Table 1
The US government programs in financing innovations

| Stages | Programs |
|-------------------------------|--|
| Early stages | Small Business Innovative Research (SBIR), Small Business Technology Transfer Program (STTR) |
| Later stages | Advanced Technology Program (ATP), Defense Advanced Research Projects Agency (DARPA), Dual Use |
| For small business assistance | Cooperative Research and Development Agreements (CRADAs), Small Business Administration (SBA), Manufacturing and Extension Program (MEP), Man Tech |

Source: Summarised from Etzkowitz et al. (2000).

Table 2
The actions of state government and private programs

| Programs | Description |
|---|---|
| Small Business Innovative Research (SBIR) | The SBIR program was established in 1982. It is the US government equity investment pool focusing on the commercialization of research and development (R&D) performed within a small firm. The funding program of early-stage R&D is designed to encourage the conversion of government – funded R&D into technological innovation and commercial application. |
| The Small Business Technology Transfer (STTR) | The STTR program was established in 1992 with the main purposes to move research and development towards commercialization. STTR focuses on the commercialization of R&D performed in universities and government laboratories. |
| Advanced Technology Program (ATP) | ATP was established in 1991 to benefit the US economy by cost-sharing research with industry to foster new and innovative technologies. The ATP program funds the companies undertaking the research in genomics and Internet tools. |
| The Defense Advanced Research Projects Agency (DARPA) | DARPA was established in 1958 to focus on the military research and development. The aim of DARPA is to ensure that the US maintains a lead in applying state-of-the-art technology for military capabilities and to prevent technological surprises from potential adversaries. |

| Programs | Description |
|--|--|
| Dual Use | The Dual Use Science & Technology Program implements dual use technologies in defense systems by jointly funding the development of these technologies by the Department of Defense and commercial industry. The Program defines 'dual use technology' as a technology that has both military utility and sufficient commercial potential to support a viable industrial base. |
| Cooperative Research and Development Agreements (CRADAs) | CRADA is a written agreement between a private company and a government agency to work together on a project. CRADA allows the Federal Government and non-federal partners to optimize their resources, share technical expertise in a protected environment, share intellectual property emerging from the effort, and speed the commercialization of federally developed technology. |
| Small Business Administration (SBA) | SBA was established in 1953 to provide financial, technical and management assistance to help Americans start, run and grow their businesses. SBA established a Micro Loan program nationwide to guarantee on bank loans to small businesses |
| Small Business Investment Corporations (SBICs) | The SBIC program was created in 1958 as a principal US government body to encourage investment (direct equity investments) in small businesses. |

| Programs | Description |
|--|--|
| | SBICs are privately-owned and managed investment firms that use their own capital, as well as funds borrowed at favorable rates with the Small Business Administration (SBA) guarantee, to make VC investments in small businesses. |
| Manufacturing and Extension Program (MEP) | MEP was established in 1988. It is a nationwide network of not-for-profit centers linked together through the Department of Commerce's National Institute of Standards and Technology. The purpose of MEP is to provide small and medium sized manufacturers with the expertise and services they need to succeed. |
| Manufacturing Technology (ManTech) | The Department of Defense Manufacturing Technology Program (ManTech) funds the enabling manufacturing technology developments required for the efficient, effective production of future weapon systems that support the Department of Defense's strategic plans. |
| California Public Employees' Retirement System (CalPERS) | The CalPERS Program was established in 1999. It is the government equity investment pool set up to invest in California start-ups and established companies seeking capital. The aim is to help the companies grow and become competitive in the institutional marketplace. |
| The National Association of Securities Dealers Automated Quotation | NASDAQ was founded in 1971 as a capital market for SME investment |

| Programs | Description |
|---------------------|--|
| (NASDAQ) | opportunities. The market provides a place for fund-raising for small companies and venture capital. NASDAQ aids small companies in raising funds before they become more established and move up to the national capital market. |
| Silicon Valley Bank | Silicon Valley Bank was founded in 1983. The bank provides credit and banking services e.g. term loans, equipment loans, and structured loans to start-up technology-based companies in the technology, life science, private equity and premium wine markets. |

Source: Jarunee Wonglimpiyarat, “*The dynamic economic engine at Silicon Valley and US Government programmes in financing innovations*” and Etzkowitz et al. (2000).

Then by using the competitive Diamond Model of Porter (1990, 2001) as a tool to analyze the success of Silicon Valley, it easy to discover that the success of this area comes from the ability to create and reinforce regional clusters of industries that become focal point of innovation in producing high-value products and services. Table 3 shows the main indicators of Silicon Valley according to Porter’s model.

Table 3
Silicon Valley characteristics according to the cluster indicators of Porter’s competitive Diamond Model

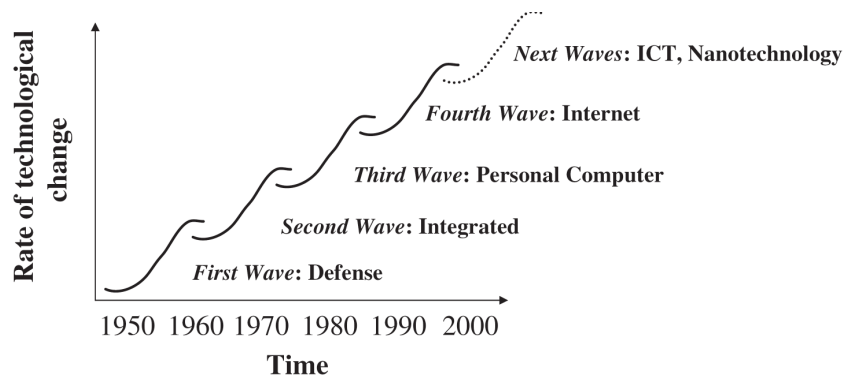
| Cluster indicators of the competitive Diamond Model | Cluster-specific model of Silicon Valley |
|---|---|
| 1. Context for firm strategy and rivalry | <ul style="list-style-type: none"> • The culture of risk-taking California-style entrepreneurship • Favorable tax policies, e.g. tax-exempt capital gains and |

| Cluster indicators of the competitive Diamond Model | Cluster-specific model of Silicon Valley |
|---|---|
| | pension funds as investment incentives to facilitate the development of VC market |
| 2. Factor (inputs) conditions | <ul style="list-style-type: none"> • Substantial degree of information sharing across competing entrepreneurial firms • Cooperation between high-technology firms, research institutions and universities in the cluster • Liquid stock market and angel capital network as the venture channels for investors in Silicon Valley |
| 3. Related and supporting industries | <ul style="list-style-type: none"> • Government-supported R&D funding program (Major program shown in Table 2) • Support of cluster-specific industrial park, specialized research centers and education institutions, e.g. Stanford University, Stanford Research Institute, Stanford Industrial Park |
| 4. Demand conditions | <ul style="list-style-type: none"> • Firms and entrepreneurs work with sophisticated local customers in the California electronics industry for the clusters' products and services, e.g. Intel's high capacity microprocessor, IBM's microcomputer and PC equipment • Collaboration is a major source of innovation as local demand helps focus on critical needs in the regional clusters (electronics-based agglomeration in Silicon Valley) |

Source: Jarunee Wonglimpiyarat, "The dynamic economic engine at Silicon Valley and US Government programmes in financing innovations", based on Porter (1990, 2001).

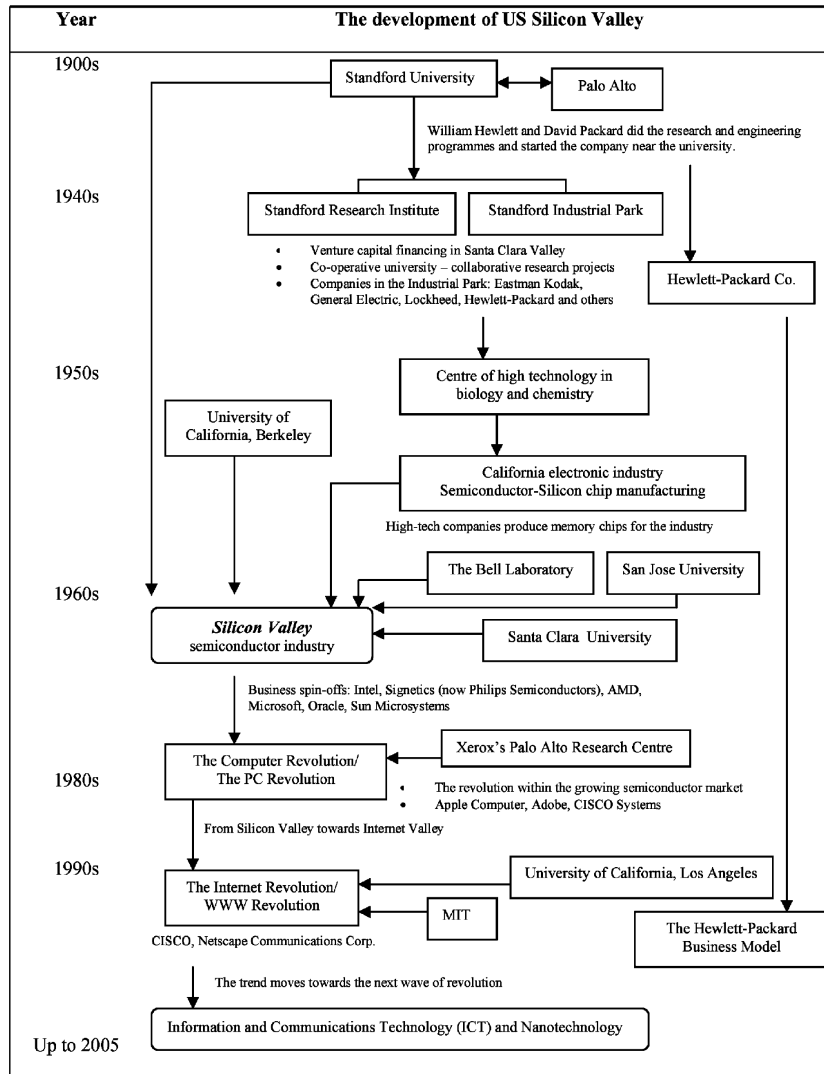
The mechanisms triggering the success of Silicon Valley also comprises the dense networks among entrepreneurs, venture capitalists, university researchers and others. The major clusters at Silicon Valley are software, semiconductor and semiconductor equipment manufacturing, computer and communications hardware manufacturing, innovation services and biomedical and eye-care, especially concentrated on the Berkley School of Optometric.

It is therefore instructive to see the development of high-tech industries in the Silicon Valley history as shown on following figures. In particular there has been an evolution of Silicon Valley from 1950 to present. In particular there are four major waves of innovation which have shaped Silicon Valley since World War II: Defense, Integrated Circuit, Personal Computer, and Internet. Each wave of innovation transformed the Valley's economy and brought about economic growth in the US.



Evolution of Silicon Valley 1950–2000s. Source: “*Silicon Valley Edge*”, Stanford Business Books.

The role of US government in Silicon Valley



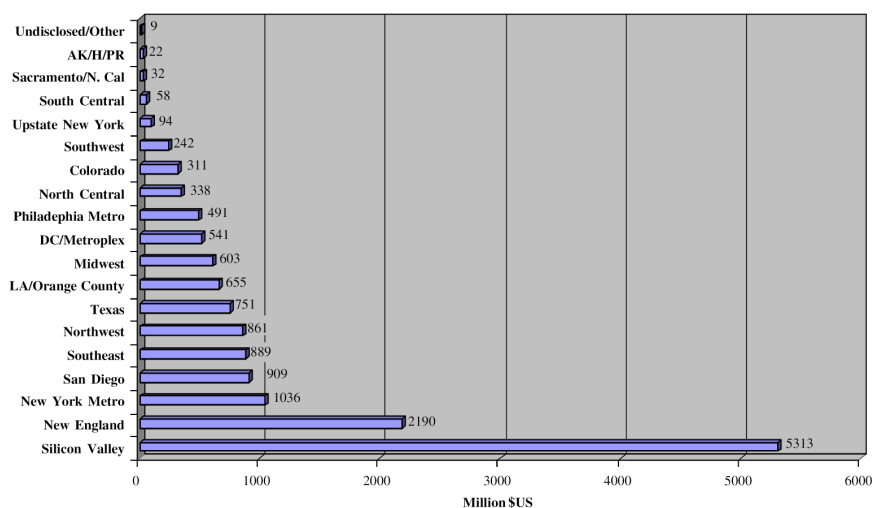
The development of US Silicon Valley. Source: Jarunee Wonglimpiyarat, “*The dynamic economic engine at Silicon Valley and US Government programmes in financing innovations*”.

3.3 Policy implications in the Silicon Valley model

We have had examples (changes in tariff policy, taxation, and so on) of what we may term changes in the institutional framework. They may range from fundamental social reconstruction down to changes of detail in social behavior or habits. It is entirely immaterial whether or not such changes are embodied in, or recognized by, legislation. In any case they alter the rules of the economic game and hence the systematic relations of the elements which form the economic world.

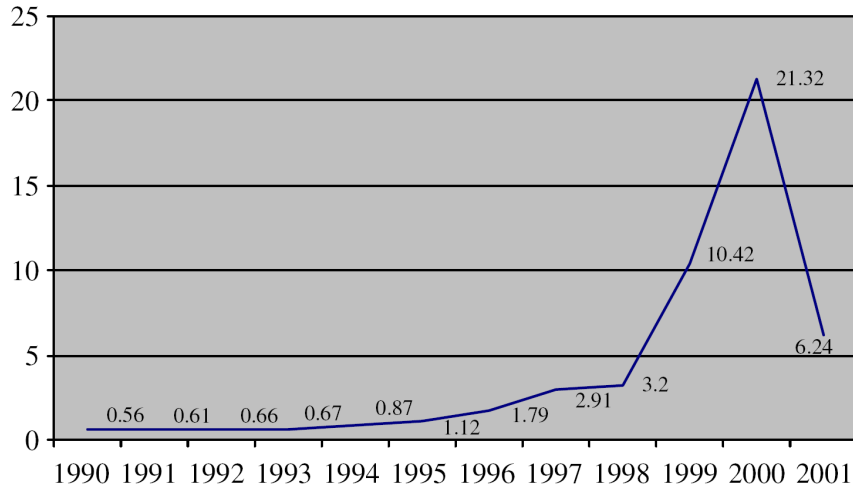
Schumpeter 1939: 11; 1962: 4–5

The analysis of Jarunee Wonglimpiyarat, on his article “*The dynamic economic engine at Silicon Valley and US Government programs in financing innovations*”, has shown that collaborative institutions are important mechanisms on clustering and catalyzing the economic development at Silicon Valley. In particular this region has significantly benefited from an active cooperation of university resources, VC and a large pool of scientists, engineers and skilled technicians.

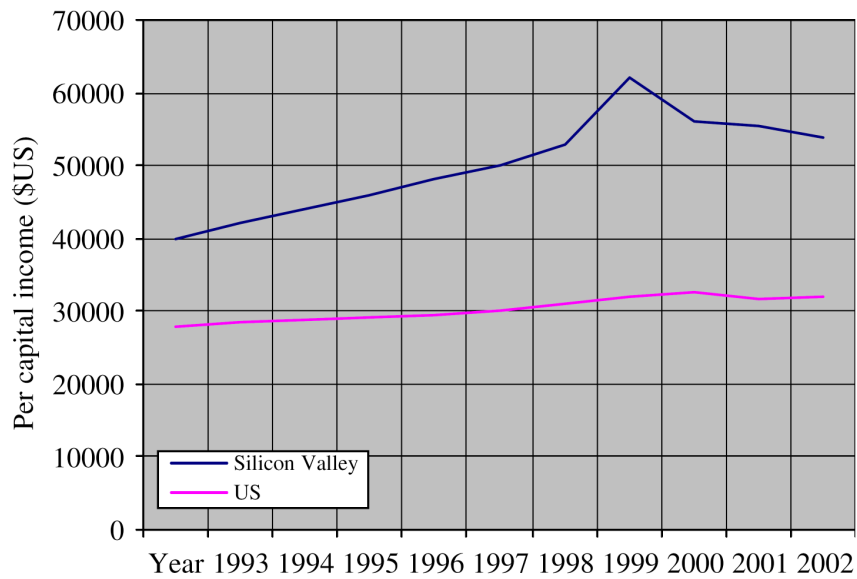


Investments by region, to Quarter 3, 2004. Source: PricewaterhouseCoopers Money Tree.

The role of US government in Silicon Valley



Total venture capital financing in Silicon Valley (US\$ Billions). Source: PricewaterhouseCoopers Money Tree Survey in Partnership with VentureOne. Note: The downturn trend from Year 2000 onwards was a result of the Internet Bubble and overcapacity in the telecommunication industry.



Real income per capita–Silicon Valley and the rest of the US. Source: Economy.com, US Census Bureau. Note: Real income includes total personal income from all sources, e.g. wages, investment earnings, self-employment adjusted for inflation and divided by the total resident population.

Then it is possible to summarize main features of US policy implications and US government policy makers for business strategists as follows:

- Silicon Valley represents risk-taking, California-style of growth through entrepreneurship. The Silicon Valley seems to have incorporated a culture where entrepreneurs are the main driving force for business success. The culture of taking entrepreneurial risk represents the local context that promotes competition according to Porter's Diamond Model. Then the success of Silicon Valley is also related to the availability of financial resources to support entrepreneurial growth.
- On the other hand, the government helps encourage a favorable business environment while the companies and industries mainly perform business functions to achieve and sustain competitive advantage in the region. The US VC firms generally focus on equity financing with the offer of stock options to attract skilled managers. Then the government acts as a major catalyst to accelerate the early-stage investments. In the case of US Silicon the funding and the equity investment undertaken by the private sectors highly motivate entrepreneurs to perform as best as possible in stimulate growth and innovation.
- Jarunee Wonglimpiyarat has benchmarked the US model respect to other nations. There is a dense networks of commercialization accelerators which are the main players of competitiveness. The US federal and state governments have formulated policies to fund the university research and support private sector investment continuously. In conclusion an attempt to replicate Silicon Valley is unlikely to succeed unless dense networks among actors that promote cooperation and accelerate technology commercialization are developed.
- Jarunee Wonglimpiyarat concludes that cluster development at Silicon Valley represents a unique set of characteristics which may not easily be replicable elsewhere. Anyway there are some cases in the world.

For example, in Canada, the Labour– Sponsored Venture Capital Corporations (LSVCCs) are the key government policy approach playing a significant role in the structure and development of the VC industry. The Hsinchu Science–based Industrial Park in Taiwan and Bangalore’s Software Cluster in India are successful in replicating Silicon Valley by forming technology incubator programs to create networks that facilitate regional development. The success of these countries is the results of the government policy approach to build incubators and technology parks in order to create technology connections and knowledge/intellectual networking.

4. Entrepreneurial Universities and Technology Transfer

Thus, technology transfer is a two-way flow from university to industry and vice versa, with different degrees and forms of academic involvement: 1. The product originates in the university but its development is undertaken by an existing firm; 2. the commercial product originates outside of the university, with academic knowledge utilized to improve the product, or 3. the university is the source of the commercial product and the academic inventor becomes directly involved in its commercialization through establishment of a new company.

The norms of entrepreneurial science: cognitive effects of the new university–industry linkages, Henry Etzkowitz

Universities are currently undergoing a “second revolution” over these years, incorporating economic and social development as part of their mission. The first academic revolution made research an academic function in addition to teaching. Now the emerging entrepreneurial universities integrate economic development as an additional function.

This classic industrial perspective of academia is expressed in Europe by the industrial group (IRDAC) in the Research Directorate of the European Union and by the Industry–University–Government Roundtable in the U.S. These organizations primarily represent large multinational firms, whether of U.S. or European origin. Such firms denote the first sectors in a typology of firm perspectives on relations with industry. Although this is changing, in such companies R&D was traditionally internalized within the firm, with a window on academic research obtained through consultation and participation in cooperation programs. In a second group of companies, typically smaller and based on low and mid-level technologies, with little or no R&D capacity, relations with universities, if any, are also informal through engaging an academic consultant to test materials or trouble shoot a specific problem. More intensive relationships occur with a third group

of firms that have grown out of university research and are still closely connected to their original source. More recently, given the rapid pace of innovation in their industrial sectors, some older firms have externalized some of their R&D and seek to import technologies or engage in joint R&D programs to develop them, thus creating a fourth group of firms that are becoming closer in their cognitive orientation to academic start-ups.

In these latter instances, traditional forms of academic-industry relations, such as consulting and liaison programs that encourage 'knowledge flows' from academia to industry become less important as an increasing number of companies look to external sources for R&D or are themselves based upon academic knowledge. As industrial sectors and universities move closer together, informal relationships and knowledge flows are increasingly overlaid by more intensive, formal institutional links that arise from centers and firms. As Henry Etzkowitz notes, *"the older forms of university-industry connections involved payment for services rendered, whether it was received directly in the form of consultation fees or indirectly as endowment gifts. The new university-industry relationships involve the multiplication of resources through the university's and faculty members' participation in capital formation projects such as real estate development and formation of firms. The capitalization of knowledge, its transformation into equity capital by academics involving sectors of the university such as basic science departments relatively uninvolved with industry, and the university's emergence as a leading participant in the economic development of its region have shifted the direction of influence in relationships between business and the university from business to the university. There are two dynamics at work in these activities: one is an extension of university research into development, the other is an insertion into the university of industrial research goals, work practices and development models"*.

The commercialization of university research, at its simplest, is a process involving transactions between the university and a commercial firm. Commercializing a technology may encompass many different types of transactions between a university and the company and different types of transactions may occur sequentially to reinforce

commercialization. Then, a relationship may develop that further interests and goals of each party. But universities themselves are complex bureaucracies with their own rules, rewards and incentive structures. Moreover, in contrast to commercial firms with a relatively simple profit motive, universities have complex objective functions that involve a variety of educational and societal objectives as well as the interests of faculty members and the larger scientific community. Universities' relationships with industry are formed through a series of sequential transactions such as sponsored research, licenses, spin-off firms and the hiring of students.

In particular the core elements in university–industry relationships are transactions that occur through the mechanisms of sponsored research support (including participation and sponsorship of research centers), agreements to license university intellectual property, the hiring of research students, and new start-up or spin-off firms. Each of these mechanisms is briefly described here below as per the article “*Entrepreneurial Universities and Technology Transfer: A Conceptual Framework for Understanding Knowledge-Based Economic Development*”, Janet Bercovitz, Maryann Feldmann, *Journal of Technology Transfer*, 31: 175–188, 2006:

- Sponsored research: an agreement by which the university receives funding for conducting a research project;
- Licenses: legal rights to use a specific piece of university intellectual property;
- Hiring of students: recruitment of students from the university, especially those working on sponsored projects;
- Spin-off firms: a new entity that is formed around the faculty research or a university license;
- Serendipity: simple luck or chance

Sponsored research is defined as a contract between the academic entity and the firm. A sponsored research project supports research commissioned through the university and provides resources for infrastructure, graduate students, course

releases and summer support for faculty members. In this way, sponsored research is an important input to the technology transfer process. The majority of sponsored research is funded by government agencies. The amount of industry support varies significantly between countries. Sponsored research may also involve company participation in an industry-funded research center and consortium. Moreover, individual firms make strategic decisions to sponsor university research. The ability of the university scientist to engage in sponsored research as well as the incentives, behavioral norms, and configurations of the relationship are part of an innovation system and affect both resources available to scientists and the types of problems considered. Sponsored research may take the form of grants or contracts. Grants are more open ended in terms of outcomes, while contracts typically enumerate a set of specific deliverable products and explicit end results. Contracts typically entail closer working relationships with industry, and both parties negotiate the legal specifications of the contract and the ownership of the resulting intellectual property.

Another contractual technology-transfer mechanism is university licenses, which provide the right for companies and others to use university intellectual property in the codified form of either patents or trademarks. These formal transactions involve a quid pro quo motivated to provide funding to universities while transferring knowledge and intellectual property rights to firms. Licensing agreements differ significantly in terms of their specifications and scope. Contractual licensing agreements involve selling a company the rights to use a university's inventions in return for revenue in the form of up-front fees at the time of closing the deal, and annual, ongoing royalty payments that are contingent upon the commercial success of the technology in a market. The licensing deal depends upon the assessment of the value of the technology in a downstream product market which is often difficult to assess and highly uncertain. Moreover in contrast to the typical goods involved in market transactions, the value of knowledge is unsure, with uncertainty being highest for the most upstream, basic research activities. Formal technology-transfer agreements are negotiated prior to the research being complete and at a

time when the commercial value of the end results is not known. Thus, negotiations are based on estimates of the subjective expected value of that portion of the knowledge that a firm will be able to appropriate. In addition to the potential for generating new sources of revenue for universities, the licensing mechanism offers an opportunity for demonstrating that the university was actively engaged in disseminating research results attractive to industry. Then licensing had previously been conducted by a small number of elite universities and these cases were well-known and generally regarded as examples of the activists roles that were required from universities in the wake of declining industrial competitiveness that was the speechifying of Bayh-Dole. New entrants tried to emulate these efforts and increased licensing activity; all this was perceived as an indication that these universities had the potential to advance industrial activity as well as to serve as engines of growth for their local economies. Thus, licensing activity conferred a certain degree of prestige for these universities. The right of faculty to share in the licensing revenue was a provision of the US Bayh-Dole Act, but the percentage varies as a matter of university policy. *Although faculties enjoy the prospect of increasing their income, the after-tax return to faculty from royalties has been relatively disappointing and compares unfavorably with the revenue that faculty may earn from consulting* (Blake, 1993).

The product on which license income is paid may be profitable only because of extensive in-house R&D, manufacturing competitiveness, or the marketing strength of the licensor. A recent survey of technology transfer officers (Jensen and Thursby, 2001) found that only about 12% of technology that is licensed is ready for commercialization. The majority of licensed technology requires significant development work and ongoing cooperation with faculty to advance towards a commercial product. There is evidence that the dimensions of licensing agreements have changed over time. At first in the US, most university licenses were granted on a non-exclusive basis to all companies reflecting provisions of the Bayh-Dole Act. Universities now are more likely to negotiate licenses that are calibrated to certain use or specific geographic

markets and reflect industry practices. American universities have also experimented with taking equity with traditional licensing fees.

The last two mechanisms, spin-off companies and the hiring of students are somewhat different as they involve a more direct technology transfer that takes place through the movement of people. University spin-offs have become a favored mechanism by which universities transfer technology to the commercial realm. Based in part on the examples of the Massachusetts Institute of Technology and Stanford University, which played an active role in the genesis of industrial clusters in Route 128 and Silicon Valley, respectively, university spin-offs are seen as a means to transform local economies and a mechanism which provides a way to capture the benefits of proximity to research universities. A variety of definitions may be used to describe university spin-offs: firms formed by university, faculty, or staff; firms formed around a university license of intellectual property; startup firms that have joint research projects with the university; and firms started by students or post-docs around research conducted at the university. While university licenses have no local restrictions, entrepreneurship is a decidedly local phenomenon. In general, *“entrepreneurs who start companies do not relocate but instead stay close to the source of their perceived competitive advantage, which is typically the referent organization where the founder was previously employed”* (Feldman and Francis, 2002). For university-based spin-offs the university serves as the source of advantage providing skilled labor, specialized facilities and expertise. In addition, faculty who start companies will split their time between the university and the firm making close location advantageous.

At the heart of technology transfer is the individual faculty member who is motivated by a set of personal and institutional incentives. For scientists, starting a company serves the purpose of appropriating the value of their intellectual property as well as providing access to additional funding mechanisms to further the scientist's research agenda. Most critically, *“academic researchers, especially government-funded researchers, must have the ability to retain some rights over their intellectual property to engage in commercial activity”* (Eisenberg, 1987).

Individual scientists have the intellectual capital to engage in commercialization activity whether by simply disclosing an invention or the more involved activity of starting a company; however, there are other barriers to consider. For example, both national culture and academic socialization can influence the degree to which individual scientists participate in technology-transfer activities. Moreover Jensen and Thursby (2002) provide three reasons why individual faculty members in the United States might not choose to participate in technology transfer activities. First, faculty who specialize in basic research may not disclose because they are unwilling to spend time on the applied R&D required to interest businesses in licensing the invention. Second, faculty may not disclose inventions because they are unwilling to risk publication delays associated with patenting that may be required to interest industrial partners in licensing the technology. Third, faculty members may not disclose, because they believe that commercial activity is not appropriate for an academic scientist. Finally, the actions of the chair of the department appear to influence behavior: if the chair is active in technology transfer then other members of the department are also likely to disclose. Most strikingly, technology transfer behavior is mediated by the experience of those in a similar position, in terms of academic rank and departmental affiliation. If an individual can observe others at their academic rank disclosing, then they are more likely to participate in technology transfer.

But the picture is not complete without an understanding of university–industry technology transfer from the firm’s perspective. Linking with external entities is a key element of successful exploration strategies that emphasize the search, discovery, and development of new knowledge. Specifically, such interactions give the firm access to knowledge that differs from, but can complement, the firm’s existing technology portfolio. It is the integration of this new knowledge that leads to path-breaking innovation. *“Academic researchers perform a great deal of cutting-edge research and universities are known sources of new knowledge”* (Rosenberg and Nelson, 1994). In general, early stage technologies such as those originating at

universities require more extensive research investment to reach commercial viability. Further, while the transfer of knowledge across organizational boundaries is always challenging, this challenge is intensified the more radical the technology to be transferred. As Mowery and Rosenberg (1989, p. 7) note, “*a new technology is a complex mix of codified data and poorly defined ‘know-how’*”. Universities are social as well as economic institutions. Faculty behavior is based on social norms, organizational structure, and incentives regarding promotion and tenure. University policies influence the comparative cost of technology transfer, and there is great variation in the composition of university–industry relationships across institutions and the ways in which participation in technology transfer activities is rewarded. Understanding historical context provides an instructive though unfortunately overlooked perspective on current activity and performance.

In any case all these elements described above may be best understood by framing patents and licensing transactions within the larger relationship framework. The national and local policy environment and legal framework, the university environment, and the characteristics of companies influence, the efficiency and thus evolution of these university–industry relationships. Institutional policies, for example, regarding faculty commercialization incentives vary greatly even within the same innovation system.

4.1 Technology Transfer in Silicon Valley

There is no doubt that university technology transfer and commercialization activities are impacting local, state, and national economies. In FY 2003, Stanford alone filed more than 300 patents and some familiar companies such as Google, Sun Microsystems, Silicon Graphics, Netscape, Cisco Systems, and Yahoo have spun off from the University. Approximately 150 new MIT-related companies are founded each year, with at least 10 percent of those directly resulting from university technology transfer activities.

Diane Palminteri, “*Accelerating Economic Development Through University Technology Transfer*”, February 2005.

Neil Bania, Randall W. Eberts, and Michael S. Fogarty on the article “*Universities and the start-up of new companies: can we generalize from Route 128 and Silicon Valley?*” point out that an important question, when analyzing technological transfer, is whether commercialization depends on geographic proximity. In fact United States has witnessed the experiences of Boston's Route 128 and Silicon Valley as models for economic development, resulting in a dramatic growth in state science and technology (S&T) programs. An underlying assumption of state S&T programs is that universities create local technology spillovers, which are then captured either within a state or metropolitan region. Technology spillovers are externalities associated with the production of knowledge created by R&D. Local spillovers are more likely if the mechanisms for transmitting technological information require personal contact. Some fraction of a university's contribution to innovation through spillovers is captured locally as new companies. Then local firms benefit from a region's technical infra-structure in various ways: by hiring graduates from local universities, by using faculty as consultants, by becoming sponsors of joint university-industry research centers, by using local universities for education and training of their workforce, and by utilizing university facilities

such as laboratories, libraries, specialized equipment, and by attending seminars.

According to Bartel and Lichtenberg, 1986, the clearest and most visible mechanism creating spillovers is the hiring of local university graduates whose education and training embodies some of the fruits of academic research. “*Because an educated and skilled workforce facilitates the diffusion of technology*” (Bartel and Lichtenberg, 1986; Wozniak, 1987), it should be expected to observe more localization of spillover benefits in places with greater concentration of skilled workers, such as scientists and engineers. Moreover, according to the newest trend of regional development theory, there is the notion of *social capital* popularized by Robert Putnam in his influential book, “*Making Democracy Work.1*”. Putnam’s idea refers to the complex of local institutions and relationships of trust among economic actors that evolve from unique, historically-conditioned local cultures. Such institutions and social relationships, built upon the experiences of a shared deep history, become embedded within a localized economy and form what Putnam describes as networks of civic engagement that facilitate the activities of politics, production and exchange.

Then it is difficult to imagine an example of regional economic development that is more successful than California’s Silicon Valley, or other famous example as Route 128. Investors from all over the world arrive with suitcases of money to place in what they hope will be the Valley’s next success story. Ambitious, educated people – mostly young – from dozens of nations arrive to take their chances in start-ups fueled by stock options. Regional development theorists study Silicon Valley to identify the underlying characteristics that have enabled this area to become one of the most innovative and prosperous regional economies in the world. Policy makers visit seeking to determine whether the characteristics identified by the theorists and journalists – and the stories they are told during their visit – can somehow be transferred to develop innovation-based economic development in their own regions. The network environment in Silicon Valley is the outcome of historically conditioned, specifically chosen collaborations between individual entrepreneurs, firms and institutions focused on the

pursuit of innovation and commercialization. The main networks of social capital in Silicon Valley are not dense networks of civic engagement, but focused, productive interactions among the following social institutions and entities:

1. The great research universities - Stanford, UC Berkeley and UC San Francisco - with their innovative approach that creates tight relationships to outside actors who commercialize applications of their research, researchers and with their recruitment of faculty and graduate students from all over the world, not just locally or nationally. (For a non-trivial example, about one-third of the graduate students at Berkeley in electrical engineering and computer science are foreign nationals; a similar proportion of the faculty is foreign born).
2. US government policy, in the early phases of microelectronics and computer networking— both as sponsor of University research and critically, as lead-user.
3. Venture Capital firms: not only as home grown source of early stage capital but also as locus of high-tech investment expertise and Godfather services to start-up companies such as the provision of experienced executives at critical moments of a firm's development, strategic and operational advice, links and leads to potential customers and partners.
4. Law firms, which provide another source for locating key personnel, finance contacts, as well as corporate and intellectual property legal services, and who often take payment in stock rather than cash.
5. The leading figures in University engineering departments, venture firms, law firms and operating firms in the Valley know one another— through frequent business and professional contact.

4.2 University of California and Stanford University

If the birth of Silicon Valley dates from the meeting of William Hewlett and David Packard in a Stanford classroom in the late 1930's, the modern era of technology transfer begins with the founding of Stanford's Office of Technology Licensing by Niels Reimers in 1970.

Lawrence M. Fisher, *The Innovation Incubator: Technology Transfer at Stanford University*, Strategy plus business magazine, October 1, 1998, Fourth Quarter 1998, Issue 13

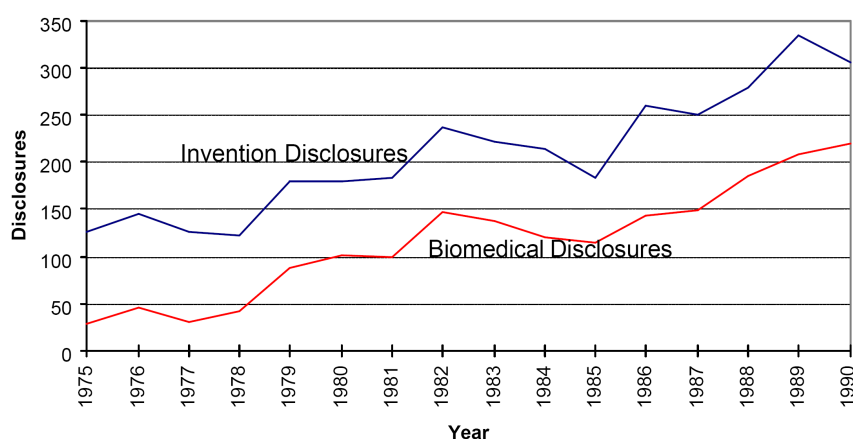
As already mentioned, the U.S. research university and the organized pursuit of R&D in industry both originated roughly 125 years ago and have grown in parallel throughout the 20th century. Although this linkage has a long history, recent developments, especially the growth in university patenting and licensing of technologies to private firms, have attracted considerable attention. In particular, the expanded licensing activities of U.S. universities have occasioned both expressions of enthusiasm by some for the enhanced contributions of university research to U.S. economic growth, and expressions of concern by others over the effects of such activities on the culture and norms of academic research. The recent increases in university patenting and licensing are widely assumed to be the direct consequences of a particular federal policy initiative, known as the Bayh-Dole Act of 1980. Although the Act's importance is widely cited, its effects on U.S. research universities and on the U.S. innovation system have been the focus of little empirical analysis. David C. Mowery, Richard R. Nelson, Bhaven N. Sampat, and Arvids A. Ziedonis on the article "*The Effects of the Bayh-Dole Act on U.S. University Research and Technology Transfer: An Analysis of Data from Columbia University, the University of California, and Stanford University*", have undertaken such an analysis, focusing on three academic institutions that have been the leading recipients of licensing and royalty income for much of the 1990s: Columbia University, the University of

California, and Stanford University, which are among the most important practitioners of the new approach to university technology transfer.

The University of California established policies requiring faculty disclosure of potentially commercially useful research results long before Bayh-Dole. Mechanisms for supporting the commercial exploitation of any resulting patents were put in place in 1943, and assignment by faculty of their inventions to the university was determined on a case-by-case basis. Patenting and any licensing were the responsibility of the UC General Counsel's office, which oversaw the creation and gradual growth of the UC Patent Office. The UC Board of Regents established the "University Patent Fund" in 1952 to invest the earnings from University-owned inventions in the UC system's General Endowment Pool: earnings from the Fund also supported the expenses of UC patenting activities and faculty research. In 1963, the UC Board of Regents adopted a policy stating that all "Members of the faculties and employees shall make appropriate reports of any inventions and licenses they have conceived or developed to the Board of Patents", that latter being a committee of UC faculty and administrators charged with oversight of the Patent Office.

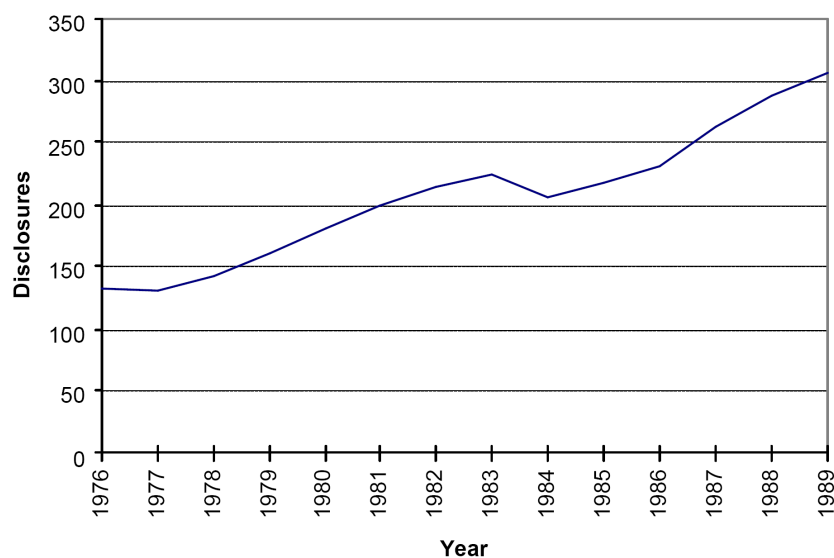
In 1976, responsibility for patent policy was transferred from the General Counsel to the Office of the President of the University, and the Patent Office was reorganized into the Patent, Trademark, and Copyright Office (PTCO). Only in 1980, however, was the PTCO staffed with experts in patent law and licensing, as part of a broader expansion in UC patenting and licensing activities. The Board of Patents was abolished in 1985, and new policies allowing for sharing by campuses in patent licensing revenues were adopted by the Office of the President and the campus Chancellors in 1986. Staff employment in the PTCO grew from 4 in 1977-78 to 43 in 1989-90. In 1991 the PTCO was renamed the Office of Technology Transfer (OTT); but even before this date, in 1990, UC Berkeley and UCLA had established independent patenting and licensing offices, relying on the system wide Office of Technology Transfer selectively for expertise in patent and licensing regulations. By 1997, four UC campuses (in addition to Berkeley and UCLA, UC San Diego

and UC San Francisco) had established independent licensing offices. Since the University of California was active in patenting and licensing well before the passage of the Bayh-Dole Act, a comparison of the 1975-79 period (prior to Bayh-Dole) and 1984-88, following the passage of the bill, provide a "before and after" test of the Act's effects. The average annual number of invention disclosures during 1984-88, following passage of the Bayh-Dole Act, is almost 237, well above their average level (140 annual disclosures) for the 1975-79 periods. The period following the Bayh-Dole Act thus is associated with a higher average level of annual invention disclosures; but the timing of the increase in annual disclosures suggests that more than the Bayh-Dole Act affected this shift.



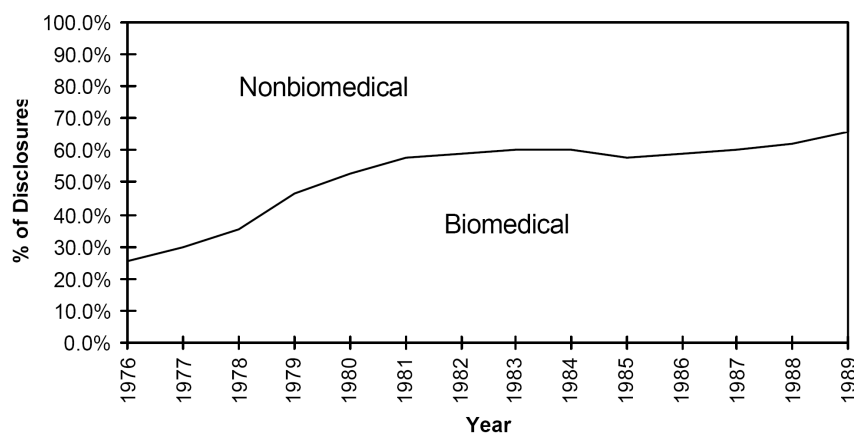
UC Invention Disclosures, 1975-1990

Then an increase in the average annual number of invention disclosures may reflect the important advances in biotechnology that occurred at UC San Francisco during the 1970s, or other changes in the structure and activities of the UC patent licensing office that were unrelated to Bayh-Dole Act. Following figure displays a 3-year moving average for annual invention disclosures by UC research personnel, omitting the first and last years in the 1975-88 periods. For example, the Cohen-Boyer DNA splicing technique, the basis for the single most profitable invention licensed by the UC system and Stanford University, was disclosed in 1974 and the first of several patent applications for the invention was filed in 1978, well before the passage of Bayh-Dole (this patent issued in 1980).



UC Invention Disclosures (3-yr. moving average)

Since biomedical inventions account for the major share of UC patenting and licensing after 1980, these assessment of trends "before and after" Bayh-Dole focuses on biomedical inventions, patents, and licenses. The shares of biomedical inventions within all UC invention disclosures began to grow in the mid-1970s, before the passage of Bayh-Dole. Moreover, these biomedical inventions accounted for a unbalanced share of the patenting and licensing activities of the University of California during this period: biomedical invention disclosures made up 33% of all UC disclosures during 1975-79 and 60% of patents issued to the University of California for inventions disclosed during that period. Biomedical patents accounted for 70% of the licensed patents in this cohort of disclosures, and biomedical inventions accounted for 59% of the UC licenses in this cohort that generated positive royalties.



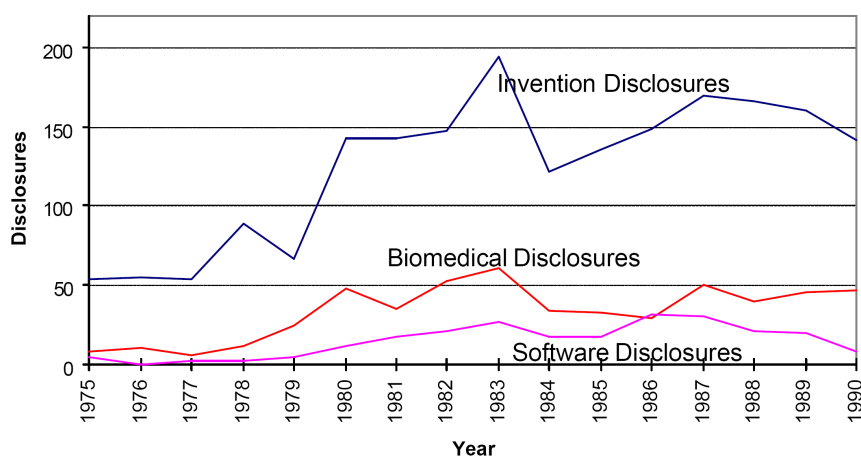
UC Biomedical Disclosures as a % of Total Disclosures, 1975-90 (3-Year Moving Average)

Biomedical inventions retained their importance during the 1984-88 periods, as they accounted for 60% of disclosures, 65% of patents, and 74% of the licensed patents from this cohort of disclosures.

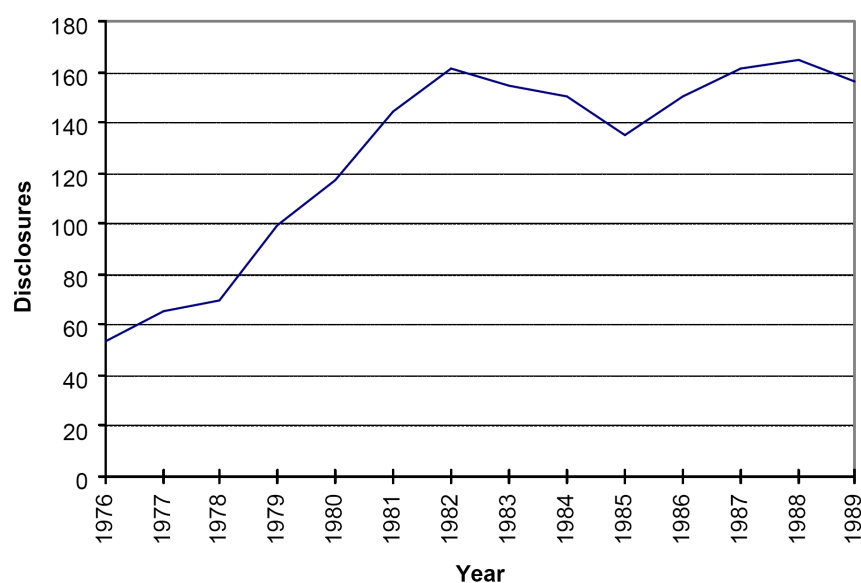
Stanford University's Office of Technology Licensing was established in 1970, and Stanford was active in patenting and licensing throughout the 1970s. Stanford's patent policy, adopted in April 1970, stated that *"Except in cases where other arrangements are required by contracts and grants or sponsored research or where other arrangements have been specifically agreed upon in writing, it shall be the policy of the University to permit employees of the University, both faculty and staff, and students to retain all rights to inventions made by them"*, Stanford University Office of Technology Licensing, 1982, p.1. Disclosures by faculty of inventions and their management by Stanford's OTL thus was optional for most of OTL's first quarter-century. In 1994 Stanford changed its policy toward faculty inventions in two important aspects. First, assignment of title to the University of inventions *"...developed using University resources..."* was made mandatory. Second, the University established a policy under which *"Copyright to software developed for University purposes in the course of employment, or as part of either a sponsored project or an unsponsored project specifically supported by University funds, belongs to the University"*, Stanford University Office of Technology Licensing, 1994a. This policy goes beyond anything adopted by the University of California, and appears

to be more comprehensive than policies in place at Columbia. Stanford University's pre-1994 policies toward faculty inventions thus occupy a middle ground between those of Columbia University prior to the mid 1980s on the one hand, and the University of California, on the other. Prior to 1994, faculty disclosure of inventions to university administrators was no more mandatory at Stanford than at Columbia prior to the post Bayh-Dole reforms there. Nevertheless, especially during the 1970-1980 periods, Stanford operated a much more elaborate administrative apparatus for the patenting and licensing of inventions than did Columbia. The expanding scale of Stanford's licensing operations during the 1970s and 1980s also suggests that a substantial fraction of faculty inventions in fact were disclosed to the OTL. Data from the Stanford OTL provide some insight into the patenting and licensing activities of a major private research university before and after Bayh-Dole. And similarly to the situation at the University of California, these data suggest that the growth of Stanford's patenting and licensing activities was affected by shifts in the academic research agenda that reflected influences other than Bayh-Dole. Below other figures display trends during 1975-90 in Stanford invention disclosures. The average annual number of disclosures to Stanford's Office of Technology Licensing increased from 74 during 1975-79, prior to Bayh-Dole, to 149 during 1984-88. Moreover, the evidence of a "Bayh-Dole effect" on the annual number of disclosures (such as the jump in disclosures between 1979 and 1980) is stronger in the Stanford data than in the UC data, although the smoothed trends (computed as a 3-year moving average) suggest that the annual number of invention disclosures was growing prior to Bayh-Dole. These data also suggest that the importance of biomedical inventions within Stanford's invention portfolio advances had begun to expand before the passage of Bayh-Dole. There is a clear indication that the annual number of biomedical invention disclosures began to increase sharply during the 1978-80 period, and the share of all disclosures accounted for by biomedical inventions increased steadily from 1977-80, leveling off after 1980 and declining after 1983. The magnitude of these increases in biomedical inventions prior to Bayh-Dole is more modest than at the University of California, but the trend is similar. These graphics suggest that

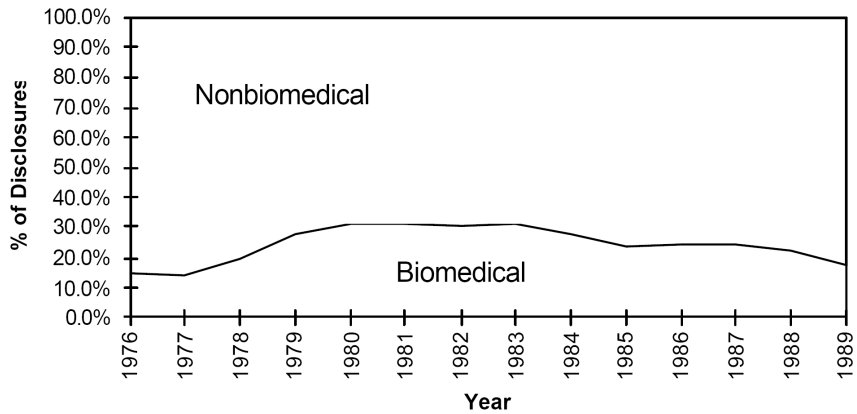
similarly to the UC system, biomedical inventions increased somewhat as a share of Stanford's (non-software) licenses during the 1975-90 period, although the upward trend is less pronounced and fluctuates more widely than in the UC data. In 1980s slightly more than 40% of the income from Stanford's "top 5" inventions was attributable to biomedical inventions, suggesting the considerable importance of these inventions prior to Bayh-Dole. This share increases to more than 96% by fiscal 1995. Stanford's licensing revenues grew by almost 200-fold (in constant dollars) during 1970-95, and its "top 5" inventions account for a larger share of gross income for the 1980-95 period than do the "top 5" UC inventions.



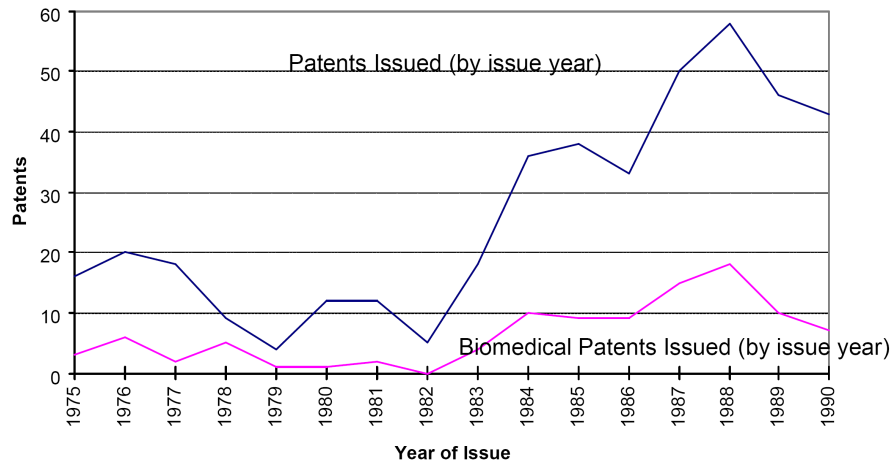
Stanford University Invention Disclosures, 1975-1990



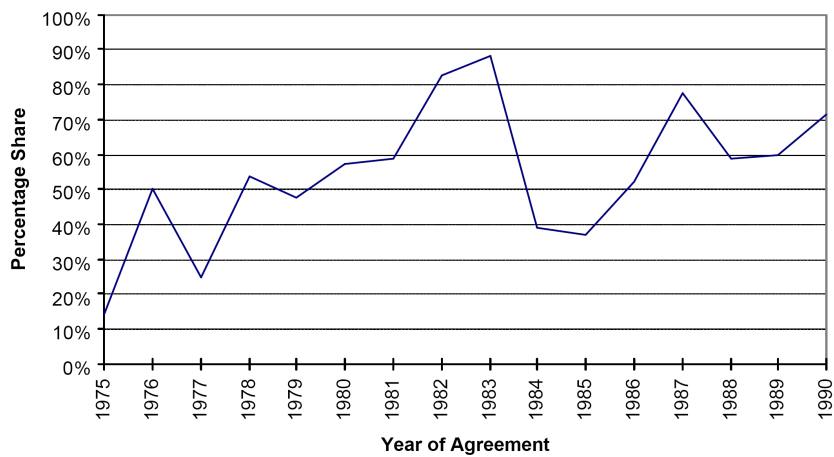
Stanford University 1975-1990 Invention Disclosures (3-years moving average)



Stanford University Biomedical Disclosures as a % of Total Disclosures, 1975-90 (3-Years Moving Average)



Stanford Patents by Year of issue, 1975-1990



Biomedical Technology Share of Stanford License Agreements (Excluding Cohen-Boyer and Software Licenses)

Both Stanford and the UC system thus experienced a shift in the composition of their invention and licensing portfolio towards biomedical inventions prior to Bayh-Dole. Bayh-Dole was an important, but not a determinative, factor in the growth and changing composition of patenting and licensing activity at these institutions.

Stanford's invention disclosures include a number of software inventions, which account for 10-15% of annual disclosures. During the 1980s, the majority of these inventions was not patented and therefore cannot be traced through annual patent counts. The importance of software disclosures in Stanford's licensing activity has grown over time. Only two of the 41 inventions disclosed during 1974-79 (less than 5%) that were licensed within eight years of their disclosure were software inventions, but this fraction increased to more than 20% for the 1984-88 periods. Many of these software inventions (for example, the WYLBUR operating system) were licensed on a nonexclusive basis to academic institutions through Stanford's Software Distribution Center during the 1980s. The majority of these licenses involved a small, one-time payment by the licensee institution. Here below a table reports some data as gross income, gross income from top 5 earners and share of income of top 5 earners related to University of California and Stanford University. It is interesting to see, as confirmation of what mentioned above, how these values increased during the period from 1970 to 1995.

Selected Data of University of California, Stanford University, and Columbia University Licensing Income

| UC | FY1970 | FY1975 | FY1980 | FY1985 | FY1990 | FY1995 |
|--|--------|--------|--------|--------|---------|---------|
| Gross income (1992 dollars: 000s) | 1140.4 | 1470.7 | 2113.9 | 3914.3 | 13240.4 | 58556.0 |
| Gross income from top 5 earners (1992 dollars: 000s) | 899.9 | 1074.8 | 1083.0 | 1855.0 | 7229.8 | 38665.6 |
| Share of gross income from top 5 earners (%) | 79 | 73 | 51 | 47 | 51 | 0.66 |
| Share of income of top 5 earners associated with biomedical inventions (%) | 34 | 19 | 54 | 40 | 91 | 1 |

Entrepreneurial Universities and Technology Transfer

| UC | FY1970 | FY1975 | FY1980 | FY1985 | FY1990 | FY1995 |
|--|--------|--------|--------|--------|---------|---------|
| Share of income of top 5 earners associated with agricultural inventions (%) | 57 | 70 | 46 | 60 | 09 | 0 |
| Stanford | FY1970 | FY1976 | FY1980 | FY1985 | FY1990 | FY1995 |
| Gross income (1992 dollars: 000s) | 180.4 | 842.6 | 1084.4 | 4890.9 | 14757.5 | 35833.1 |
| Gross income from top 5 earners (1992 dollars: 000s) | | 579.3 | 937.7 | 3360.9 | 11202.7 | 30285.4 |
| Share of gross income from top 5 earners (%) | | 69 | 86 | 69 | 76 | 85 |
| Share of income of top 5 earners associated with biomedical inventions (%) | | 87 | 40 | 64 | 84 | 97 |
| Columbia | | | | FY1985 | FY1990 | FY1995 |
| Gross income (1992 dollars: 000s) | | | | 542.0 | 6903.5 | 31790.3 |
| Gross income from top 5 earners (1992 dollars: 000s) | | | | 535.6 | 6366.7 | 29935.8 |
| Share of gross income from top 5 earners (%) | | | | 0.99 | 0.92 | 0.94 |
| Share of income of top 5 earners associated with biomedical inventions (%) | | | | 0.81 | 0.87 | 0.91 |

Source: David C. Mowery, Richard R. Nelson, Bhaven N. Sampat, and Arvids A. Ziedonis on the article “*The Effects of the Bayh-Dole Act on U.S. University Research and Technology Transfer: An Analysis of Data from Columbia University, the University of California, and Stanford University*”

5. Industrial Clusters in Silicon Valley and Route 128

Silicon Valley and Route 128 have been the centers of innovation and commercialization for the electronics, computer and data communications industries in the postwar period.

Technology, Entrepreneurship and Path Dependence: Industrial Clustering in Silicon Valley and Route 128, Martin Kenney and Urs Von Burg, Industrial and Corporate Change, Volume 8, Number 1, 1999

On previous chapters I have examined the entrepreneurial habitat of the Silicon Valley and its main drivers such as University Technology Transfer, venture capitals, social networking and a common environment and life style that led the Bay Area to be the leader region in the world for high tech start ups. Despite the enormous success of the Silicon Valley, it is necessary in this analysis to mention also another important and comparable high tech cluster in the USA, Route 128 based in Massachusetts Boston area.

Silicon Valley and Route 128 in fact occupy a special role in the actual technological scenario and world economic development. Firms started in these two regions after World War II have been important actors and enormous beneficiaries of the increasing electronics global economy. Apple Computer, Cisco Systems, Digital Equipment Corporation, Intel, Lotus, Sun Microsystems are few of the most important companies based in these parts of the world. These two regions share similarities that make them an ideal paired case study analyzing variables such as culture, industrial organization and technology in regional development.

Before World War II neither region was central to the electrical and electronics industry, even if both did have some firms in the industry. Both regions benefited significantly from Cold War military spending, and neither region was entirely dependent upon such spending (Markusen et.al., 1991; Leslie,

1993). Moreover each region counts some of the most prestigious research universities in the United States, Stanford and University of California in the West Coast, Harvard and MIT in the East Coast. Today both regions are global leaders with large teams of highly talented manpower, ample supplies of venture capital and infrastructures that encourage new firm formation. Recently greater attention has been given to explaining the industrial dynamic and the divergence in the performance of these two regions. Considering their importance to evolution of the electronics industry and the postwar US economy, the history of Silicon Valley and Route 128 have received remarkably study. Observers have credited various variables as key to the high technology development of these two regions, mainly the proximity to research universities (Storper, 1993), labor mobility (Angel, 1990; Saxenian, 1994), cutting edge technology, abundance of venture capital and entrepreneurship (Gilder, 1989). More often the divergence is explained by significant differences in norms, legal institutions and behavior model of both firms and entrepreneurs in the respective regions. In this chapter I first examine the growth of Route 128, its strengths and weaknesses. Finally I compare this cluster to the Silicon Valley with a focused analysis of those cultural patterns that led these two regions to be important players in the technological scenario, though their strong differences.

5.1 Route 128: origin of the name

In 1951, the first segment of Route 128 was opened. By 1956, the expressway stretched 65 miles from Gloucester to Braintree. Then the proximity to university labs and to expanding suburban communities drew so many high tech companies to the area that Route 128 was dubbed “America’s Technology Highway”.

Route 128 and the Birth of the Age of Hich Tech, by Alan R. Earls, Arcadia 2002

Route 128, also known as the Yankee Division Highway (for the 26th Infantry Division), and originally the Circumferential Highway, is a partial beltway around Boston, Massachusetts, United States. The majority of the highway is built to freeway standards, and about 3/5 of it is part of the Interstate Highway System. With the rapid growth of high-technology industry in the suburban areas along Route 128 from the 1960s to the 1980s, "Route 128" came to symbolize the Boston high-tech community itself. However, today the industry has expanded significantly onto Interstate 495 as well, the next beltway out. In 1955, Business Week ran an article titled "New England Highway Upsets Old Way of Life" and referred to Route 128 as "the Magic Semicircle". By 1958, it needed to be widened from six to eight lanes, and business growth continued. In 1957, there were 99 companies employing 17,000 workers along 128; in 1965, 574; in 1973, 1,212. In the 1980s, the positive effects of this growth on the Massachusetts economy were dubbed the "Massachusetts Miracle". Major companies located in the broader Route 128 area included Digital Equipment Corporation, Data General, Thermo Electron Corporation, Analog Devices, Computervision, GTE, Polaroid, Sun Microsystems, BEA Systems, EMC Corporation, and Raytheon.

5.2 History of Route 128

Nearly 60 firms were founded during the late 1960s and early 1970s to produce minicomputers. The majority were started by engineers who had worked for DEC or other minicomputer producers. Typically, engineers founded new companies in order to design minicomputers that their former employers would not support. This scenario is reminiscent of Silicon Valley. However, by the late 1970s the minicomputer industry stabilized and new entrants faced entrenched rivals.

Romanelli, 1987, p. 166

Massachusetts at the beginning of 1900s had an established industrial structure with textile and automotive firms. In 1961 MIT, Massachusetts Institute of Technology, and differently from Harvard University, MIT was involved in research and consulting for business. MIT started to sign agreement with the most important firms around the area: General Electric e Westinghouse. During the first decades of 1900s, MIT had a primary role in the industrialization process of the region. One of the main actors of this growth was Vannevar Bush, Professor of Electronics Engineering. During the World War II, Bush became director of OSRD, Office of Scientific Research and Development and he revolutionized the relationships between universities and government financing the research centers of universities in the development of new war technologies. MIT shortly became a bridge between the US government and Boston industrial cluster. During the war period electronics companies were the first to be beneficiary of these investments and registered a strong growth, among these General Electrics, Westinghouse, RCA and Bell Labs. The economic development of Boston district over those years revitalized also the financial sector and in 1946 George Doriot, Professor at Harvard Business School, with other investors founded the ARD, a venture company whose mission was to support start ups. It was in 1946 that the Venture Capital's model started, the same model that continue maintaining the progress of new American technologies.

After the World War II growth continued and during the Cold War government invested a lot on new Radar technologies. In 1951 a six lanes highway called Route 128 was build. Quickly Route 128 ended up to referring to the technological cluster surrounded from the highway. Over the 50s 175 start ups were created in the area delimited from Route 128 highway, mainly thanks to investments for Defense that amounted up to 6 billion Dollars. During 70s Route 128 became the main technological center of the United States with industries specialized in high tech products. In fact there weren't low technological products such as radio, televisions, and consumer electronics. After Vietnam war Route 128 drastically decreased its production and 40% jobs were cut. Lot

of firms that have been prosperous during war period due to government investments realized that they needed to struggle in the consumer electronics business. Then Massachusetts started to experience the Minicomputer production, computers much cheaper than Mainframe and adapt for company usage. Already existing firms started to product Minicomputer (DEC, DG etc.), and new start ups born as Prime Computer and Computervision. At the end of 70s Minicomputer market in Route 128 amounted about 9 million dollars. A new prosperous entrepreneurial environment was initiated and lots of observers called this period of the history the “*Massachusetts Miracle*”.

In the mid - 1980s the minicomputer industry experienced pressure on sales from workstations built around high - speed microprocessors. These workstations connected to LANs gave near-minicomputer performance on the user’s desk at much lower cost. Given these advantages, the minicomputer firms’ market share was eroded by the less expensive workstations. Essentially, the difficulties experienced by the minicomputer firms were the result of the deterioration of their technological paradigm. The stagnation of the minicomputer industry combined with the end of the Regan administration military buildup had a severe effect on the Route 128 economy. Even though this difficult period, Route 128 still has a number of very successful high tech companies and has powerful electronics core industry in which its firms are globally dominant.

5.3 Regional Diversification

Even though the two regions had somewhat different industrial foci, what is as interesting is the consistency with which, as new electronics technologies became commercializable, these two regions were leaders. So, for example, the leading start up firms in market segments such as workstations and computer networking were formed in Silicon Valley and Route 128. No other regions had major start ups.

Technology, Entrepreneurship and Path Dependence: Industrial Clustering in Silicon Valley and Route 128, Martin Kenney and Urs Von Burg Industrial and Corporate Change, Volume 8, Number 1, 1999

Each region had a core industry, but both also diversified. Main starting points for diversification came from different institutions related to an economy consisting of firms, corporate research laboratories and universities. Moreover the role of major research universities in providing seeds for new industries is another common feature. Similarly it is important also the role of spinouts from the ongoing development activities of established firms. But another set of institutions that contributed the beginning for building new industries are the corporate research laboratories in Silicon Valley and their greater presence on the West Coast than in Route 128 is an important difference by providing the development of new technologies for other electronics industry segments.

For example in 1952 IBM relocated the first major electronics research center in San Jose. IBM's goal was to secure access to talented West Coast engineers unwilling to relocate to its East Coast research laboratories (Mayadas, 1998). Many of the innovations that Silicon Valley HDD start ups later commercialized came from IBM's research laboratory. The IBM San Jose Laboratory also developed the technology for relational databases. However the commercialization was slow and this provided the opportunity for Larry Ellison to found Oracle,

which is now the second largest independent software company in the world (Wilson, 1997). Of all the corporate research laboratories in Silicon Valley, Xerox's Palo Alto Research Center (PARC) has received the most attention and contributed the most to the Silicon Valley. In 1970s Xerox PARC developed many of the technologies defining computing in the 1990s, such as graphical user interfaces, LANs (Ethernet), desktop workstations, the mouse and a number of others. On the other hand Xerox proved to be incapable to commercialize these new technologies. But Silicon Valley networks of organizations promoting start ups demonstrated to be perfectly capable of funding entrepreneurs to commercialize these technologies, often with personnel directly from PARC.

On the other hand one aspect of both regions is their ability to self-correct, because not all apparent opportunities are successful. Many venture capitalists lost large sums on technologies, such as pens-based computing, superminicomputers and artificial intelligence. But after a period these firms failed and the failure didn't destroy the economy based on the social networking and entrepreneurial ecosystem that mainly characterized both regions.

5.4 Route 128 today

"We had been doing a lot of our expansion in Boston, but now Boston's getting pretty jammed up itself."

Mitchell Kertzman, president and CEO of Sybase Inc., a Silicon Valley software company

Paul Judge in the article *Boston Route 128: complementing Silicon Valley*, write that Boston Route 128 is now experiencing a new successful period in its economy. According to him and other observers this boom seems to be different than the "Massachusetts Miracle" of the 1980s. While that expansion

rode the coattails of computers driving out companies such as Digital Equipment, Data General, Wang, and Apollo, Boston's current resurgence is driven by software, telecommunications, medical technology, and financial services. Having suffered a sharp decline in the early 1990s, Boston's technology companies seem to have found ways to complement Silicon Valley rather than compete head-to-head. This doesn't mean that there aren't open competitions between these two regions: for example IBM's Lotus Development Corp., based in Cambridge, is holding its own in groupware versus Netscape and Microsoft. EMC Corp. in Hopkinton, Massachusetts, is the world leader in computer data storage products. And Open Market Inc., another Cambridge company, is successfully competing against Microsoft and Netscape in selling software for electronic commerce. But lot economists, venture capitalists, and technology executives observe that today Boston's strength lies in fields like Internet software and biotechnology, which are fueled by the concentration of talent flowing out from MIT, Harvard, and the area's seven other major universities. Bill Kaiser, a partner at Greylock Venture Partners, a Boston-based venture capital firm that has roughly one-third of its portfolio invested each in Silicon Valley companies, says Boston's more conservative approach to building companies is not a bad thing. This view of Silicon Valley is echoed also by John B. Landry, the former chief technology officer of Lotus and a senior consultant to IBM. *"The Valley is a monoculture. I don't care about Larry Ellison's suits or his Japanese garden. I'll take Boston any day. People seem to have a better sense of what's important in living a life."* (Landry, 1997)

A key resource in the Boston area is MIT, as well as Harvard and several other universities that have developed technology expertise in specific areas: Boston University in photonics, for instance. MIT remains the leading institution for technology business creation. A study by MIT and the Bank of Boston released earlier this year the first national review of the economic impact of a research university, and stated that MIT graduates and faculty had founded 4,000 companies, employing 1.1 million people and generating \$232 billion in worldwide sales.

Interestingly, Silicon Valley is a leading destination for MIT-bred entrepreneurs. The five states with the highest numbers of MIT-related jobs are California (162,000), Massachusetts (125,000), Texas (84,000), New Jersey (34,000), and Pennsylvania (21,000). *“Indeed, just because knowledge is being created in Boston, it won't necessarily be applied in Boston”*, observes Douglas Henton, president of Collaborative Economics, a San Jose (Calif.)-based economic consulting and forecasting firm that is benchmarking the Boston area's innovation economy against that of Silicon Valley. At the same time he noticed that some key indicators are showing that the area's technology sector continues to prosper, though not as rapidly as Silicon Valley's. Massachusetts has the highest number of patent applications per capita of any, for instance. Massachusetts also is showing stable growth in the number of "gazelles," Henton's term for publicly held companies that double revenues every four years.

Anyway, Silicon Valley remains the leader and undisputed champion in creating values and technology startups into big companies whose products and business strategies are shaping the world.

6. Current Macroeconomic Analysis of the USA

There is a persistent worry among politicians and the general public about international trade. In particular the general public interprets the decrease in the value of US dollar with respect to other currencies as evidence of deterioration in the US economy. On the contrary the decreased value of the dollar has reduced the US balance of trade deficit.

A Statistical review of current economic conditions in the U.S.,
May 2010 San José State University, Department of Economics

According to the Bank of Italy analysis, during the third 2009 quarter USA GDP started to increase with a 2.2 per cent rise on an annual basis, after a -0.7 per cent decrease observed on previous quarter. The economic seed is going further with +5.5% in the last quarter of 2009 but, even though these symptoms of recover, overall 2009 GDP contraction amounted at 2.4%. In 2010 International Monetary Fund indicates +2.7%, but lots of financial analysts are suspicious regarding an effective re-starting of the economy.

The economical crisis, originated at the beginning of 2007 in the “*subprime*” loans market, ended up involving the whole system so that the American economy entered a phase of open regression. In September 2008 Lehman and Brothers, one of the most prestigious American global financial services firm, got bankrupted and the event signed a terrible moment in Wall Street, so that one of the strongest economic crisis since 1930s started. To avoid a cash flow excess and the beginning of a very dangerous spiral regression, government reacted with a public action aimed to help financial markets. This public policy was continued more and more strongly by Obama Administration since January 2009. In February 2009 the new President approved a fiscal operation called American Recovery and Reinvestment Act ARR, which amounted 787 million dollars to stimulate the demand.

Albeit the massive public intervention operated by President Obama, a communal feeling of mistrust against the financial sector have reduced the credit flow and the crisis has involved also private demand as well as firms, then leading to a sensible increase of unemployment rate (10% in 2009 and 9.7 % up today). The substantial change in the American stock market had surely consequences in those countries mainly exposed to the financial crisis, as United Kingdom, but also in those countries whose economic growth depends on the export to North America, as European countries, China and Japan.

Anyway the US economy has certainly been helped from the actuation of ARRA law in February 2009. In December 2009 1/3 of total 787 million dollars has been distributed between public investments, family tax reduction and fiscal incentives to industries. According to economists, GDP growth during third quarter of 2009 is mainly due to the American Recovery and Reinvestment Act.

On the other hand, regarding the economic reaction there are still lots of risk factors pending. Economists think that in future quarters of 2010 and 2011 a reduction of the private demand will be determined from family desire to recover their balance and the internal wealth will remain definitely lower than before the crisis. Firms' investments are still suffering due to the reduction of credit from venture capitals and banks. In any case, "*Senior Loan Officer Opinion Survey*", a market survey issued from Federal Reserve in October 2009, reported a significant attenuation on the restrictions to the credit adopted in the early stage of the crisis. During the last months of 2009 and beginning of 2010 firms started again to issue stocks and between October and December 2009 shares amounted about 100 million dollars, quite the same level of the economic trend during previous decade.

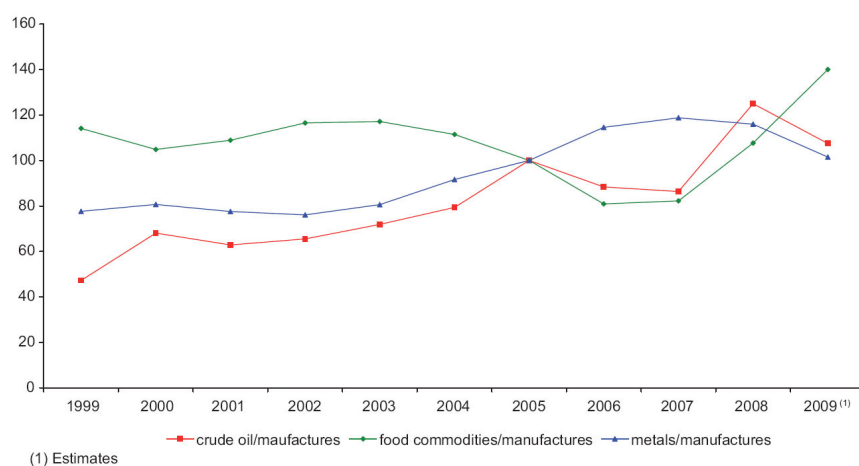
6.1 Global Economy

Market nervousness concerning the fiscal positions of several European high – income countries poses a new challenge for the world economy. This arises as the recovery is transitioning towards a more mature phase during which the influence of rebound factors, such as fiscal stimulus, fades, and GDP gains will increasingly depend on private investment and consumption.

Global Economic Prospects, The World Bank

The international economic crisis has been far more severe than expected. The rapid, broad-based expansion that had begun in 2003 ended and world economic activity slowed sharply, especially in the second half of 2008 and the first six months of 2009. What at first appeared to be a liquidity crisis confined to the United States and the other developed countries – then a situation not likely to influence the emerging countries because of their decoupling – turned into a global crisis and spread out in all continents. Global output sagged; international trade collapsed and so did commodity prices, which in the early part of 2008 had soared recording highest levels, thanks in part to demand originating from the emerging countries. In 2008 world GDP grew by 3.2 per cent, two points less than in 2007. The slowdown was a general trend but it was most perceptible in the advanced countries and worsened markedly after the summer. World trade in goods and services slowed very rapidly, more than production. Annual growth rate fell down more than 4 percentage points, to 3.3 per cent. Trade operations shrank in the fourth quarter of 2008, for the first time since 1982, and the contraction continued in the first months of 2009. This reflected not only the drop in demand but also the difficulty of get access to credit, which penalized more heavily exports from countries with underdeveloped banking systems. Anyway the economic fall related to trade actions is less striking when measured in current dollars, owing to the surge in prices of raw materials up

to the middle of the year. The altered global economic context also affected foreign direct investment (FDI), which according to UNCTAD database fell down about 15 per cent over the year, quite all the decrease coming in the fourth quarter. In general, the prices of raw materials were highly volatile, with an initial surge that was only partly offset by the retreat recorded after the summer. For energy commodities, the average annual increase in prices was 40.1 per cent, for food commodities 23.4 per cent, enough in any event to improve the terms of trade of producing countries. Since March 2009 the downward movement in prices appears to have halted or in some cases – oil, for instance – to have reversed. Despite the volatility of commodity prices, inflation was held down by the abundant supply of manufactured goods on the market, and the average increase in consumer prices in dollars measured in dollars came to 6 per cent in 2008.

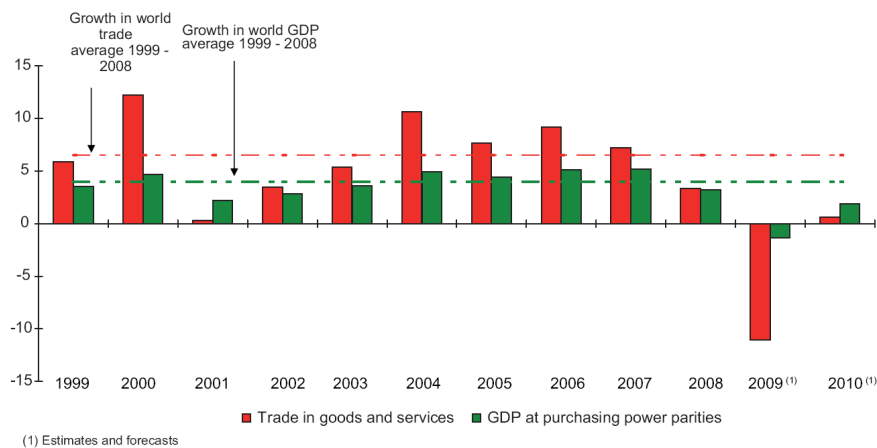


Prices of raw materials related to manufactures. Indices, 2005=100
Source: Based on IMF data

Last year the dollar depreciated slightly against the other main currencies, as in 2007, but in the more recent months it regained some ground, especially against the euro, as the uncertainty prevailing in financial and real markets fueled demand for US securities, which are deemed relatively safe. Continuing a trend that began in 2005, the Chinese renminbi gradually appreciated against the dollar in the first half of 2008, but it remained practically stable in the second half, in concomitance with the period of the dollar's strengthening. This

year the growth rates of global output and world trade are expected to fall further, with trade forecast to contract by 11 per cent.

The crisis, therefore, has not run its course. Nevertheless, commodity prices have begun to increase again. Trade flows have restarted, especially in the developing regions, as is shown by the period-on-period growth rates in Chinese imports, and consumption shows some signs of reviving in the main industrial countries. It is likely, therefore, that the worst phase of the crisis is close to the end and that world trade and production will begin to expand again in 2010, although more slowly than in the past. The repercussions on employment could last longer, however.



World output and trade. Percentage changes in volume
Source: Based on IMF data

6.2 USA economy profile

While the U.S. economy is showing signs of entering a recovery phase, the shape of the recovery remains a subject of considerable debate. Some analysts suggest that the sharp correction in economic activity has led to significant pent up demand that will drive a V-shaped recovery.

Roubini Global Economics, RGE Briefing, United States: Economic Profile

The United States of America has the world's largest economy. According to the CIA World Factbook, 2007 GDP is believed to be \$13.84 trillion. This is three times the size of the next largest economy, Japan, which has a GDP of \$4.4 trillion. US dominance has been eroded however by the creation of the European Union common market, which has an equivalent GDP of over \$13 trillion, and by the rapid growth of the BRIC economies, in particular China, which is forecast to overtake the US in size within 30 years. The recent failure in the US housing and credit markets has resulted in a slowdown in the US economy. 2007 GDP growth was estimated at 2.2% but in 2008 it is projected to be just 0.9%, down from the 10-year average of 2.8%. In common with most developed countries, Services is the key sector of the economy. In 2007, services made up 78.5% of GDP, industry 20.5% and agriculture less than 1%. Around two-thirds of the total production of the country is driven by personal consumption. Although the US is often referred to as a free market economy, this is not entirely true, since there are government regulations protecting certain sectors, notably energy and agriculture. It can be more accurately described as a 'consumer economy'. Since the US economy is also the largest economy in the world, and the US consumer drives two thirds of the US economy, the US consumer is also a big driver of global economic activity. The forces of supply and demand directly drive the price levels of goods and services. What to produce, and how much of it is to be produced depends on the price level fixed by the interaction of supply and demand. The

role of government in the US economy is crucial when it comes to decision-making regarding monetary and fiscal policies. The federal government takes all the necessary initiatives to ensure the growth and stability of the United States. The US government makes full use of economic tools such as money supply, tax rates, and credit control, among other things, to adjust the rate of economic growth. For the most part, the US Federal Government also regulates the operations of private business concerns in order to prevent monopolies. The government renders a number of direct services in the form of providing support for national defense, monetary aid for research and development programs, and funds for highway construction & infrastructure in general.

The question of national debt is a controversial one within the US. At the start of 2008, the US federal debt stood at \$9.2 trillion. This is a worrying 67% of GDP and equates to \$79,000 for each American taxpayer, a number just over 117 million people. To add to the concern, American consumers are also increasingly dependent on debt and have been re-mortgaging their houses to higher loan amounts, and using the extra cash to fund high street purchases. This debt figure is the largest in the world in absolute terms, but as a percentage of GDP it is less than Japan and similar to several European countries. Most of the debt is funded by central banks and sovereign wealth funds from Asia, Europe and the Middle East.

6.3 A new player in the US economy: The role of China

There is no doubt that this unprecedented undertaking to build a new China–U.S. partnership is ground-breaking and it cannot be smooth all the way. Through practice, we can see that this is the only and inevitable way it can be done.

Dai Bingguo, the Chinese State Councilor

There is a Chinese proverb that speaks of treading different paths that lead to the same destination. Our two nations have unique histories ... We have traveled different paths, but that shared future is our common destination and responsibility. And, ultimately, that is what this dialogue is about.

Hilary Clinton, U.S. State Secretary

Quotes from the China–US Strategic and Economic Dialogue

From many years a huge amount of the US deficit is attributed to the import and export activity with a new global player in the worldwide economy, China. In 2009 China has been confirmed the first in the top list of principal USA suppliers, with an amount of exported goods of 296 billion dollars. Despite its advantage and leadership, China as well reported in 2009 a decrease on export trade economy especially to USA with -12.2% compared to 2008. This is the highest figure among other exporting countries to USA and it represents 33% of the total commercial deficit of USA. It is important to stress that, in this global deceleration, including the Chinese economy, and in the actual continuous change versus “de-globalization”, American Administration has demonstrated open collaboration and détente to China. In fact there is a strong relationship between the two countries, mainly due to China global expansion and that China is today the first creditor of United States. Today, the US is in hock to China to the tune of \$800 billion dollars in treasury bonds, and potentially a much larger sum in shares and other investments, after a decade-long borrowing binge by governments, families and corporations. The crisis, which had its roots in the home of the unbridled free-market capitalism, has supercharged the transfer of power from the west to the emerging economies of China, India and Latin America.

6.4 Challenges for the USA in the 21st century

It requires aggressive action to fix our financial systems and get credit flowing again. It requires substantial support from the International financial institutions targeted to those emerging markets and developing economies most affected by the crisis....But we have a strong consensus on the need for both recovery and reform so that we never face a crisis like this again.

Timothy Geithner, Treasury Secretary of Obama Administration, at G-20 finance ministers, 2009

Recently, the IMF has described the US current account deficit as unsustainable. The International Monetary Fund has said it could have a significant adverse effect on interest rates and global capital markets. The American economy is observing a record-low household saving rate and a large federal fiscal deficit. Thus it is essential to support the adjustment by strong US national saving to avoid a burden falling on investment and growth, both in America and abroad. Like many countries in the world, the United States too had been undergoing profound economic changes.

A wave of technological innovations in computing, telecommunications, and the biological sciences were profoundly affecting how Americans work and play. At the same time, historical factors like collapse of communism in the Soviet Union and Eastern Europe, the growing economic strength of Western Europe, and more recently the emergence of powerful economies in Asia, expanding economic opportunities in Latin America and Africa, have had affected US economy. The increased global integration of business and finance posed new opportunities as well as risks. All of these changes were leading people in the US to re-examine everything from how they organize their workplaces to the role

of government. Perhaps as a result, many workers, while content with their current status, look to the future with uncertainty. The US economy though a lot better than many economies, faces some other long-term challenges. Notwithstanding the fact that many Americans have achieved economic security and some have accumulated great wealth, significant numbers continue to live in poverty. Disparities in wealth, while not as great as in some other countries, can be seen as still larger than in many. Environmental quality remains a major concern. Substantial numbers of Americans lacked health insurance. And global economic integration has brought some dislocation along with many advantages. In particular, traditional manufacturing industries have suffered setbacks, and the nation has been facing a large and seemingly irreversible deficit in its trade with other countries. The response to the terrorist attacks of 11 September 2001 showed the remarkable resilience of the economy. Moderate recovery took place in 2002, with the GDP growth rate rising to 2.45%. A major short-term problem in first half 2002 was a sharp decline in the stock market, fueled in part by the exposure of dubious accounting practices in some major corporations.

The Iraq war in March/April 2003 shifted resources to military industries and introduced uncertainties about investment and employment in other sectors of the economy. Though, the United States will continue to be the world leader for many more years, it will have to resolve some long-term problems in order to sustain the growth. These include inadequate investment in economic infrastructure, rapidly rising medical and pension costs of an aging population, sizable trade deficits, and stagnation of family income in the lower economic groups.

6.5 Import – export between USA and Italy

The United States and Italy cooperate closely on major economic issues, including within the G–8. Italy was the United States' twelfth–largest trading partner in 2008, with total bilateral trade of \$51.6 billion comprised of exports to Italy totaling \$15.5 billion and imports from Italy worth \$ 36.1 billion.

Bureau of European and Eurasian Affairs, Background note:
Italy

In the list of 20 main trading partners of USA in 2009 Italy covered the 12th position, with a total amount of about 28 billion dollars, losing a lot if compared to the 36 billion dollars reported in 2008. In addition a decrease of Italian market share in USA has been registered, slowing down from 1.72% in 2008 to 1.70% in 2009.

List of main USA trade partners, Italian position and market share

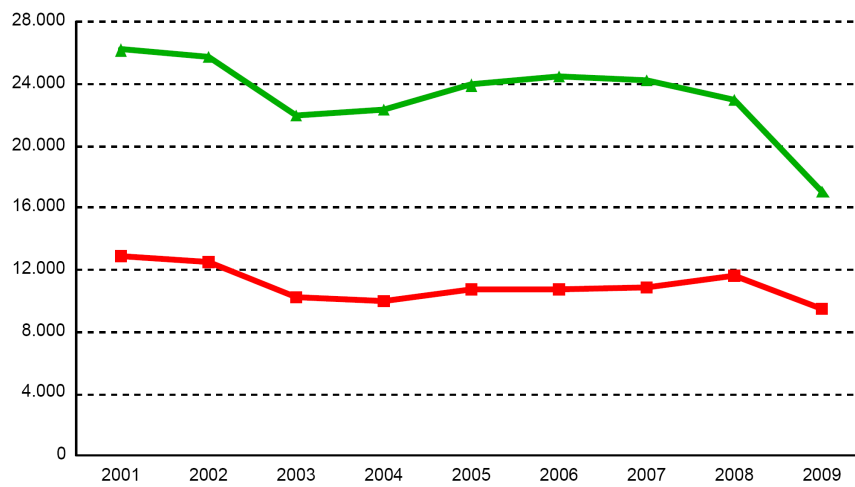
| | | | Market share | | Var. % |
|------------------|-----------|-----------|--------------|--------|--------|
| | 2008 | 2009 | 2008 | 2009 | 08/09 |
| Total | 2.103.641 | 1.588.085 | 100% | 100% | -25,9% |
| 1.China | 337.773 | 296.402 | 16,06% | 19,02% | -12,2% |
| 2.Canada | 339.491 | 224.911 | 16,14% | 14,44% | -33,8% |
| 3.Mexico | 215.942 | 176.537 | 10,27% | 11,33% | -18,2% |
| 4.Japan | 139.262 | 95.949 | 6,62% | 6.16% | -31,1% |
| 5.Germany | 97.497 | 71.253 | 4,63% | 4,57% | -26,9% |
| 6.United Kingdom | 58.587 | 47.486 | 2,79% | 3,05% | -18,9% |
| 7.South | 48.069 | 39.235 | 2,29% | 2,52% | -18,4% |

Current macroeconomic analysis of the USA

| | 2008 | 2009 | Market share | | Var. % |
|-----------------|---------------|---------------|--------------|--------------|---------------|
| | | | 2008 | 2009 | 08/09 |
| Chorea | | | | | |
| 8.France | 44.049 | 34.034 | 2,09% | 2,18% | -22,7% |
| 9.Taiwan | 36.326 | 28.375 | 1,73% | 1,82% | -21,9% |
| 10.Venezuela | 51.424 | 28.094 | 2,44% | 1,80% | -45,4% |
| 11.Ireland | 31.347 | 28.066 | 1,49% | 1,80% | -10,5% |
| 12.ITALY | 36.135 | 26.416 | 1,72% | 1,70% | -26,9% |
| 13.Malaysia | 30.736 | 23.279 | 1,46% | 1,49% | -24,3% |
| 14.Saudi Arabia | 54.747 | 22.046 | 2,60% | 1,41% | -59,7% |
| 15.India | 25.704 | 21.176 | 1,22% | 1,36% | -17,6% |
| 16.Brasil | 30.453 | 20.074 | 1,45% | 1,29% | -34,1% |
| 17.Nigeria | 38.068 | 19.128 | 1,81% | 1,23% | -49,8% |
| 18.Thailandia | 23.538 | 19.085 | 1,12% | 1,22% | -18,9% |
| 19.Israel | 22.339 | 18.745 | 1,06% | 1,20% | -16,1% |
| 20.Russia | 26.783 | 18.221 | 1,27% | 1,17% | -32,0% |
| 21.Netherlands | 21.123 | 16.103 | 1,00% | 1,03% | -23,8% |
| 22.Switzerland | 17.782 | 16.033 | 0,85% | 1,03% | -9,8% |
| Other countries | 415.374 | 299.572 | 19,75% | 19,23% | -27,9% |

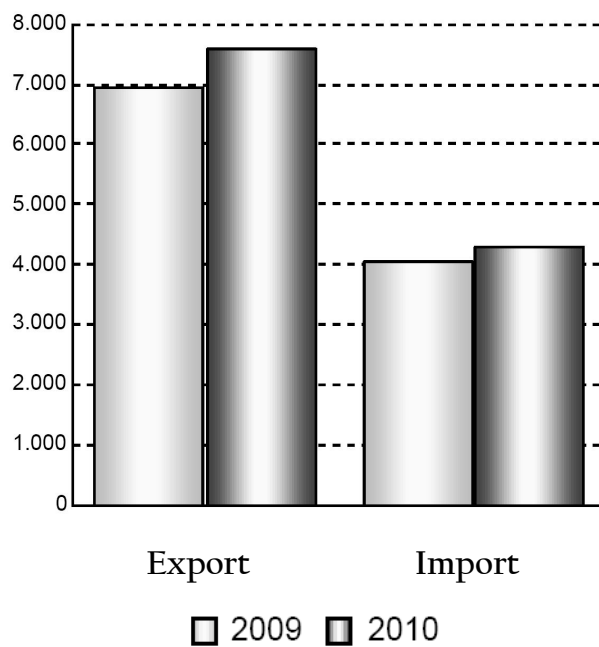
Source: US Department of Commerce; data elaboration analysis from ICE New York. *Stati Uniti, Nota Congiunturale. Istituto Nazionale per il Commercio Estero Italiano*, Giugno 2010

Italian Import – Export to and from USA: green line symbolizes exports, red line imports. Numeric values refer to millions euro.



Source: Statistics elaborated from “Istituto Nazionale per il Commercio Estero Italiano”, Giugno 2010.

January – May Italian import – export trend to and from USA. Numeric values refer to millions euro.



Source: Statistics elaborated from “Istituto Nazionale per il Commercio Estero Italiano”, Giugno 2010.

Despite a little growth in early 2007, 2008 and 2009 have reported a slow trend of the Italian market share in USA. However this negative inclination is registered since 2001 and it seems mainly due to the high value of Euro respect to Dollar. However economists say that a cause is also the incapability of Italy to be competitive in some of the most dynamic American sectors, such as informatics and new high tech fields. For this reason it is important to analyze the economic drift of import and export between Italy and USA related to ATP, Advanced Technology Products. These sectors are not traditional to the Made in Italy and include biotechnologies, aerospace, ICT and electronics. But these fields are becoming more and more essential as they have relevant strategic importance for the development and competitiveness of a country. Therefore US Department of Commerce reports and issues statistics regarding these products apart. In 2009 imports coming from these sectors amounted 301 million dollars respect to 331 in 2008, and this figure represent 19% of total importations in USA. Import of high tech products from Italy in 2009 was about 2.6 million dollars, 9.9% of total Italian export rate. This percentage is increasing respect to 2008 when the Italian high tech export rate was just 7%. In any case the figure of Italian ATP exports in USA is still very low compared to other European countries as France, Germany and Ireland. For example Ireland high tech exports in USA equal 51% of the total exports, France 30%. Even some emerging Asiatic countries report a higher export rate in advanced technology products: Malaysia for example reached 64% and China 30% in 2009.

Referring to Italy it is interesting to analyze these export statistics by sector. In particular the two most relevant Italian industries with sufficient presence in USA are aerospace and biotechnologies that in 2009 have reported a positive growth respect to 2008 with 405 million dollars exported products instead of 349 in 2008.

USA ATP – Advanced Technology Products – Import. Numeric values refer to million dollars.

| | ATP – Advanced Technology Products | | USA Total Imports | % ATP on Total Imports |
|----------------|------------------------------------|--------------|-------------------|------------------------|
| | 2008 | 2009 | 2009 | 2009 |
| China | 91.392 | 89.699 | 296.402 | 30,26 |
| Mexico | 40.326 | 39.722 | 176.537 | 22,5 |
| Japan | 26.713 | 19.869 | 95.949 | 20,7 |
| South Chorea | 16.392 | 15.234 | 39.235 | 38,8 |
| Malaysia | 20.099 | 14.900 | 23.279 | 64,0 |
| Ireland | 17.605 | 14.451 | 28.066 | 51,5 |
| Canada | 16.625 | 14.263 | 224.911 | 6,3 |
| Taiwan | 13.784 | 12.131 | 28.375 | 42,8 |
| Germania | 11.584 | 10.401 | 71.253 | 14,6 |
| France | 12.073 | 10.177 | 34.034 | 29,9 |
| United Kingdom | 10.758 | 9.273 | 47.486 | 19,5 |
| Thailand | 8.055 | 6.723 | 19.085 | 35,2 |
| Singapore | 8.194 | 6.564 | 15.659 | 41,9 |
| Israel | 3.167 | 4.603 | 18.745 | 24,6 |
| Belgium | 2.891 | 4.214 | 13.781 | 30,6 |
| Costa Rica | 1.389 | 3.430 | 5.601 | 62,2 |
| Switzerland | 3.007 | 2.793 | 16.033 | 17,4 |
| Philippines | 3.304 | 2.632 | 6.797 | 38,7 |
| Italy | 2.862 | 2.631 | 26.416 | 9,9 |
| Netherlands | 3.143 | 2.503 | 16.103 | 15,5 |
| Other | 1.114 | 14.469 | 354.339 | 4,1 |
| Total | 331.170 | 300.681 | 1.558.085 | 19,3% |

Source: % of Advanced Technology Products exported in USA over the total exports. *Stati Uniti, Nota Congiunturale. Istituto Nazionale per il Commercio Estero Italiano, Giugno 2010.*

USA ATP – Advanced Technology Products – Imports from Italy by sector. Numeric values refer to million dollars.

| Sector | 2008 | 2009 | % |
|--|-------|-------|------|
| Biotech | 191 | 195 | 15,6 |
| Life Science | 232 | 211 | 16,8 |
| Opto-Electronics | 16 | 12 | 1 |
| Hardware, Software and Telecommunication | 144 | 131 | 10 |
| Electronics | 246 | 168 | 13 |
| Flexible Manufacturing | 128 | 110 | 9 |
| Advanced Materials | 15 | 7 | 1 |
| Aerospace | 464 | 420 | 33 |
| Weaponry | 2 | 1 | 0,1 |
| Nuclear Technology | 0,3 | 0,3 | 0,0 |
| TOTAL | 1,439 | 1.256 | 100% |

Source: US Commerce Department.; ICE New York data elaboration. *Stati Uniti*, Nota Congiunturale. *Istituto Nazionale per il Commercio Estero Italiano*, Giugno 2010.

7. Current Macroeconomic Analysis of Italy

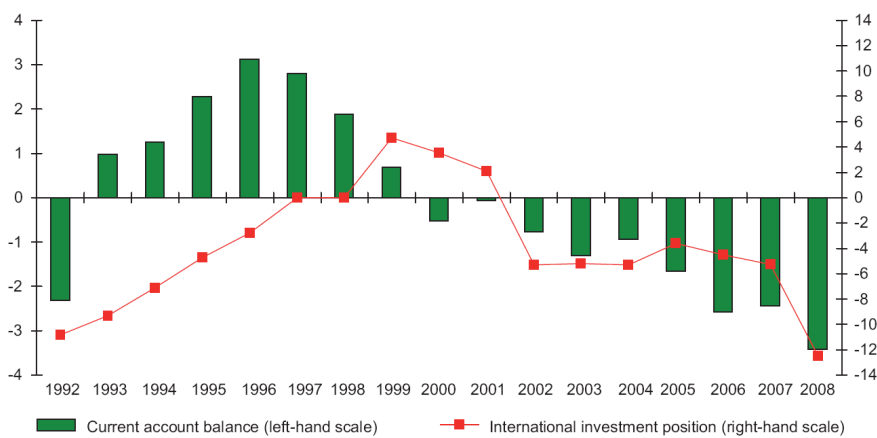
Italian economic growth has been fairly anemic in the last 10 years, averaging 0.2% over 2001–2009 and 1.1% over 2000–2007 (stripping out recession years), and we see few reasons for this to change going forward. In the aftermath of the international financial crisis, we expect growth to settle between 1–2% through to 2019, with weaker external demand and reduced credit availability (compared to the peak of the previous credit bubble) underpinning this trajectory.

Italy – Economy, Business Model International magazine, September the 15th, 2010, *Italy: Major Macroeconomic Challenges Ahead*

The recession set off by the global financial crisis has hit the Italian economy harder than the rest of euro area. This emerges from the results for 2008, which show that GDP declined by 1 per cent in Italy, against average growth of 0.8 per cent in the euro area, from the data on the first quarter of 2009, which indicate a contraction compared to a year earlier of 6 per cent in Italy and 4.8 per cent in the euro area, and from the projections for the entire year. The Italian economy's greater fragility seems rooted in the same structural problems that had broken its growth even before the crisis erupted. The decline was particular large in manufacturing output, hit by the fall in investment and by the contraction in exports of goods and services (down by 3.7 per cent in 2008), which intensified in the closing months of the year. The data for the first quarter of 2009 show a larger collapse in Italy's exports than in those of the other euro area countries (down by 21.7 and 16.3 per cent, respectively, from a year earlier). The decline in national demand in 2008 translated into an even larger reduction in imports (–4.5 per cent), despite the slight real appreciation of the euro (1.4 per cent on average for the year based on the producer prices of manufactures). In the first quarter of 2009

imports of goods and services diminished by 17 per cent, reflecting the further deterioration in the economic situation more than proportionately. The Italian economy's overall degree of international openness declined, therefore, on both the export and import side of the ledger. The same phenomenon also occurred in several other euro-area countries and appears to be an expression of the turning inward of the economies hit hardest by the shrinking of global demand. But even before last year's decline, the external openness of the Italian economy and, in particular, the ratio of imports of goods and services to domestic final demand, was the lowest among the euro-area countries of comparable size.

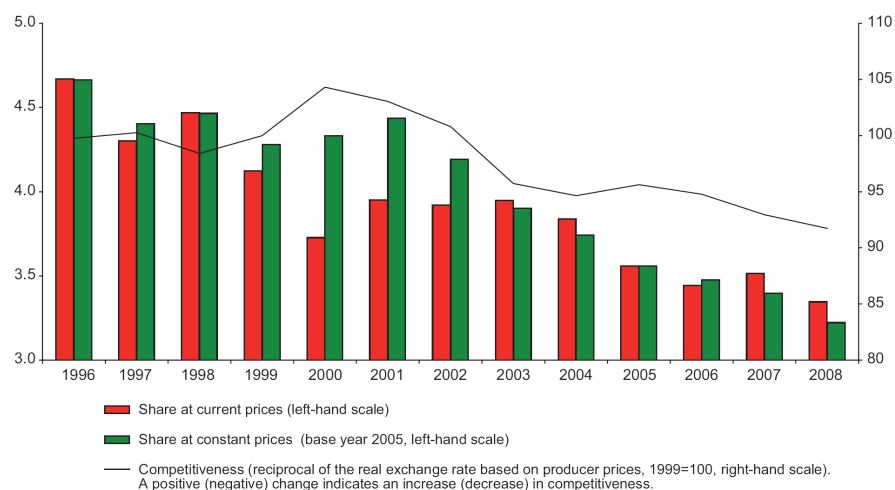
The external current account deficit rose from €38 billion to €54 billion (3.4 per cent of GDP in 2008) as a result of the deterioration in all the main components and, in particular, the balance on investment income. The growing foreign debt accumulated in recent years, amounting to 12.5 per cent of GDP at the end of 2008, generated much larger outlays for interest payments.



Italy's current account balance and international investment position, as a percentage of GDP. Sources: *Based on Bank of Italy and Istat data*

The balance on merchandise trade (FOB-FOB) turned slightly negative, but the deterioration was due exclusively to the unfavorable movements in relative prices. The surge in commodity prices was only partially buffered by the appreciation of the euro. The reversal of trend in the second half

of the year was insufficient to offset the previous increase. The most recent weeks have brought signs that point to incipient economic recovery in some emerging regions, but which could lead to higher import costs. Net of energy, Italy's trade surplus rose in 2008 as a result of a pronounced drop of 3.8 per cent in the value of imports of manufactures, due to the reduction in domestic demand. The value of merchandise exports was practically unchanged from the previous year, edging up by 0.3 per cent. The increase in prices compensated almost perfectly for the contraction in volumes (-5.1 per cent), which gained pace during the year and intensified further in the first few months of 2009 (-24.1 per cent in the first quarter). Exports were hurt by the global recession, but the scale of their decline was greater than that in foreign demand, pointing to a fresh loss of market share at both current and constant prices.



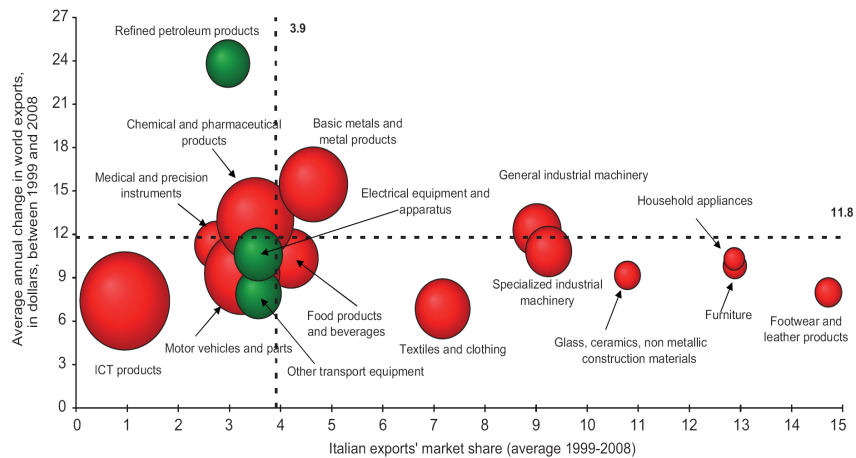
Italian exports' competitiveness and world market shares.

Sources: *Based on Bank of Italy, Eurostat and WTO data*

This downtrend in export shares for both goods and services has been under way for more than a decade and is one Italy has in common with most of the developed economies. It stems from changes in the international distribution of manufacturing activities, with the greater weight acquired by China and other emerging countries, and from the upward movement in the prices of raw materials, which has expanded the shares of some commodity-producing countries. Nevertheless, Italian exports have also lost shares in relation to those of the euro area, falling

from 12.2 to 10.9 per cent over the last decade (at current prices). The main factor in this has been the dynamic inefficiency of the model of export specialization, i.e. concentration in sectors characterized by relatively slow-growing world demand. Net of this unfavorable composition effect, the decline in Italian exports' share of euro-area exports would come to only 0.3 percentage points.¹⁰ Italian firms' competitiveness continued to be eroded by the unfavorable trend in labor productivity, which made their production costs grow more than those of their competitors, despite wage moderation.

Moreover, in 2008, and particularly in the first half of the year, Italian firms again had to cope with the repercussions of the appreciation of the euro on the competitiveness of their products. They did this by keeping the increase in the prices of exports outside the euro area (2.4 per cent) smaller than that in the prices of goods sold on the internal market (3.4 per cent). In addition, there was a further widening of the gap between the growth in unit values (5.6 per cent) and export prices (2.8 per cent), which can be read as a sign of exporting firms' strategies to upgrade the quality of products and of the process of selection of firms triggered by international competition. The firms that are unable to sustain competition in the medium-low segments of the market close or else they are absorbed by other companies that are better able to withstand competition, thanks, in part, to the transfer of low-unit-value production abroad.



The size of the circles represents the sector's average share of world exports in the period 1999-2008. Red (green) circles identify sectors in which Italy's share decreased/increased between 1999 and 2008.

Italy's market shares of world exports by sector. Sources: *Based on data published by Eurostat and national statistical institutes*

The international economic crisis also influenced the flows of direct foreign investment, which plummeted for both inward and outward investment (by 60 and 55 per cent, respectively). Even before the crisis, at the end of 2007, Italy's share of the world stock of inward foreign direct investment amounted to barely 2.4 per cent, more than one percentage point below its share of world GDP, offering further confirmation of the Italian economy's scant ability to attract the interest of multinational companies. Lighter forms of the internationalization of production, such as those observable indirectly from the data on outward and inward processing trade, also fell back in 2008. The incidence of this trade on final trade flows has been declining over the past decade.¹¹ This, however, does not necessarily indicate a weakening of the international fragmentation of production, since the related activities also develop through channels other than processing trade.

7.1 Italy and foreign countries in the World economy

Despite significant government stimulus spending aimed at dampening the recession, growth in advanced economies remains sluggish as they are mired in persistent unemployment and weak demand. Recent concerns about the sustainability of sovereign debt in Europe, and the stability and efficient functioning of financial markets more generally, have added to the list of concerns. The present situation emphasizes the importance of mapping out clear exit strategies to get economies back on a steady footing.

Preface by Klaus Schwab Executive Chairman to the Global Competitiveness Report 2010–2011, World Economic Forum

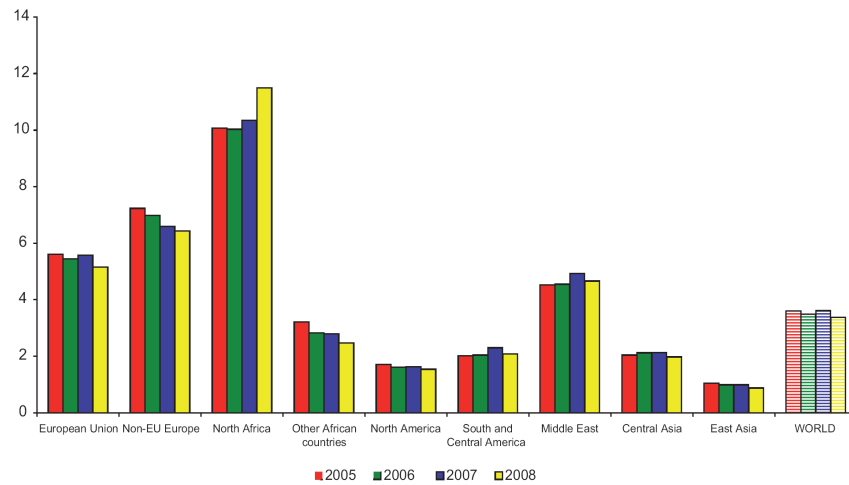
Against the background of a progressive contraction in trade with nearly all of the regions of the world, the deterioration in the balance of trade in 2008 derived mainly from trade with the commodity-producing countries and regions (Africa, the Middle East and Russia), given the effect of the hike in commodity prices on the value of imports in the first half of the year. Other factors were the growth in the deficit with China, contrary to the trend for the EU, with a further increase in China's share of the Italian market, and the reduction in the deficit with the United States, where the recession's effect on Italian exports were added to those of the depreciation of the dollar. By contrast, the balance with the European Union improved as a result of a larger decline in imports than exports, which reflected the greater intensity of the recession in Italy compared with the rest of the region.

Available data on the first few months of 2009 show an ongoing sharp contraction in exports and imports with all the regions, while the trade balances benefit from the decline in the prices of imported raw materials compared with the peaks reached in the first half of last year. Italian exports lost share in 2008 in nearly all the regions, giving up the slight gains made in 2007. The only notable exception was North Africa, where

Italian exports strengthened their position again, possibly partly as a result of sales of intermediate and capital goods connected with the international fragmentation of production. The spotty information now available for the current year, bearing on the first two or three months, depending on the country, show that Italian exports continued to lose share in several European outlet markets but recovered some ground in China, Germany and the United States, albeit in a context of strongly slumping demand.

Over a longer perspective, it is striking that, precisely in the years when the introduction of the euro was likely to foster the intensification of trade between the countries that adopted the single currency, the share of Italian exports going to the market of the European Union has tended to decline. Actually, the same tendency has also involved other euro-area countries, such as France and Spain, but it has been especially pronounced in Italy. It appears to reflect not only the strengthening of Italian firms' longstanding propensity to seize market opportunities arising in emerging regions that are relatively close to Italy, such as Central and Eastern Europe, North Africa and the Middle East, but also the greater competitive difficulties faced in the markets of the European Union. The data on cross-border affiliates are available only up to 2007 and show ongoing expansion of both Italian firms' affiliates abroad and foreign firms' affiliates in Italy. Most of the sales revenues of Italian firms' affiliates abroad continues to come from European markets, but sales to Africa and Latin America have grown at a faster pace. Among foreign firms' affiliates in Italy, the share attributable to North America has diminished, primarily to the benefit of Europe but also of several Asian countries.

Current macroeconomic analysis of Italy



Italy's market shares by region. Percentages of world merchandise exports at current prices. Source: *Based on IMF-DOTS data*

8. Outlook of Italian technology based SMEs

Financial constraints to the development of innovation are often considered one of the main impediments to high-technology firms seeking to expand and grow. In particular this is the case of small and medium size high-tech firms. In the U.S. and the U.K. a variety of sources of finance are available to the start-ups of innovative firms; in the other European countries, and particularly in Italy, these means are still uncommon so that the development of technology is often prevented.

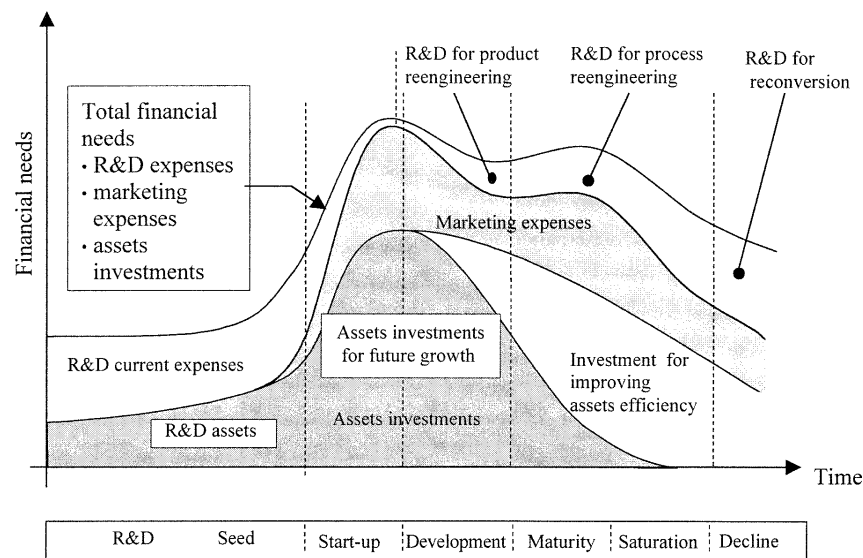
Giancarlo Giudici, Stefano Paleari, The Provision of Finance to Innovation: A Survey Conducted among Italian Technology based Small Firms.

During 1990s international economy structure changed a lot favoring high technology products. Italian exportations do not have understood these global changes and they are still too much based on *made in Italy* products and low technological goods. At the same time Italian export has decreased on a global basis especially during the last economic crisis. The modest technological level of Italian exports has negative influences also in the potential growth of the country. Modern theory of international economy in fact shows how the export economy is not neutral from the long period growth. In particular, specializations in not-technological sectors verges on reducing growth prospective of a country (Grossman and Helpman, 1990). On the other hand, specializations on activities based on high technological level favor the expansion of a country in long term period (Guerrieri, Pianta and Dalum, 2001). Therefore empirical studies confirm that the imitation of high advanced technologies make products of these sectors flexible in term of pricing and led to niche advantages (Kraay and Ventura, 2001).

A recent study about the historical evolution of high-technology sectors in Italy emphasizes that in this country, despite a well-timed entry in innovative sectors, there has been

no capability to steady the initial competitive position in new research-based industries. Nevertheless, with the exception of the nuclear sector and, partially, chemistry and electronics, in Italy economic conditions and knowledge seem not to be lacking in order to compete successfully in information and multimedia technology patterns, microelectronics, biotechnology, industrial automation and advanced materials. In particular, this is the case of small innovative niches, in which small size firms tend to have some competitive advantages compared with large firms. Besides, it is well known that an important factor influencing the viability of small firms is capital requirements: there are compelling reasons why lack of finance will serve as an impediment to small firms and there is evidence (Acs and Audretsch, 1990) that SMEs, in particular operating in high-tech sectors, are more likely to be subject to liquidity constraints than the larger firms. In the U.S. and the U.K. a variety of sources of finance are available to the start-ups of innovative firms; in the other European countries, and particularly in Italy, these means are still uncommon so that the development of technology is often prevented. In fact, firms belonging to traditional sectors may remain small, but fast-growing innovative firms have to enlarge in order to follow the development of the market, to expand and diversify production in new niches, to develop new technological and managerial skills. In the early-development phase the lack of financial resources may be the most relevant problem faced by these firms (Westhead and Storey, 1997). In particular, technology-based small firms experience different financial problems during the business lifecycle, due to the need of R&D and marketing expenses and peculiar typologies of investments. Several empirical studies show that access to and costs of finance are some of the most important factors which affect the ability of a technology-based firm to grow. This is particularly true during the phase of the introduction of a new product in the market because finance is needed in order to develop intangible and specific resources. The risk of failure in developing new technologies is higher than in traditional firms: thus, new products may be technically unfeasible or not tradable, or a dominant design pattern may be not yet spread out.

Financial needs in the different stages of the lifecycle of an innovative product.



Source: Giancarlo Giudici, Stefano Paleari, *The Provision of Finance to Innovation: A Survey Conducted among Italian Technology based Small Firms*

Firms compete in order to impose their new technical standards on the market giving rise to the risk of projects becoming obsolete. Moreover, once a dominant design pattern has been imposed, there is no assurance about the customer appeal of the new product, since markets could be underdeveloped or even not existent. So according to Sutton analysis of 1996, firms entering in high-tech sectors incur in high “exogenous” sunk costs determined by R&D activity, but also in “endogenous” costs like advertising and information expenses in order to enhance the knowledge and demand for products.

The observations made in previous sections suggest that TBSFs, in order to maximize the value of their investments, should resort to external financing by seeking investors willing to evaluate their investment based on the future opportunities of value creation rather than the present value of assets. Sandri (1994) and Caprio and Spisni (1994) define venture capital as a “patient capital”, expected to follow the project lifecycle: thus, by the fact that high-tech investments are risky and have a long maturity, equity capital should be used more intensively by innovative firms than by traditional ones in order to finance the

grow-up phase. Therefore, considering the obstacles to direct access to financial markets, during the first stages of high-tech firms development, the role of venture capitalists, merchant banks and closed-end funds (who in the medium/long run have the aim of obtaining capital gains from selling stakes of fast-growing small and medium size companies) is extremely relevant.

Venture capitalists (VCs) are well-informed financial intermediaries, able to face problems related to risky investments in high-technology projects, to engage in active monitoring and therefore to add value to the entrepreneurial team. VCs place valuable managerial competencies at growing small firms' disposal; their stakes in the equity capital have a relevant image effect, which arouses intangible benefits in objective markets. In Italy, a legislative background potentially suitable to promote the equity market development has been at work for a few years; however, an integration with other EU small markets joining the Euro-NM, in order to establish a specific stock market for fast-growing SMEs ("Nuovo Mercato"), has just been launched and the establishment of liquidity segments in the existing official Stock Market is forthcoming. Recent analyses about the experiences of international small caps' markets show that the most relevant problem is the "thinness" of SMEs (and in particular TBSFs) equity trading.

8.1 Science and technology parks in Italy

The world's first science park started in the early 1950s and foreshadowed the community known today as Silicon Valley. In Europe, Pierre Laffitte, the mastermind and founder of Sophia Antipolis Science Park in France, described the concept of cross fertilization as the interchange between different cultures or different ways of thinking that is mutually productive and beneficial; "the cross-fertilization of science and the creative arts" not only in terms of economic, but also on a social and cultural level. He applied this concept for the creation of Sophia Antipolis Science Park.

Wikipedia, the free encyclopedia, Science Parks



Map of main Scientific and Technological Parks in Italy

Source: DITT, Atlante Tecnologico Italia 2010

The term “research and development” (R&D) refers in the business enterprise (people, financial means and resources) to the examination of technological innovations with the aim of improving existing products or production processes and to develop new products. These aims should both enhance the

competitiveness on international markets and also push ahead with the integration of innovation and research at international level. For this, in addition to innovations, also qualified human resources are required and the ability to implement generated knowledge. Diverse finance and tax tools were created to support industrial research in companies.

The Italian Ministry for Education, Universities and Research (MIUR) is placed above the university and research administration. In the field of R&D, MIUR draws up national research programs and defines thus the general research framework and aims, prospects for Italian research in the context of national and international research and the possible influence in certain sectors. PNR, which is updated annually, refers, in particular, to research and innovation topics with the aim of linking and integrating the two areas. PNR envisages the following impact:

- Intensification of the cooperation between public and private institutions in the field of technological and scientific R&D;
- Promotion of technological and scientific projects with innovative character;
- Facilitation of spin-offs and start-up foundations in the high tech field;
- Up-valuation of the excellence and performance principles;
- Focusing on main areas and strategically important sectors, internationalization, multi-discipline and multi-functionality;
- Increase in funds and financing

Currently, a version of the PNR 2010–2013 is being worked on, which points out as primary aims both the strengthening of the research system (research department 'Curiosity driver', basic research for the development of new technologies, build-up of competitiveness by strengthening the infrastructure of strategic research, internationalisation of R&D) and also the increasing competitiveness of the production system (technology department with high priority on competitiveness, dissemination of innovation and strengthening of the

productions system, access to loans and capitalisation of companies).

Special attention is paid to the sectors in alternative energies, nuclear energies, agriculture, the environment, 'Made in Italy' and sustained mobility. Thereby, in particular, in the R&D sphere, attention is paid to the integration of the regional, national and European activities and the strengthening of the link between Northern and Southern Italy.

There are different players in technological R&D in Italy: each player is equipped with own competence and roles and active in public and private institutions. In addition to the public sector, many private companies and institutions also show great commitment. There are numerous public research facilities and other public institutions, such as universities, which devote themselves to special sectors in the field of Research and Development. Of fundamental significance is, however, also the support provided by the public Italian facilities that make available a part of the State budget for Research and Development.

The individual Italian regions are deeply committed in Research and Development: the budget of the different funds enables private or public companies to generate new knowledge and technologies with a high innovation value. Thereby it is intended that the productivity of companies be boosted, which are mainly in the areas nanotechnology, biotechnology and IT. A part of the institutional work of ministries is devoted to the Research and Development fields. The focus lies here in the smoothing of cooperation between numerous national and international companies. At national level, research facilities are continuously growing in significance, which was additionally enhanced by PNR 2005–2009, as they redefined their objectives and also the content direction. The facilities receive the necessary support for the concretisation if there are ever more complex aims, which require a strong concentration of the resources and expertise.

In Italy there are numerous R&D facilities and institutions; the most important are listed here following:

- Agenzia Spaziale Italiana (ASI)
- AREA Science Park – Consorzio per l'Area di Ricerca Scientifica e Tecnologica di Trieste
- Centro Italiano Ricerche Aerospaziali (CIRA)
- Consiglio Nazionale delle Ricerche (CNR)
- Istituto Nazionale di Alta Matematica (INDAM)
- Istituto Nazionale di Astrofisica (INAF)
- Istituto Nazionale di Fisica Nucleare (INFN)
- Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS)
- Museo Storico della Fisica e Centro Studi e Ricerche Enrico Fermi

Institutions of the Ministry of Foreign Affairs

- Centro Internazionale di Fisica Teorica (ICTP)
- Centro Internazionale per l'Ingegneria Genetica e la Biotecnologia (ICGEB)

Institutions of the Ministry of Environmental Protection

- Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA)
- Agenzia Regionale per la Protezione dell'Ambiente (ARPA)
- Istituto Centrale per la Ricerca scientifica e tecnologica Applicata al Mare (ICRAM)

Institutions of the Ministry of Economics and Finance

- Istituto di Studi e Analisi Economica (ISAE)
- Istituto Italiano di Tecnologia (IIT)

Institutions of the Ministry of Health

- Agenzia Italiana del Farmaco (AIFA)
- Agenzia Nazionale per i Servizi Sanitari Regionali (AGE.NA.S)

- Istituti di Ricovero e Cura a Carattere Scientifico (IRCCS)
- Istituto Superiore di Sanità (ISS)

Institutions of the Ministry of Production

- Istituto per la Promozione Industriale (IPI)
- Agenzia Nazionale per le Nuove tecnologie, l'Energia e lo Sviluppo Economico Sostenibile (ENEA)

Institutions for the Ministry of Agriculture and Forests

- Consiglio per la Ricerca e la Sperimentazione in Agricoltura (CRA)
- Istituto Nazionale di Economia Agraria (INEA)
- Istituti di Ricerca e Sperimentazione Agraria (IRSA)
- Istituto Nazionale di Ricerca per gli Alimenti e la Nutrizione (INRAN)
- Unità di Ricerca per il Monitoraggio e la Pianificazione Forestale (CRA-MPF)
- Istituto Sperimentale Italiano "Lazzaro Spallanzani"
- Laboratorio Centrale di Idrobiologia
- Institutions for the Ministry of Communications
- Istituto Superiore delle Comunicazioni e delle Tecnologie dell'Informazione (ISCOM)
- Consorzi universitari e Organizzazioni
- Consorzio Interuniversitario per le Biotecnologie (CIB)
- Consorzio Interuniversitario Lombardo per l'Elaborazione Automatica (CILEA)
- Consorzio Interuniversitario per le Applicazioni di Supercalcolo per Università e Ricerca (CASPUR)
- Consorzio Interuniversitario Nazionale per l'Informatica (CINI)
- Consorzio Nazionale Interuniversitario per le Telecomunicazioni (CNIT)
- Consorzio Interuniversitario "Istituto Nazionale di Biostrutture e Biosistemi" (INBB)

- Consorzio Interuniversitario Nazionale per la Scienza e Tecnologia dei Materiali (INSTM)
- Istituto di Studi e Analisi Economica (ISAE)
- Istituto Nazionale di Statistica (ISTAT)
- Laboratorio di Luce di Sincrotrone ELETTRA
- Rete Informativa Scienza e Tecnologia (RISeT)

Special research institutions

- Accademia Internazionale di Bergamo per le Scienze Mediche Avanzate
- Associazione Italiana per la Ricerca Industriale (AIRI)
- Associazione Levi-Montalcini
- Associazione Nazionale per gli Interessi del Mezzogiorno d'Italia (ANIMI)
- BIC La Fucina
- BioGeM
- Biotecne – Consorzio per le Ricerche e lo Sviluppo delle Biotecnologie
- CEINGE Biotecnologie Avanzate
- Centro Biotecnologie Avanzate (CBA)
- Centro di Ecologia Teorica ed Applicata (CETA)
- Centro di Oncobiologia Sperimentale (COBS)
- Centro di Ricerca in Matematica Pura ed Applicata (CRMPA)
- Centro di Ricerca Sviluppo e Studi Superiori in Sardegna (CRS4)
- Centro Nazionale per le Risorse Biologiche (CNRB)
- Centro per la Ricerca Elettronica in Sicilia (CRES)
- Centro Provinciale Ricerche Bonomo per la Ricerca e la Sperimentazione in Agricoltura
- Centro Studi di Economia Applicata all'Ingegneria di Catania (CSEI)
- CIES – Scuola Superiore Majise – Centro di Ingegneria Economica e Sociale

- Colosseum Combinatorial Chemistry Centre for Technology
- Comitato di Parlamentari per l'Innovazione Tecnologica e lo Sviluppo Sostenibile – Onlus (COPIT)
- Consorzio Campano di Ricerca per l'Informatica e l'Automazione Industriale (CRIA I)
- Consorzio CETMA – Centro di Progettazione, Design e Tecnologie dei Materiali
- Consorzio Italbiotec
- Consorzio Italiano per la Ricerca in Medicina (CIRM)
- Consorzio per la Ricerca in Elettronica Industriale Veneto (CREI VEN)
- Consorzio per la Ricerca Scientifica e Tecnologica (CORITECNA)
- Consorzio per la Sperimentazione e la Divulgazione delle Tecniche Irrigue (COTIR)
- Consorzio Roma Ricerche
- COTEC – Fondazione per l'Innovazione Tecnologica
- Ev-K2-CNR – Ricerca Scientifica e Tecnologica in Alta Quota
- Fondazione Biomedica Europea – Onlus (FBE)
- Fondazione Carlo e Dirce Callerio
- Fondazione di Ricerca Istituto Carlo Cattaneo
- Fondazione ELBA
- Fondazione Europea B. Ramazzini
- Fondazione Istituto Gramsci
- Fondazione Politecnico di Milano
- Hydrocontrol
- Istituto Affari Internazionali (IAI)
- Istituto di Ricerche Farmacologiche Mario Negri
- Istituto Internazionale per gli Alti Studi Scientifici Eduardo R. Caianiello (IIASS)
- Istituto Scientifico Biomedico Euro Mediterraneo (ISBEM)

- Istituto Sperimentale Italiano Lazzaro Spallanzani
- Istituto Superiore di Ricerca e formazione sui Materiali speciali per le Tecnologie avanzate (ISRIM)
- Istituto Superiore Mario Boella (ISMB)
- Marche Innovation Training (MIT)
- Neuroscienze PharmaNess
- SAGO – Società di Ricerca per l'Organizzazione Sanitaria
- Scienter
- Semeion – Centro Ricerche di Scienze della Comunicazione
- Tecnoalimenti – Società Consortile di Ricerca Tecnobiologica applicata all'Industria Alimentare
- TCN – Tecnologie per il calcolo numerico. Centro Superiore di Formazione

Associations, Institutions and Foundations Active in the Scientific and Technological Research and Development Segment

Associations

- Agenzia Italiana per la Promozione della Ricerca Europea (APRE) (www.apre.it)
- Confindustria (www.confindustria.it)
- Conferenza dei Rettori delle Università Italiane (CRUI) (www.cruai.it)
- Rete Italiana per la Diffusione dell'Innovazione e il Trasferimento Tecnologico alle Imprese (RIDITT) (www.riditt.it)
- Associazione Parchi Scientifici Tecnologici Italiani (APSTI) (www.apsti.it)

Institutions

- Istituto per la Promozione Industriale (IPI) (www.ipi.it)

Foundations

- Fondazione Ugo Bordoni (www.fub.it)
- Fondazione Cariplo (www.fondazionecariplo.it)
- Fondazione EBRI (www.ebri.it)
- Fondazione Marino Golinelli
(www.golinellifondazione.org)
- Fondazione Guglielmo Marconi (www.fgm.it)
- Fondazione Politecnico Milano
(www.fondazionepolitecnico.it)

The commitment of private and public universities in R&D is of immense importance. In 2006 alone 30.3% of the national overall expenditure for R&D was born by the university structures. In recent years the investments aimed at national research programs increased as did the number of different support possibilities for researchers and Ph. D. candidates. In Italy there are currently 95 universities, of which 67 are public (data 2006). But Italy's State funding of the R&D segment is, compared to USA, Great Britain, France and Germany is extremely low; the same as private financing by companies, which is rather low and limited. The reason for this is, on the one hand, the absence of investment incentives, on the other hand Italian companies are characterised by being small or medium in size with about 100 employees, whereby the financial framework for R&D services is limited. For a renewal of the Italian production system in accordance with scientific-technological deadlines, Italian companies must be willing to make a structural renewal, which pre-supposes a specialisation in R&D.

Behind the term Science Park or Science and Technology Park or Technology Pool or Technology Centre is frequently hidden a conglomerate of different companies, an organisation and a particular activity. Numerous definitions have emerged:

- Science and Technology Parks are the result of cooperation between companies, universities, institutions and public and private research centres. The aim is the promotion, development and coordination of

research activities and innovations within a pre-defined boundary.

- The technology park constitutes an interface between the main players in the region.
- The development of regional competitiveness is ensured via knowledge transfer and the provision of innovation-supportive services.
- The fundamental aims of all science and technology parks are the knowledge development and value creation of local productions by means of growth and transformation of entrepreneurial activities.
- Technology parks use the following instruments: Incubation of new companies, finding ideas and the realisation of R&D projects and their dissemination, generation of venture capital, technology transfer, market analysis and support in the protection of intellectual property, site marketing for the attraction of national and international investors and training.
- Parks merge the necessary innovations of the companies with the knowledge generated in the research centres.
- Science and technology parks have the legal form of a consortium, a cartel company or a share company with predominant private participation.

Today there are thousands of companies, which, operating a turnover of more than 10 billion Euros, are the partners of Italian parks. The specialisations of the respective parks correlate with the specific industrial development of the region in order to ensure in that way close links with the local industrial companies. The following core sectors are thus most frequently covered: ICT, agriculture and foods, biotechnology, automation and the environment.

Currently there are, according to the Italian Network for Innovation Dissemination and Technology Transfer (RIDITT), 44 Science and Technology Parks in Italy. The Association of Italian Science and Technology Parks (APSTI) list all active parks on its website. Data regarding the geographical distribution of Innovation and Scientific Parks highlight a much more diffusion and presence in those regions with higher

industrial activity, Lombardia, Piemonte, Emilia Romagna and Veneto. Industrial districts cover a larger regional area, in which numerous small and medium-sized companies in the segment are concentrated, which in addition are marked by strong integration. Characteristic is also the specialisation of the individual companies, which divide up the district into different production phases, and thus they act with each other in a sub-contractor relationship. The district model is in Italy very common. Altogether today there are about 200 districts. Typical features of Italian companies, which explain the success of the district form in Italy, are the small and medium-sized corporate size and the high degree of specialisation.

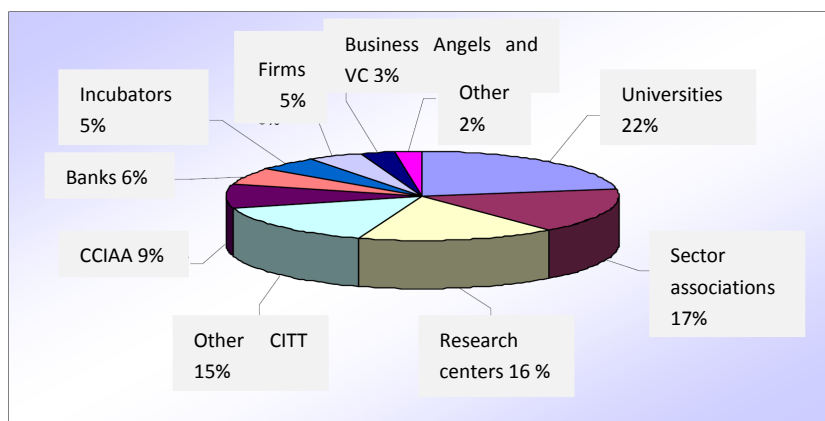
The university centres of excellence in research were funded for the first time in 2000. The background of this funding was the support and promotion of research in an environment monitored by professors and lecturers. The respective universities must show the following criteria:

- Inter/Multi-discipline of the specialisation topics
- Integration of research activities with further training
- Scientific-industrial partnerships for the support of strategic research
- Attraction of Italian and international researchers from abroad, mobilisation of researchers between universities and public and private research facilities.

The centres funded by MIUR must submit in their applications that they can within three years independently function economically, which can be achieved, for example, by the foundation of spin-offs.

The Italian Science and Technology Parks are developing, together with the technology districts and the excellence centres increasingly to important interfaces for research and economics. At the various sites in Italy, they are pursuing similar aims. Thereby both the strengthening of the respective region and the resident research facilities and companies, also the intensification of the international relations are the focus of attention.

One more aspect of this analysis, which highlights the broker role that CITT (*Centro Internazionale per Trasferimento dell'innovazione Tecnologica*) sometimes covers, is regarding the partnerships between CITT and other player of the National Innovation System. Following picture shows the strong connection with knowledge producers, such as Universities and research centres that represent 38% of collaborations, and relations with financial system, just amounting 9%. Except for the Experimental Stations and Special Companies and CCIAA Laboratories, which dedicate 90% of their activity to private companies, all others CITT categories offer part of their research activity paired at 50% of their time and the remaining time is spend for activities commissioned from Public Administration and public projects.



Collaborations between CITT and others players of SIN

Source: Mallone M., Moraca A., Zezza V., “*I centri per l’innovazione e il trasferimento tecnologico in Italia: un survey condotto nell’ambito della Rete Italiana per la Diffusione dell’Innovazione e il Trasferimento Tecnologico alle imprese (RIDITT)*”. IPI – Istituto per la Promozione Industriale, Roma

8.2 Spin-offs from Italian University Research

“New growth theory” and “Knowledge based economies” reflect the attempt to understand the role of knowledge and technology in driving productivity and economic growth. In this view, investments in research and development, education and training and new managerial work structures are key.

OECD, Organization for economic co-operation and development, *The knowledge-based economy*

The progressive affirming of economy based on knowledge has highlighted how competitiveness of a country is even more influenced from public research system (University and public research centers) and from the capability of this sector of favoring the born of high technological level companies, apart from the consolidating of already existing firms.

According to theory debate, then policy makers, changes in the research system are object of very discordant thoughts. Some experts are favorable to make research activity promoted from EPR - *enti pubblici di ricerca* - more focus on industrial applications. In accordance with this view point a major cooperation between research centers and industry is not a threat for academic activities but instead promote and favor the knowhow and technology transfer, thus creation of new qualified employment and an increase of financial resources destined to research. Positive effects would be consequent from a major valorization of research results both for EPR and private firms promoting research activity.

Contrary to this view other experts as Salter and Nelson think that EPR have to focus their work on the training and valorization of human resources then creating a stock of knowledge available to private firms or other people and organizations. According to this opinion the deviation of EPR activity to industrial applications not only causes a distortion of the way of using resources destined to research, but mainly do

not guarantee an effective increase of innovation in the industrial system (Nelson, 2002; Guena and Nesta, 2005). Then Salnet says that the EPR system should worry about how to “*create talents, and not technologies*”.

Even with these critics, USA and European universities started to promote concrete actions in order to give value to their knowhow even through spin-off companies. This social and historical change has faced lot of difficulties especially for Italian universities. In fact this new event at the beginning was not well accepted from universities; spin-offs were just a few numbers of companies born from researchers' ideas but with null cooperation of the university, instead often disapproving it. Only at the beginning of 90s spin-offs firms started to be considered, so that quite all Italian EPRs organized to adopt some policy for sustaining these new generation of companies.

At beginning of 1980s there has been an evolution of universities in USA and Europe toward new management policies including research activities. The historical and primary object of universities was to create and train human capital thus the generation of knowledge. In addition to these aims there was a new one purpose, add value to research results in order to transform these in industrial applications. Close to the typical research objects there was a new one vision and mission of university that became “*a knowledge industry*”, “*an industry of specialized human capital*”, “*an industry dedicated to technology transfer*”, then “*an industry with the mission of territorial development*”. These changes in the world of Universities aimed to support the creation of new technological spin-offs was an international revolutionize not well understood and perceived from Italian government and institutions. New policies to sustain research activities and creation of spin-offs have been adopted only few years ago by research centers in Italy. By consequence, Italian EPR started to acquire expertise and new organization models too lately compared to other European countries and USA. While in USA the new event of university spin-offs has been working for years, in Italy the phenomenon started just at the beginning of 90s. Thus respect to other European countries Italy has always been characterized by a small number of spin-offs. On the other hand, as per the high level of knowledge coming

from Italian universities, lots of these start-up ideas had success abroad because of their low risk profile due to the distinguished high technological content.

Anyway regarding the geographic distribution of spin-offs and research centers in Italy in the total number of 202 firms in 2005, 122 were localized in the north of Italy, 57 in the central Italy, and 23 in the south of Italy. This asymmetric distribution is mainly due to the major entrepreneurial activities located in the north and central parts of Italy, especially in regions as Emilia Romagna, Liguria, Lombardia, Piemonte, Veneto and Toscana. It is necessary to observe that the EPR phenomenon and then the creation of spin-offs self strengthen with the consolidation of competencies, experience and activities.

Regional distribution of spin-offs

| Regions | Number of spin- | % of spin-offs |
|-----------------------|-----------------|----------------|
| Toscana | 38 | 18.8 |
| Emilia Romagna | 37 | 18.3 |
| Lombardia | 32 | 15.8 |
| Piemonte | 15 | 7.4 |
| Liguria | 15 | 7.4 |
| Umbria | 11 | 5.4 |
| Veneto | 9 | 4.5 |
| Puglia | 8 | 4.0 |
| Friuli Venezia Giulia | 8 | 4.0 |
| Calabria | 7 | 3.5 |
| Lazio | 5 | 2.5 |
| Marche | 5 | 2.5 |
| Trentino Alto Adige | 4 | 2.0 |
| Campania | 3 | 1.5 |
| Sicilia | 3 | 1.5 |
| Sardegna | 2 | 1.0 |

| Geographic area | Number of spin-offs | % of spin – offs |
|-----------------|---------------------|------------------|
| North | 122 | 60.4 |
| Center | 57 | 28.2 |
| South | 23 | 11.4 |

Main Italian EPR active on of spin-offs' creation

| Public Research Institution – | Number of spin- | % of |
|---|-----------------|------|
| Istituto Nazionale per la Fisica della Materia (INFN) | 27 | 16.6 |
| Università di Bologna | 19 | 11.7 |
| Politecnico di Torino | 13 | 8.0 |
| Scuola Superiore San'Anna di Pisa | 13 | 8.0 |
| Università di Ferrara | 9 | 5.5 |
| Università di Padova | 9 | 5.5 |
| Politecnico di Milano | 8 | 4.9 |
| Università di Firenze | 7 | 4.3 |
| Università di Perugia | 6 | 3.7 |
| Università di Milano | 6 | 3.7 |
| Università di Siena | 6 | 3.7 |
| Università Politecnica delle Marche | 5 | 3.1 |
| Università della Calabria | 5 | 3.1 |
| Università di Pisa | 5 | 3.1 |
| Istituto Nazionale per la Fisica Nucleare (INFN) | 4 | 2.5 |
| Università di Udine | 3 | 1.8 |
| Università di Foggia | 3 | 1.8 |
| Università di Parma | 3 | 1.8 |
| CISE | 3 | 1.8 |
| Area Science Park di Trieste | 2 | 1.2 |
| Istituto Trentino di Cultura | 2 | 1.2 |
| Univesrità di Padova e INFN | 1 | 0.6 |
| San Raffaele Biomedical Science | 1 | 0.6 |

Important examples of Italian excellences in research activity are Superior School of Sant'Anna in Pisa, National Institute of Physics, INFN, Polytechnic of Milan. Important cases of study regarding spin-offs born in these three Italian incubators are Icube srl, Phoenix – Optical technologies research, TREuropa srl.

Icube is a spin-off created in 1996 from two Ph.D engineers at San'Anna in Pisa working on a project in the open source software. The mission of the company is to develop software technologies for management systems used in large organizations via free software and open source platform. In 2002 Icube changed the product offer and mission thus developing a new informatics protocol for the document management of P.A..

Then Phoenix RTO is considered an example of spin-offs economically interesting. In fact it was created in 1998 from the idea of two Physics Ph.D researchers, with years of experience in the optics technologies and engineering. INFN promoted the creation of this start-up whose mission was to create high innovative machinery for the spectroscopy analysis and optical receiver. During the project also the Laboratory of Quantum Electronics at the Department of Information Engineering of Padova, DEI, was involved. Initially the company business profile was delivered to a niche sector and over the years the company started to expand its activity internationally.

TREuropa is another excellent example of spin-off initially incubated at the Polytechnic of Milan in 2000. It was started on the basis of a patent for the permanent scatter technique, an algorithm for measuring millimeters deformations of terrestrial surface. TRE created the instruments to realize these measures and to elaborate images from SAR satellites. In 2003 the company turnover already amounted at 2.5 million euro.

The paper *“How effective are technology incubators? Evidence from Italy”*, written by M.G. Colombo and M. Delmastro, reports an analysis regarding whether Italian Science Parks have been successful in fostering the establishment and growth of new technology-based firms (NTBFs). For this purpose, a sample

composed of 45 Italian NTBFs which at the beginning of 2000 were located on technology incubator within a Science park is compared with a sample of off-incubator firms. Aspects considered in the study include the personal characteristics of founders of NTBFs, the motivations of the self-employment choice, the growth and innovative performances of firms, propensity towards networking, and access to public subsidies. They discovered important results showing that Italian parks managed to attract entrepreneurs with better human capital. In addition, on-incubator firms show higher growth rates than their off-incubator counterparts. They also perform better in terms of adoption of advanced technologies, aptitude to participating in international R&D programs, and establishment of collaborative agreements and networks of organizations and institutes, especially with universities.

The main objective of this paper was to contribute to show the added value to NTBFs if located within a Science Park or a University incubator. In fact, in spite of the popularity of such institutions and their rapidly growing number in Europe over the 1980s and 1990s, it is still doubtful whether they have been successful in supporting the establishment and post-entry development of NTBFs. In particular, regarding Italy, on the one hand, the supply of entrepreneurs is larger in this country than in other European countries. On the other hand, most Italian new firms are in mature industries, the country is a slowcoach in high-technology sectors, and the national innovation system is weak; then, the provision of key inputs to firms' innovative activities such as technical, financial, and other business services, suffers from serious market failures. From one side, Italian Science Parks and BICs have been rather successful in attracting entrepreneurs with high quality human capital, thus, playing a positive selection role. On average founders of on-incubator firms have a richer educational background, mainly scientific and technical studies, than off-incubator: entrepreneurs with a Ph.D. degree and those with a graduate degree in engineering or in other scientific and technical fields account for a significantly higher percentage in the on-incubator category than in the off-incubator one. The paper written by M.G. Colombo and M. Delmastro also shows that

on-park firms have easier access to public subsidies. From this point of view, the selection activity performed by Science Parks and University Incubators has the beneficial effect of tunneling those subsidies to more promising ventures. Lastly, the results of the empirical analysis show that these on-incubator firms outperformed off-incubator firms according to indicators such as the education of the workforce, the adoption of innovative information and communication technologies, participation in research projects sponsored by the EU, and the ability to take advantage of the scientific and technical services provided by research organizations.

Altogether, such analysis supports the view that science parks are an important element of a technology policy in favor of NTBFs. This holds true especially in a country like Italy which is characterized by a fragile national innovation system.

8.3 Italian Venture Capitals and Private Equity market

The analysis of the determinants and the effects on firm performance of venture capital finance for a sample of Italian enterprises indicates that small, young and more innovative firms are more likely to be financed by a venture capitalist. Our results confirm that venture capital can help reduce financial constraints for firms that are more difficult for external investors to evaluate.

Diana Marina Del Colle, Paolo Finaldi Russo and Andrea Generale, *The causes and consequences of venture capital financing. An analysis based on a sample of Italian firms*, issued from Banca d'Italia.

Private Equity investment funds arranged privately without the need for a publically traded stock or bond issues. It is an investment activity on the risk capital of not quoted firms, with the aim of adding value to the company in the medium – long period. In this way, Venture Capital activity is not “ontologically” different from Private Equity but it represents a

particular segment of it, financing the beginning of start up and future activities during the expansion process of a company. Then Venture Capitalists are firms that specialize in investing mainly in new start-up companies in the early stages before their products or services become successful or well-known. They often take an equity position for their investment giving them shares in the company before it goes public. Once the company is large enough and successful enough to go public, it will do an initial public offering (IPO) of common stocks. Then those owning shares may sell them collecting their profits.

Small and young firms, lacking a long track record, are usually more difficult for external investors to evaluate and therefore may face financial constraints. Young and small firms in high-tech sectors are more likely to invest in riskier projects and to lack the amount of real assets needed as collateral by banks. In these situations Venture capital can help solve the financial problems faced by these firms. Indeed, this form of financing has been very successful in the United States and has spurred the growth of many high-technology firms. Venture capital (VC) contracts share some features with debt contracts and some with equity contracts. The venture capitalist holds a stake in the firm, but his control rights are proportionately greater when the entrepreneur must be induced to put more effort into ensuring the success of the project. Kaplan and Stromberg (2004) refer to this feature as a “*separation between control and cash flow rights*”. Control rights allow the venture capitalist to participate to the main decisions of the entrepreneur. The empirical evidence for the United States indicates that venture capital financing is mainly directed at small firms operating in high-tech sectors and that the performance of venture-backed firms is significantly different from that of similar firms that did not receive this form of financing. Differences in performance pertain to many aspects, such as R&D intensity, firm sales growth, and investment, which have been found to be generally higher for venture-backed firms than for others.

In the 1990s venture capital and private equity financing developed rapidly not only in the United States, but also in the major European countries. Anyway the determinants and effects

of VC differ in the European countries compared with what the empirical literature has shown for the United States. In particular, since a substantial part of European VC investments has financed large firms, it is likely that other factors influence the probability of receiving VC funds over and above the need to obtain outside finance for small and risky firms. As to Italian Equity and VC, it is important to analyze the characteristics of venture-backed firms in Italy and to compare the results with the US experience.

An empirical analysis of Bank of Italy, “*The causes and consequences of venture capital financing. An analysis based on a sample of Italian firms*”, by D. M. Del Colle, P. Finaldi Russo and A. Generale, compares the performance – in terms of various balance-sheet indicators – of venture-backed firms with that of non venture-backed ones within a representative sample of venture-backed Italian firms between 1989 and 2002.

Private equity and venture capital
(aggregate data)

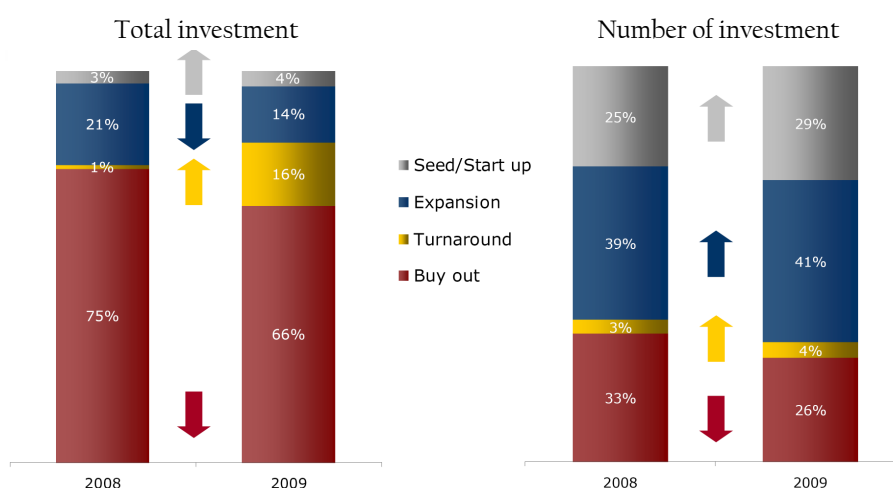
| | Italy | | | European Union ⁽¹⁾ | | | United States | | |
|--|-------|-------|-------|-------------------------------|--------|--------|---------------|---------|---------------------|
| | 1998 | 2000 | 2003 | 1998 | 2000 | 2003 | 1998 | 2000 | 2003 |
| Investment: | | | | | | | | | |
| Euro millions | 944 | 2,968 | 3,034 | 14,077 | 33,564 | 28,689 | 19,141 | 115,086 | 16,301 |
| % of GDP | 0.9 | 2.5 | 2.3 | 1.8 | 3.9 | 3.1 | 2.5 | 10.8 | 1.7 |
| Investment share in High-Tech sectors % | 11.0 | 23.0 | 7.0 | 26.7 | 41.8 | 23.4 | 69.2 | 69.3 | 78.3 |
| Investment share in Seed and Start-up Stages % | 12.0 | 18.2 | 1.9 | 11.0 | 19.1 | 7.0 | 34.1 | 27.5 | 20.2 |
| Investment share in Seed, Start-Up and Expansion Stages % | 43.3 | 51.0 | 21.2 | 40.4 | 55.8 | 27.8 | 84.6 | 84.8 | 74.7 |
| Divestments through the Stock market (as a % of investments in the year) | 3.2 | 2.6 | 1.4 | 7.1 | 2.9 | 5.5 | 23.7 | 30.5 | 10.8 |
| New funds raised (Euro millions) | 1,051 | 2,925 | 1,937 | 19,690 | 45,653 | 26,189 | 26,460 | 114,551 | 9,535 |
| Share of new funds raised from pension funds % | 6.9 | 4.0 | 10.0 | 24.4 | 22.9 | 18.3 | 60.1 | 40.1 | 42.3 ⁽²⁾ |

Sources: National Venture Capital Association (NVCA) for the United States; European Venture Capital Association (EVCA) and AIFI for Europe; AIFI for Italy.

Another analysis of Bank of Italy, “*Il Private Equity in Italia*”, issue 41, shows some critical factors of Italian equity model. This study considers some important aspects that would restrain the developing of VC and Private Equity in Italy as the Silicon Valley model. The most important reasons of this lack are:

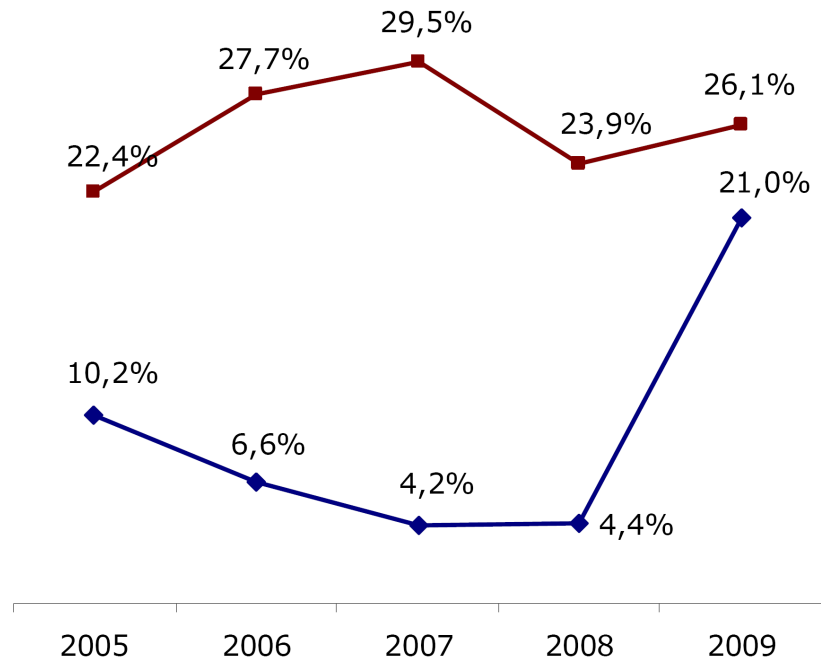
- Severe tax and fiscal normative for new business activities because of the risk of failure and bankrupt, especially of start-ups;
- Italian entrepreneurs low inclination and propensity to share risk capital and stock issues with external private equity or VC firms.

The Bank of Italy analysis of VC and Private Equity activities in Italy stresses how these intermediate organizations cover relative importance only in buy-out or expansion phase, mainly for large size companies.

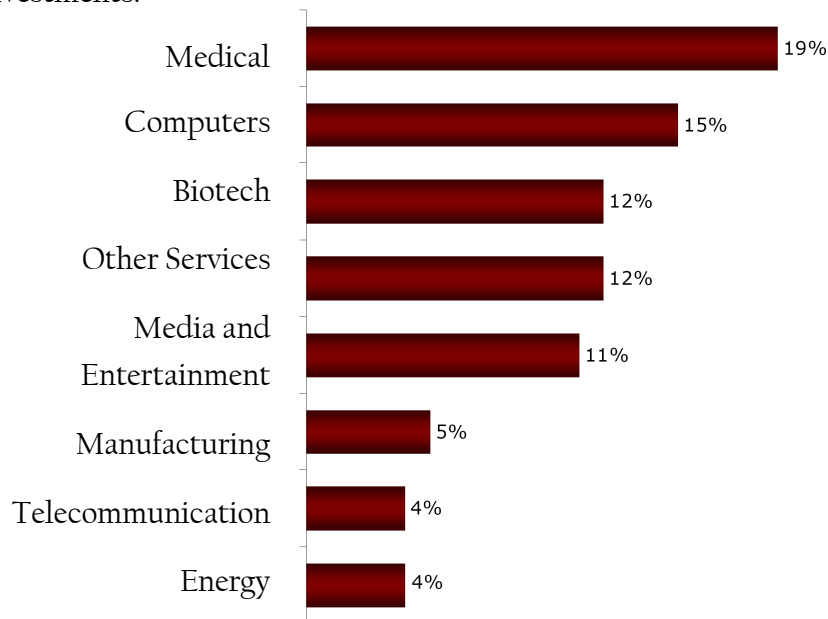


Source: *Il mercato Italiano del Private Equity e Venture Capital nel 2009*, Convegno Annuale AIFI, Associazione Italiana del Private Equity e Venture Capital, Milano, 15 Marzo 2010

Even though the economical crisis, there has been a sign of recovery in 2009 with higher investments by Private Equity Banks in high tech firms. Main technological sectors where Italy excels are Medical, Biotech, Computers and also embedded electronics solutions.



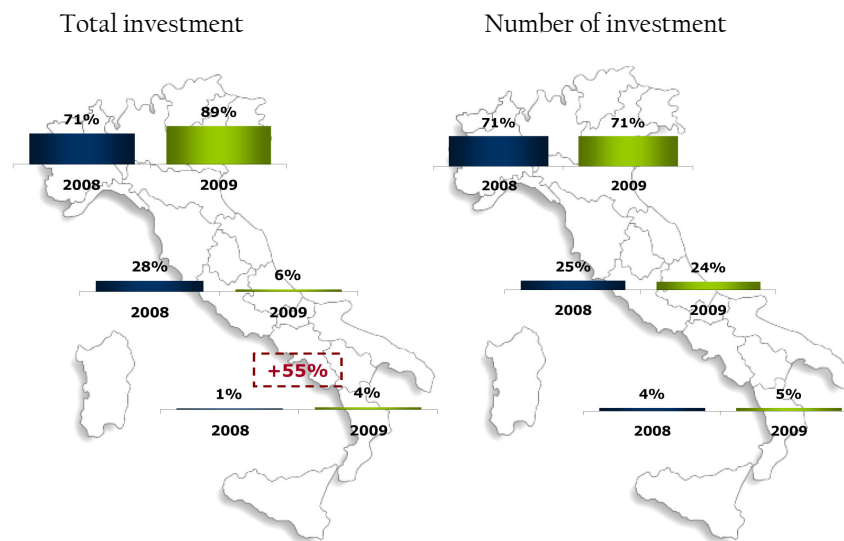
Evolution of %investments in high tech firms. Blue line refer to %amount of investment, brown line refers to % of number of investments.



Distribution % of high tech investments by sectors

Source: *Il mercato Italiano del Private Equity e Venture Capital nel 2009*, Convegno Annuale AIFI, Associazione Italiana del Private Equity e Venture Capital, Milano, 15 Marzo 2010

Despite VCs and Private Equity have concentrated their investments mainly in North Italy, during 2009 we assist to a little increase of funds destined to South companies as Equity. Anyhow this important increase, South and Central Italy still remain underdeveloped and characterized by old fashion and family oriented companies, thus far from new economy and VCs model.



Distribution % of investments by region in Italy

Source: *Il mercato Italiano del Private Equity e Venture Capital nel 2009*, Convegno Annuale AIFI, Associazione Italiana del Private Equity e Venture Capital, Milano, 15 Marzo 2010

Subsequently on one hand lots of obstacles as strict government normative and entrepreneurs old fashion mentality are still inborn and congenital to Italian system. On the other during the last few years Italy has assisted to a new wave of positive reaction to the business model imported from USA. Lots of events have been organized from young entrepreneurs, university researchers and people with years of experience abroad now willing to develop an innovative model in Italy similar to the one of Silicon Valley and other USA industrial districts. Here below are reported some of the most important business events that occur in Italy and new model of private incubator or Private Equity.

Events, awards, business plan competition

- Working Capital
- Techgarage
- Intesa Sanpaolo Startup Initiative
- Mind The Bridge
- Start Cups e Premio Nazionale dell'Innovazione
- Fulbright BEST
- Silicon Valley Study Tour
- *Forum Ricerca e Innovazione* in Padova, with sponsorship of European Community, Ministry of Research and Innovation, Ministry of Economic Development and Regione of Veneto. The Forum is organized by Dr. Moreno Muffatto, Full Professor of Economics disciplines at Department of Innovation and Information Engineering, DEI, at University of Padua and is planned as a series of debates, round-tables and workshops with the aim to affirm the importance of University Research to increase the innovation and competitiveness of Italy.
- *Innovation Lab 2010*, a new project of “Università Roma Tre”, organized by Carlo Alberto Pratesi e Paolo Merialdo, Full Professors of Economics and Engineering, with the contribute of lots of companies, venture capitalists, business angels and media. The aim is the creation of a round table of business angels, VCs and entrepreneurs willing to promote Italian technologies and innovation.

Incubators

- H-Farm in Treviso
- M3I in Padova
- Polo Tecnologico, Navacchio (Pisa)
- Area Science Park Trieste
- Incubator of Polytechnic of Torino
- Incubator of Polytechnic of Milano
- Netvalue in Cagliari

Early stage venture capital

- 360 Capital Partners, which invest in all high tech businesses except biotech
- Innogest, which invest in all high tech businesses except biotech
- Quantica, that operates investments all business
- d'pixel, seed/early stage Internet/ICT
- TT Ventures TTVenture is a privately run and capitalised fund, focused on high growth technological areas and pursuing a balanced risk approach TT Venture has already established a significant network with universities, agencies and institutions and is now recognized as a reference VC fund in the Italian research environment TTVenture is the first Italian closed-end fund dedicated to Technology Transfer: it aims at reducing the gap between R&D centers, companies and investors, supporting the development of high tech projects in the field of Biomedicine, New Materials, Agro-Food and Energy/Clean Technologies.

- Italian Angels for Growth, Italian angel network that invests in all businesses

Banks Venture Capital

- Atlante (Banca Intesa)
- SICI (Regione Toscana)
- Finlombarda (Lombardia)
- Filas (Lazio)
- Friulia (Friuli)

The analysis of venture capital financing in Italy indicates that this form of finance satisfies a variety of needs. The empirical evidence has shown that small firms and those with more severe asymmetric information problems are more likely to find the support of the venture capitalist, thereby confirming the evidence based on the experience of the United States that venture capital is able to reduce significantly financial constraints for smaller firms. Results also rationalize the high

frequency with which larger firms resort to the venture capitalist; in this case, results indicate that larger firms demand venture capital services in order to re-balance a financial structure that is too far tilted towards debt rather than equity. For small firms venture capital financing is followed by an increase in the maturity of debt.

9. Italian presence in the USA

Despite a downturn in 2009 caused by the global economic crisis, Italian exports to the US market remain important. In fact, during the first semester of 2010, Italian exports increased 7.31% in comparison to the same period last year, a value of 13.5 billion dollars. Our market share is approximately 1.5 % and we have a trade surplus of 6.6 billion dollars.

Bilateral relations and investments opportunities, Embassy of Italy in Washington, www.ambwashingtondc.esteri.it

The globalization phenomenon in the American and global economy has much more touched investments than trade. Direct Investments Abroad – then divided in greenfield and cross border acquisition – from 2000 until 2007 have seen a wide real spread. This boom was possible because of the liberalization of capital that allowed such investments more easily.

According to data released from UNCTAD (*United Nations Conference on Trade and Development*) in the last 2009 World Investments Report, global investments abroad have registered a actual growth running IDE international stock up to 15000 USD. Still 2008 data released from UNCTAD show how the economic crisis has constrained outgoing capitals and investments of about 13%. Most of the international capitals' movements registered from UNCTAD are cross border mergers & acquisition of already existing companies. Even if there was a relative increase over the second half of 2007, the phenomenon has faced a contraction of 28% off in M&A cross border. Less availability of capitals and the overestimation of companies quoted on the Stock Exchange caused a slowdown in fusion and acquisition operations. According to fDi Market data elaboration, even Greenfield projects have decreased from 16000 in 2008 up to 13670 in 2009.

Then even though the global crisis, analyzing IDE (Investimento Diretto all'Estero) towards USA, data confirmed that United States is the most important investor in the world

and principal player operating investments acts abroad. At the same time USA cover since 2004 top positions in the classification of countries where business activities are more easily issued from International Bank. Moreover Bureau of Economic Analysis of US Department of Commerce has observed 8.4% increase of stock IDE USA abroad and 8% increase of foreigner operators in USA. Unites States is also at the top positions of countries with major attraction. According to UNCTAD data, USA in 2008 have been the country with the highest foreigner investments – 19.5% in terms of stock and 16.8% in terms of credit flow. USA is also the first country in the world with highest number of merge and acquisition operations estimated as 23% of the total value.

Out of all OCSE countries, USA has consolidated its leadership with an amount of 320 billion of incoming credit in 2008. Second position is covered from France with 97 billion. After that USA is also the country that attracts more projects of investment in the world counting 1220 projects in 2009 compared to China that has had 1140. First investor in USA is Great Britain with 871 projects, followed by Germany (735), Japan (699), Canada (475), France (405), and from Italy (217) and Spain (187). Official statistics issued from USA Government and released by BEA, Bureau of Economic Analysis, total amount of global investments in USA in 2008 was 2279 billion dollars with a 8% increase respect to 2007, when we assisted to a significantly deceleration.

A new important consequence needs to be considered, that Financial Times has already observed some time ago: United States is becoming more and more a *low cost* country where it is possible to make business investments and manufacture products in competition with traditional Asian countries. This phenomenon is mainly due to the dollar devaluation and to the aggressive incentives actuated by different country governments and Obama Administration.

9.1 Italian investments in the USA

In terms of investments, the crisis allowed for some of our industries to penetrate a market which is nevertheless characterized by increasing competition. The United States market – with a national income greater than 14.000 billion dollars, a population of over 300 million and a average per capita income of 47 thousand dollars per year – is of strategic importance in comparison to the rest of the world because of its dimensions, its central position in the global economy and its capacity as the driving force of consumption models.

Bilateral relations and investments opportunities, Embassy of Italy in Washington, www.ambwashingtondc.esteri.it

Italian investments in USA have increased respect 2007 and Italy has gained two positions in the classification of first 20 investors in the USA. With a stock amounting over 17.6 billion dollars Italy today covers the 16th position. These investments represent only 0.8% of the total capitals from United Kingdom (454 billions), Japan (260 billions), Germany (212 billions), Nederland (260 billions) and France (75 billions). Regarding credit flows to USA, Italy cover 13th position with 5.8 billion dollars invested in 2008. But even in this case Italy is very far from other European nations especially Nederland which generated 72 billion dollars and consequently 177% increase, United Kingdom which produced 55 billion dollars (+197%), Switzerland with 35 billion dollars (+1800%) and France with 14 billion dollars (+128%). According to Annual Report issued from Bank of Italy at the end of 2008 Italian investments in USA amounted 22.4 billion euro, then 7.7% of the total Italian ventures abroad.

Most relevant sectors where Italian firms mainly invest are industrial production of machinery and credit and insurance services. Despite some little discrepancies between Bank of Italy and official American data, they both confirmed that the country is certainly placed in very low position respect to other

European competitors. But at the same time Italian ventures have increased a lot over the last years. Bureau of Economic Analysis sets Italy in the 16th position on the list of 20 main investors in USA and this point represents a 32% increase than the year before. Even according to fDI (Foreign Direct Investments) which register all Greenfield projects, Italian presence in United States is relevant. Since 2003 until 2009, Italy has realized 217 investments projects in USA, which are the second country in the world where Italian assets are directed, while China is the first choice. Over this period United States have seen 9% of Italian IDE abroad; China has represented 10% over the total 2240 Italian projects. Again according to fDI statistics, Italy is the 6th country with highest numbers of Italians abroad. Then countries with a major number of active Italian companies are New York, California and Florida and jobs created over 2003 – 2009 period amounted at 18000 corresponding to a total value of 4 billion dollars. Latest Italia Multinazionale 2008 report (Reprint – Politecnico of Milan and ICE, issued on January 2009) registers a presence of 2012 Italian companies in USA.

Finally since 2005 up today there have been different acquisitions operated from Italian companies in USA. Even though a very low value of Dollar penalized Italian export, at the same time it has encouraged acquisitions abroad by Italian companies. According to M&A KPGM Corporate Finance during 2008 Italy has operated 23 acquisitions in USA with a total value of 7.7 billion euro. Just to mention few principal Italian companies with Manufacturing and Production Division in USA: FIAT (case New Holland), Autogrill group, Beretta, Barilla, Pirelli Tire North America, Ansaldo Signa and Augusta Westland, both belong to Finmeccanica group, Permasteelisa, Segafredo Zanetti, Panaria, Marazzi, Luxottica, Bonfiglioli, Caleffi, Bracco and Panini. An important acquisition was made in 2006 when Lottomatica of Agostini Group, bought up GTECH Holding Corporation in West Greenwich, Rhode Island, for 4.7 billion dollar. GTECH is a leading international company in high technologies for games and infotainments applications.

Among all the M&A operations made by Italian companies in 2007 it is important to indicate on this paper the followings, all in high tech and medical–scientific businesses:

- ENI with an investment of 4.7 billion dollars has bought the Americana Dominion Group Resources, one of the biggest petrol companies in USA; then on April 2007 ENI got 70% of the petrol deposit in Nikaitchuq, Alaska;
- Tenaris, an Italian company manufacturing structures and machinery for petrol extraction, bought up at 2 billion dollars Hydril, a Texan company leader in pressure control systems during petrol extraction;
- Zach System, a company belonging to pharmaceutical Zambon group whose core business is chemistry products, has bought up for 65 million dollars assets of the chemistry branch of Pgp Industry, Pittsburg;

In addition some of the major production investments made from Italian companies are the followings:

- ENEL, though the controlled ENEL North America, announced the opening in Kansas of a Division for the production of wind power, with an investment of about 400 million dollars.
- NUVERA, an Italian company active in alternative energy business, opened a Research Division in Massachusetts where they study about combustible hydrogen cells for hydrogen engines.

Also in 2008 there have been lots of interesting investments performed by Italian companies in USA:

- Bracco acquired E–Z–Em, one of the main players in the world for medical instruments used for gastrointestinal radiology. E–Z–Em is also quoted at the Stock Exchange Nasdaq. With this investment Bracco confirms a strong presence in USA as the company started in 2001 with the acquisition of Acsit, a

manufacturer of advanced systems for radiology and cardiology. Moreover Bracco has opened a laboratory in Minnesota and has also a participation in Hlt, a start-up in medical instruments sector.

– Finmeccanica has acquired DRS Technologies, leading company in integrated electronics products for the defense, with an investment of 2.8 billion euro. Finmeccanica is then one of the most important Italian reality in USA with its branches in Pennsylvania, New York, Texas, California, New Jersey, Kansas, Virginia, North and South Carolina. The company collaborates with the USA government for important projects such as the presidential helicopter US101 and the C27J cargo aircraft.

– Nice a company based in Treviso leading in the automation systems, has acquired Apollo Gate Operators in San Antonio, one of the main firm that makes gates powered by solar energy. By this investment the company has faced the opportunity to enter in the USA market that for this business amounts 800 million.

– Fincantieri Group has bought up for 120 million dollars Manitowoc Marine Group (Mmg), the naval construction division of Manitowoc in Michigan with the purpose to enter in the USA marine defense industry.

– Genextra, an Italian Biotech Company, has approved last September 2009 a capitalization totaling 25 million dollars to American Intercept, thus controlling 70% of shares.

– Stmicroelectronics, Italian-France colossus in the semiconductors field, has acquired genesis Microchip, a firm in digital TV business, for 336 million dollars.

Therefore other significant investments by Italian companies in USA regarding extension of specific departments:

– Finmeccanica, through the controlled AugustaWestland in Philadelphia, has opened a new production department where AW139 helicopter will be assembled.

- Tecnosport an Italian company based in Brunico in the photovoltaic business opened a branch in California.
- Pirelli has expanded the production department in Rome, Georgia, with an investment of 15 million dollars and has signed an agreement of 20 million dollars with one of the biggest group in photonic sector, Cyoptics, with the object to integrate Ptg Photonics, the Pirelli photonic division.
- ENEL through the controlled ENEL North America has completed a wind energy project in Texas developing a system made up of 21 wind engine mounted over some towers. It is the first of a list of wind Energy Parks to build in USA. ENEL has also been involved in the realization of two centers for the production of geothermic energy in Nevada.

These cases above confirm that, even during a general economic crisis, USA still represents a good opportunity of global expansion for Italian companies. In particular the low value of Dollar respect to Euro ended up being favorable for Italian companies to invest in USA. For this and other reasons not only large companies have made investments in USA. Even small and medium size firms are discovering how important investments abroad are and how essential is to be more and more multinational in order to be competitive. In fact it is interesting to analyze the Italian presence in United States of companies that have invested through financial participation of Simest – Società Italiana per le Imprese all'Estero S.p.A. – the Italian agency which promotes Italian investments abroad. According to the latest balance Simest has 238 participations abroad among which 15 with American companies such as Poliform USA, Amplifon, Alenia North America, Emilamerica, Marangoni Tread North America. Moreover in 2009 Simest has approved more than 40 projects in USA with a total investment of 600 million euro.

9.2 Italian Brain drain

Having shown the low propensity to return, our investigation highlights the fact that Italy's migration bucks the trend present in literature. In Italy, the brain drain is permanent. Highly qualified individuals are not willing to return to Italy once they have been exposed to the job possibilities in the host country. The knock-on effect hinders social and economic growth in Italy.

Simona Monteleone and Benedetto Torrìsi in the article "A Micro Data Analysis of Italy's Brain Drain", 08 January 2010

Recently the Italian press, popular newspapers as well as more academically oriented articles, have reported the uneasiness of many Italian college graduates forced to work abroad for the lack of jobs and research opportunities in their home country (Johnson, 1967; Grubel and Scott, 1966; Mountford, 1997; Beine et al., 2001; Beine, Docquier and Rapoport, 2006). Doquier and Rapoport (2009) assess the overall impact the brain drain has on countries of origin, evaluating the costs and benefits of such migration for developing countries both in macro- and micro-economic terms. The micro-economic analysis offers the more interesting focus of study. Simona Monteleone and Benedetto Torrìsi in the article "A Micro Data Analysis of Italy's Brain Drain", show, using a micro-data analysis, that, as far as Italy is concerned, such migration is permanent and not a transitory phenomenon. Their paper aims to elaborate an empirical model which identifies the main factors determining Italy's brain drain, assesses the propensity to return of highly qualified Italian emigrants and highlights those factors which stimulate the return.

Numerous works in the literature have shown the effects that the brain drain produces on the countries of origin. Beine, Docquier and Rapoport (2001) Stark (2003) Schiff (2005) Beine, Docquier and Rapoport (2006) hold that the possibility of unrestricted access to the International job market (where the yield on human capital is higher than in the home market),

provides incentives for individuals in less developed countries to gain better qualifications, with a positive knock-on effect for the country of origin. Dustmann and Weiss (2007) instead contend that the return of emigrants is substantial and suppose that emigrants decide to return home when the benefit of staying abroad (salary) is greater than the cost (expenses and household costs). They provide three main reasons for why individuals decide to return “home”: consumption in the home country supplies a greater degree of satisfaction than consumption abroad; purchasing power in the home country is lower, the salary abroad is higher and prices in the country of origin are lower; the accumulation of capital achieved by emigrants in the foreign country, through a process of learning by doing, enhances their earning power in their home country. Transitory migration comes to the fore in the work of Mayr and Peri (2008). The authors examine the migration of qualified subjects from countries with average levels of per capita income, such as countries in East Asia and East Europe, towards countries with high income levels. Mayr and Peri show that subjects from richer countries (East Europe, Asia and Latin America) have a higher propensity to emigrate and to return home compared with subjects from poor countries such as countries in Africa.

The scarcity of empirical contributions in the international literature derives from the difficulty of collecting microdata. Indeed, most of the studies analyze the phenomenon taking macro-data as their starting point. That is why Simona Monteleone and Benedetto Torrasi have based their research paper on a sample of 350 contacts among PhD researchers and professors in different universities of the world. This work develops a platform of data, in relation to the participation and involvement in the chain of an Italian immigrant researcher sample in countries with strong research appeal: United States, Canada, Germany, France, Switzerland and Australia. The sample of respondents is represented by individuals who are highly educated in different fields of scientific research or highly skilled workers.

The analysis is based on three main factors here below reported.

– *Who are the people who emigrate?*

The subjects who leave Italy do so in order to go to another country which can offer them better living and working conditions. The Italian researchers abroad mainly have an age between 31 and 40 (46.6%), most migrating with the qualification of a PhD (47.7%), 53.1% have fixed-term contracts and work mostly at public universities (70.8%); 59% of respondents are men; most people have lived abroad for more than a year; subjects can become researchers abroad at the age of 30, while older subjects become teachers, whereas the same are usually much older when they reach similar positions in Italy. Young migrants have a basic preparation (degree) and education (PhD or specialization) which is clearly valued abroad, given the results of respondents for both the period of stay, and the type of host research body. A fundamental aspect of the survey understands how the countries which host Italian emigrants perceive the career of individuals engaged in research and what are the mechanisms governing career progression. A clear majority of researchers (93.5%) confirmed that career progress is judged as significantly meritocratic. The results of Simona Monteleone and Benedetto Torrisi investigation show that the young people who emigrate have a level of basic and higher academic achievement (degree, and doctorate or specialization, respectively) which is widely recognized abroad, both in terms of the results relative to the length of stay, the type of host research body, and the position occupied. In Italy, the type of work the subjects can find after many years of study does not correspond to their level of academic qualification, either in terms of salary or job satisfaction.

– *Reasons for leaving Italy*

The reasons for emigrating are: first, employment opportunities (95.7%), second, prestige of the host organization (82.7%), third the enhancement of their skills (78.3%), fourth extension skills (75.5%), fifth economic reasons (72.8%) followed by the possibility of using new technologies, particularly the host country's interest for the topics of research proposed. With regard to the opinions expressed in relation to the main integration, 79% express overall satisfaction with how work is organized, their workplace, policies supporting research,

freedom to pursue different avenues of research, career prospects, working hours, relationships with their superiors and colleagues, the availability of scientific equipment, affinities in working groups, the level of bureaucracy, the ease of access to information, and workplace safety. Another significant emigration aspect concerns the relationship between age and career progress. At the age of 30, subjects go abroad to become researchers; older subjects become teachers. The targets for young migrants are significantly age-correlated.

– Propensity to return

Contrary to the prevalent thrust of the literature which sees recent migration as a transitory phenomenon, the results of this analysis show that in Italy it is permanent. This result is obtained by evaluating the emigrants' propensity to return. This degree of propensity has been assessed on the basis of the percentage of responses given in relation to a scale of evaluations designed to highlight the subjects' attitude to the idea of returning to their home country. Over 70% of respondents have a low or no propensity to return to Italy. The main factors that discourage the propensity to return to Italy are access to funding for research, development of new research abroad, greater earnings and more job opportunities, better perception of work and organization of work, perception on the quality of life and the possibilities for inclusion in the social fabric of the host country.

A result of this analysis shows policy implications on this phenomenon that is not any more temporary but seems to be established. Initially, the subjects in question had basic education; they were followed in the 1990s by waves of graduates; and today emigrants are chiefly highly qualified workers. While Italy may well provide a high level of education and training, the real beneficiaries are the countries of destination. This phenomenon generates a range of negative effects on the economic and social development of the country. On one hand there is the clear difficulty highly qualified workers have of finding suitable jobs in Italy; such workers are obliged to engage with a system that is unable to provide them with suitable compensation and meritocratic career progress;

on the other, the fact that destination countries have over time consolidated strategies to attract qualified workers. The propensity to return on the part of emigrants increases in relation to their age at the time of arrival in the foreign country, but decreases in proportion to the number of years spent in the country. The greater the extent to which emigrants are integrated in the host country, the looser their ties to their home country and consequently the lower their desire to return home.

The policy implications suggested in the paper to be applied to the Italian system should be:

- create more opportunities for highly qualified subjects;
- stimulate research, use resources appropriately with the aim of creating suitable infrastructure for the development of research environments;
- revise appropriately the recruitment system for more qualified subjects, in order to make the best use of available human capital, thus contributing to the economic growth of the country;
- align salaries with the qualifications of personnel working in research.

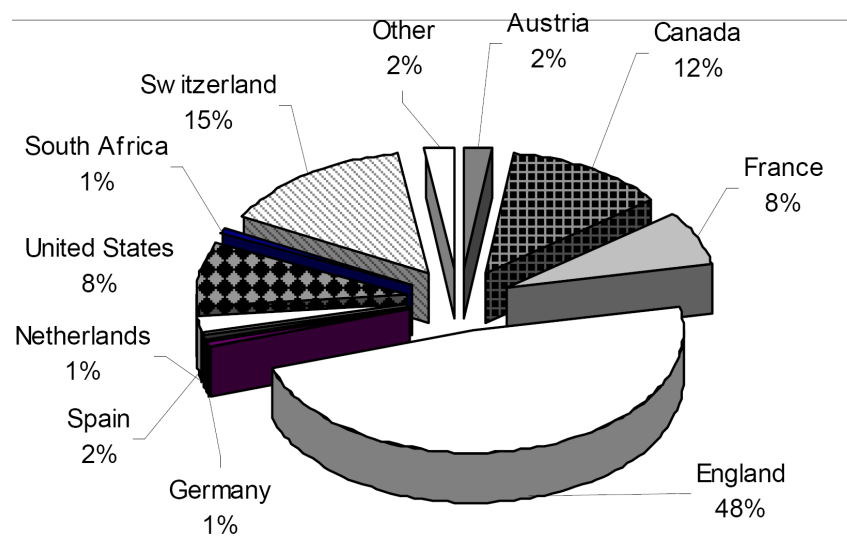
The return migration is a very important channel and is able to reverse the brain drain into brain gain for the sending country. The evidence obtained in this study should lead policymakers in both developing and developed countries not to focus their attention in restricting migration flows of educated individuals. Not only are destinations countries likely to benefit from the inflow of these skilled immigrants, but these flows may also be beneficial for countries of origin, if favorable policies could be applied.

Italian presence in the USA

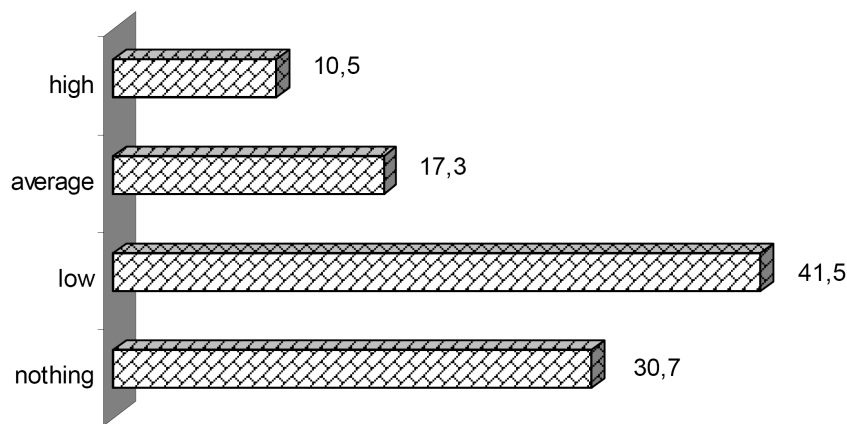
| | X21 career progress abroad | | | | | Total |
|--------------|----------------------------|-------------------------|-----------------|------------------|---------------------|-------|
| | Fairly meritocratic | Absolutely meritocratic | notmeritocratic | Not meritocratic | hardly meritocratic | |
| Austria | 3,0 | 2,2 | 0,0 | 0,0 | 0,0 | 5,2 |
| Canada | 4,0 | 10,8 | 0,0 | 0,0 | 1,4 | 16,3 |
| France | 5,0 | 6,1 | 0,4 | 0,4 | 0,7 | 12,6 |
| England | 6,0 | 3,6 | 0,0 | 0,0 | 0,0 | 9,6 |
| Germany | 2,0 | 0,7 | 0,0 | 0,0 | 0,0 | 2,7 |
| Holland | 4,0 | 0,7 | 0,0 | 0,0 | 0,0 | 4,7 |
| Spain | 1,0 | 1,4 | 0,0 | 0,0 | 0,7 | 3,2 |
| USA | 9,0 | 8,3 | 0,0 | 0,0 | 0,0 | 17,3 |
| South Africa | 1,0 | 0,7 | 0,0 | 0,0 | 0,0 | 1,7 |
| Switzerland | 9,0 | 12,3 | 0,0 | 0,0 | 2,9 | 24,2 |
| Other | 1,1 | 1,4 | 0,0 | 0,0 | 0,0 | 2,5 |
| Total | 45,1 | 48,4 | 0,4 | 0,4 | 5,8 | 100,0 |

Chi square Test= 51,153-p-value= ,937

Distribution % of opinions by host country in relation to assessment of career progress Source: *elab. StatEcon from StatEcon database - Unict - Anno 2009*



Source: *elab. StatEcon on database StatEcon - Unict - Year 2009*
 Distribution % of respondents by host country



Distribution % of the propensity to return to Italy

Source: *elab. StatEcon from StatEcon database – Unict – Year 2009s*

Distribution % of opinions by host country in relation to assessment of career progress Source: *elab. StatEcon from StatEcon database – Unict – Anno 2009*

9.3 Italian – American communities in the United States

Italian – Americans have served an important role in the economy of the United States, and have founded companies of great national importance, such as Bank of America by Amedeo Giannini in 1904, and companies that have contributed to the local culture and character of U.S. cities, such as Petrini Markets, founded by Frank Petrini in 1935. Italian–Americans have also made important contributions to the growth of U.S. economy through their business expertise; such as the management of the Chrysler Corporation by Lee Iacocca, and the creative innovation of Martin Scorsese for film companies such as Columbia Pictures and Warner Brothers.

Wikipedia the free encyclopedia, Italian American

In the United States, the number of Italian citizens who are registered with AIRE (Register of Italians Resident Abroad) is 208,328 (Ministry of Foreign Affairs data, updated in February 2009). They are distributed in the eleven consular jurisdictions in the following percentages: 30,62% in New York, 11,47% in Philadelphia, 8,86 % in Miami, 8,11% in Los Angeles, 7,92% in Newark, 7,81% in Boston, 7,81% in Chicago, 6,64% in Detroit, 5,68% in San Francisco, 2,58% in Houston and 2,49% in Washington, D.C.. Italian-Americans, and to be more specific, Americans with Italian origins, whose census has been officially taken are about 15 and a half millions. They constitute the fourth ethnic group of European origin following Germans, Irish and Britons. However, the two main Italian-American organizations in the United States – NIAF (National Italian American Foundation) and OSIA (Order of Sons of Italy in America) – contest this data and say that a more realistic number reflecting Italian-Americans living in the United States is between 25–26 million people.

There are about one thousand Italian and Italian American associations whose census is currently taken: most of these (about 700) are in the New York Consular Jurisdiction alone. The Italian Consular network is thus organized in the United States: 11 First Category Consular Offices (Boston, Chicago, Detroit, Philadelphia, Houston, Los Angeles, Miami, New York, San Francisco, Newark and Washington) and 76 Second Category Consular Offices (Honorary Consulates and Vice Consulates, Consular Agencies and Consular Correspondents.) Moreover there are eleven Committees of Italians Residents Abroad in the United States (COMITES, elected in the consular jurisdictions with at least three thousand Italians registered with AIRE), five Councillors of the General Council of Italians Abroad (CGIE), one of the three representatives in the Italian Parliament for North America (The Honorable Amato Berardi in Philadelphia), and six Patronati (offices run by trade unions) with several offices in the United States (Inca-Cgil, Acli, Ital-Uil, Inas-Cisl, Epasa, and Encal-Cisal).

“First generation” Italians who came to the States in the ‘50s and the first part of the ‘60s are side-by-side with younger,

or who have immigrated to the United States more recently, generations, consisting of qualified people with university degrees. Young entrepreneurs, concentrated in the New York area and who invest in the United States, but who keep their main centers of interests in Italy, represent a specific category within this group. In addition there are Italian scientists-entrepreneurs, researchers who have applied their discoveries and inventions in industrial spheres, particularly in the Information Technology and Hi Tech fields. In the world of Research, many young Italian operators try to stay on in the United States after their initial period of study. In today's global context, the presence of Italian researchers in America has significantly contributed to our country's success and, by assisting the exchange of researches and projects often at the highest level of scientific research, represents a veritable bridge between Italy and the United States, thus contributing to the development and the strengthening of bilateral relations, with mutual benefit for both countries.

These last few years have witnessed a renewed interest towards our country from the Italian-American community. This is due to several factors, to include the great success of Italy and Italian products, especially in the fashion area, art and sport; more frequent tourist travels and a renewed interest in the Italian language, which often fourth generations are most interested by.

9.4 Scientific cooperation between Italy and USA

"It is important to distinguish between two separate phenomena: the mobility of human resources and the loss of those brains forever."

Is the Italian Brain Drain Becoming a Flood?, by Cristina Pelizon, May 10, 2002

Scientific cooperation between Italy and the United States and specifically among the two countries' Universities and Research Organizations is regulated by a bilateral agreement and by a number of protocols of understanding pertaining to the individual agencies. These include the recent agreement for cooperation in nuclear energy research signed by Secretary of Energy Steven Chu and by Minister of Italian Economic Development in September 2009. Bilateral cooperation covers all main scientific fields and disciplines: astronomy, biology, chemistry, energy, pharmacology, physics, information technology, engineering, math, neurosciences, and science of materials. Cooperation and exchanges among researchers at Italian and American Universities is very strong. There is a relevant numerical presence of Italian researchers in agencies such as the National Institutes of Health (in Bethesda, Maryland) and laboratories as the Fermi National Laboratory (in Batavia, Illinois).

The Italian Embassy in Washington D.C. facilitated the creation of ISSNAF (Italian Scientist and Scholars in North America Foundation), a non-profit Foundation that connects Italian scientists who are active in the U.S.. One of the objectives of the Foundation is to strengthen cultural, scientific and technological exchanges between the two Countries. Relations with the most prominent Italian (ASI, CNR, ENEA, INAF, INFN, INGV, ISS, OGS) and American (DOE, NASA, NIH, NOAA, NSF, NIST) research organizations, reach their peak at the biennial meeting for the review of the scientific and technological cooperation between Italy and the U.S. (the last one was held in Washington on April 22 and 23, 2008).

The scientific sectors of the highest priority for Italy are:

- Biotechnology
- Energy
- Environment
- Information and Communication Technologies
- Health
- Marine Protected Areas
- Nanotechnology
- Physics and Other Fundamental Sciences
- Space Technologies

Agencies responsible for the allocation of research and development funding include the Department of Defense (DoD), the Department of Homeland Security (DHS), the National Science Foundation (NSF); the Department of Energy (DoE); the National Institutes of Health (NIH), the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), the National Institute of Standards and Technology (NIST), and the Environment Protection Agency (EPA).

Role and Structure of the U.S. Federal Government

U.S. policy in the field of sciences depends strongly on the choices made by two decision-making bodies: the Office of Management and Budget (OMB) and the Office of Science and Technology Policy (OSTP), which are part of the Executive Office of the President (White House). Agencies and Departments essentially implement the policies indicated by OSTP and OMB. This process produces the draft budget that the President requests from Congress for each Fiscal Year, based on the proposals made by each individual Agencies and/or Departments. The budget is usually presented in early February of the previous year. Congress discusses the President's request and, after hearing the directors of the relevant Agencies and Departments, and experts in the relevant fields, approves the budget for the following year by the end of the previous year, at times making even substantial changes. The process that uncovers the amounts available for R&D is very complex (usually it takes almost 18 months), and involves the scientific environment, Administration offices and Congress. For the year 2010 the Federal Government appropriated \$150.5 billion for R&D, up by 3.5 billion (+ 2.4%) compared to 2009. Briefly, the 2010 R&D budget is apportioned as follows: basic research: \$30.75 billion, applied research: \$28.54 billion, development: \$83.71 billion, infrastructures for R&D: \$4.8 billion. The Department of Defense (DoD) received \$86.4 billion (+0.1%) for its R&D programs. Particular focus was given to missile defense and basic and applied research in DoD fields. The Department of Homeland Security (DHS) received \$1.16 billion. The Department conducts research programs that were

previously managed by other Departments (Department of Transportation, Department of Energy and Department of Agriculture). The National Institutes of Health (NIH) are part of the Department of Health and Human Services. Their budget is \$30.4 billion (+2.3%). The National Aeronautics and Space Administration (NASA) ranks second in terms of the amount of U.S. federal funding among U.S. federal agencies. Its R&D budget is \$12.08 billion, down to 4.8% from the previous year. The National Science Foundation (NSF), whose mission is to promote scientific progress, improving health and wellbeing and ensure national defense, has a budget of about \$5.1 billion (+6.2%). The Department of Energy (DOE) oversees technological research in a number of fields including basic energy science, environmental science, and clean energy technology. The DOE's 2010 budget is about \$10.6 billion. Specifically, the budget of DOE's Office of Science is \$4.4 billion. The National Oceanic and Atmospheric Agency (NOAA), that manages the National Weather Service and the Earth observation programs, have a budget of \$694 million. The National Institute of Standards and Technology (NIST) that reports to the Department of Commerce promote the development of innovative technologies through public/private partnerships. Its budget for R&D is \$561 million. The Environmental Protection Agency (EPA) has an R&D budget of \$594 million.

Technological and cultural synergies between USA and Italy

Then regarding cooperation between Italy and USA, there exists an important formative program "ISSNAF", summer formative program for science in the United States and Canada for Italian students, that is aimed at Masters students, who will be given the opportunity to work in prestigious North American labs, while being provided guidance for their thesis development work by an advisor, who will coordinate the tasks with the students' Italian thesis advisor. The main subjects selected for 2010 include physical and social sciences, computer science and computer engineering, mathematics, energy production and storage, environmental impact control methods,

nano-materials development, transportation and structural security control, advanced nuclear projects, space engineering. The notices that have been published are related to those sectors for which funding has been obtained relatively to the available bursaries, and they replicate the Fermilab Model. Possible destinations in the United States include Fermilab, the University of Chicago, the Argonne National Lab, and NASA's JPL.

One other important event that stresses the existing relation between USA and Italian science is the opening of Eni-MIT solar frontier center, SFC. Massachusetts Institute of Technology (MIT) President Susan Hockfield and Eni CEO Paolo Scaroni have then celebrated the opening of the Eni-MIT Solar Frontiers Center (SFC). Originally announced in July 2008, the Solar Frontiers Center, headquartered on the MIT campus, promotes research in advanced solar technologies through projects ranging from new materials to hydrogen production from solar energy. The opening of the Center comes out of an alliance signed in February 2008 between Eni and MIT. Over the first two years, the Center has produced significant scientific and technological breakthroughs including:

- Construction of the first ultra-flexible solar cell;
- Development of the first solar cell printed on paper;
- Advances in the production of virus-based metal contacts for solar cells;
- Development of solar cells that mimic the photosynthetic process;
- Advances in the understanding of how photosynthesis splits water molecules;
- Construction of a prototype to maximize return on investment in solar thermal plants using parabolic mirrors for sustainable deployment of concentrating solar power.

The Eni-MIT Solar Frontiers Center is further evidence of the commitment of Eni to the development of cross border initiatives in the field of renewable energy, particularly solar energy.

Collaboration with MIT promotes the creation of technological

and cultural synergies through a multidisciplinary approach. In particular, the cooperation between MIT researchers and those of the "Research Center for non-conventional energy – Eni Donegani Institute", promotes the exchange of expertise through the pursuit of common objectives. In addition to the Solar Frontiers Center, Eni supports projects in energy research at MIT on traditional hydrocarbons, methane hydrates, and global climate change and transportation options. The alliance with MIT has a duration of five years and involves a financial commitment from Eni for \$50 million in total, equally distributed between the Solar Frontiers program and the MIT Energy Initiative (MITEI) – the research group responsible for the study of solutions aimed at transforming the energy system to meet the challenges of the future, of which Eni is a founding member. The partnership with MIT is the most important of the various strategic alliances and scientific collaborations signed by Eni with universities and centers of excellence worldwide.

In 2007 Eni launched the Eni Award to develop improved uses of renewable energy, promote environmental research and cultivate new generations of researchers. This year, Professor Angela Belcher of MIT was selected as the winner in the "Energy renewable and non-conventional" section, for her innovative and fundamental studies on the development of natural systems able to reconvert and use energy.

9.5 Italian Excellences in the USA

Depressed by the prevailing economic climate, young Italian graduates are finding it easier to obtain and retain jobs overseas. It is not the education received in Italy that is the problem. On the contrary, Italians have demonstrated abroad that their education is one of the highest quality. But graduates find that jobs they obtain don't match the skills they have developed during studies. And so Italians move abroad, found new companies and create center of excellence in the world.

Italy: Brain Drain Rises as Economy Struggles
www.thomaswhite.com, May 21, 2010

An important feature to analyze is represented from presence in USA of those considered top excellences of Italy, in other words those people that moved to USA to invest their talent. According to ISSNAF (Italian Scientists and Scholars of North America Foundation), there are about 10000 scientists and researchers who teach or research or create new companies in USA. This type of investment is not quantifiable in capital terms as it is regarding development of new ideas, creation of value and wealthy from Italian people in USA and only in rare cases this wealth comes back to Italy: it is a kind of Human Capital Investment.

– Sangiovanni Vicentelli is a scientist, engineer and entrepreneur. Graduated in 1971 from Polytechnic of Milan, he has become Professor of Engineering at Berkley University and at the same time he has founded different high tech companies among which Cadence and Synopsis.

– Mauro Ferrari, graduated from University of Padua and post graduated from Boston University, he has been working for years in Houston, Texas, where he is director of biotech nanotechnologies laboratory at University of Texas (<http://www.uth.tmc.edu/gsbs/tutorial/ferrari.html>). He is an important name in the American scientific community.

– Francesco Stellacci, graduated from Polytechnic of Milan he has been professor at MIT of Boston, and later he has founded an Italian start-up, Molecular Stamping, with a 10% participation of MIT. The startup was born thanks to a patent of the Italian researcher and it is involved in the DNA analysis and discovering of new drugs for Alzheimer and cancer.

– Francesco Della Porta is one more Italian scientist and entrepreneur whose vocational training has been completed in USA. Once back to Italy he does activity research on bio-informatics.

Francesco Stellacci and Francesco Della Porta are examples that have already increased the value of their investment in USA. In

fact Stellacci has announced his official return to Europe to guide the research program of Nan-medicine European Center (CEN), that has been recently founded in Milan and that works on innovative solutions for the prevention, diagnosis and care of cancer, heart and neurological pathology. On the same wave Della Porta after a long training in USA has come back to Trento at BK Foundation.

– Federico Capasso, another Italian scientist with international reputation. Graduated in Physics from University La Sapienza of Rome, he has been researching for year in USA at Harvard where he is the director of Capasso Lab, a research center of Harvard School of Engineering where more than 30 young researchers works on quantum electronics, opt-electronics, nano-wire lasers and semiconductors. His research publications are innumerable and he also holds 50 patents registered in USA (<http://www.seas.harvard.edu/capasso/>).

– Carlo Ratti, an Italian prestigious name at MIT of Boston. Graduated from Polytechnic of Turin, he is now the director of 35 researchers at Senseable City Laborator where they study paradigm of future cities. Then he also has established his own architecture studio.

List of Italian scientists in USA is very long and on ISSNAF web site there are lots of interviews to these Italian excellences all involved in different research activities.
(<http://www.issnaf.org>)

Even if a little more complex to identify them, Italian Venture Capitalists in USA are another important Italian resource abroad. Here below two important examples of Italian VCs are reported, one on the West and one on the East cost:

– Giacomo Marini who founded and is nowadays the director of NOVENTI, a venture capital company in Silicon Valley that promotes and invests especially in new energies.

– Alessandro Piol, son of the first historical Italian venture capital Elserino, who created in Italy the first VC found, Kiwi

Ventures. Graduated at Harvard and then at Columbia in NY, is today one of the board directors of Vendana Capital fund, in New York.

One other important aspect of this analysis is characterized by Italian investments in American Universities and Research Centers. More than often Italian companies invest in prestigious research programs co-founded with research centers and universities, among which MIT of Boston has a relevant notoriety.

– ENI, that has already realized very important acquisitions in USA, has signed an agreement with MIT for new research programs dealing with development of new solar panels. Over next five years ENI has managed to invest 50 million dollars for this plan of searching for new solar energy. Moreover the agreement with MIT foresees also the study of new technology for the discovering of petrol and methane deposit in sea beds, research activity in capturing of carbon dioxide in the atmosphere, climatic changes analysis. Anyway solar energy will much involved MIT and Eni especially because they both are occupied in the Solar Frontiers Research program where ENI has invested 25 million dollars.

– Techint, with Roberto Rocca Project, has financed since 2005 up today 45 research scholarships at MIT and has allowed 30 young students from Polytechnic of Milan to have an experience in the USA, thus consolidating the Italian know-how in mechanics and aerospace engineering, engineering of materials, bio-medical engineering, math, physics, energy engineering and transports. This investment of the company on future themes amounted at 250000 dollars per year.

– Thanks to the investment of Compagnia San Paolo of Turin, in 2009 MITOR project started. Polytechnic of Turin is involved in this program very similar to Rocca Project organized from Polytechnic of Milan. In fact MITOR finances over 200000 dollars every year to allow the presence of Italian students from Polytechnic of Turin at the prestigious MIT of Boston Research Center.

–DAINESE, well-known Italian company in the manufacturing of bikers' dresses, cooperates with MIT and NASA in the realization of a new spatial pressurized suit.

– PIRELLI Ambiente and Columbia University (Earth Institute) collaborates since 2004 in the analysis and evaluation of environmental control systems.

In addition Italian companies as Finmeccanica finance Fulbright scholarships, 80000 dollars each, that covers two years equivalent master in scientific and technological subjects for Italian students in USA.

– Fulbright BEST program (Business Exchange and Student Training), promoted from USA embassy in Rome, finances scholarships, therefore covering costs of academic courses in Entrepreneurship and Management and give the opportunity to attend internships in American companies, with six months full immersion agenda in the Silicon Valley. Some important Italian companies that promote the Fulbright program and the project of encouraging entrepreneurship in Italy are ENEL, Green Power, Mediaset, Dompè Farmaceutici, Nethical, Poste Italiane, Regione Lazio, Regione Toscana, CNR and also USA firms as IBM, HP and Alcoa.

Fulbright program was established in 1946 under legislation introduced by the late Senator J. William Fulbright, to promote the peace process through cultural exchanges between the United States and the other countries of the world. In fact original mission statement is the famous sentence: *“Our future is not in the stars but in our own minds and hearts. Creative leadership and liberal education, which in fact go together, are the first requirement for a hopeful future for humankind”*, Senator J. William Fulbright, *The Price of Empire*, 1989. The Fulbright program is the oldest governmental program of cultural exchanges in the world and has awarded 294,000 scholarships since 1946 promoting approximately 7,500 Fulbright scholarships annually. The US-Italy Fulbright commission is a bi-national institution in charge of the Fulbright Program in Italy since

1948. It is run by a Board of Directors, composed of 12 members among whom six members are U.S. citizens appointed by the U.S. Ambassador to Italy, six members are Italian citizens appointed by the Minister for Foreign Affairs. The Minister of Foreign Affairs and the U.S. Ambassador to Italy are honorary presidents of the Commission that have the undertaking to promote study, research and lectureship opportunities in Italy and in the U.S. through the Fulbright scholarships for Italian and American citizens. It then organizes and sponsors cultural and educational activities with both a national and international outreach and offers an Information Service on the Fulbright Program and on study and research opportunities in the U.S. and in Italy. One of the most important scholarships is the Fulbright BEST program, created to encourage scholars to come to Italy and to carry out research and lecture on topics of contemporary interest, contemporary arts, science and technology, areas related to entrepreneurship and technology transfer, as well as the traditional field of American studies.

In addition to all research programs mentioned above, the Ministry of the Environment and for the Protection of the Territory has recently financed a project, in cooperation with MIT of Boston, for the realization of ecological house. Furthermore still lots of activities and R&D projects are started and promoted from Italian companies in USA:

- Pirelli Lab in 2005 has created in Georgia one of the most important photonics research center investing more than 30 million dollars and employing more than 150 scientists and researchers.
- In 2007 Italian biopharmaceutical EUROGRAND has announced a R&D investment in Ohio paired to 5.5 million dollars to expand laboratories already based at Vandalia, close to Daytona, where there are employed 200 scientists and researchers.
- Lamborghini has recently inaugurated in Seattle, in partnership with Washington University and Boeing, a new research center specialized in aerospace design, *Advanced composite structures laboratory*, with the aim of promoting new

projects of medium – long term in aeronautical and astronomy subjects.

Finally one more important aspect of Italian presence in USA is the one related to those entrepreneurs that have found the American continent fertile to create new innovative companies. Most of them have gained high success and became notorious in the international panorama:

– Roberto Crea, international biologist, inventor of synthetic insulin and founder of successful companies such as ProtElix and CreAgri.

– Luigi Zappacosta, engineer from Abruzzo, who has been living for twenty years in San Francisco, where he was the founder of Logitech, one of the most important hardware brand in the world.

– Fabrizio Capobianco who founded in 2001 in Redwood City, Silicon Valley, Funambol, an Italian start up with 25 people, among whom high skilled scientists and engineers, that develop and design wireless solution. Funambol was entirely financed from American Venture Capitalists.

An important facet of the link between Italy to USA is also described from incubators of Italian high tech companies in USA. There are different kind of incubators among which also organizations of projects providing assistance and support to technological start up willing to have a presence in USA, with the scope to expand the business and to attract funds in that part of the world where they are more available.

– H-Farm, founded in Italy in 2005, by Riccardo Donadon, it is an international platform, a unique organization redefining the role of venture capital and incubator. H-Farm culture and vision is about *“Humanity. Simplicity. Collaboration. Creativity. Rationality. Passion. Curiosity. Innovation. These words express the mind of H-People. It's not about the identity of a single company but rather a shared culture, a framework to innovative start-ups to grow and flourish.”*

H-Farm developed 4 epicentres – Italy, Seattle, Mumbai, London – 4 market areas with different cultures that work responding to specific market demands, to enable the business at international level. H-Farm proposes to be the “*next generation incubator*”. H-Farm main activity is to provide support to start-ups, from capital resources to a full range of services and logistics to enable rapid growth. H-Farm invests in selected ideas, providing capital support from the seed throughout the early stage. Incubator services include office space and facilities and support for marketing, financial advice, human resources, legal, accounting and business development. Most importantly, H-Farm provides advice on strategy, branding and corporate structure. Since its founding, all of H-Farm's start-ups have become innovative companies and several have already had successful exits.

– M31, a high tech incubator based in Padova founded in 2005 by Dr. Ruggero Frezza, Full Professor of Automation Controls at Department of Information Engineering of University of Padova. The company has opened last July the 1st M31 USA, a corporate start up in Santa Clara, Silicon Valley. M31 mission is to help and support high tech Italian start ups during their early stage with business development and fund raising activities. The official vision statement says: “*M31 is a company that designs and develops enterprises through the application of the "open innovation" model for which the know-how of the company and its partners is shared to power new market, enterprise and culture scenarios*”. With the opening of M31 USA, the Italian incubator has extended the original idea of supporting high tech Italian companies in the global expansion throughout the USA market, thus creating a bridge and a technology transfer network between USA and Italy.

M31 strongly believes that starting new businesses means being “*intelligently courageous*” and also believes that by applying well defined and controlled processes, it is possible to transform all that enormous potential into true economic growth for M31, for all its stakeholders and for the entire society. Hence the company is studying the application of innovative financial instruments to enable partners to participate in new businesses since the very beginning. The

instruments are different in each case and the following is an example:

- Research and development projects in which the partners and M3I both contribute to support the development of new entrepreneurship in the form of a contract in which the ownership of the results is shared in proportion to mutual investment.
- Dedicated financing, in which the partners provide M3I funds to allow the development of new enterprise and to achieve predetermined objectives; part of the financing will be converted into shares of the new company.
- The compensation for M3I activities is in the form of royalties.

M3I provides for the new incubated companies the following services:

- strategic planning;
- direction and management;
- administration and accounting;
- quality and production;
- marketing and sales;
- secretarial, G&A;
- education and training;

and, through partners :

- assistance for the protection of intellectual property;
- legal assistance.

Finally M3I designs and develops new companies, products and services in the IT market and IT applications. M3I has a strong technical and scientific background thanks to a "stellar" team of young professionals coming from university research labs. M3I also offers training and assistance in order to transform customers in partners and create the optimal conditions for the creation of new companies or business opportunities. It also often uses an "ecosystem" metaphor to describe how all M3I stakeholders interact in the company building process. In this

metaphor, M3I is acting like a biodiversity generator, a “*company evolution engine*”.

– Non-profit association MIND THE BRIDGE, is a initiative founded by Marco Marinucci in 2007 who acts as its executive director, defining the main directions of the organization. Marco (a Google manager in his day job) got inspired when involved in a business plan competition and mentoring project in Africa. Blown away by the radical impact such initiative played, he decided to replicate the model with the hope to have a similar impact in Italy, his own country.

The foundation is led by a Board that steers the direction of the initiative and defines the organizational details. The ultimate goal of the foundation is to create the conditions to foster a sustainable Italian entrepreneurial eco-system, spur more ideas, and subsequently reinvigorate the complex new-venture economy, providing new entrepreneurs with direct exposure to potential venture capital investors from the most experienced, entrepreneurial eco-system in the world, the Silicon Valley. Every year Mind the Bridge runs an annual business plan competition with the purpose of selecting the best innovative business ideas among all the potential Italians talents. One of the newest activities of Mind the Bridge is the Gymnasium, a mentoring and coaching program that takes place in Silicon Valley and Italy.

The association is finally intentioned to promote the Italian presence in Silicon Valley, boosting the creation of Italian start ups in the west coast cluster and supporting them during the fund raising through Venture Capitals firms (www.mindthebridge.com). Mind the Bridge has recently signed an agreement with the start up incubator of Polytechnic of Milan and with PniCube, the Italian association of Italian university incubators and business plan competitions. Thanks to this agreement, Italian start ups will have the possibility to be hosted at Plug&Play Tech Center in Sunnyvale, a prestigious Californian incubator whose network counts thousands relations with the major players in the USA high tech market, Sun, Yahoo, Google, Microsoft, Nokia, EBay, and with major University centers such as Stanford, MIT and Berkley.

– BAIA, Business Association Italy America, is a business network created by and for entrepreneurs, managers, and professionals operating between Italy and the USA. As a nonprofit, BAIA is a collaborative organization open to new members and focused on promoting innovation. BAIA mission is to shape programs to enhance knowledge sharing and cooperation for the growing Italian professional community in the US. BAIA was founded in 2006 in San Francisco and BAIA Italy in 2007 in Rome. Current US and Italian activities are in Los Angeles and Boston, Milan and Genoa. As a growing Italian professional community in Bay Area, BAIA mission statement is *“to offer its community opportunities to network; it facilitates the open exchange of knowledge between Italy and the US and it promotes a business ecosystem that fosters innovation”*. BAIA today is formed from 4,500 Community members, more than 15 corporate supporters, in high tech, science, food, education, finance, art, and 1,100 online members through BAIA Link discussion group, BAIA blog and Social networking media. BAIA expertise is mainly focused in Technology and Science, Software, Embedded systems, Wireless, Networking, Web2.0, Industrial Design, Manufacturing, Automotive, BioTech, Life & Medical Science, Energy, Environment, Business and Entrepreneurship, Venture Capital, Private Equity, Finance, Start Ups, Art, Food, Fashion, Interior Design, Higher Education. Lastly BAIA benefits from important affiliations and partnership: it cooperates with Partnership for Growth Program, it indorsed by Italian Consulate and supported by Italian Embassy in Washington. Finally here following the list of main Italian Companies Bay Area in Silicon Valley:

– WSN Lab Telecom Italia: the Wireless Sensor Networks Lab of Telecom Italia has been established in June 2006 with the mission to research and develop Wireless Sensor Networks technologies that will enable new advanced products and services in various application domains such as health care, building management, assisted living. To accomplish its mission the Wireless Sensor Networks Lab partners with leading

universities and companies to develop cutting-edge technologies in the following areas:

- Sensors
- Middleware services
- Secure and Reliable systems
- Distributed Signal Processing
- Applications on Health care, Building management

– Funambol, Inc., founded from Fabrizio Capobianco in 2001 as the Sync4j open source project. Funambol has become over the years the leading mobile open source project in the world, with millions of downloads. Its commercial software is used by many of the leading companies in the mobile industry, including carriers, device manufacturers, internet companies, service providers, software firms and system integrators. The name of the company derived from the Latin words funis (rope) and ambulare (walking), meaning a tightrope walker. Just as a tightrope walker must be strong, brave, disciplined and nimble, Funambol aim is continuously to balance the needs of open source community and its commercial customers. Funambol's vision is to make it easy to keep billions of mobile phones and devices in sync with personal computers, email systems and social networks via the cloud: *“Open source mobile cloud sync and push messaging for billions of connected devices”*.

– Novedge, LLC started from Italian Franco Folini, is a privately held company whose mission is *“to market high quality software products for the design and manufacturing industry.”* The company also invests significantly in the on-line ordering system to guarantee customers' purchase experience easy and straightforward.

– No Hold, Inc., founded in 1999 from Diego Ventura when he envisioned a company that would create a fundamental shift in the way businesses interact with their customers on the Web. Today, those companies can use noHold Instant Support for significant reductions in technical and customer support costs while developing stronger customer loyalty. In essence, the company proposes a *“one-two”* punch affecting the bottom line.

noHold has been providing companies like Comcast, Linksys, D-Link, RIM (BlackBerry), eBay Australia, Dish Network, and Magellan with unparalleled support technology and services. A small team of driven and talented individuals power the technology behind noHold's Patented Virtual Agents (U.S. Patent 6,604,141) and Patent Pending Confederated Knowledge.

– Zipidy, Inc. founded by Cosimo Spera, is a private company categorized under Computer and Custom Computer Services and located in Chico, CA. Current estimates show this company has annual revenue of 340,000.

– SGI founded from Giovanni Coglitore, develops, markets and sells a broad line of low-cost, mid-range and high-end scale-out and scale-up servers and data storage solutions as well as differentiating software. SGI sells infrastructure products designed-to-order for large-scale data center deployments. In addition, it provides global customer support and professional services related to products. SGI mission is to *“enables enterprises to meet their computing and storage requirements at a lower total cost of ownership and provides them greater flexibility and scalability”*.

– Evector, founded in Gorizia, Italy, and now with offices in San Francisco. Evector has created a solution for the burgeoning world of on-line content. Evector's PagesPlus is a simple yet powerful platform that manages myriad streams of information, and integrates the diverse content sources with existing content management systems. Evector's PagesPlus mission is *“to empower organizations by giving them the ability to build and manage sites incorporating an array of content – from user-generated to professionally produce – and then display and distribute that information in a highly flexible manner”*.

– Expert System is the leading provider of semantic software, which discovers, classifies and interprets text information. Its vision is to create, sell and support *“enterprise software technology and solutions that: analyze text to unlock the hidden value of the 85% of the world's information that is unstructured (e.g., articles, emails, corporate documents); eliminate inefficiencies in acquiring, transforming, interpreting*

and applying text-based information for everyday corporate tasks; support richer, improved decision making at all corporate levels". The company was Established in 1989 and Italian Mr. Walter Pezzini is today VP of Professional Services at Expert System USA.

– Adsignals, Inc. is an Italian American company; more specifically it is a California-based provider of innovative solutions and technologies to the Internet Advertising Industry. Company mission is *"to offer innovative, efficient and niche solutions to better match internet advertising supply and demand"*. On the wave of Web 2.0, Adsignals believes that the Internet has not yet expressed its full economic potential, and thinks that through innovation and collaboration more value will be created for everyone.

– Foldier, Inc.: Ph.D. CEO. Michele Ursino founded foldier in 2006 after spending more than 15 years delivering software solutions in the manufacturing and medical sectors. foldier is the web-based tool for searching, aggregating, organizing and sharing personal content, whether it's on a personal hard drive or in a Web application. foldier works on top of existing technologies to operate through a single web interface. The interface collects and distributes pre-designated information across all types of digital media as well as conventional desktop storage systems.

– Neptuny, a start up created by the incubator of Polytechnic of Milan and based in California. The company deals with informatics systems optimizing costs and energetic consumption. Neptuny has an office in Silicon Valley since 2009 in order to develop sales and technological partnerships with other players of the Valley.

Lastly a final significant aspect of Italian presence in USA is regarding patents registered every year from Italian companies in USA. According to USPTO database (U.S. Patent and Trademark Office) in 2009 Italian patents took out in USA amounted 1842, then increasing compared to 2005 when the total number was 1706. Even though this numbers show a

relevant attendance of Italian technologies in USA, France and Germany are much more ahead with 3800 and 10000 patents respectively.

Anyhow this study of gateways and Italian center of excellence in USA is significant to understand the need of our technologies to migrate in this country. USA is still an important and huge market especially where industrial districts as Silicon Valley and Route 128 have developed a thick network of partnerships to promote a dynamic entrepreneurial ecosystem.

As noticed on previous chapter, despite a new wave of revitalization of Italian Venture Capital has taken place during these years, it is still difficult to imagine an example of regional economic development that is more successful than California's Silicon Valley, or others. In Italy we count an average of 10 up to 20 important events per year aimed to promote start-ups, business and research. In Silicon Valley there is a huge size of networking activity and an average of hundred business events and social networking round tables per week. Investors from all over the world arrive with suitcases of money to place in what they hope will be the Valley's next success story. Ambitious, educated people— mostly young— from dozens of nations arrive to take their chances in start-ups fueled by stock options. Regional development theorists study Silicon Valley to identify the underlying characteristics that have enabled this area to become one of the most innovative and prosperous regional economies in the world. Policy makers visit seeking to determine whether the characteristics identified by the theorists and journalists— and the stories they are told during their visit— can somehow be transferred to develop innovation-based economic development in their own regions. Riding the newest wave of regional development theory is the notion of social capital popularized by Robert Putnam in his influential book, *Making Democracy Work*. Putnam's idea refers to the complex of local institutions and relationships of trust among economic actors that evolve from unique, historically-conditioned local cultures. Such institutions and social relationships, built upon the experiences of a shared deep

history, become embedded within a localized economy and form what Putnam describes as networks of civic engagement that facilitate the activities of politics, production and exchange. In these locales of tight civic engagement people know one another and one another's families; they meet frequently in non-work related organizations and activities. They constitute a dense and rich social community. Business relationships are embedded in community and family structures. Those structures not only generate contact and information or transmission, but they reinforce trust by sanctioning, in powerful and multidimensional ways, the breaking of trust. In Putnam's model, cooperation based on trust, which in turn is rooted in complex and deep social ties, propels development. It is an inherited historical characteristic. Silicon Valley is, however, an economic space built on social capital, but it is a vastly different kind of social capital than that popularized by the civic engagement theorists. In Silicon Valley, social capital can be understood in terms of the collaborative partnerships that emerged in the region owing to the pursuit by economic and institutional actors of objectives related specifically to innovation and competitiveness. It is the networks resulting from these collaborations that form the threads of social capital as it exists in Silicon Valley. Then the network environment in Silicon Valley is the outcome of historically conditioned, specifically-chosen collaborations between individual entrepreneurs, firms and institutions focused on the pursuit of innovation and commercialization.

10. M31: an entrepreneurial ecosystem

A closer look at history of past economic recoveries, however, seems to indicate that an economic turnaround not only requires large scale, “top-down” action, but also –and more frequently– of “bottom-up” initiative by clusters and networks of organizations that form a “business ecosystem”.

Mariano Bernardez, *The power of entrepreneurial ecosystems: extracting “booms” from “busts”*

An entrepreneurial ecosystem is a group of non-competing companies, including start-ups, established companies and a coordination entity, which share the same vision, values, culture, strategy and business processes and decide to form an organization in order to explore economies of scale in business functions such as business development, financing, market analysis, marketing communications, IT / MIS infrastructure, human capital management, legal support, financial & accounting management. M31 is an Italian company based on Padua that has based its activity on this strategic model, then sharing an entrepreneurial ecosystem and becoming a unique example in Italy of private high tech incubator.

10.1 Rationale

“Business incubators are one of the newest tools on the enterprise development scene. A business incubator is a facility that provides affordable space, shared office services, and business development assistance in an environment conducive to new venture creation, survival, and early-stage growth.”

David N Allen, Richard McCluskey, *Structure, Policy, Services, and Performance in the Business Incubator Industry*, from *Entrepreneurship: Theory and Practice* 1990, issue: Winter, pages: 61–78

M31 – a privately-owned Company conceived and promoted by Prof. Ruggero Frezza was founded in 2006 and it is based in

Padova, Italy. M3I looks for, co-founds and develops – through an incubation model – high-tech start-up companies typically in the fields of Information and Communication Technologies (ICTs), Medical and Bio-Technologies, Semiconductor Technologies and Clean-Technologies. M3I aims to be a profitable company through commercialization of university-born, novel technologies by forming new ventures together with graduate students, inventors, entrepreneurs and investors. M3I is structured and organized specifically to shape new ideas and cutting-edge research-work into new products, services or business models, supporting the creation and rapid growth of new technology ventures. M3I's implicit goal is to overall create a positive feedback-loop which would incentivize more of the best doctoral students to become successful entrepreneurs. From the one hand, this will generate an increasing number of investment opportunities for M3I and on the other hand it will create new role models for the students to aspire. For the past three years, having executed with success on its initial business plan, M3I has been growing to the point where now is becoming of strategic importance to replicate and adapt its model in diverse other locations. Geographical expansion is part of the M3I's growth strategy because its valuation depends essentially on the equity that it vests in its startups: it increases with the larger number of profitable new enterprises, their growth and their successful exit. Overall, creating M3I centers in different locations means:

1. to increase the access to deal-flow and related technologies
2. to increase the number and the quality of exit opportunities
3. to increase M3I valuation by creating synergies among the different M3I centers, e.g. by:
 - sharing know-how and best practices among them
 - developing new market opportunities for the portfolio start-ups, e.g. international markets

Currently, M3I is opening M3I USA, the M3I affiliated company in the USA.

10.2 M3I USA

“A crisis is a terrible thing to waste”

Paul Romer, Stanford University Economist, Florida, 2009

Since M3I's inception, its founding and Management Team had the vision and set the goal to open the US operations, as soon as the project would become financially viable and would be at the right time of maturity. Setting up M3I USA operations is considered a key milestone in the M3I's growth strategy, because:

1. M3I's Italian start-ups need eventually to expand internationally in order to scale-up (the US market is still a key one: typically 30-40% of the world's market). In this context M3I's start-ups will greatly benefit by having a US presence which develops and expand their business, e.g. M3I USA can serve as marketing, sales and support office. For example, this is already the case for:

- CenterVue, novel ophthalmology equipment, which is partnering with Fremont, CA based Optovue, Inc. for the distribution in the USA of its products
- SiI4, highly skilled and innovative developer of embedded PC systems which is partnering with Vista, CA based Embedded Technologies, Inc
- Zond, a highly skilled software engineering and service company, which is looking for projects and customers-base in the USA.

2. The access to the US market, enabled by M3I USA, would accelerate the exit strategy of the Italian start-ups.

3. In order to potentially support the growth of the most promising portfolio start-ups, Venture Capital firm's money, experience and network could become key - (Venture Capital industry is well established and VC money is predominant in the USA (\$28.8B in USA versus \$6.5B in Europe and around

\$130M in Italy, 2008, with 40% of the total US coming only from Silicon Valley).

4. US, and Silicon Valley in particular, have an established, strong tradition and unique mechanism in place for:
- innovation & new technology development from private and governmental excellence research centers and Universities such as Stanford University, SRI, Xerox Parc, Lawrence Berkeley National Lab, UC Berkeley, just to name a few
 - innovation transfer and commercialization through unique infrastructure such as the Menlo Park VC and angels community, experienced corporate and IP law firms, tech-savvy entrepreneurs with an inherent culture of risk taking, highly skilled work-force and management, etc.,

All these ingredients and more make the San Francisco Bay Area the perfect playground to identify, found and grow new technology start-ups. Therefore, M3I's Management is focusing on expanding its operations with M3I USA as the next step in the company's growth process. M3I USA will be launched and will operate on the basis of open innovation. From the one hand, M3I USA generates revenue by providing business development services and support for M3I's portfolio start-ups and for other Italian companies. From the other hand, M3I USA grows by retaining part of the equity of new high-tech ventures selected, founded and nurtured with its experienced and by skilled team.

10.3 Initial Task

“Well-educated professionals and creative workers who live together in dense ecosystems, interacting directly, generate ideas and turn them into products and services faster than talented people in other places can”,

Richard Florida, 2009

M3I USA starts operations with three initial, main business objectives:

1. Develop business opportunities in the US for the M3I portfolio start-ups
2. Introduce to the US market and support the development of other Italian high-tech/ ICT companies willing to build a presence in the United States.
3. Identify, select, found and [engineer] new high-tech start-ups with strong potential for rapid growth and fast exit.

Therefore, M3I USA is initially organized in two separate Divisions: the Business Development Division (BD-Div) and the Technology Investment Division (TI-Div).

The Business Development Division (BD-Div)

The Business Development Division of M3I USA provides a range of market related services to both M3I's portfolio companies in Italy and other Italian companies. In the BD-Div, market oriented professionals help and support the start-ups in terms of business development, marketing and communication, sales and after-sales service. The parent company M3I has so far created and engineered several successful technology startups, which can benefit of the business services offered by M3I USA:

- CenterVue which has developed innovative automated diagnostic instruments for eyecare
- EKN, the Eye Knowledge Network, which is the WEB division of CenterVue, providing services to the global community of eye-care professionals
- Sil4 which designs a range of embedded PCs and custom computing solutions
- Adaptica which has developed innovative Adaptive Optics for optical components and systems
- Zond which is a leading, cost-competitive player in cross-platform software development.
- Adant which develops innovative antenna systems to enhance the performance of RFID and wifi communications
- Uqido which creates web-services for schedule and queues management.

In more details, the M3I USA BD-Div finds customers and activates distribution channels within the US and provides marketing services, product management and sales support as

well as technical service to the above companies and to the upcoming M3I's portfolio start-ups in Italy. M3I USA enters into separate contracts/agreements with those Italian start-ups that need and require business support. Depending on the start-up's individual needs and the related services, M3I USA utilizes different charges profiles which should include fixed fees and commissions, whenever the latter apply. The Business Development Division offers the same range of services also to other companies, which are external to the M3I portfolio and are willing to have a presence in the US and in the Silicon Valley in particular.

The Technology Investment Division (TI-Div)

Similarly to its parent company in Italy, M3I USA does scouting, identification and selection of the most promising innovative technology projects which are eventually turned into new high-tech ventures. The deal flow is sourced from extensive networking at universities, research labs, private companies, angels, early-stage VCs., including entrepreneurs, technologists, engineers, PhDs and Professors. On this basis, M3I USA searches for, evaluates, filters and tests many new ideas, before turning only the most promising into financeable ventures by bringing together the human and financial resources necessary to develop their products and services for their commercialization. M3I USA will provide the best selected deals and investment opportunities to its parent company M3I and to its Investment Fund of reference (TTVenture). M3I provides its start-ups a range of resources including seed funding, office space and related office services, such as initial management, corporate and business development expertise support, marketing and sales, administrative and financial/accounting services, IT, human resources as well as legal service (corporate and IP) and QA/RA services. The vision of M3I is the one of a shared environment for the portfolio start-ups that creates a powerful internal ecosystem where those companies find mutual support and synergies – where possible – which would be otherwise not available should they operate out of their own location. An additional major advantage is that by sharing the office and all

other necessary services, G&A costs (general and administrative) will be remarkably reduced for each individual start-up.

10.4 Focus Areas and Operations Model for the Start-ups

Stanford professors like Frederick Terman encouraged their students “*providing extended assistance to other firms in the region, providing new entrepreneurs with encouragement, advice, computer time, space and even financing*” which also created a close-knit professional community where “*the informal socializing that grew out of these quasi-familial relationships supported the ubiquitous practices of collaboration and sharing of information among local producers*”.

Saxenian, 1994, p. 32

Unlike some other existing technology incubators such as H-Farm in Italy and Idealab in Pasadena, CA, M3I does not exclusively or predominantly focus on software, Internet-based or WEB services start-ups. Given the operational experience of its management team, M3I focuses mainly on business ideas involving hardware, instruments, equipments and/or devices.

M3I USA plans to operate focusing on new business ideas possibly based on hardware, devices and equipments. Similarly to the parent-model in Italy, M3I USA will originate fabless companies, where the start-up holds the technology, develops the products and then finds collaborations with both suitable manufacturing contractors and sales & marketing partners or selected worldwide or local distributors. In this way, M3I USA portfolio companies will immediately be able to leverage manufacturing, marketing and sales and other possible synergies with M3I's portfolio companies.

10.5 Location

“Silicon Valley is the world’s most dynamic economic region as it is a habitat for innovation and entrepreneurship. It is located on the San Francisco, California Peninsula.”

Jarunee Wonglimpiyarat, *“The dynamic economic engine at Silicon Valley and US Government programs in financing innovations”*, Boston University, USA

The location of choice for M3I USA is the San Francisco Bay Area, with a particular eye on the Silicon Valley, a rectangular strip of land which stretches for about 50 miles south to north and 15 miles east to west from San Jose. The Bay Area, with roughly 6 million people, is the world’s number one high-tech pole thanks to a unique infrastructure which supports the Silicon Valley high-tech innovation model based on several pillars:

- leading universities like Stanford and UC Berkeley with strong ties to the local industry and vice-versa;
- a strong entrepreneurial spirit embedded in the society and present at the universities, where risk and failure are tolerated
- a sophisticated financial environment comprising angel investors, Venture Capital and private equity firms
- extremely highly-skilled international workforce, with experienced and entrepreneurial managers



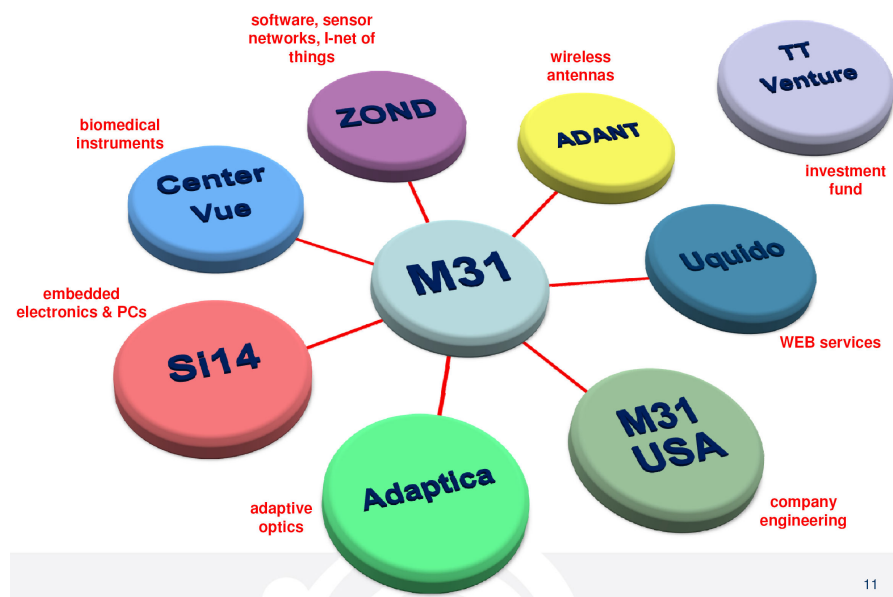
This unique infrastructure creates a particularly fertile ecosystem capable of fostering innovation also by attracting talents from around the world. In addition to this, is worth mentioning that M3I's management has long lasting relationships with the Bay Area's academic community as well as with the local high-tech community in multiple industries.

II M31 USA: company and organization

“All galaxies begin life forming stars.”

Chris Martin, coordinator Galaxy Evolution Explorer, Caltech.

The Andromeda Galaxy is a spiral galaxy approximately 2,500,000 light-years away in the constellation Andromeda. M31 is the code assigned by celebrated French astronomer Charles Messier to the galaxy Andromeda. Like Andromeda, M31 proposes as a cluster of “stars”, i.e. a group of creative entrepreneurs, managers, researchers and engineers, who spark new technologies, innovative products, new businesses and new companies. For each new project, product or company, M31 brings together a network of technology, research, commercial and financial partners.



11.1 Vision and Mission

Vision Statement

“M31 USA shares the vision of its parent company, M31, i.e. the one of becoming a recognized player in promoting and developing new technology entrepreneurship among the young generations of – primarily – Italian engineers and researchers.”

Mission Statement

“M31 USA develops new technology enterprises by applying the open innovation model. The skills and experience of M31 USA team members and its investors add value in shaping the new enterprises, helping them in launching new products and guiding them into conquering market shares. M31 USA aims at becoming profitable and at creating value through commercialization of novel technologies by forming new ventures together with graduate students, inventors, entrepreneurs and investors. M31 USA aims at creating a positive feedback-loop which would incentivize more of the best doctoral students to become successful entrepreneurs. From the one hand, the positive loop will generate an increasing number of investment opportunities and on the other hand it will create new role models for the students to aspire.”

11.2 Legal Form and Shareholding

With regard to the legal form of the company, M31 USA will start in the form of a US Limited Liability Company or LLC which appears to be the best option for the initial stages of M31 USA. When establishing M31 USA, we shall consider the principal needs that we can indicate as:

- Legal protection of M31 activities in the US

- Ability to deliver services in the US
- Ability to contract with US parties, including possible partners and consultants
- Flexibility to manage capital flows from M3I and possibly engages in investment activities in US companies.

M3I USA will be established as a limited liability company (LLC). An LLC offers flexibility as well as the ability to match the needs of M3I in the United States. Some advantages of using an LLC form as opposed to a corporation for the proposed activities include the following:

- An LLC offers entity protection from liability and thus insulates M3I from possible claims
- An LLC is governed by a private operating agreement and is not bound by the same level of corporate formalities that corporations have to abide to. As such, the LLC can offer a highly customized level of solutions for structuring management and employment relationships
- The operating agreement gives privacy and flexibility to the parent company insofar as structuring operations and also the compensation structure, including the ability to customize such agreement toward the activities of the portfolio companies
- An LLC is a fully recognized legal entity that can enter into contracts and joint ventures
- An LLC can own participations in portfolio companies as well as make investments

An LLC does not offer the same level of established legal precedent and tools if the company intends to raise capital from third party investors and may be a less favored target choice of entity from an M&A standpoint. However these two last considerations would not seem to apply given the principal needs expressed by M3I. The initial shareholding of M3I USA will be M3I Italia Srl 90% and Management Team 10%. Since the beginning of its operations M3I USA considers the opportunity to open the Shareholding to suitable investors to

increase its financial strength and make available more resources for potential investments.

11.3 Exit Strategy

"Always start at the end before you begin. Professional investors always have an exit strategy before they invest. Knowing your exit strategy is an important investment fundamental."

Rich Dad

The value of a M31-type company lays in the number of new enterprises it creates and the equity it vests in all those enterprises. Thanks to this business model, it is expected that the company's valuation will grow significantly in a reasonable time horizon. M31 is different from a traditional incubator (which only offers space and maybe few services, e.g. IT) and it is also different from a VC firm which invests in start-ups through dedicated funds. The direct involvement of M31 in the management of the startups reduces the team's risk and the overall risk of failure. In addition, the general costs sharing structure for the incubator's startups is expected to make both time-to-profit shorter and profits higher. The exit processes in view from M31 USA will be strictly connected to those of the Parent Company M31:

- the acquisition of M31 by some multinational technology transfer companies like Pera in the UK or Sagentia;
- the acquisition of M31 by a corporate Venture;
- the buy back of the investor's shares by the company or other shareholders;
- IPO;
- the acquisition of the investor's shares by a consortium of companies started by M31.

11.4 The Changing Venture Capital Scene in Silicon Valley

And without those occasional but huge exits, the entire ecosystem can fail. Venture firms need big returns to raise new funds. Without venture money a lot of the innovation in Silicon Valley would end.

Michael Arrington, VCs And Super Angels: The War For The Entrepreneur , Aug 15, 2010

In the process of establishing M31 USA it is important to analyze and understand how the Venture Capital sector has developed for the last couple of years in the US, particularly in Silicon Valley. Historically, Silicon Valley accounts for approximately 40% of all the Venture Capital money flowing in the United States. Lately the Silicon Valley Venture Capital scene is changing due to the economic and financial crisis of the last two years. VC investments and number of deals have constantly decreased since Q108 and have mostly dropped in Q408 and Q109 due to the panic brought in by the recession. New investments have practically stopped and the market has stood mostly on 2nd and 3rd rounds of existing investments rather than on new deals. As a long term result of this situation, VC companies will consolidate in larger companies and many smaller VCs will disappear. Some industry experts say the number of Venture Capital firms could drop by as much as half in the coming two years. VC market remained flat during Q2 and Q3 2009 and the predominant sentiment is now of cautious optimism that the worst of the financial crisis and economic decline is behind and that the situation will recover in 2010 (in part and fully only in 2011). The first nine months of 2009 mark the worst nine-month period for brand new VC investments in the past 15 years. A Money Tree report of October 2009 shows that, while overall VC investment rose slightly from Q2 to Q3, the picture is much bleaker when first-round financings are considered. VCs invested a total of \$2.19 billion in 462 first-round deals in the first nine months of this year (see chart). To find another nine-month period as bad, you have to go back to

the third quarter of 1994 to the first quarter of 1995, when VCs invested a total of \$1.77 billion in 480 first rounds. The third quarter also marked the third consecutive quarter that came in below \$1 billion for first-round deals. The last time we had three consecutive sub-\$1 billion quarters was the fourth quarter of 2002 to the second quarter of 2003. Even in that recession period, VCs put more money to work in brand new deals than they are doing today. In fact they invested a total of \$2.49 billion in 549 first rounds from the fourth quarter of 2002 to the second quarter of 2003.



11.5 Leading Technologies

The analysis of the few current business proposals which M3I has received and M3I USA could consider supporting, shows that deal flow can be divided into four main technology categories, plus a small number of “others”.

The four categories are listed according to the type and the number of proposals M3I has received. It is worth noting that a similar grouping applies also to the deals normally funded by VC firms for the past few years:

1. Energy & Cleantech
- 2a. Life Sciences & Bio-Technologies
- 2b. Healthcare & Biomedical Engineering

3. ICT & Internet
4. Semiconductors
5. Other

In this context, considering M31 USA skills and experiences, Medical and Bio- Technology are separated into two subgroups: 2a. and 2b. Biotech involves chemical, biochemical and microbiological technologies and processes, e.g. drug discovery, while Medical Technologies involves devices, instruments and equipment for applications in healthcare.

11.6 Examples of Investment Opportunities

During the first months of prospection and market analysis, M31 USA has already got in contact with numerous opportunities and possible deals covering a large range of applications.

W.H.O.

World Hearing Organization Inc. (WHO) manufactures and commercializes solar-powered high-performance hearing aids. It deploys a network of seasoned LHCPs to provide free hearing screening and quality hearing care to patients in partner vision care offices. WHO has 6 models of ultra low-voltage (1v), low-noise IC design, solar powered, 7-prescription hearing aids. It has cleared FDA 510(K) and received CE approval.

DoctorYou – Biosensors for Point of Care Diagnostic (POC)

A small portable enzyme-based amperometric POC biosensor is proposed for easy, low cost and simultaneous monitoring of four key physiological parameters, starting with the ones related to obesity monitoring: the content of cholesterol, bilirubin, glucose and transaminases. Screenprinted- electrodes and MicroElectrodeArrays will be applied.

Color-Blind Glasses

Daltonism is the inability to perceive differences between some of the colors. It afflicts about 7–8 % of the world's male population. The scientific innovation is based on the idea of remapping, through an innovative process, the color space into the region without ambiguity. The business idea is to establish a start-up company in order to commercialize the technical breakthrough. The team, heterogeneous but complementary, is characterized by both solid scientific and entrepreneurial skills.

Microsystems for Innovative Methods in Diagnosis and Therapy of Cancer

Human immune system is a high-potential resource to fight most diseases, but it generally fails against cancer. Advances in biotechnology are necessary to improve the effectiveness of cancer immuno-therapies. The research made at the University of Bologna has brought to the development of micro-systems which can handle just one or few cells, providing new methods for training the immune system's cells to destroy cancer cells and for better monitoring the effectiveness of cancer immuno-therapies.

How to Establish a New Industry Based on Production and Utilization of Sustainable Bio-fuels using Jatropha Curcas

The need for mitigation of Climate Change, energy security, scarcity and volatility of fossil fuels, are indicating bio-fuels as a potential global business. *Jatropha curcas* represents an optimal feedstock for bio-fuel production: not-competing with food crops, low agricultural input, adapted to semi-marginal lands, it reduces poverty and prevents desertification in tropical and subtropical developing countries. Agroils America aims to establish a new industry of sustainable bio-diesel and bio-jet-fuel feedstock in US and other American Countries.

11.7 M31 USA network

“The most crucial aspect of Silicon Valley is its networks.”

Emilio J. Castilla, Hokyu Hwang, Ellen Granovetter, and Mark Granovetter, *Social Networks in Silicon Valley*

One of the most important assets in Silicon Valley is a wide and pervasive network of relationships among the 3 local pillars of innovation:

1. **industrial partners**, represented by some of the biggest and most innovative companies in the world;
2. **financial capitals**, thanks to the highest concentration of venture capital funds in the world,
3. **innovative ideas**, provided by Bay Area top Universities and governmental and private Research Institutes.

The aim of M31 USA is to —plug” itself into these valuable networks starting from the very beginning. In this sense here is a list of different networks in which M31 USA should be plugged in for its own benefit.

University Network: Bay Area Academic Excellence

Some of the most innovative ideas in the world are conceived in the Bay Area Universities. One of M31 USA aims is to create strong relationships with one or more representatives from each of the following universities:

- The UC Berkeley
- Stanford University
- UC Davis
- Santa Clara University
- UC Santa Cruz
- UC San Francisco

Business Associations Network: Italian Associations

According to AIRE and U.S. Census Bureau there are about 17.8 millions of Italian–American US citizens (equal to about 6% of

the total population). This community is particularly strong in California, with about 1.1 millions of Americans of Italian descent, concentrated mainly in Los Angeles and San Francisco area. Some of them are organized in business network that are willing to support a –business linking– initiative such as the one proposed by M31 USA. In this sense M31 reference network will be:

BAIA – Business Association Italy America – www.baia-network.org

BAIA is a non-profit association that promotes business ventures initiated by Italians and Americans and, in particular, plays the role of facilitator between the Italian research and production system and Silicon Valley based economic players. The Association is independent and autonomous, funded by its members and sponsors. BAIA is open to individuals, businesses and associations. Its main objective is to support businesses, individual entrepreneurs or professionals who want to start or expand their operations in California and the US. BAIA produces tangible value through the creation of a professional forum where knowledge and opportunities are exchanged in an open and effective way. Organizing discussions with companies, networking events, conferences and roundtables, and partnerships with local, national and international organizations are some of the main activities promoted by BAIA. BAIA gathers experts, professionals and entrepreneurs in a wide range of areas focusing on issues regarding the business, new technologies and access to venture capital.

SVIEC – Silicon Valley Italian Executive Council – www.carrferrell.com/sviec/index.html

SVIEC, a cohesive group of Italian and Italian-American technology executives, meets together on an informal basis to network, socialize and stay current on issues relating to technology, the law, government and public policy. As a special group of technology executives within the National Italian American Foundation (NIAF), the major advocate in Washington D.C. for nearly 25 million Italian Americans and for strengthening the ever increasing cultural and economic ties between Italy and the U.S., SVIEC hosts bi-monthly gatherings

where its members can meet other Italian and Italian American technology executives from the San Francisco Bay area, as well as hear from highly-influential guest speakers on a variety of compelling topics.

An Existing Framework: Partnership For Growth – P4G

<http://italy.usembassy.gov/p4g/italiano/default.asp>

Launched in 2006 in Italy by US Ambassador, Ronald Spogli, Partnership For Growth is the framework for US Embassy initiatives aimed at Italian economic growth promotion. Its areas of intervention are:

– *Technology Transfer Acceleration*: supporting inventors in their technology business development, by promoting business exchange training program such as Fulbright BEST (<http://www.bestprogram.it>), providing them with entrepreneurial role model and social network (IGN – 1st Generation Network – www.lgeneration.net) or giving them access to Silicon Valley environment (Mind The Bridge – www.mindthebridge.org).

– *Investments and Capital*: development of a financial environment supportive for innovation and industrial development, by supporting several seminars and financial initiative such as business angels network creation, as IAG (Italian Angels for Growth, <http://www.italianangels.net>).

– *IP protection lobbying and education*

Several of these initiatives could be somehow synergistic with M3I mission and activities. In particular the Fulbright BEST program and the Mind The Bridge Foundation are most likely to be complementary with M3I's activity.

Fulbright BEST – <http://www.bestprogram.it>

The Business Exchange and Student Training grant is a yearly training program of immersion in American entrepreneurship, which lasts for six months. It is open to certain (15–20) Italian graduates of science faculties, as it seeks to build a stronger bridge between the worlds of science and business. It combines a semester at a business school (actually: Santa Clara University, CA), followed by a fellowship in a start-up company. Participants usually are young researchers interested in creating and developing entrepreneurial businesses in Italy.

Specifically, they must be recent laureates and students working on a Master's or PhD program in science, technology or engineering with an innovative business idea that they want to commercialize. One of the requirements to be a successful applicant is to propose his own potential business idea for a start-up company, and to explain the project (in English) during the interview. The candidates' screening is made by the Fulbright Steering Committee. In this context, those Silicon-Valley-tested high-tech business ideas can provide an additional list of potential suitable deals for M31 to incubate.

Mind-the-Bridge – MTB – www.mindthebridge.org

Mind-the-Bridge is a non-profit organization founded by Marco Marinucci in 2007 who acts as its Executive Director and who defines its directions. Marco (a Google manager in his daily job) got his inspiration when he was involved in a business plan competition and mentoring project in Africa. Blown away by the radical impact such initiative played and similar initiatives can play in third-world countries, he decided to replicate the model in Italy with the hope to have a strong impact in his own country. The foundation is overseen by a Board headed by Marco that steers the direction of several entrepreneurial initiatives and defines their organizing and logistics. However, the vision and ultimate goal of the foundation is to create the conditions to foster a sustainable Italian entrepreneurial ecosystem, spurring new ideas, and subsequently reinvigorating the complex new-venture economy, providing new entrepreneurs with direct exposure to potential venture capital investors from the most experienced, entrepreneurial ecosystem in the world, i.e. Silicon Valley. Every year Mind-the-Bridge runs an annual business plan competition which screens and selects the best innovative and promising business ideas coming from a pool of Italian entrepreneurs who apply and participate. For example, one of the newest activities of Mind-the-Bridge is the Gymnasium, a mentoring and coaching program that takes place both in Silicon Valley and in Italy. Already at first sight (pending confirmation), the business model of M31 USA and the objectives of the MTB foundation seem to be well aligned. It also appears that the projects of MTB and the interests of M31 USA are potentially complementary. Let's analyze why and

how. MTB, a group of strong individuals with an established powerful network, is involved with a very interesting range of opportunities. For example, MTB's is already becoming the "main proactive early-stage deal flow provider" to investors (through its bus plan competition) and its vision is to become a major player in influencing or even determining the rules of technology development in Italy. However, MTB seems to lack of an effective organization and structure with the capital in place to turn all the promising opportunities and ideas into actions. To this regard, M31 and M31 USA have the organizational structure, capital and the right objectives to turn those ideas into actions. Therefore, a possible synergistic scenario is for M31 USA the one of seeking an alliance with MTB, where M31 and M31 USA will become MTB's "operational arm". At this point, M31 and M31 USA can tap into and take advantage of the deal flow provided by MTB Business Plan Competition (through four regional road-shows - e.g. North West, South - and culminating with the Venture Camp each November in Milan). M31 will utilize its structure, organization and operation's experience to screen and select the best-suited business plans which arise from MTB's competition. After having picked the "right" business plans, M31 will start the incubation and "acceleration" process to develop successful start-ups. A strategic partnership between MTB, M31 and M31 USA is therefore considered and suggested. For example, office space could be shared in a suitable Silicon Valley location. In addition, MTB could act as communication and marketing tool for M31 and M31 USA, besides being one of their top deal flow providers.

US Market Access Center - <http://www.usmarketaccess.com>

The US Market Access Center is part of the San Jose City Incubator Initiative, comprising the San Jose Bio Center (biotech startups incubation), the Environmental Business Cluster (cleantech startups incubation), besides the US MAC (foreign startups incubation). Located in San Jose, CA the US MAC is a good trade gateway into the United States for international businesses. US MAC has the market information, competitive knowledge and strategic contacts needed for emerging technology companies enhance profitability and

achieve success, all on an affordable budget. To establish presence, market share, and revenue growth in the US market, the US MAC offers many consulting and home office services:

- US Office solutions
- Market intelligence
- Competitive intelligence
- Market Entry Strategies
- Revenue Generation Strategies

USMAC attracts Italian entrepreneurs and companies through email marketing campaigns and Webinars. The email campaigns promote US MAC's US Affiliate Office program, which provides Italian companies with 'virtual office' presence in the US, and most importantly, access to free mentorship and consulting for one year. USMAC's free Webinars are held once per month, in Italian and English. US MAC has a database of Italian technology entrepreneurs, companies and trade groups, which continues to grow. This database also includes ex-patriot Italians, working in the technology sector in Silicon Valley. USMAC also has over 80 mentors and consultants, segmented by sector experience and by specific business growth expertise, including marketing, sales, board recruitment, product development, capital raising, etc. These mentors and consultants are approved and screened by US MAC, and agree to provide 2-5 hours per month of free consulting to US MAC clients. US MAC's primary role and services are that of a business accelerator.

1. Introduce Italian start-ups to the culture and business opportunities of Silicon Valley.
2. Provide Italian start-ups with growth support with step-by-step coaching, marketing and business development support, and assimilate the companies into the Silicon Valley culture.
3. Accelerate growth of qualified companies (mentoring, coaching, marketing and business development)
4. Qualify Italian companies (deal screening) USMAC counts on M31 USA's collaboration and support in:
5. Provide funding (seed and venture capital)
6. Provide interim management team, marketing and business development support.

11.8 The Market of Innovation

To estimate the market of innovation in California in which M3I USA operates, several proxies can be used. In our case, we have adopted the following ones:

1. Startup Scalability
2. Patent Registrations
3. Venture Capital Investments
4. Exits from Startups

11.8.1 Startup scalability

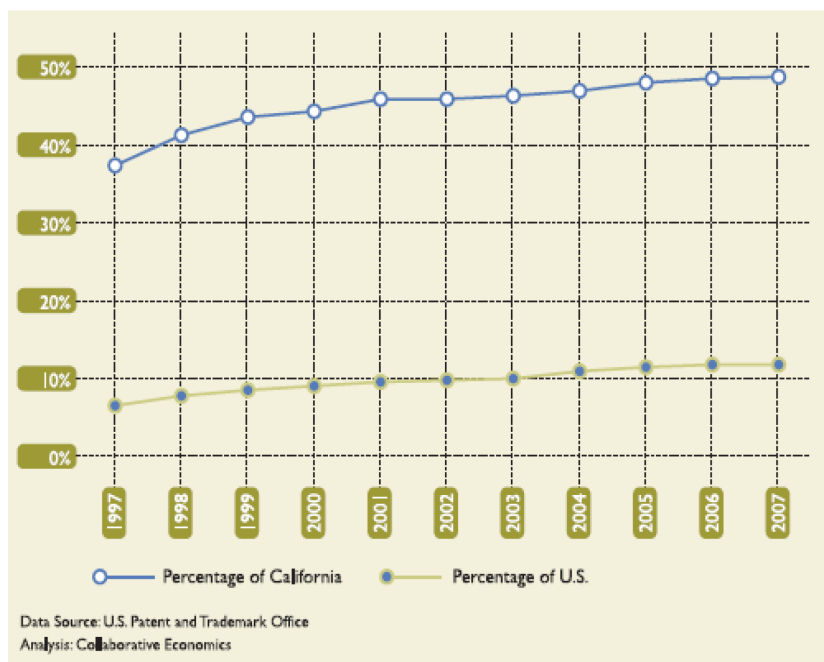
By using ChubbyBrain database², out of its 5,400 companies incubated in incubators in the US, 2,311 of those were determined to be “scalable companies”³ for an average of 47 per state. It is worth noting that while there are data on more than 5400 incubated companies, not all of these companies will appear in the public ChubbyBrain database because survey focus is mostly on scalable, technology-driven businesses. These scalable incubated companies are distributed across the states as seen in the map aside. California and New York appear at the top in the number of scalable companies.

² ChubbyBrain (CB) is a NYC-based information services technology startup using tenets of natural language processing and mass collaboration to structure vast amounts of unstructured data about private startup companies and the investors (venture capitalists, angel investors, incubators, etc) that back them. It launched its public beta in February 2009, here available: <http://www.chubbybrain.com>. Out of 28,000+ startups in its database, 5,400 of those are companies incubated in 300+ incubators.

³ CB doesn't provide a clear definition of its means in their analysis but specify only that “consulting, retail or service companies that may be in these incubators are not included in CB database”.

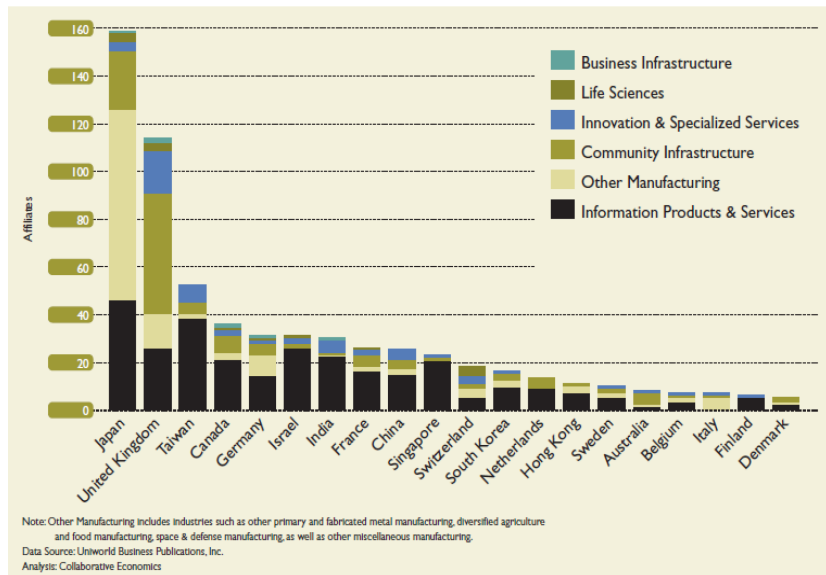
11.8.2 Patent Registrations

We consider the number of patent registrations as a proxy for the innovation market potential in the U.S.. California (with 19.638 patents in 2007) represents by itself about 10% of the total number of U.S. patents (79.556 in the same year). Silicon Valley by itself counts for almost half of California IP creation, with 9.538 patents registered in 2007. The most innovative city in the US is San José, in Silicon Valley, with 2.140 patents registered in 2007, while in the top ten are ranked also other Silicon Valley cities, such as Sunnyvale, Palo Alto, Fremont and Cupertino.



Patent Registrations Silicon Valley's Percentage of US and California

Silicon Valley is also a cross-borders open innovation environment, with an increasing percentage of its patents co-created by foreign co-inventors (10% in 2006, 11% in 2007).



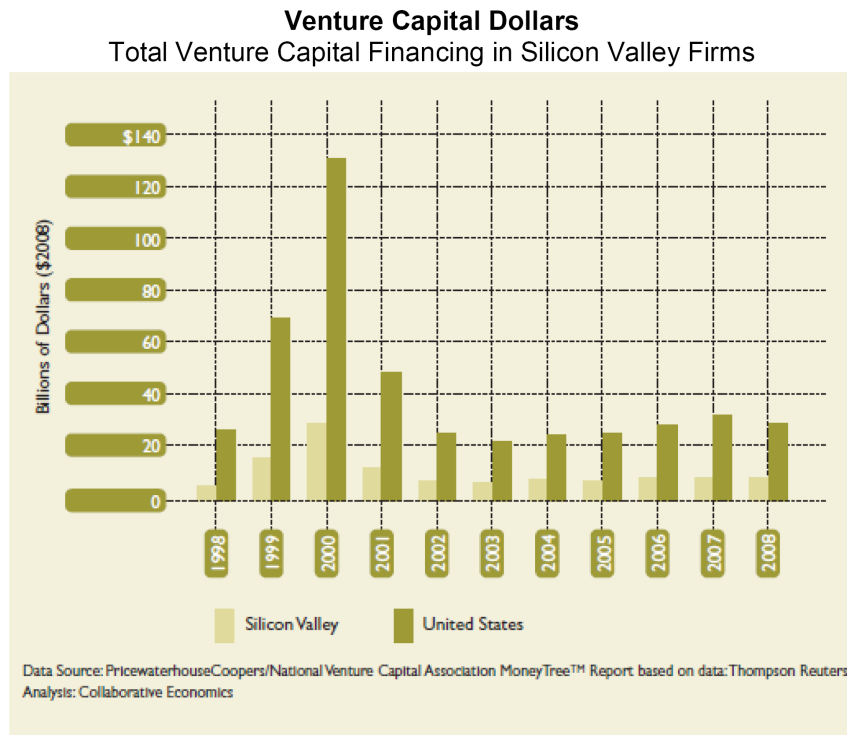
Foreign Companies in Silicon Valley By industry Group – 2008

In fact Silicon Valley nurtures diversity and attracts several companies from all over the world (while smaller nation such as Switzerland, Netherlands and Belgium have some meaningful presence in Silicon Valley, Italy with a weak focus on innovative, high-tech industries, does not...at least until now).

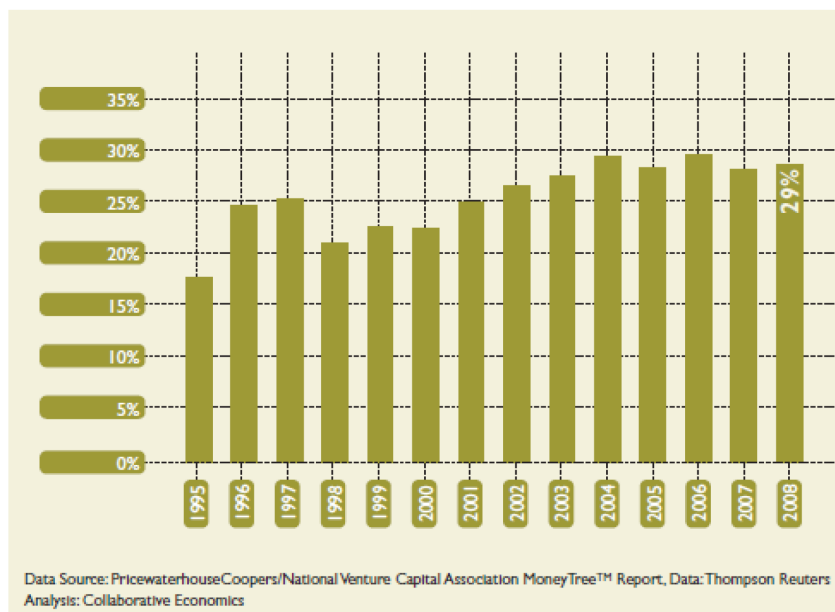
11.8.3 Venture Capital Investments

Venture capital investments are a consequence of the quality of high-tech startup companies' growth in Silicon Valley (and vice-versa start-ups are in Silicon Valley because of the strongest concentration of world leading VC firms). Therefore, if we consider those investments as a proxy for the innovation potential of Silicon Valley, by using published data it is possible to estimate in detail that innovation potential. After rising steadily since 2005, total venture capital (VC) investment in Silicon Valley dropped 7.7% from 2007 to 2008 (because of the recession). However, up to the third quarter of 2008, investment was about the same with those of 2007 (in the fourth quarter of 2008, the recession started). Nationwide, investment dropped 11.4%. While investment has slowed down in 2009,

Silicon Valley continues to account for 29% of total U.S. VC investment and continues to be considered the main location for investment.

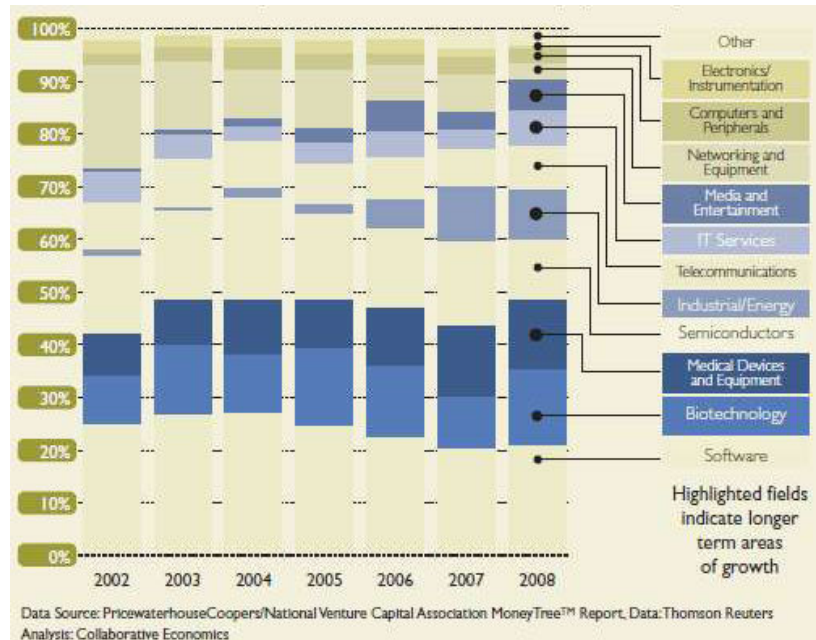


Moreover, if we look in relative it's interesting to observe the trend of increasing U.S. investments into Silicon Valley, which raised from 22% in 2000 to 29% in 2008.



Silicon Valley percentage of Total U.S. Venture Capital

Currently Biotechnology is the second most invested sector after Software. The five industries with the greatest growth in 2008 are IT Services (64%), Media and Entertainment (55%), Biotechnology (36%), Industrial/Energy (21%), and Consumer Products and Services (15%). The highlighted industries in the chart represent the industries growing over the longer term. It is interesting to analyze the clean-tech sector, where investments in Silicon Valley increased 94% from 2007 to 2008 – valuing almost \$1.9 billion (25% of the total US clean-tech investments of ~\$8B). In 2007, Silicon Valley alone accounted for 55% of California and 31% of U.S. clean-tech investment. The bulk of this investment was in energy generation (solar about 25% of total cleantech investments) followed by energy infrastructure.



Venture Capital Investment in Silicon Valley by Industry

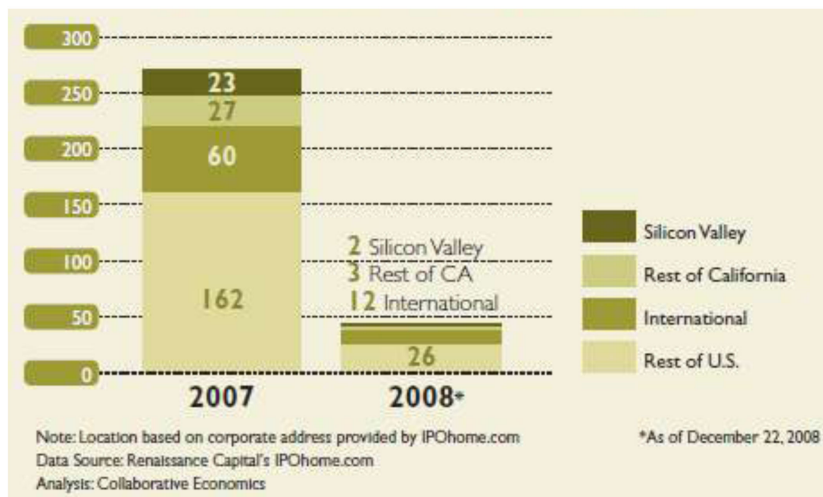


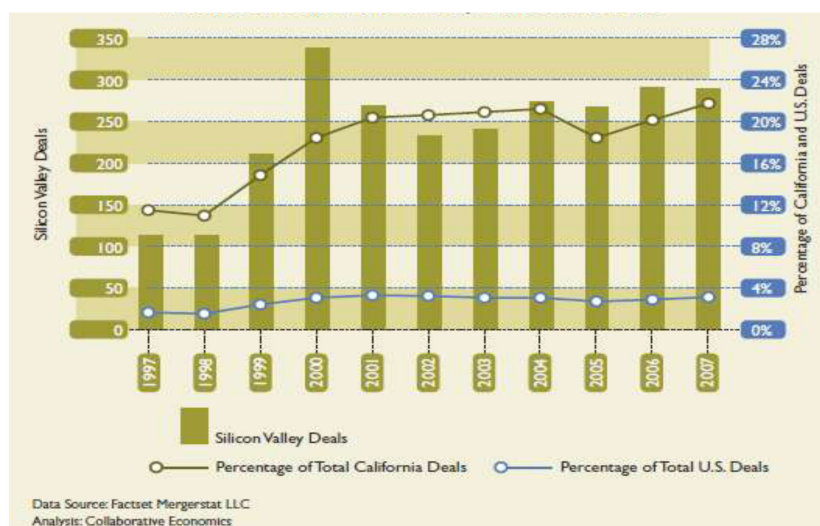
Millions of dollars invested in Clean Tech

11.8.4 Exits from Startups

Another important parameter to be taken into account to value the innovation market potential is not only the financial inflow (VCs investments) but also the financial outflow (i.e. exits by IPOs or trade sales). Initial public offerings (IPOs) have slowed dramatically globally (but will be picking up in 2010 due to the backlog from '08 and '09). While in 2007 there were 272 IPO pricings in the U.S. stock market, in 2008 there have been only 43 total. Silicon Valley-based companies represented 8% (23) of the total IPO pricings in 2007 and 5% (2) in 2008. Accounting for 22% in 2007 and 28% a year later, non-US companies are representing a larger percentage of the world's IPOs. 291 mergers and acquisitions (M&As) took place in Silicon Valley in 2007 (a steady number from 2006), making up roughly 22% of total California M&As, but only 3% of total U.S. deals. Since 2003, the value of total M&A deals in the region has increased 35% valuing \$35 billion in 2007. However, Silicon Valley clean-tech represents an exception to the overall U.S. trends. While M&A activity in clean-tech dropped nationally in 2008, it rose 25% in Silicon Valley and 7% in California.

Total Number of IPO Pricings
Silicon Valley, California, U.S. and International Companies





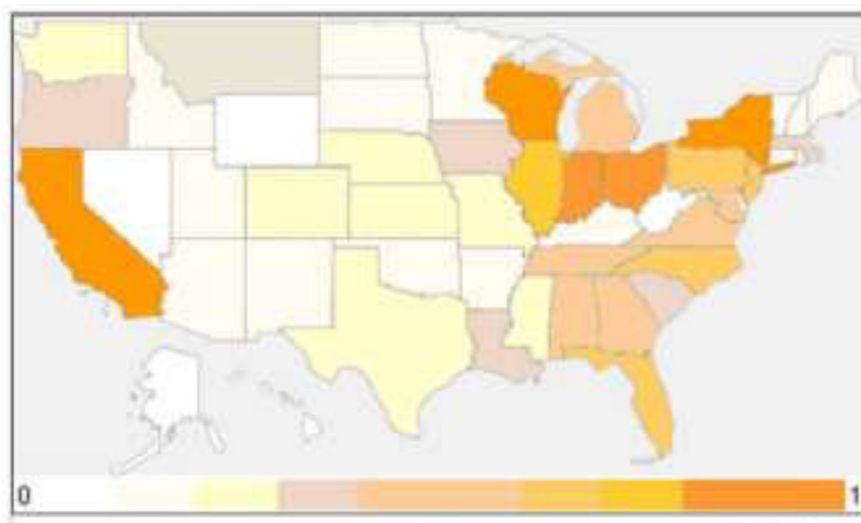
Number of Deals in Silicon Valley, California and U.S.

11.9 Incubators and Technology Transfer Centers

The U.S.-based National Business Incubation Association (NBIA – www.nbia.org) estimates that there are about 5,000 incubators worldwide. As of October 2006, there were more than 1,400 incubators in North America, up from only 12 in 1980. This number is expected to grow in the next few years. In fact many policymakers are talking about business incubators as a means to foster economic development and hence job creation. For example, President Obama has proposed \$250 million in spending to create a national network of private-public business incubators. California has the highest density of business incubator nationwide, so we expect M3I in US will face a fierce competition from several types of incubators. According to a recent survey made by ChubbyBrain project on a representative sample of 300 US incubators and more than 5400 US incubators-backed startups, the last ones are shown concentrated across the United States in the map aside. As the chart shows, incubating companies are centered in California, New York, Indiana, Ohio, Wisconsin and Massachusetts. This makes sense given the next chart which shows the distribution of business incubators across the states

where again California, New York, Ohio, Indiana, and Wisconsin are among the states with the highest number of incubators. The average number of incubators per state was 8.3, while it is 27 in California. Incubators that proliferated locally and nationally during the dot.com boom can be grouped in four categories, by using the following taxonomy:

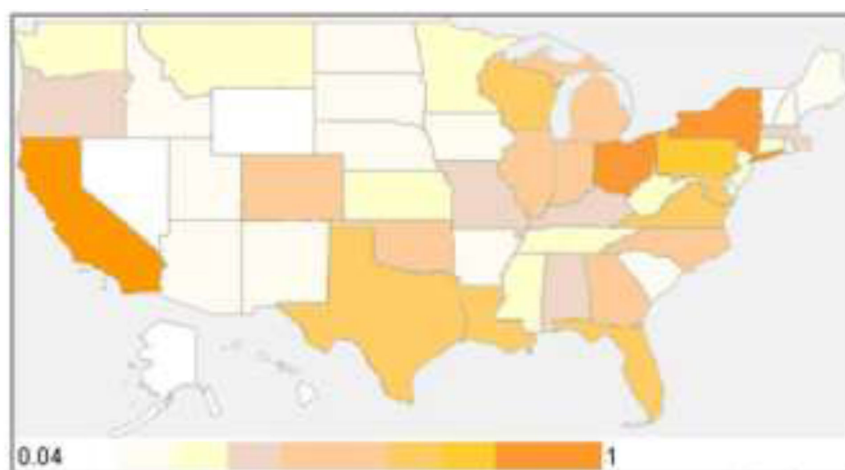
1. Local Economic Development Incubators
2. Academic and Scientific Incubators
3. Corporate Incubators
4. Private Investors' Incubators



ChubbyBrain

Google Docs
www.chubbybrain.com

Total incubated companies



ChubbyBrain

Google Docs
www.chubbybrain.com

Distribution of the Incubators in the US

Their main characteristics are summarized in the following table:

| | Local Economic Development Incubators | Academic and Scientific Incubators | Corporate Incubators | Private Investors' Incubators |
|---------------|---|--|--|--|
| GOAL | Non-profit | Non-profit | Profit | Profit |
| MAIN ACTIVITY | Generalists | High-Tech | High-Tech | High-Tech |
| OBJECTIVES | <ul style="list-style-type: none"> - job creation - re-industrialization / revitalization - economic development - support to particular target groups or industries - development of SMEs and clusters | <ul style="list-style-type: none"> - commercialization of technologies - development of entrepreneurial spirit - civic responsibility - image - new sources of finance | <ul style="list-style-type: none"> - to develop entrepreneurial spirit among employees – keep talents - monitoring - access to new technologies and to new markets - profits | <ul style="list-style-type: none"> - profits by selling stocks from a portfolio of companies allowing to risks to be spread. - co-operation between companies within the portfolio |
| TARGETS | <ul style="list-style-type: none"> - small commercial craft or service companies. - rarely hi-tech comp. | <ul style="list-style-type: none"> - projects internal to institutions prior to company creation - external projects | <ul style="list-style-type: none"> - internal and external projects, generally related to the activity of the company. | <ul style="list-style-type: none"> - technological start-ups generally ICT related |
| OFFERING | <ul style="list-style-type: none"> - hosting and shared services - administrative assistance - consulting <u>Occasionally</u> : coaching –training-networking access to financing | <ul style="list-style-type: none"> - concept testing - technical advice and support - intellectual property advice - seed capital - basic management advice - access to business angels and venture capitalists - access to industrial networks - strategic advice | <ul style="list-style-type: none"> - financial resources - prototype and market testing - access to commercial markets <u>Occasionally</u> : long-term strategic partnership - Access to multiple competencies | <ul style="list-style-type: none"> - management and strategy advice - supply of one or several types of financing and search of complementary financing. - personal networks - hosting and administrative assistance - legal services, public relations, recruiting, etc... |
| KEY PROBLEMS | <ul style="list-style-type: none"> - durability –lack of stability of resources - quality of management and provided-services - highly dependent on the quality of the manager - governance, risk of conflicts about the objectives, bureaucratic red-tape, time spent in negotiating with the different partners. | <ul style="list-style-type: none"> - legitimate inside the institution - legal status, governance, independence and operational flexibility. - income sources - management quality - access to external resources and network | <ul style="list-style-type: none"> - Strategic position of the incubator for the corporate structure. - management independence and ability to mobilize internal resources. - Durability of the mission of the incubator - conflicts about the objectives between the owners / the managers of start-up and the company. | <ul style="list-style-type: none"> - quality of projects sourcing - level and conditions of the incubator payment in comparison with provided services . - valorization of the incubator's participation at the entry and the liquidation. - durability of the incubator |
| TRENDS | <ul style="list-style-type: none"> - regular development - increasing territorial coverage | <ul style="list-style-type: none"> - rapid development under the aegis of public programs. | <ul style="list-style-type: none"> - testing of the concept in numerous companies - likely to develop | <ul style="list-style-type: none"> - high levels of consolidation and restructuring of the sector - still looking for a successful model |

By using this framework, California competitors are listed and grouped as follows.

1. Local Economic Development Incubators

- Business Technology Center of Los Angeles County (BTC), in Altadena: www.labtc.org.
- Central Valley Business Incubator (CVBI), in Fresno: www.cvbi.org.

- **The Contra Costa/Tri-Valley Telecommunication Incubator**, in San Ramon
- **The Daly City Business Center**, in Daly City: www.DalyCityBusinessCenter.com
- **El Pajaro Community Development Corporation**, in Watsonville: www.elpajarocdc.org
- **The Environmental Business Cluster (EBC)**, in San José: www.environmentalcluster.org
- **i3 Advanced Technology Incubator**, in Santa Clarita: www.canyonsecondev.org
- **Oakland Small Business Growth Center**, in Oakland: www.oaklandnet.com
- **Communications Technology Cluster (CTC)**, in Oakland: www.ctcluster.com
- **San Diego Technology Incubator**, in San Diego: www.sdincubator.org
- **Software Business Cluster**, in San José: www.sjsbc.org
- **BioCenter**, in San José: www.sjbiocenter.com
- **Women's Technology Cluster**, in San Francisco: www.wtc-sf.org
- **Redondo Beach Information Technology Center**, in Redondo Beach: www.techcenter.net
- **Santa Barbara Technology Incubator**, in Santa Barbara: www.sbtechnology.com
- **The Enterprise Network (TEN)**, in Santa Clara: www.tensv.org
- **Entretech**, in Pasadena: www.pasadenaentretec.com
- **CleanStart**, in Sacramento: www.cleanstart.org
- **Marina Technology Cluster**, in Marina www.marinatechnologycluster.org
- **Sonoma Mountain Business Cluster**, in Rohnert Park <http://sonomamountainbusinesscluster.com>

Amongst this category of incubators, we have to include another group of Silicon Valley incubators, also known as Ethnic Incubators or Foreign Incubator or Foreign Innovation Center. These incubators represent a US gateway for respective national emerging high-tech companies and reversely a gateway for US companies willing to enter into foreign national market

or to identify and work with a selected portfolio of emerging foreign-national companies. A selection of those incubators is:

- **US Market Access** (also known as International Business Incubator), established in 1995 in San José (www.usmarketaccess.com) is a non-profit business incubator and trade gateway into the United States for any (and only) high-tech international companies. It is mainly owned by the City of San José.
- **iPark Silicon Valley**, established in 2000 in San José, is the US gateway for South Korea's emerging information and communication technology companies seeking to establish and grow a robust presence in the U.S. market and vice versa. Now its operations are managed directly by KOTRA (<http://english.kotra.or.kr/wps/portal/dken>)
- **Jetro's Business Innovation Center**, established in 2001 in San José ([/www.jetrosf.org/bic/en](http://www.jetrosf.org/bic/en)), is the U.S.-Japan Business Incubator Center (U.S.-Japan BIC), which is supported by JETRO and hosted by USMAC.
- **ITRI International**, established in San José in 2000, (<http://www.itri.com>) is a R&D bridging institution between US and Taiwan, supporting Taiwanese startups by its VAS (Venture Acceleration Sphere) program and Incubation Center.
- **StepOne Ventures** (www.stepone.com), established in 2002 in Sunnyvale, is a consulting company that helps Spanish technology firms succeed in the US market. It provides business development and fundraising support, while it does not offer any [tangible] incubation service, such as offices or temporary management.
- **Irish Innovation Center**, it will start its operations in 2010 in San José (www.itlg.org) and will act as gateway in US for Irish start-up and viceversa.
- **Innovation Center Denmark**, established in Palo Alto in 2006 (www.siliconvalley.um.dk/en) act as a bridge between companies, research institutions and capital in Denmark and Silicon Valley. It accelerate the entry of Danish companies into Silicon Valley, promote US investments in

Denmark, facilitate research cooperation and provide inspiration to help drive innovation in Denmark.

- **Swissnex**, in San Francisco, is the Swiss Consulate technology and incubation arm which supports Swiss start-ups entry in the US market and viceversa.

We have to notice that, at this time, there is no Italian presence for Italian startup companies. Therefore, M3I USA could fill the hole left by the Italian government and become the future (in Italy only and with different brand from US based startups offering) Italian Innovation Center in Silicon Valley, a US gateway for Italian hi-tech startups, until Italian government will not set up its own Innovation Center in Silicon Valley.

2. Academic and Scientific Incubators

- **UCLA on-campus technology incubator** (housed in the CNSI): www.cnsi.ucla.edu
- **UCSF QB3 Garage**: <http://qb3.org/garage/home.html>
- **Santa Clara – Global Social Benefit Incubator**, www.scu.edu/sts
- **Momentum Biosciences–Biotech Incubator** (UCLA & Caltech) <http://www.momentumbiosciences.com>
- **Caltech OTT**: www.ott.caltech.edu
- **Stanford OTL**: <http://otl.stanford.edu>
- **Berkeley IPIRA**: <http://ipira.berkeley.edu>
- **UCSF OTM**: <http://otm.ucsf.edu>
- **UC DAVIS Innovation Access**: <http://www.innovationaccess.ucdavis.edu>

3. Corporate Incubators (selection; most of them operate as corporate VC rather than an Incubator)

- **NASA Commercialization Center**, in Ponomo www.acceltech.csupomona.edu/ncc/nasa.asp
- **Givan Institute** in Mountain View www.girvan.org
- **Panasonic Digital Concepts Center**, in San José: www.vcpanasonic.com

- **Chevron Technology Ventures**, in San Ramon: www.chevron.com/ctv
- **Steamboat Ventures** (The Walt Disney Company), in Burbank: <http://steamboatvc.com>
- **Qualcomm Ventures**, in San Diego: <http://www.qualcomm.com/ventures>
- **SAP Ventures**, in Palo Alto: <http://www.sap.com>

4. Private Investors' Incubators

- **Plug&Play Technology Center (PnP)**, in Sunnyvale: www.plugandplaytechcenter.com
- **Y Combinator**, Mountain View: www.ycombinator.com
- **Idealab**, in Pasadena: www.idealab.com
- **Forsightlabs**, in Menlo Park: www.forsightlabs.com
- **The Foundry**, in Menlo Park: www.thefoundry.com
- **ECompanies**, in Santa Monica: www.ecompanies.com
- **Arrowhead Research Corporation**, in Pasadena: www.arrowres.com
- **Opinno**, in San Francisco: <http://www.opinno.com>

Because of their business model, these incubators are the most similar and therefore strongest competitors. In this sense further information are provided below:

– **Plug&Play Technology Center (PnP)**, in Sunnyvale: www.plugandplaytechcenter.com. Founded in 2006 by Saeed Amidi, Plug&Play Tech Center is the leading IT startup accelerator in Silicon Valley. It has supported more than 500 tech start-ups on their path toward success and currently it is supporting more than 250 start-up companies (mainly: digital, ICT, web). It offers classic incubation services such as office leasing (3 sites in Sunnyvale, Redwood and Palo Alto, 17.000 m2 total), IT recruiting and administrative services. Moreover it has its own venture capital fund (Amidzad, with 70+ direct investments presently), a wide network of (about 90) institutional and corporate VCs (\$500+ mln raised in 3 years) and a certified list of business angels (P.A.P.A. Plug&Play Angels). In 2009 it launched ER (Executive in Residence)

program to provide incubated startups with seasoned entrepreneurs for temporary top management positions. It has strong relationship with many Universities and the objective to fund 2 startups annually out of each university in its network. PnP runs more than 100 events per year very well known in the Valley (such as PACT, iPhone Play and Clean Play). Finally, PnP has developed a wide network of international relationship with foreign incubators (such as Barcelona Activa), Universities (such as Cambridge and Singapore) and Government Agencies (such as Canadian and Australian Government).

– **Y Combinator, Mountain View:** www.ycombinator.com. Y Combinator is an American seedstage startup funding firm, started in 2005 by Paul Graham, Robert Morris, Trevor Blackwell, and Jessica Livingston. Y Combinator provides seed money, advice, and connections to startups in cycles of two 3-month programs per year. It doesn't provide startup with physical offices, since it funds mainly software companies and supports them only during their first business steps (i.e.: demo development). In exchange, YC takes an average of about 6% of the company's equity. Unusual among funding firms, Y Combinator provides very little money (\$17,000 for startups with 2 founders and \$20,000 for those with 3 or more). As of June 2009, Y Combinator had funded over 118 startups, the best known of which are reddit, Loopt, and Justin.tv. The number of startups funded in each cycle has been gradually increasing. The first cycle in summer 2005 had eight startups. In the summer 2009 cycle, there were 26.

– **Berkeley Ventures, in Berkeley:** www.berkeleyventures.com. Founded in April 2009 by Chris Doner, BV provides startups with shared offices (it has a 2.500 m2 headquarter) with an initial period of free rent, recruiting services (in partnership with UC Berkeley and Stanford), business mentorship, training programs and seed funding ranging from \$5.000 to \$ 10.000. By now it has 6 startups, mainly in software and web industry.

12 M31 USA Operations

“In the end, all business operations can be reduced to three words: people, product and profits. Unless you've got a good team, you can't do much with the other two.”

Lee Iacocca

In business economics operations are defined as those jobs or tasks comprising of one or more elements or subtasks, and which are performed typically in one location. Operations transform resource or data inputs into desired goods, services, or results, and create and deliver value to the customers.

12.1 Business Development Division

The Business Development Division of M31 USA provides a range of market related services to both M31's portfolio companies and other Italian high-tech companies. Overall, it plays the critical role to ensure a profitable P/L structure and a positive cash flow to the company from the very beginning of operations. The activities of the BD Division aim at reducing the initial investment done by the shareholders and at creating own financial resources covering the running costs and eventually for investments generated by the Technology Investment Division. In the BD-Div, market oriented professionals help and support the start-ups in terms of business development, marketing and communication, sales and after-sales service. The M31 USA BD-Div finds and activates sales and distribution channels within the US and provides marketing services, product management and post-sales support as well as technical service to the M31's portfolio start-ups in Italy. M31 USA enters also into separate contracts/agreements with those Italian companies that need and require business support.

Depending on the companies' individual needs and the related services, M31 USA utilizes different fee schemes which include fixed fees and commissions, whenever the latter apply. The Business Development Division also could consider offering its services to other companies, which are external to the M31 portfolio and are willing to have a presence in the US and in the Silicon Valley in particular. The BD Division operations will start immediately after incorporation.

12.2 Communication and Marketing

The Communication and Marketing Plan of M31 USA serves both internal Divisions and establishes the company as a reputable player at the intersection of technology transfer, start-up development, and venture investing.

Launch Phase

The launch of M31 USA is aimed at building awareness and credibility for the company in the Silicon Valley community and beyond. Specifically:

- Create an identity that is distinctive, attractive, and credible for its target audiences. Given that M31 USA, is a non-descriptive name, it will be important to communicate what the company does and what it stands for with a tagline and/or a brief description.
- Maximize the corporate visibility in order to place M31 firmly on the map of aspiring local entrepreneurs. These goals will require the following activities.

A – Content strategy:

- Naming/branding: identify niche, analyze & prioritize audiences & their preferences, and define the tagline.
- Messaging/positioning: identify and develop key messages that position the company clearly and unequivocally as a player in the US start-up space.

- Cultural mediation, e.g. adapt & localize key concepts and vocabulary used by M31 in Italy (e.g., social responsibility)
- Message consistency: ensure all US team members & key communications use main messages consistently

B – Development of corporate marketing collaterals:

- Corporate presentation;
- US website;
- Corporate videos;
- Other marketing materials

C – Media strategy & plan:

- Social media
- Online media
- Traditional US media

Ongoing Activities

A – Executive communication services:

- Speechwriting
- Media training
- Management/facilitation of key meetings

B – Point of Contact and spokesperson for all visibility-related opportunities

- Liaison with relevant constituencies as appropriate: local Italian organizations, US VC firms, local universities, etc.
- Evaluation and management of sponsorships (similar to Intelligenza Coraggiosa), endorsements (e.g. Mind The Bridge), and other opportunities for visibility

C – Development of M31 USA marketing materials to market products and services of M31 portfolio companies as well as of other Italian tech companies represented by M31 USA.

D – Ad-hoc coaching to ensure sales effectiveness of sales associates:

- public speaking
- leadership & influencing skills in the US

12.3 Value Proposition for BD Customer Companies

The BD Division faces a solid and heterogeneous competition in internationalization services arena, for its business development services for non-M31 startups, coming from:

- **Business development** services companies for the US market, with a specific value proposition for Italian companies (such as Project4U, www.projectforyou.com) or a broader geographic target (such as LMT Corporation, www.lmtcorporation.com).
- **Local economic development** companies, usually fully or partially owned by public institutions (such as US Market Access, www.usmarketaccess.com) that support business development in specific areas or under certain conditions.
- **Italian institutions for internationalization:** several Italian institutions support SMEs and other companies in their internationalization process, through services such as “sportello internazionalizzazione” and “centri estero” (provided by the local Chambers of Commerce), “Sportello regionale per l'internazionalizzazione” (provided by the Regional administrations), several services provided by the Italian Chambers of Commerce Abroad (CCIE, www.assocamerestero.it), Mondoimpresa (www.mondimpresa.it), ICE (www.ice.gov.it); some of these services are integrated in a web platform called Globus (<http://www.globus.camcom.it>).

Moreover, for any foreign company, it is always possible to create its own commercial branch in the US as soon as sales volume or American market strategic relevance make it more reasonable rather than buying services from an external provider, such as M31 USA. Another threat is also represented by the future, possible exit event of the Italian start-ups which

could end its business relationship with M31 USA. As most of the business developer in the Valley, the Business Development Division offers the following services to its customer companies and to outside companies too:

- **Company Profile and Contact Information:** this service is offered when the client knows the name(s) of the companies of interest, and is just seeking more information about them. Information requested may include a brief profile of the companies' major products/services, joint venture partners, major clients or projects, global presence, current contact information, as well as general financial information when available.

- **Market Analysis:** an analytical report of the US market that will help the client to make a decision on whether or not the US market is right for the company's product/service. Typical information includes current trends in the market, the size of the competition, and barriers (tariff and non-tariff) and incentives for entry.

- **Market Assessment:** provide customized and detailed reports of the client market and its competitors, including technology and market trends, potential distribution channels, competitive and substitute products, competitive history and strategy, and market projections. This report will empower the client to determine its opportunity in the US market and to make appropriate resource allocation decisions.

- **Competition Analysis:** an executive summary which includes a list of the 3 to 5 major competitors already present in the market, including a brief profile about the company's history, strengths, list of joint venture partners, and contact information.

- **Market Entry Strategy:** a report which provides the client with information on the most appropriate mode for entering the US market. It involves quantitative and qualitative research on the company's product, size, and experience in other international markets, as well as the type of customs tariffs the product is subject to.

– **Partner Identification and Introduction:** partner Identification involves identifying a list of potential companies that could be interested in a partnership with the client. The client can expect a 1–2 page report, which will include a list of potential partners (i.e. distributors, agents, reps, trading companies, competitors, prospective customers, and JV partners) complete with their full contact information. Partner Introduction involves contacting a number of companies on the client’s behalf, introducing them to the client, and relaying the gathered feedback to the client. The client can also expect a 1–2 page report summarizing the communication and feedback established with the companies.

– **In-country Partnership Screening & Analysis:** under this service, the BD Division will conduct actual phone and/or face-to-face interviews with a number of companies selected by the client and based on a set of 3–5 questions provided by the client. Following the screening process, the client can expect a 2–3 page report summarizing the communication established with the companies and the market intelligence gathered in the process.

– **Business Plan and Market Entry Review:** before making the leap into the US market, the BD Division can help the client to ensure that it is well positioned with its business plan and market strategy. It means reviewing its business plan for content, localization, format, and general quality to guarantee that it will meet the expectations of potential American business partners. In conjunction, BD Division will conduct a market entry review to assess and validate client potential in the US market. Along with a market assessment and competitor review, this will include a feasibility analysis of the financial projections provided in client’s business plan.

– **Pitch Coaching and Presentation Review:** as client primary opportunity to showcase its company to potential American business partners, its business presentation is a key component of its market entry strategy. In order to help it optimize its impact, the BD Division performs presentation review focusing on both content and presentation style.

– **Temporary Workspace Solution:** if necessary M3I USA will provide its Clients with a temporary workspace while visiting the Silicon Valley for a cost-based pricing.

When needed, some of these services could be provided by using subcontractors. Following the initial phases, M3I USA aims at extending the Business Development offering in order to provide one or more of the following services:

– **In-country Appointments/Logistical Support:** companies planning an independent visit may be interested in this service, which provides the client with customized one-on-one business appointments in country with contacts the client already has. In addition, we will provide logistical support such as visa, hotel flight-pick-up, and escorting the client to and from the meetings.

– **Trade Show Support Services:** this service includes registration to trade show, walking the show with the client, facilitating personal introductions, and hotel and transportation arrangements, among other services.

– **Trade Missions to and from the US:** the BD Division leads senior-level trade missions between American and Italian businessmen and women. The goal of these missions, which are typically 3-5 days long, is to explore trade and investment opportunities that hold the most potential for new business developments and improved trade relations between the two countries. Furthermore, the BD Division facilitates visa procedures, pre-screens contacts, arranges business appointments, and coordinates logistics, among other services.

– **One hour to multi day meetings and trainings with Silicon Valley institutions and companies**

– **Recruiting local US sales and marketing team**

12.4 SWOT Analysis

SWOT simply stands for Strengths, Weaknesses, Opportunity and Threats. SWOT analysis therefore is the process of accessing the strengths, weaknesses, opportunity and threats of an industry or organization. A SWOT analysis is so important that it has to be conducted frequently on a business.

Ajaero Tony Martins, *Building a Business: Using the SWOT Analysis to Dominate Your Niche*, Business Development Strategy, July 7th, 2010

Strengths

- An integrated know-how of products and technology with direct access to any information or assistance regarding them, thanks to M3I integrated business model
- A good relationship with some VCs and incubators, such as US Market Access (international business incubator in San José), with direct access to its database and network.
- Some distribution contracts signed and revenue flow already ongoing, representing a good bottom line to start with.

Weaknesses

- Foreign management team not yet fully integrated with Silicon Valley environment and therefore with an underdeveloped contacts portfolio
- Products portfolio to be promoted not yet well known in the US market and sometime still under development, resulting in potential risk adverse reactions
- Team working among its professionals still to be proved

Opportunities

- Tap into Silicon Valley opportunities/deal flow

- Large and virtually still unexplored market in the US for M31's portfolio startups
- Developing a reverse flow of revenues, generated by American companies willing to develop their business in Europe (to be shared with Italian sister company)

Threats

- US economy still relatively weak
- Competing local companies competing in the same space, category of the Italian start-ups or other clients of M31 USA

13 M3I startups and main technologies

Thanks to TT Venture partnership M3I is able to achieve its original vision, the one of a shared environment for its portfolio start-ups which creates a powerful internal ecosystem where those companies can find mutual support and synergies – where possible – otherwise not available should they operate out of their own location. TTVenture, the Technology Transfer Venture Capital Fund partner of M3I, is a privately run and capitalized fund, focused on high growth technological areas and pursuing a balanced risk approach. TT Venture has already established a significant network with universities, agencies and institutions and is now recognized as a reference VC fund in the Italian research environment. TTVenture is the first Italian closed-end fund dedicated to Technology Transfer: it aims at reducing the gap between R&D centers, companies and investors, supporting the development of high tech projects in the field of Biomedicine, New Materials, Agro-Food and Energy/Clean Technologies.



M3I Italia Portfolio, 2010

**Sensors, networks,
Artificial Intelligence**



**Virtual and Augmented
Reality industry
R.E.A.L. system patented
(Remote Expert Assistance
for Lines)**



M31 USA Portfolio 2010, that includes Italian M31 start ups plus two Italian high tech companies, henesis and V.R.Media.

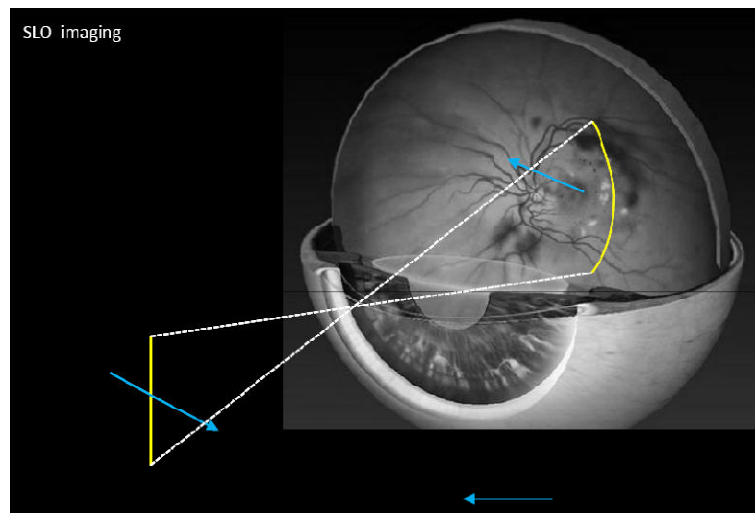
13.1 CenterVue

Mission Statement

Promote telemedicine-based programs for screening diseases with a major social impact through the development of leading-edge diagnostic systems and the provision of the services needed to promote and sustain the above programs, largely on the WEB.

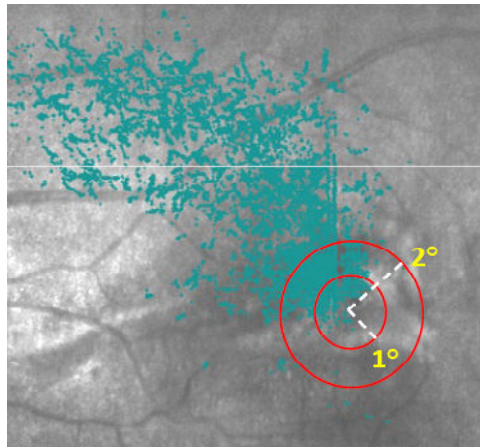
Maia

The most important product of Center Vue is MAIA a biomedical instrument for diagnostic ophthalmology, retinal screening purpose and macular integrity access prevention. According to World Health Organization 2008, AMD is the leading cause of visual impairment in industrialized countries and ranks third as a cause of visual impairment in the world. The innovation of this instrument is the use of the new SLO technology for image screening.



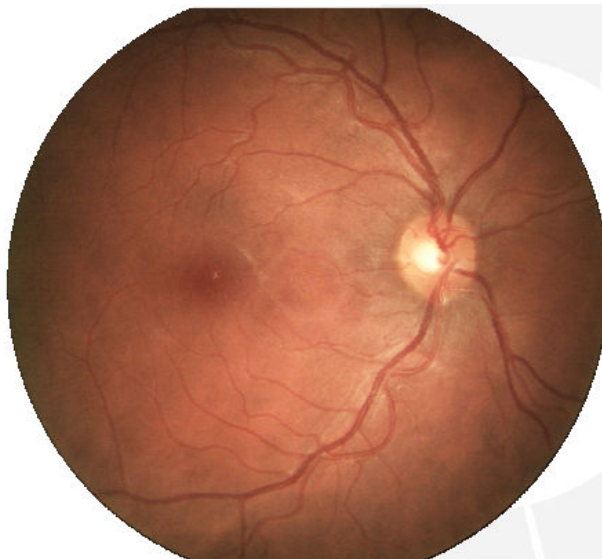
The scanning laser ophthalmoscope (SLO) provides a high-quality image of the fundus using less than 1:1000 of the light necessary to illuminate the fundus with conventional light ophthalmoscopy. During image acquisition, only one point on the fundus is illuminated at any one time. The laser sweeps across the fundus in a raster-like fashion so that a piece-by-piece image of the fundus is built up on the monitor. In addition, because the SLO only illuminates a small area of the fundus at any one time, only a small amount of the patient's pupil is used for illumination. This means that pupil dilation is not usually necessary when acquiring fundal images with the SLO. However, the optical resolution of the SLO is currently only 10–20 μm per pixel, and therefore is currently insufficient to be able to produce accurate measurements of retinal vessels.

Moreover MAIA technology is based on four main phases: high quality retinal imaging, automatic eye tracking, automated perimetry and software analysis. When an exam starts some lights impulse with different intensity are emitted in different parts of the retina around macula area. The patient is required to press the button of a mouse whenever he perceives these impulses. Once the exam is terminated, Maia software elaborates the data and gives a diagnosis regarding the patient macular integrity. During the exam Maia is also able to calculate the main area of fixation of a patient.



Retinal image of fixation point from MAIA

The second product manufactured from Center Vue is DRS, a fully automated retinal camera for screening diabetic retinopathy. Being the new frontier of non-mydriatic retinal imaging, DRS allow patient auto-sensing, auto-alignment and auto-focusing. Thanks to its fully automated operation, DRS requires minimal operator training. DRS is conceived to maximize patients flow and it is entirely operated through its intuitive touch-screen interface. It supports single- or multi-field acquisition protocols, providing seven different, standardized, 45° fields. Then DRS exam is very fast as the instrument works sensing the patient, self-aligns to the target eye, focuses the retina, adjusts the flash level and captures the image in less than 30 seconds.



Retinal image from DRS

13.2 SiI4 Embedded Solution

Vision Statement

To become a recognized industry leader in Embedded Hardware and Software solution.

Some history: from M3I R&D division to SiI4 Embedded Solution

SiI4 is a company grown in M3I Italy. M3I was established in 2006 in Padua and during the first year of activity it developed an inner division specialized in hardware integrated solutions. M3I first R&D team was formed by young post graduates from University of Padova. The beginning team increases its competences and knowledge of new technologies and in the mean time enlarges the R&D division. In 2007 M3I R&D takes part at the Embedded and Communication Alliance Program supported by Intel. M3I participates as General Member and shortly starts a partnership with Silica, branch of the multinational Avnet, leading company in the distribution of software and services for enterprise computing.

In 2008 M3I establishes a corporate called Embedded Solutions and starts an important collaboration with General Software, later acquired by Phoenix. The new company quickly starts to cooperate with two other startups incubated in M3I and needing electronics solutions for their products. In 2008 M3I finally finds a strategic partner with whom it launches a new company. On January 26th 2009 M3I releases Embedded Solutions branch and a new startup – SiI4 – was established.

On April 2009 SiI4 has already reached the break-even point. Just few months after opening, SiI4 starts a partnership with Freescale, the leading manufacturer of microcontrollers, microprocessors and semiconductors. Over the same year SiI4 sign an agreement with Silica, a division of Avnet Electronics Marketing EMEA, that today is the third largest semiconductor distributor in Europe. As a consequence of this agreement, on May 12 up to 16 2009, SiI4 takes part at Freescale and Silica

seminar in Padua where IMX27 microcontroller applications have been presented.

Si14 continues to expand its business with new partners and on May 27th 2009 the company enters in EtherCAT Technology Group, an Industrial Ethernet organization that supports and promotes worldwide the further technology development. Then from July 1th, Si14 started to be part of Line Avnet South Europa – the whole Avnet Group composed by Abacus, Memec, Silica, Ebv – and it started a collaboration for the distribution of Si14 products in the south of Europe. Si14 growth continues and on April the 19th 2010, NMI Electronics, a company specialized in designing electronic products, become Si14's partner in order to provide complete solutions in the Spanish market. Then on April the 28th, Si14 enters the US market and signs an important Distribution Agreement with Embedded Technology Inc, American leading supplier of embedded computing. On summer 2010 Embedded Innovator, and Intel magazine that focuses on the latest designs, ideas and solutions for today's embedded developers, published a white paper on Touch-Screen Automation Technology realized by M31 R&D in collaboration with Si14.

The definition of embedded system is a computer system designed to perform one or more dedicated functions often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Physically, embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants, just to mention some typical applications. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure.

Si14 develops and manufactures state-of-the-art Embedded Computers, integrated systems and turn-key solutions including hardware, software and custom interfaces. Applications include:

- Computational Vision and Image Processing
- Biomedical Instruments and Monitors

- High Speed Telecommunication Devices
- Real-Time Control of Industrial Processes
- Building & Home Automation
- Gaming Machines, Kiosks, Point-of-Sales
- Digital Signage
- In-Vehicle Infotainment Units

Main developed skills are as per following.

- Hardware design & development:
 - Schematics and layout development for x86, ARM and PowerPC architecture, FPGA/ASIC, A/D, D/A and signal conditioning
 - Electrical lumped parameter pre-layout simulation in order to reduce time and development cost
 - Electrical distributed parameter post-layout simulation in order to reduce prototyping and production cost
 - Customization of the technology in any kind of solution
- Firmware design & development:
 - BIOS sources development and customization for x86 platforms
 - Design and support for both Linux and Windows
- Distributions
 - Linux and Windows custom operating system support
 - Data processing using FPGA/PLD devices
- Software design & development:
 - Object oriented design;
 - Application-specific, fully integrated software solutions
 - Real Time Operating Systems, Linux and Windows distribution and drivers

- Other:
 - Embedded Wi-Fi 802.11 b/g/n and WiMax technology



Mirach board, Intel® Atom™ processor Z5xx series

13.2.1 Open Embedded Linux on ARM Technology

Si I4 main expertise is on developing and manufacturing off the shelf embedded solutions based on ARM processors and supported by Linux OS.

Features like Graphical User Interface (GUI), TCP/IP networking, USB, Flash file system are needed in more and more embedded products. Using Linux as OS is a very good way to quickly add these features in your product (assuming your ARM target hardware has enough memory). But writing Linux based applications is quite different from writing stand-alone, no OS applications. One of the biggest advantages of Linux is that it is an open source OS available under GPL, which means you don't have to pay royalty when you sell your product. No wonder, Linux is number choice as an embedded operating system for ARM micro-controllers. Moreover, more and more real-time variants of Linux are now available – especially for use in those applications that demand real-time performance.

In all of the past years' Linux hype, journalists missed to notice that Linux is Unix in all but legal title and that differences between most features of Unix and Linux are trivial (at least in comparison with the fundamental differences between versions of MS Windows). All modern Unixes operate

in fundamentally the same way, because they all implement the same set of international standards ('Single Unix' and POSIX) governing the interaction of applications and hardware. Everything Unices do is built on these standards and Linux implements them more consistently than many. That's one of the reasons why Linux could be so easily ported to virtually every hardware platform available. A fundamental understanding of Linux not only provides a good grounding in this OS, it also encourages platform independent skills in general computing, e.g. in system administration, programming, network management, security, etc. Because it is open and standards based, Linux leave open the system's software sources to its administrator and can only be managed well by those who understand underlying computing principles. Therefore Linux is making steady progress in the embedded systems scenario. Because Linux is covered under the GPL (General Public License), anyone interested in customizing Linux to his PDA, palmtop, wearable or even embedded device can download the kernel and applications freely from the Internet and begin porting or developing.

For this and more reasons Si14 organized trainings to its sales representative in order to teach people fundamentals on using Linux OS on its modules and to give them the whole understanding how powerful embedded solutions market is today, especially when developed in an open environment as Linux.

Linux OS

The following quotes are taken from the Linux Kernel README, and it is the official description of the Linux Kernel:

Linux is a Unix clone written from scratch by Linus Torvalds with assistance from a loosely-knit team of hackers across the Net. It aims towards POSIX compliance.

It has all the features you would expect in a modern fully-fledged Unix, including true multitasking, virtual memory, shared libraries, demand

loading, shared copy-on-write executables, proper memory management and TCP/IP networking.

It is distributed under the GNU General Public License.

Further information on the Linux Kernel can be found on the main kernel.org site.

AMR Linux

ARM Linux is a port of the successful Linux Kernel to ARM processor based machines, started mainly by Russell King, with contributions from countless others. ARM Linux is under constant development by various people and organizations around the world. The ARM Linux kernel is being ported, or has already been ported, to more than 500 different machine variations, including complete computers, network computers, hand held devices and evaluation boards.

Linux Support for the ARM Architecture

Linux is an open source operating system running on all major processor architectures, including ARM processors. It is supported by a large group of engineers contributing back into the open source (similar process to the FSF's GNU tools). This makes Linux a very dynamic and fast moving operating system. Furthermore, once the kernel is ported to a new architecture, most of the user-space tools are readily available and require little or no adaptation.

Key benefits of Linux on ARM:

- Complete scalable operating system providing a reliable multi-tasking environment
- Based on an open source model (GPL)
- Leverage a wide range of UNIX and open source applications
- Huge number of application that can be ported to a standard based system
- Early availability on ARM processor-based platforms
- Used in many ARM technology-based designs including networking and wireless space

- Broad support through open discussion forums
- Responsive community of collaborators
- A well known programming environment
- Running the same application on the target as on the host
- Good price and no bookwork regarding licenses
- Net resources – e.g. handhelds.org, Open Source Operating Systems for Handheld Devices
- Guarantee of support in the future

Si14 BSPs – Linux Virtual Machines

Si14 BSPs are offered as a Linux virtual machine, which uses the OpenEmbedded cross-compile environment. We use Linux OS because of different reasons:

- OpenEmbedded runs on Linux
- Linux offers an interface which is common to all the different devices running it; this makes it easy to develop cross-platform applications
- NFS and TFTP services are required for development and debugging.

The reason why Si14 work on a Virtual Machine running Linux is that it can be used on any host OS thanks to VirtualBox / VmWare Player and it avoids distribution-specific issues. Then cross-compilation tool-chain is already configured and ready to use in a Virtual Machine and other useful services are already set up. Finally it is an efficient instrument easy to update and maintain and, as a standardized environment, it is more adapt when giving customer support.

Open Embedded and Linux: Si14 solutions based on Ångström distribution

OpenEmbedded Project is a framework that allows developers to create a complete Linux Distribution for embedded systems.

Key features are:

- Lightweight, fast, customizable
- Specific ARM patches included

- Thousands of packages readily available (including graphic libraries, web technologies, X server...)
- Well documented
- Actively maintained (<http://www.openembedded.org/>)

The Ångström distribution is a Linux distribution for a variety of embedded devices. In particular Angstrom is an OpenEmbedded-generated distribution for ARM technology. The distribution is the result of a unification of developers from the OpenZaurus, OpenEmbedded, and OpenSIM pad projects. Our standard Linux file system contains an enhanced Angstrom version, including several packages useful for embedded systems.

13.3 Zond: M31 R&D division

ZOND is the core engineering and software team of M31. Composed by more than fifteen highly skilled specialists, it is primarily focused on the development and implementation of new technologies and deploying novel products and services in the ICT world. Its offerings range from the design of applications or web-services to complex solutions dealing with distributed systems of customized hardware and firmware modules.

Mission Statement

ZOND has identified a set of objectives to perform its mission. For each objective, a strategy has been outlined and is being carried on.

- **Keep maximum technology advantage:** Zond invests and capitalizes on scouting and exploring new hardware and software technologies. Its strategy is obtaining key exclusive partnerships with Si14 (M31 firm with a technology

advantage in Intel Atom and ARM chips) and with Nokia's Qt, keeping Zond ahead of equivalent competitors.

- Capitalize on **core know-how** and developed technologies: for each project, Zond accumulates the developed hardware and software technologies, progressively minimizing following project time to completion and development. At the same time, a royalty scheme of the developed technologies represents Zond main investment in mid-term cash flow.
- **Research activity** as added value and further differentiation: thanks to its strong links with several advanced Engineering research labs at DEI (Department of Information Engineering at the University of Padua), Zond invests in applied research to provide further added value to its range of services and applications. Similar effort will be put in developing new patents.
- **Mind-mining**: Through continuous formation and offering several stages and training positions, Zond selects and recruits the best promising engineering talents from the DEI. These young minds form Zond core team of excellence.
- **Network of Partners and Consultants** : As for its top notch hardware and software, Zond focuses also on selecting high quality partners and consultants in order to raise the quality of supplied services and to offer maximum training quality to its core team.

Zond over the years has developed following main skills and expertise:

- Design and implementation of “networks of things” (networks of sensors and actuators), such as surveillance networks or home automation systems.
- Strong expertise in Qt programming (Qt is the most advanced and fast growing C++ programming framework available today – just acquired by Nokia).
- Design and implementation of custom firmware for Atom or ARM based embedded systems.

- Web 2.0 development using Ruby on Rails & PHP (EKN – the Eye Knowledge Network).
- IT Service design and implementation (M31 Headquarters, spinoff services, customer IT service offerings). Experienced with multimedia frameworks and streaming.

13.3.1 SAN, Sensor Actor Network

In 2008 Zond has performed a study of the house automation products present on the Italian market and has designed and developed a new approach and product line for Master Divisione-Elettrica. Deliverables include an advanced imx-27 based microcomputer, touch-screen interfaces and web-services. These products, together with innovative iPhone/iPod based controls, have been preliminarily presented in February 2009 and represent a new, top-quality, highly-competitive, richer product line at a fraction of the cost of similar products. SAN framework was started under commission of a Zond customer, Master, and today is the main prestigious IP of M31 R&D.

On last June a white paper has been issued on Intel Newspaper regarding SAN technology. Here below some quotes of the scientific article wrote by By Fabio Dalessi, CTO, M31 S.p.A. General Member of the Intel® Embedded Alliance.

TOUCH-SCREEN AUTOMATION SIMPLIFIED

Sensor and Actor Framework Enables Rapid Innovation

“The profusion of consumer devices with continuous connectivity, fluid graphics, and intuitive touch interfaces is raising expectations in automation markets—including industrial automation, building automation, and home automation. These new expectations create difficult challenges for developers, who must implement the latest network and user interface innovations while minimizing cost and time to market. These

development challenges are amplified by the fact that automation markets are highly fragmented, with each application presenting a unique set of requirements.

.....

Embracing these market needs, M31 subsidiary Si14 provides highly modular solutions based on low-power Intel® Atom™ processors and the Nokia* Qt* application and graphical user interface (GUI) framework. Intel Atom processors let designers execute the same code both in a desktop PC and in the field, greatly reducing the length of debugging and testing. The Intel Atom processor can also run graphics-rich applications, meeting customer demands for compelling and natural user interfaces.

...

Internet of Things. The convergence of Web-service standards and protocols as a “lingua franca” for Machine-to-Machine (M2M) communications is boosting the interoperability of machines and is leading to what is often called the Internet of Things. In this paradigm, even the simplest of objects are online. In a household, for example, a single kitchen lightbulb can communicate with other lightbulbs in the house and is addressable and controllable from the Web. According to a recent study by Juniper Research, M2M communications is expected to be a \$100B USD/year business this year, with the number of connected devices growing exponentially to 412 million by the year 2014 (see Figure 1).

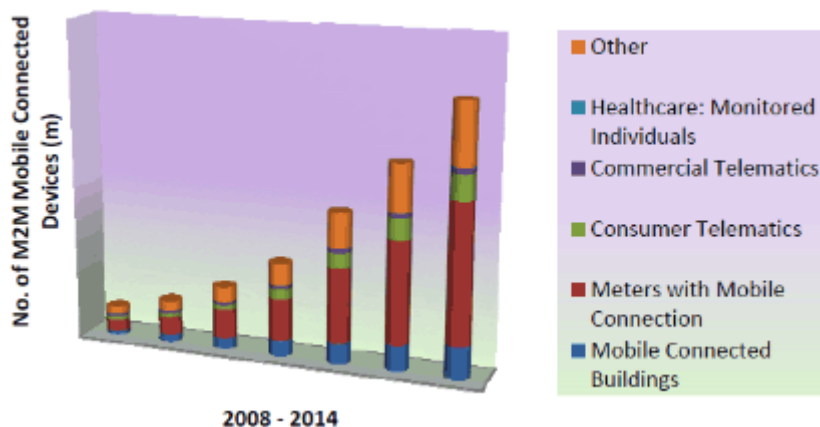


Figure 1. The number of mobile M2M will rise to 412 million by the year 2014. Source: Juniper Research, “MSM - The Rise of the Machines,” 2009.

Intel- and Qt-based solutions

As noted earlier, Si14 is addressing these market needs with modular solutions based on Intel Atom processors and the Nokia* Qt* software framework. Figure 2 illustrates one of our hardware platforms, the Si14 Ultra Mobile PC. This platform measures only 82 x 134 mm, yet it provides a complete PC solution. The board features an Intel® Atom™ Z5xx family processor and a variety of optional industrial and consumer I/O. We chose the Intel Atom Z5xx family as the basis for our hardware for a number of reasons, including:

- Low power consumption—under 5W for the processor and chipset—which supports the fan-less design requirements common in industrial automation.
- Wired and wireless connectivity features, allowing our devices to be part of the growing Internet of Things.
- Robust graphic capabilities, allowing the delivery of graphics-rich applications that present a natural and efficient interface to end users. In our case, the 3D accelerators incorporated into the Intel Atom Z5xx processor series chipset are particularly important. As we will show, our software uses 3D graphics to provide smooth user interfaces.

A case study: Si14 SAN Framework

The Si14 Sensor and Actor Network (SAN) Framework is a combination of hardware and software modules for industrial automation. On the software side, the solution builds on the Nokia Qt framework to provide a set of high-level design tools, APIs, and interfaces. These high-level tools include a uniform XML standard that allows developers to create control networks entirely in easy-to-understand XML. Developers who want lower-level control over their systems can use JavaScript, or can drop down into C++. Modules in the SAN Framework include:

Gateways. At the core of our framework, the gateways manage the abstraction, routing and communication of sensing and acting devices. The gateways serve as a bridge between the Internet and one or more automation-specific buses, thereby exposing sensing and acting devices to the Internet. The gateways can also interact with one another, allowing a

system with multiple automation networks and multiple gateways to be fully integrated.

- Thanks to the use of standard technologies such as XML, JavaScript Object Notation (JSON) and RESTful web services, the gateways act as a unifying platform which readily interfaces with other existing frameworks and can easily integrate additional components, architectures, and technologies. The gateways support the vast majority of home and industrial standard radio or wired buses and protocols, such as Ethernet, Wi-Fi*, RS232 and RS485, CAN, and ZigBee*. Adding protocols and devices is easy because every component of the framework is expandable via plugins.
- Each gateway can also run an embedded Web server, allowing users to access the system remotely from a standard Web browser on their PC or smartphone.

Human Interfaces. These are graphic software modules used to configure and control the system. They provide smooth visual interfaces based on multitouch screens and advanced 2D/3D OpenGL effects. With these advanced interfaces, controlling even the most complex situation can become straightforward and intuitive. Thanks to the advanced graphics engine integrated into the Intel Atom Z5xx family chipset, we can deploy highly sophisticated interfaces on the gateway itself without bogging down the processor. Alternatively, the interface can run on a remote desktop.

Web supervisory control and data acquisition (SCADA) application. The whole SAN Framework is Web-enabled, allowing the sensors and actors to be exposed on the Internet through SCADA-specific interfaces for remote monitoring and control. The system can also interact with Web-based M2M services thanks to standard JSON and RESTful interfaces.

- The SAN Framework enables the abstraction and control of complex systems in homes, buildings, and industry. Example applications include solar panels, cash machines, kiosks, and domestic appliances. Figure 3 illustrates typical applications and system architectures.

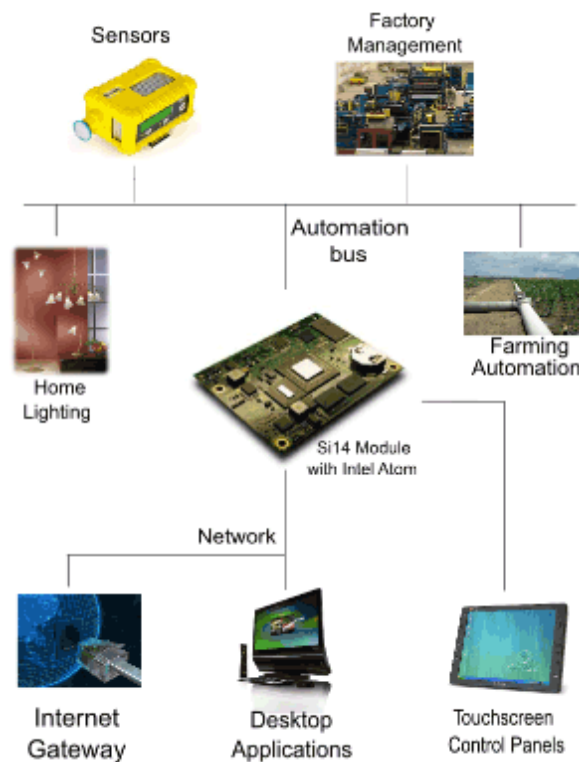


Figure 3. Example system architecture and applications possible with the SAN Framework.

One of the main advantages of this framework is its ability to interconnect and integrate different devices, enabling them to interact in a coordinated and consistent way. Thanks to its use of QtScript—a simple and powerful ECMAScript-based language—the framework makes it possible to define complex system behaviours and reactions. Developers can build countless scenarios, enabling the system to manage almost any conceivable event. In addition to meeting the needs of today’s systems, this adaptability and expandability allows developers to future-proof their products.”

13.3.2 Last Inch Technologies

As of today, the market is very rich in vendors of hardware boards to be used in the embedded market. Such huge hardware offering is always coupled with reference hardware designs and – more or less– extended Software Development Kit (SDK)

with the purpose of helping the purchasers of the hardware boards with the reduction of hardware and software development costs.

Most of the times, though, even if using the full SDK, the purchaser still has to face the task of developing the final application and firmware, often from scratch. Such task may require a very specialized and trained development team with specific embedded development skills, that small or medium companies, willing to innovate their products, cannot afford.

That is why Si14 embraces the following emerging approach: providing modular hardware boards not accompanied just by a general purpose SDK but by a full, *uncustomized*, "vanilla" software solution targeting a specific market segment. This highly coupled software solution, specifically tuned on the supplied modular hardware, only needs the very final customization to be made, allowing to effectively cut costs, and, as a side effect, attracting new customers. Modern embedded market is dominated by the driving force of everyday intelligent devices such as smart phones and net-books. These devices are creating new standards in common expectation on how a 2x4in piece of silicon should perform and interact with users.

Such a large offer of features-rich, low-power, cost-effective hardware solutions even if mainly targeted at a mass production market, represents also a great opportunity and challenge for medium and small companies willing to innovate their products according to new connectivity demands and emerging paradigms of human-machine interaction.

In addition, for certain large-scale application domains, hardware vendors provide specialized Software Development Kits (SDK). An SDK is mainly a set of software libraries accompanied by documentation, demonstration code, and various tools that help developers at writing their own target applications. This term is becoming more and more popular with the advent of applications for smart phones and app stores. The constant-rate growing of this market prompts vendors to improve and enrich their SDKs. With a better SDK developers can attract more end customers by reacting faster to their needs, and developing better and more appealing applications. Finally,

more end customers translates into more revenues for the hardware vendor.

These SDKs are so rich and continuously improved both by companies and supporting user community that developers can write applications that require only the very last-inch piece of work, just what developers are really interested on. All boring details related to the specific hardware, sensors and actuators are hidden and compressed behind a single line of code. In more niche sectors, the above is not true, and, for obvious reasons, hardly can ever be so. In fact, custom hardware and small volumes discourage big vendors providing last-inch solutions. Nevertheless, as we will demonstrate with a real world example, bridging the concept of last-inch solutions – with the adequate adjustments – also to smaller markets can be quite profitable both for hardware vendors, industrial players and end customers.

Indeed the typical interaction between medium/small companies and innovation issues is: first a great enthusiasm motivated by a smart idea, maybe borrowed from daily usage of some nice piece of embedded product. Finally, the idea is simply given up causing a loss for the innovating company, a missed revenue for hardware vendors and lower quality and usability for end users.

The last-inch approach is the challenge and opportunity to not look at customers just as customers but as partners in building each own value.

In this sense, the last-inch approach is aimed at:

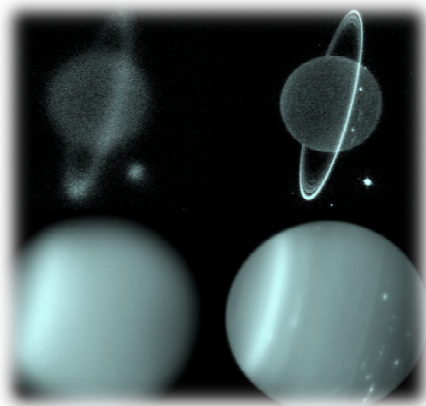
- simplifying hardware design though the reuse of complex ready-to-use modules, leaving the industrial partners to implement a straightforward peripheral board for their needs
- offering a unique interface to talk to, that alleviates the hardware/software dichotomy in favor of a higher level, application-oriented perspective
- providing partners with an SDK that lets them reach the last-inch phase at no-effort, while retaining the ability to customize the application at their needs
- promptly supporting partners during their last-inch phase, to mitigate the absence of a rich community

13.4 Adaptica

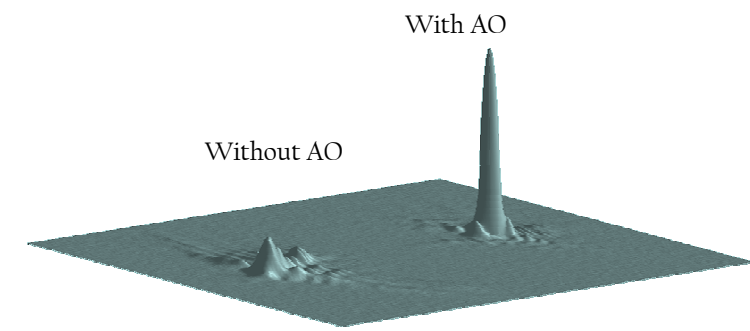
ADAPTICA designs and manufactures adaptive optics components and systems, deformable optical elements and high performance, easy to integrate, opto–electronic devices for the optimization and enhancement of optical systems.

Through the use of the most modern optical, mechanical and electronic technologies ADAPTICA develops embedded adaptive optics systems with characteristics of size and cost that makes them easily fit into existing optical systems or in course of design.

Adaptive optics (AO) is a novel technology used to improve the performance of optical systems by reducing the effects of changing optical aberrations. Created for astronomical applications AO is now a key technology for many different industries. Adaptica thinks to move from Astronomy and general scientific applications going to industrial applications.



Uranus with the Keck Telescope: Credits:Hammel, De Pater (Keck Obs.)



Improving of the performance of optical systems by reducing the effect of wavefront distortions, was a technique used in astronomical telescopes and laser communication systems to remove the effects of atmospheric distortion, and in retinal imaging system to reduce the impact of optical aberrations. Adaptive optics works by measuring the distortions in a wavefront and compensating for them with a spatial phase modulator such as a deformable mirror or a liquid crystal array. The aberration of the incoming light beam is detected by the wavefront sensor that controls the deformable mirror through the electronic control in order to compensate for any such aberrations.

Adpatica in just one year since it was incorporated in M31, has developed five Adaptive Optics products of which 3 are deformable mirrors and 2 are complete system. One of Adaptica key advantage is its capability of developing a whole adaptive optics solution, a system made up of deformable mirrors, wevefront sensor and control electronics. The following block scheme represents a very simple adaptive optics system.

Besides its original use for improving nighttime astronomical imaging and retinal imaging, adaptive optics technology has also been used in other settings. Adaptive optics is used for solar astronomy at observatories such as the Swedish 1-m Solar Telescope. It is also expected to play a military role by allowing ground-based and airborne laser weapons to reach and destroy targets at a distance including satellites in orbit. The Missile Defense Agency Airborne Laser program is the principal example of this.

Adaptive optics has been used to enhance the performance of free space optical communication systems. Medical applications include imaging of the retina, where it has been combined with optical coherence tomography. Development of an Adaptive Optics Scanning Microscope (ASOM) was announced by Thorlabs in April 2007. Adaptive and active optics are also being developed for use in glasses to achieve better than 20/20 vision, initially for military applications. Thus other main applications of this technology now coming out are:

- Enviromental Video surveillance
- Microscopy, which can benefits of AO for static lens correction.
- Wide Field Microscopy, strong reduction of the cost of high quality optical objectives is achieved by the use of AO
- Robotics Vision AO allows real time optical accommodation for robotics vision
- 3D imaging the use of AO allows to increase the instrumental depth range.
- Satellite or UAV optics, AO for reducing the dimensions and weight of satellite or UAV optical layout (Fraunhofer Institute for Photonic Microsystems)

13.4.1 Mathematical origin of adaptive optics

In mathematics, the Zernike polynomials are a sequence of polynomials that are orthogonal on the unit disk. Named after Frits Zernike, they play an important role in beam optics. There are even and odd Zernike polynomials. The even ones are defined as:

$$Z_n^m(\rho, \varphi) = R_n^m(\rho) \cos(m\varphi)$$

And the odd ones as:

$$Z_n^{-m}(\rho, \varphi) = R_n^m(\rho) \sin(m\varphi)$$

where m and n are nonnegative integers with $n \geq m$, φ is the azimuthal angle, and ρ is the radial distance $0 \leq \rho \leq 1$. The radial polynomials R_n^m are defined as

$$R_n^m(\rho) = \sum_{k=0}^{(n-m)/2} \frac{(-1)^k (n-k)!}{k! \left(\frac{(n+m)}{2} - k\right)! \left(\frac{(n-m)}{2} - k\right)!} \rho^{n-2k}$$

for $n - m$ even, and are identically 0 for $n - m$ odd.

For $m = 0$, the even definition is used which reduces to $R_n^0(\rho)$. Rewriting the ratios of factorials in the radial part as products of binomials shows that the coefficients are integer numbers:

$$R_n^m(\rho) = \sum_{k=0}^{(n-m)/2} (-1)^k \binom{n-k}{k} \binom{n-2k}{(n-m)/2-k} \rho^{n-2k}$$

A notation as terminating Gaussian Hypergeometric Functions is useful to reveal recurrences, to demonstrate that they are special cases of Jacobi Polynomials, to write down the differential equations, etc.:

$$\begin{aligned} R_n^m(\rho) &= \left(\frac{n}{(n+m)/2} \right) \rho^n {}_2F_1 \left(-\frac{n+m}{2}, -\frac{n-m}{2}; -n; \rho^{-2} \right) \\ &= (-1)^{(n+m)/2} \left(\frac{(n+m)/2}{(n-m)/2} \right) \rho^m {}_2F_1 \left(1+n, 1-\frac{n-m}{2}; 1+\frac{n+m}{2}; \rho^2 \right) \end{aligned}$$

for $n - m$ even.

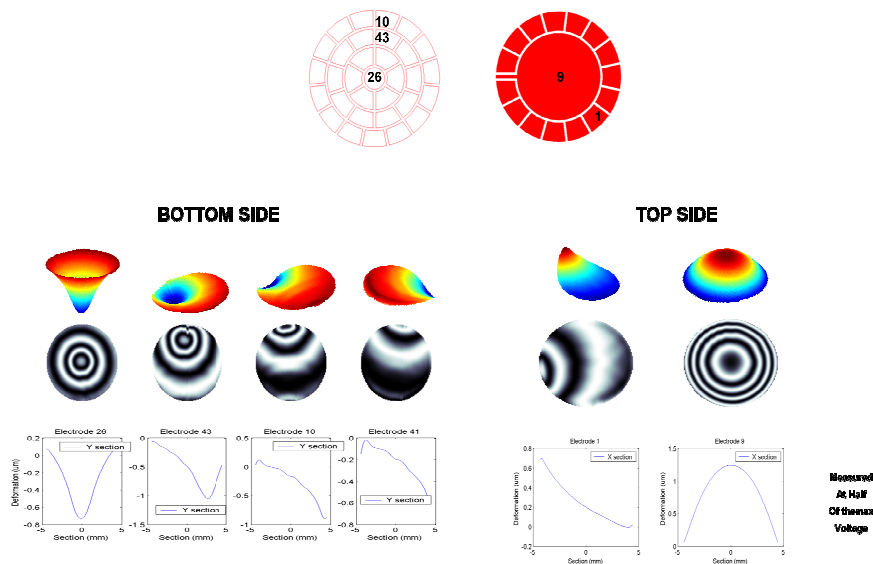
The functions are a basis defined over the circular support area, typically the pupil planes in classical optical imaging at optical and infrared wavelengths through systems of lenses and mirrors of finite diameter. Their advantage is the simple analytical properties inherited from the simplicity of the radial functions and the factorization in radial and azimuthal functions; this leads for example to closed form expressions of the two-dimensional Fourier transform in terms of Bessel Functions. Their disadvantage, in particular if high n are involved, is the unequal distribution of nodal lines over the unit disk, which introduces ringing effects near the perimeter $\rho \approx 1$, which often leads attempts to define other orthogonal functions over the circular disk.

In precision optical manufacturing, Zernike polynomials are used to characterize higher-order errors observed in interferometric analyses, in order to achieve desired system performance.

In optometry and ophthalmology the Zernike polynomials are used to describe aberrations of the cornea or lens from an ideal spherical shape, which result in refraction errors.

They are commonly used in adaptive optics where they can be used to effectively cancel out atmospheric distortion. Obvious applications for this are IR or visual astronomy, and Satellite imagery. For example, one of the zernike terms (for $m = 0, n = 2$) is called 'de-focus'. By coupling the output from this term to a control system, an automatic focus can be implemented.

Another application of the Zernike polynomials is found in the Extended Nijboer–Zernike (ENZ) theory of diffraction and aberrations. Zernike polynomials are widely used as basis functions of image moments.



Characteristics of Saturn, an Adaptica deformable mirror

In addition to the Hardware solutions, Adaptica develops also the whole software architecture for its system. The software structure is based on a client server system which comprises the following:

Server

- Basic level AO libraries to control the mirror voltages (shape) – AOLIBS
- Server SW for:
 - Controlling the AOLIBS

- Command all IO64 from the inside
- Controlling IO64 from the Ethernet

Client

- SW to control IO64 – Distributed in a USB PEN inside the IO64 package

13.5 Adant

Adant's technology enables reliable and increased data rate wireless connectivity. It consists of a driver and physical reconfigurable antenna subsystem suitable to improve almost any wireless communication system.

Vision Statement

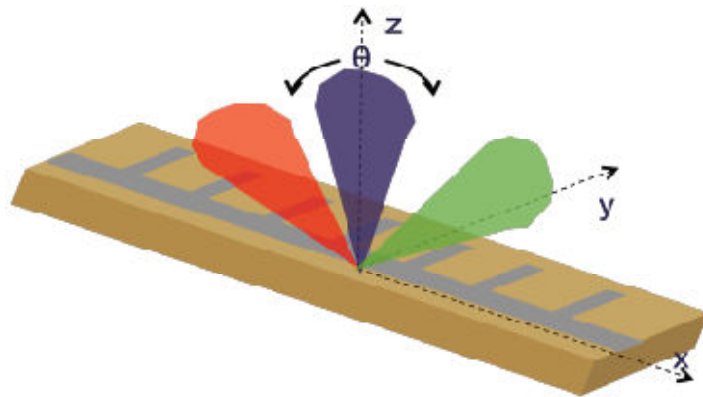
ADANT's vision is to become the smart antennas market leader by providing

- Increased channel capacity at any given signal to noise ratio (SNR) and for the same available bandwidth
- More reliable connection
- Consume less power at fixed transfer data-rate to any wireless communication systems.

Technical overview

An antenna is a transducer designed to transmit or receive electromagnetic waves in free space. It is a necessary building block of a communication system that allows transmitting a signal in space without any need for cables. Most of the antennas employed nowadays in standard communication systems radiate the energy with static polarization and fixed direction. However it is possible to employ different techniques to vary the electrical characteristics of an antenna and dynamically change its radiation properties (direction of radiation, polarization state and frequency of operation). Such antennas are classified as reconfigurable antennas. The working principle of a type of reconfigurable antenna is shown in

following Figure. The direction in which the energy is radiated can be dynamically varied for a fixed frequency of operation.



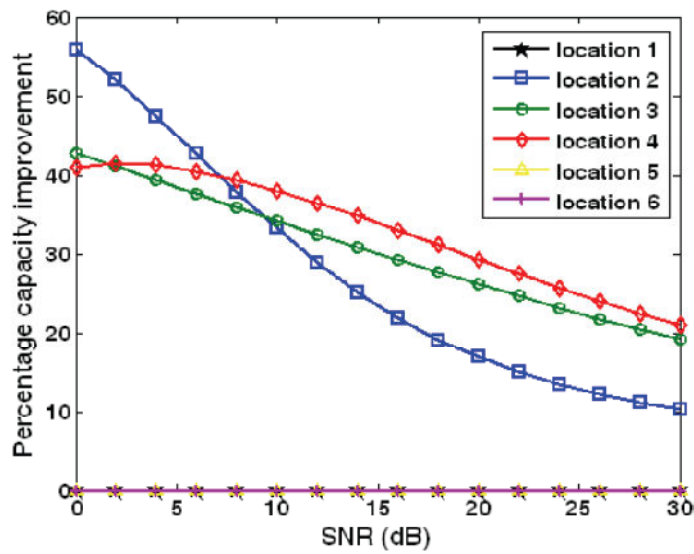
Reconfigurable antenna with beam scanning capabilities. The direction in which the energy is radiated can be dynamically varied for a fixed frequency of operation.

The founding team of Adant has developed reconfigurable antenna systems tailored for MIMO wireless communications and RFID. These reconfigurable antenna systems use RF switches like PIN diodes, FET transistors and MEMS switches or variable capacitance like varactor diodes to dynamically change the current distribution on the antenna structure and change the antenna radiation properties. Using such switching system the antenna radiation properties can be reconfigured in the order of nanoseconds allowing for real time system adaptation.

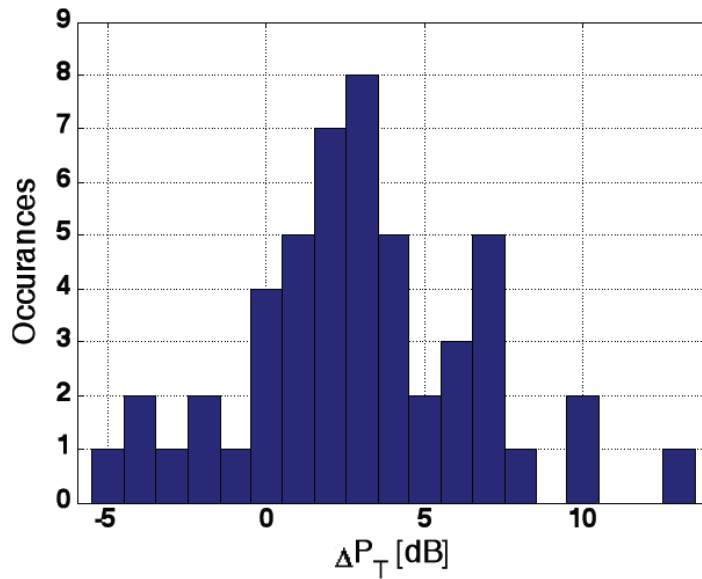
Reconfigurable antennas for MIMO systems

MIMO technology is a novel and revolutionary communication technique that uses multiple antennas at the transmitter and at the receiver to increase the spectral efficiency and throughput with respect to standard systems. In order to take full advantage of MIMO systems it is necessary to have several antennas spaced far apart one from the other; this in general prevent integrating the technology on portable devices. Moreover the current MIMO technology can be highly

improved, dramatically increasing the throughput and the wireless connectivity. This can be achieved through Adant's reconfigurable arrays. These antennas, by dynamically changing their radiation properties, allow selecting the optimal channel over which transmitting the information. As depicted in Figure 8, in standard MIMO communication systems, there is a single channel between the transmitter and the receiver that can be used to transmit the information. Using Adant's reconfigurable antennas different channels can be generated (each corresponding to a particular signal multipath) and the one that provides optimal connectivity can be selected. In order to properly selecting the array configuration at the transmitter and at the receiver without the need of switching between all the possible antenna configurations Adant's has developed a proprietary algorithm that is used to drive the antennas. Such algorithm is loaded on a microcontroller and it is used to set the necessary DC bias needed to activate the antenna switching system. Note in fact that a DC bias is used to activate the switching network used to tune the array radiation characteristics. Adant's antenna system first sense the wireless channel and then select the antenna configuration that allows for optimal performance. The improvement that can be achieved using Adant's technology over standard non reconfigurable antenna systems consists mainly in higher throughput and reduced power consumption for a fixed data rate. Figure 9 shows the results of capacity (throughput) and power saving improvement achievable using one of Adant's reconfigurable antenna system with respect to a standard array of dipoles currently employed on wireless communication devices. Adant's technology allows for peak throughput improvement up to 100% with respect to standard MIMO systems and half of the power used at the transmitter can be saved.



Power saving distribution using one of Adant’s antenna systems with respect to a standard non reconfigurable MIMO antenna system. The distribution shows an average power saving of 3 dB (half of the power is used to provide the same throughput of a standard non reconfigurable MIMO system



Percentage throughput improvement as a function of the signal to noise ratio at the receiver of one of Adant’s antenna systems with respect to a standard non reconfigurable MIMO antenna system. The percentage improvement is reported for different environments (locations).

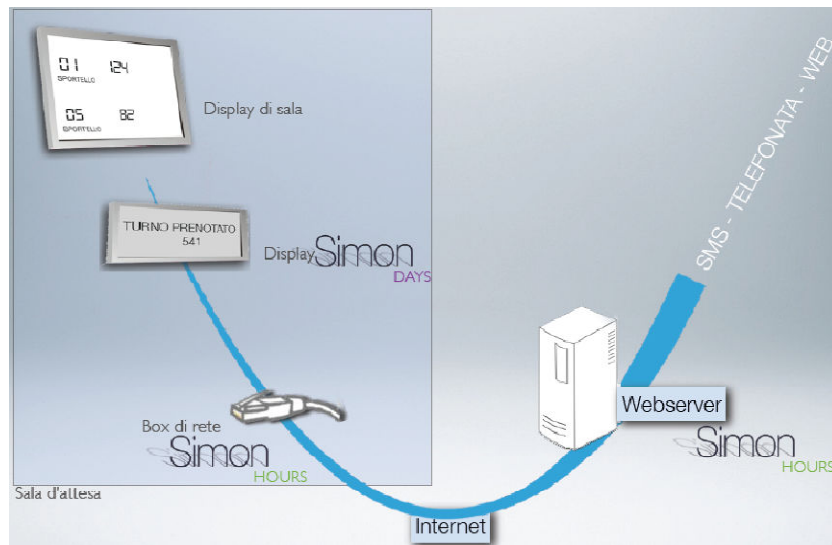
Reconfigurable antennas for RFID systems

Dynamically changing the direction in which the energy is radiated or the polarization of the radiated field, the electromagnetic field can be “moved” such as to read also tags that receives faint signals with standard RFID systems. Polarization alignment between the reader’s antenna and the transponder allows for maximum power transfer, while changing the direction of radiation allows concentrating the electromagnetic field towards the transponder. Adant’s antenna technology allows to continuously changing the state of polarization and the direction of radiation with a single, compact antenna structure.

13.6 Uquido

UQIDO is a new and innovative ICT start ups incubated in M31 and it develops time management system. Simon is the first product of Uquido and it is a software system who allows people and their business to manage the time resource in a more efficient way. The idea of product related to Simon come from two young students from University of Padua and Verona and is based on the fact that today 86% of Italians think that wait on a queue for hours is cause of stress. In a word Simon is software that allows to book events in real time and to eliminate waiting and queues. The software estimates a time serving for the customer that can so avoid waiting for hours. The system is always updated and via phone message it is possible to ask for update situation. It is also possible to book an appointment via message to Simon.

Here following the block diagram of the system:



Uquido is start up of M31 incubated less than one year ago. Simon is now under product developing and testing phase. A first feedback about a prototype of Simon came from the University of Verona that has been using the software for test purpose at the matriculation office for months. First test has revealed a success case as there have been sent more than 5,543 sms per day, average rate of usage was 71% and average error rate 0,7 minute.

13.7 Henesis

Vision and Mission Statement

In a high number of applications, the amount of information that should be managed is increasing every day: it is therefore crucial to make such information usable. In both plant and animal life, interaction with the environment is based on the information collected by an efficient, complex, and multimodal sensing and perception system, in which HW and SW are tightly connected.

Henesis mission is to conceive, develop and sell, artificial perception systems, able of efficiently manage complexity (in the amount of data, their acquisition, transport, processing, in the physical model, in both HW and SW aspects)

Key words of Henesis have become:

INFORMATION CENTERED

NATURE INSPIRED

MANAGING COMPLEXITY

Henesis mission is to conceive and sell artificial perception systems, in the fields of environment and Human Machine Interfaces (HMI). To answer these needs its main strategic business is IOT (Internet of Things) for Environmental perception adopting a advanced Artificial Intelligence and Hardware and Software Internet codesign. As a recent spinoffs of University Sant'Anna of Pisa, Henesis is still working in some software, but at the same time it has already developed some available products. Henesis main business and applications are:

Neuromorphic computation

Henesis applies advanced soft computing technologies to real life problems to solve real complex problems. Its skills on this subject are:

- Memory Prediction Framework expertise
- Cellular Nonlinear Networks expertise
- Genetic programming and algorithms expertise

Applications:

- Multimodal sensory fusion (customer: TOYOTA EUROPE)
- Environmental data processing (from WSN)
 - Complex Body Motion data processing
 - Tactile information processing (robotics)
 - Automatic train-pantograph inspection
 - Soft Computing and Medical Imaging

Distributed perception

Henesis offers a **complete solution** to “complex” remote monitoring problems based on Wireless Sensor Networks and Internet. “Complex” means, for instance: complete absence of electrical power line, large areas, long term missions, low cost, complex interpretative models (Neuromorphic Computation unit), complete absence of maintenance.

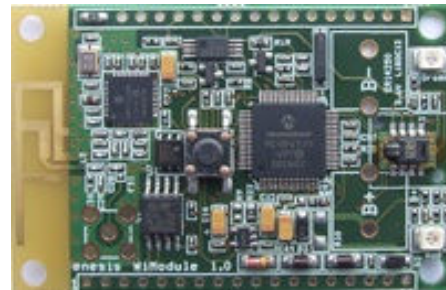
HeNePro Protocol

- Nodes sleeping most of the time
- Only battery powered nodes (bridge: option)
- Quasi-Asymmetric protocol for tree-structured networks, optimized for data collecting purposes
- Self organizing, self healing network
- Advanced automatic set-up, management, and optimization
- Long node autonomy (1-3 y), infinite with solar panels
- Customization for specific applications

The “universal” h-module

Hardware feature:

- μ P: 8 bit 12MIPS @ 2.5V
- Memory Configuration:
 - FLASH std: 128 kB
 - FLASH expanded: 16Mb
 - SRAM std: 4kB
 - EEPROM: 1Mb
- IEEE 802.15.4™ 2.4 GHz
- ZigBee compliant
- Sensors
 - triaxial accelerometer (1mg sensitivity, $\pm 2g$)
 - SHT11 digital sensor for T/H (calibrated)
 - DS18B20(Z) for T (low cost)
 - Thermocouple reading
 - Battery level
 - plug and play for digital sensors (1-wire)



13.8 VR Media

VRMedia Srl is a young company operating in the sectors of Virtual and Augmented Reality, developing innovative hardware/software products and solutions devoted to Companies and Research Centers. VRMedia products are commonly used in the Industrial sector, for technical personnel training and for advanced after sales services, as well as research activities and VR applications development by universities, hospitals, and research centers. VRMedia products are also used in the fields of Cultural Heritage and Entertainment. VRMedia is not just about building an innovative technology. It's also about using it to create advanced multimedia applications, and to contribute to the dissemination of the culture of Virtual Reality through projects participation, custom development & consultancy. VRMedia expertise range from Virtual Reality equipment to software engineering, and from project supervision to development and consultancy.

Mission Statement

VRMedia mission is to promote the use of advanced Real-time 3D Graphics tools and of Wearable Technologies in the area of industrial design and training, implementing solutions that, based on these assets, are able to improve the competitiveness of partner companies.

XVR

VRMedia is the developer of the XVR (eXtreme Virtual Reality) technology, an innovative development environment dedicated to virtual reality and augmented reality applications. Based on a powerful C++-like scripting language, XVR contents can be developed without the need of external compilers, generating efficient and multi platform bytecode, suitable to be deployed both on professional VR installation and on Internet WebPages or multimedia CDROMs. Scene-graph management, collision

detection, real-time physical simulation, network communication and VR devices management are built-in the technology.

REAL

The REAL – AR Assistant is a mobile system of remote maintenance exploiting Augmented Reality. It allows on-site technicians to receive audio/video support from Remote Experts consulting the information provided by these on a wearable viewer.

In order to reach their goals, companies always strive to increment their efficiency (OEE) and to reduce their costs (TCO). Moreover, it is more and more important to share information and to communicate in real time. It is therefore very important to reduce the MTTR of plants and to have locally or remotely available the competencies needed to solve problems in the shortest time possible.

Industrial plants often require maintenance from skilled personnel. These technicians need a continuous training on processes and on the operations of assembly/disassembly, calibration etc. Some of these procedures are so complex that they result difficult to remember after the training. Moreover, very often the training is still not sufficient to address complicated issues which might require the direct intervention of Suppliers. As a matter of fact, training for maintenance may result expensive and not always very effective.

Then REAL enables real-time assistance in remote training, following step by step users in the different stages: assistance, maintenance, troubleshooting. Augmented Reality allows combining the real and the virtual world, generated by a computer, blending these two dimensions into one single real-time visualization. Based on the experiences matured in mobile computing, VRMedia is now able to propose a postal certification system using wearable technologies, able to temporally and geographically trace the mail delivery operations. The device is operating both outdoor, during the delivery stage, and indoor, to update and upload/download data.



REAL display



Service operator using REAL devices

VRMedia has won the "Mind the Bridge" competition as the startup representing "the best of Italian innovation" 2009. The Gran Finale ceremony took place in the Silicon Valley at Stanford University (USA) on March 18th.

Conclusions

The aim of this project is to analyze the inner context of some successful high tech industrial cluster in the USA, mainly the most famous one Silicon Valley, in order to understand what makes this area of the world so unique and inimitable. As Italian migration of brain and technology is permanent and not any more a transitory phenomenon it is important to study the actual Italian situation to identify which aspect of our country are not favorable to develop such industrial high tech cluster. A deep analysis of Italian excellence and companies in USA helped to comprehend that Italy has so many capacities to develop most of the highest value technologies existing in the world. Italy well provides a high level of education and training, and Italian graduates abroad are recognized as excellent example of knowledge. But on the other hand the real beneficiaries are the countries of destination that have over time consolidated strategies to attract qualified workers. Then this phenomenon generates a range of negative effects on the economic and social development of our country.

Besides the brain drain there is also the phenomenon of high tech companies that often finds a difficult environment in their own country especially during the early stage. Nevertheless, with the exception of the nuclear sector and, partially, chemistry and electronics, in Italy economic conditions and knowledge seem not to be lacking in order to compete successfully in information and multimedia technology patterns, microelectronics, biotechnology, industrial automation and advanced materials. In particular, this is the case of small innovative niches, in which small size firms tend to have some competitive advantages compared with large firms. But an important factor influencing the viability of small firms is capital requirements: there are compelling reasons why lack of finance will serve as an impediment to small firms and there is evidence that SMEs, in particular operating in high-tech sectors, are more likely to be subject to liquidity constraints. In the U.S. a variety of sources of finance are available to the start-

ups of innovative firms. In particular Venture Capitalists and Angels are firms that specialize in investing mainly in new start-up companies in the early stages before their products or services become successful or well-known. In Italy, these means are still uncommon so that the development of technology is often prevented. In fact, firms belonging to traditional sectors may remain small, but fast-growing innovative firms have to enlarge in order to follow the development of the market, to expand and diversify production in new niches, to develop new technological and managerial skills. In the early-development phase the lack of financial resources may be the most relevant problem faced by these firms. An analysis of VC and Private Equity activities in Italy stresses how these funds raising firms cover relative importance only in buy-out or expansion phase mainly of large size company. This analysis considers also some other important aspects that would restrain the developing of VC and Private Equity and then start ups in Italy. The most important reasons of this Italian lack are a severe taxation system and fiscal normative for new business activities because of the risk of failure, especially for start-ups. Then it must be considered also the Italian entrepreneurs low inclination and propensity to share risk capital with external private equity or VC firms.

Additionally to all these factors, a lack of cooperation between University Research and industrial sectors makes the situation even worst. Italy is one of the European countries that have the lowest amount of annual GDP in Research. Then University system seems to have a conservative approach that often does not allow innovation. In fact University Incubator and Science Parks in Italy mainly work on the training and valorization of human resources then creating a stock of knowledge available to private. According to this vision the deviation of EPR activity to industrial applications not only causes a distortion of the way of using resources destined to research, but mainly do not guarantee an effective increase of innovation in the industrial system. About this Salnet says that the EPR system should worry about how to “*create talents, and not technologies*”.

Despite such unfavorable environment, during the last few years Italy has assisted to a new wave of positive reaction to the business model imported from USA. Lots of events have been organized from young entrepreneurs, university researchers and people with years of experience abroad and now willing to develop an innovative model in Italy similar to the one main industrial districts in the USA. In addition lots of deal flow and business development providers have established in USA to create a kind of bridge between Italian technology and USA industrial cluster. It seems like Italian technologies need to spark innovation abroad to survive and for this reason many business gateways have been created. Just to mention some of these, BAIA, Business Association Italy America, Fulbright BEST, Mind The Bridge, SVIEC and so on. Therefore these gateways to USA provide also a positive influence for the country as they promote business and study exchange program and encourage a reverse action of Italian brain drain, thus beneficial for our country.

One more recent reality is the creation of private incubator in Italy that have become in few years leading providers of high tech solutions. It is the case of H-Farm in Treviso and M3I in Padova. Having worked for M3I Italy and involved on the project of a new start ups in Silicon Valley, M3I USA, I have analyzed the strengths of this new model and the strategy to be adopted for Italian start ups. Then a technical excursus presents the actual companies incubated in M3I and M3I USA; this gives an idea of how much added value there is in these business ideas. The main result of this case study is the additional major advantage of M3I incubator strategy: sharing the office and all other necessary office services, G&A costs (general and administration) will be drastically reduced for each individual start-up. Moreover M3I Italy and US incubation model is based on three distinct legs: the incubation function (space, and office shared services), the financing function, the management function. It results a true hands-on involvement as all three functions being very critical components in reducing the initial startup risks.

This analysis mainly based on working experience leads to the conclusion that some important action plans should be

done by Italian government and entrepreneurs in order to foster a new industrial time for innovation. I have identified some main activities to be done:

- Consider the Human Resources to be a strategic mean
- Facilitate the acceleration process through innovation by supporting University Research and cooperation with industry
- Fostering competition in ICT market
- Change taxation and legal rules to promote sparking of new technologies and high tech SMEs
- Convert an old fashion mentality into a new innovative ecosystem

According to Porter's model the cluster-based policies make possible innovation and support trans-disciplinary research networks among academics and entrepreneurs through information and knowledge exchange. Clusters are a practical means of linking research to marketable innovations. But a cluster develops also because of cultural and territorial features related to industry that make possible innovation. The culture of taking entrepreneurial risk represents the local context that promotes competition and the success of Silicon Valley is also related to the availability of financial resources to support entrepreneurial growth.

Despite a new attitude mainly coming from young environments unrelated to public sectors or from researchers abroad willing to generate a reverse action, Italy is still far from the innovative model of Silicon Valley. What Italy most misses is the change of mentality from a conservative approach to a risk and failure tolerant environment that encourages entrepreneurship and a result oriented culture. While Italy is still struggling on this difficult revolution, the new strategy based on creation of gateways to the USA and incubator start ups seems to be the best solution for new Italian high value technologies and entrepreneurial ideas. It is a strategy that in future could be led to a reverse gain thus creating gateways not only to high tech Italian firms, but also to US ones willing to explore the Italian market.

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