San Jose Silicon Valley CHAMBER OF COMMERCE

Creating a Regional Economic Development Initiative

Phase I: Initial Findings

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Prepared by

COECON collaborative economics

Contents

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Executive Summary

The Regional Economic Development Initiative (REDI) is a private-public partnership engaging stakeholders in a collaborative effort to create jobs by focusing on Silicon Valley's most promising economic opportunities. REDI is led by the San Jose Silicon Valley Chamber of Commerce in cooperation with the City of San Jose, Santa Clara County, and supported by the regional business community.

The first phase of REDI (completed February 2015) comprised of interviews with business leaders, a review of current economic research, and analysis of local labor market and venture capital data, all aimed to identify the most promising opportunities for regional business growth. We found that the dynamics of Silicon Valley's core economy are changing and that there is a growing focus on the interdependence of major export engines, support industries, and the service economy. A new wave of innovation, the **Internet of Things** (IoT), is a key driver of future opportunities in Silicon Valley. IoT is based on the convergence of software, hardware and sensors, and has wide applications in both consumer and industrial markets. This wave builds on each of Silicon Valley's prior waves of Defense, Integrated Circuit, the Personal Computer, the Internet and Social Media. Silicon Valley may be at an inflection point as the region prepares its businesses, talent and infrastructure to take advantage of this next wave; however, other regions in the United States, Europe and Asia are competing to take the lead.

Our major finding is that the emergence of the Internet of Things (IoT) is creating a number of new opportunities for companies to connect with each other and with public sector partners to leverage exciting innovations in:

R&D Centers: Silicon Valley is the Research and Development (R&D) home for global technology firms that are attracted by a high concentration of skilled talent. These R&D centers are building the platforms (hardware and software) that make IoT.

Agile Manufacturing: Collaboration between traditional tech firms, local contract manufacturers and global manufacturing firms in the design and prototyping of new kinds of "smart" hardware represents an exciting opportunity for innovation, driven by IoT.

Health IT: Advanced health care services and research in the region are converging with information technology, advancing Health IT services. The integration of IoT and traditional health services is giving both health care institutions as well as the individual consumer better access to real time data and processing power.

Smart Buildings: Building and construction industries are being transformed by a move toward greater energy efficiency and new advanced materials, devices, and systems that promote greater productivity and savings. IoT represents the integration of traditional energy savings technology with the power of big data's predictive and intelligent capabilities.

The Silicon Valley Regional Economic Development Initiative

The goals of REDI are to create and implement a collaborative economic development strategy to retain existing jobs, to stimulate job growth and to ensure the strongest possible economy throughout the Silicon Valley region.

REDI strives to build on regional activities and create one regional voice to:

- **Promote the region:** Market Silicon Valley as the "the global capital of innovation and entrepreneurial success";
- **Recruit New Businesses:** Augment local cities' capacity to meet with significant companies to encourage them to locate in or relocate to the greater Silicon Valley region, and welcome them when they arrive;
- **Retain Existing Businesses:** Help cities meet with significant employers and growing companies in the region to show appreciation and assist with expansion;
- **Attract Public Investment:** Garner support and advocate for the region in securing resources for significant, strategic economic development projects at the regional, state, and federal level; and,
- **Support Local Entrepreneurs:** Encourage new business creation throughout the region

Why REDI is Important Now
A Sense of Urgency Due to Global Competition

Silicon Valley is a major center of innovation. A recent MIT study identified Santa Clara and San Mateo Counties as the top "hotspots" for quality startups in California.[1] The analysis was based on whether the company had an initial public offering or acquisition within six years of founding and other factors such as if it was connected with a high-tech cluster. The success of Silicon Valley startups can be attributed to the nurturing ecosystem of the region and the innovation infrastructure in place.[2]

While Silicon Valley has been the hub of innovation for over six decades, this central position is not guaranteed in the future as other regions around the nation and globe develop their own innovation economies. This includes globally competitive regions such as Tel Aviv, Munich/Stuttgart and Beijing, as well as emerging innovation regions such as New York City, Austin, Boston and Seattle. Recognizing the growing nature of global competition, Michael Moritz, chair of Sequoia Capital, an early investor in Google, Cisco, NetApp and Instagram among other successful tech firms, recently said, "In the first decade and a half of the century, non-US (and non-European) tech companies have advanced further than anyone could have imagined. Today, six of the 20 most valuable internet companies are based in China..."[3]

Many of these other innovation regions are providing incentives that attract companies and talent from Silicon Valley. The high cost of housing and the relative cost of doing business in Silicon Valley make it increasingly difficult for established firms to expand operations. As innovation becomes a global business and other regions invest heavily in creating the economic environment and talent infrastructure essential for success, it is imperative that Silicon Valley businesses, governments, and community organizations, work together across sectors and organizations to develop an economic strategy for regional prosperity and competitiveness.

While the current work in the region by local economic development offices, business groups, and community organizations is strong, it is time to align and leverage these efforts to address regional issues such as access to talent, cost of living and transportation. All entities should work together with leadership from the business community. Private sector leaders have firsthand knowledge of what it will take for businesses to grow and thrive, and by extension create good jobs and higher levels of regional prosperity for all citizens. A collaborative regional approach, driven by civic leaders, is what Silicon Valley needs to remain on top.

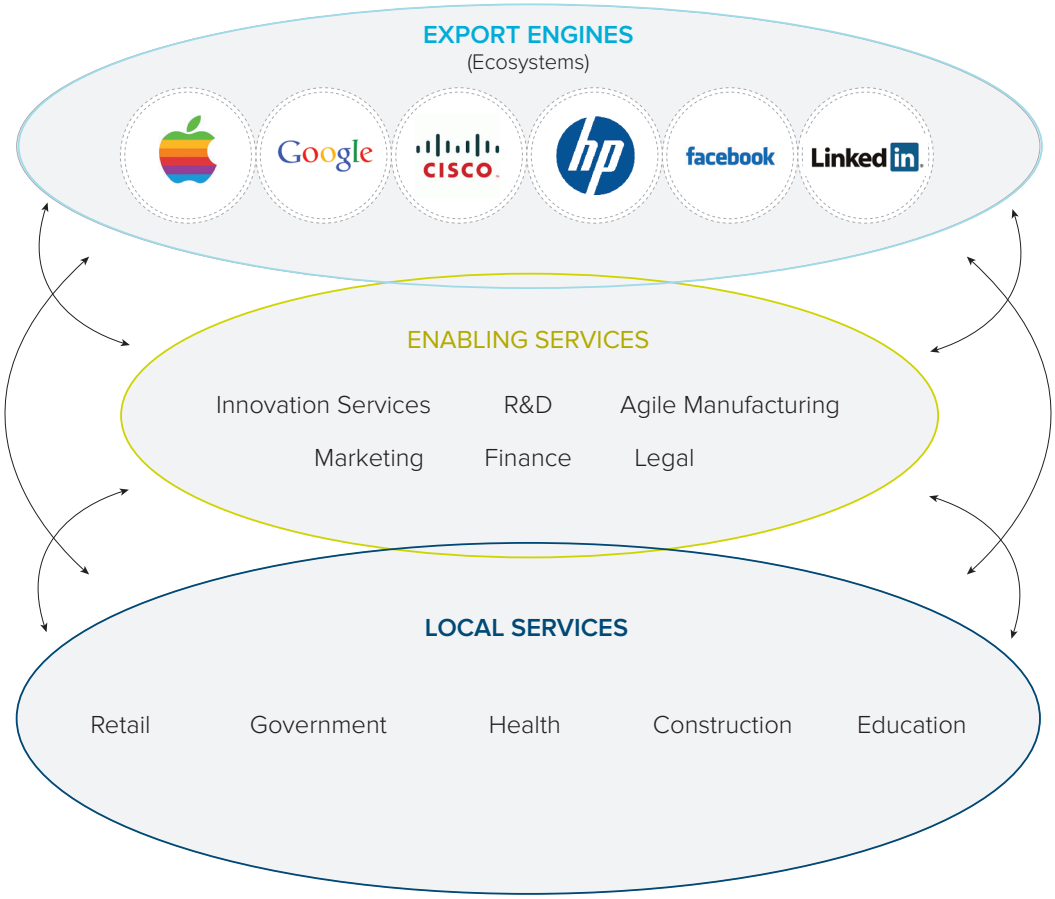
1. Krieger, Lisa. "Silicon Valley really is more innovative, study finds." San Jose Mercury News. Feb. 5 2015.
2. Stern, Scott. Massachusetts Institute of Technology and the National Bureau of Economic Research. Stated in "Silicon Valley really is more innovative, study finds" by Lisa Krieger. San Jose Mercury News. Feb. 5. 2015.
3. Moritz, Michael. "Technology's next 25 years belong to the world, not the US." Financial Times. Feb. 3 2015.

What REDI Must Do to Make Silicon Valley Competitive
Connect the Regional Economy and Ensure Prosperity for All

While Silicon Valley has led the state and national economic recovery from the recession, it has not evenly impacted all of the region's industries and residents. The innovation economy is currently strong and the creation of one innovation job is estimated to generate roughly five more jobs in the rest of the economy (svcip.com). However, there remains a lack of well-paying, middle-class jobs to meet the needs of an increasingly diverse population and to ensure opportunity for everyone. Therefore, REDI 's focus is on opportunities that result in job creation in a wide range of occupations and in a variety of industries.

REDI engages more than just Silicon Valley's well-known technology firms. Taking an inclusive view of the region's economy, REDI acknowledges and focuses on supporting, retaining, and growing all of Silicon Valley's businesses, including support and service industries. Silicon Valley's integrated ecosystem can be divided roughly into three interrelated parts (see image below). The top level is the global companies that are headquartered in Silicon Valley such as Apple, Google, Cisco, HP, Facebook, and LinkedIn, which have been generating wealth for the region through exports. The critical second level involves companies that support these global companies, such as agile manufacturers, research and development (R&D) firms, marketing, finance and legal services companies. The third essential tier encompasses the majority of regional employers and jobs who constitute the service economy, such as retail, government, health, construction, and education. The success of one tier affects the success of the other tiers in a vital cycle and the prosperity of the entire community and economy is closely connected.

Silicon Valley's Evolving Innovation Habitat



How REDI Relates to Other Regional and Local Activities
Integrating Economic Development and Competitiveness Initiatives

REDI is about leveraging regional efforts and creating an economic development strategy to strengthen the competitiveness of the region. Long-established organizations have affected great change in the Silicon Valley over the years through a variety of important efforts. REDI builds on this work to focus on promoting the greatest opportunities, without redundancy.

The table below shows the relationship among these regional groups in terms of focus and membership.

Organization	History	Focus	Members
Silicon Valley Leadership Group	The Silicon Valley Leadership Group, founded in 1978 by David Packard of Hewlett Packard, represents nearly 400 of Silicon Valley's major employers and focuses on policy issues that affect the economic health and quality of life in Silicon Valley including areas such as education, housing and transportation.	**Policy**	**Major employers**
San Jose Silicon Valley Chamber	Founded in 1886, the San Jose Silicon Valley Chamber is a nonprofit business association representing nearly 1,500 employers and a quarter of a million employees throughout the greater Silicon Valley. Its mission is to create a strong local economy, provide business connections and represent the interests of business to government.	**Economic Development**	**Broad-based business membership**
Joint Venture Silicon Valley	Joint Venture Silicon Valley was established in 1993 to bring leaders from business, government, education, and the community together to act on regional issues affecting economic vitality and quality of life. Joint Venture initially focused on specific initiatives and continues to provide expertise and guidance on key economic, social and governance issues in the region (see the Silicon Valley Index).	**Regional governance issues**	**Business, local government and non-profits**

Given the context of globalization and dramatic technological advances, Silicon Valley's approach to addressing competitiveness issues as a region must also evolve. Instead of tackling economic and social issues at the municipal level, Silicon Valley must define itself as an integrated region, competing on a global level. Whereas in the past, Silicon Valley cities often viewed their greatest competitors as other cities within the region, Silicon Valley cities now face competition from integrated regions all over the world. In light of these realities, Silicon Valley must work together as a whole to attract and retain innovative businesses.

In 2014, the Silicon Valley Leadership Group and the Silicon Valley Community Foundation launched the Silicon Valley Competitiveness and Innovation Project (SVCIP), a data-driven policy initiative that benchmarked Silicon Valley in relation to other innovation regions and quantified the need for policy action within the Silicon Valley region. SVCIP identified the need for coordinated policy action in areas such as education, housing, transportation, research and development and immigration, with opportunities for action at the federal, state and local level (see svcip.com). REDI will leverage the work of SVCIP, focusing on how these policy changes might be implemented locally.

Local economic development organizations have a history of working collaboratively. Under the umbrella of Joint Venture Silicon Valley in the 1990's, regional entities formed the Silicon Valley Economic Development Alliance (SVEDA) to provide an online "one stop" service for business expansion and recruitment. REDI is grounded in this collaborative spirit and will work with local economic development organizations to expand SVEDA's efforts to assist in retention, expansion and recruitment, while developing a regional marketing message and strategy that promotes the Silicon Valley region as a global leader in innovation and entrepreneurship. REDI will also work with two of its major local sponsors, the economic development offices in both the City of San Jose and Santa Clara County, to help develop and implement this regional economic development strategy, focusing especially on strategic marketing and critical investments in talent and infrastructure.

REDI aims to leverage the important work of these and other regional organizations to create a unified, strategic economic development plan with the purpose of growing jobs, businesses and the economy. While significant progress has been made by all of these organizations, the region needs to develop a single voice and message. Silicon Valley must communicate to the world that it is the global capital of innovation and entrepreneurial success and an excellent place to start and expand a business.

How will REDI Move Forward
Creating a Roadmap for Action

The first phase of this project identified the most promising opportunities for action by conducting interviews with key business and regional leaders, analyzing labor market and investment data, and reviewing regional and national economic trends.

Given these quantitative and qualitative analyses, we have identified the following promising economic opportunity areas, which could be accelerated with strategic, collaborative support through REDI:

- **R&D Centers:** Technology anchor firms performing R&D;
- **Agile Manufacturing:** Contract manufacturing firms involved in collaborative design and production of smart devices working with larger companies in the region;
- **Health IT:** The integration of information technology (IT), personal hardware, and big data with health services; and,
- **Smart Buildings:** The convergence of energy efficiency technology, green construction and smart buildings.

All of these opportunity areas are connected to the new wave of innovation, the Internet of Things (IoT), which is a key growth driver. IoT is based on the convergence of software, hardware and sensors, and has wide applications in both consumer and industrial markets.

The next stage in the REDI process will be to engage private sector business leaders in each of these opportunity areas to lead the planning and execution of REDI's action plan. The initiative will recruit influential members of the private sector ("civic entrepreneurs") who are committed to the success of the region and understand the benefits of working collaboratively. We interviewed many of these individuals through the course of REDI's first exploratory phase, and will also recruit other leaders to join in the effort.

Civic entrepreneurs will be organized into teams in each opportunity area to develop business plans and early wins. There will be two facilitated sessions per team to discuss opportunities for action and requirements for success. From these sessions, champions and specific implementation commitments will be identified and captured in a tangible action plan. As part of this mobilization and commitment stage, local economic development organizations will be engaged to identify the specific roles they can play in support of these business plans.

The final stage of REDI will focus on driving action towards early wins, building momentum and developing an organizational structure to support implementation. The implementation organization will depend on the nature of the opportunity-specific action agenda. It will most likely not be a brand new organization but rather a carefully negotiated compact among existing players, identifying shared goals and complementary roles with strong business leadership and collaboration among key community leaders.

STAGE 1
Identify Economic Opportunities and Recruit Civic Entrepreneurs

STAGE 2
Mobilize Civic Entrepreneur Team and Secure Commitments to Action

STAGE 3
Launch Action Plans, Achieving Early Wins and Creating a Sustainable Platform to Support

Initial REDI Findings: Identifying the Most Promising Opportunities

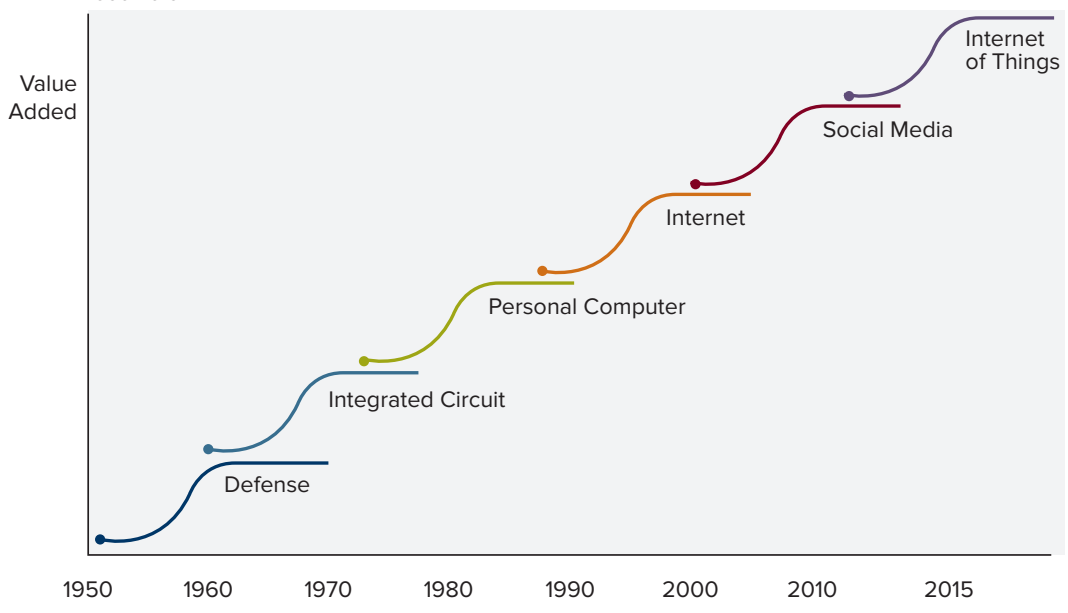
Initial research into economic trends, supported by interviews, revealed an emerging focus on the IoT in Silicon Valley.[4] Leveraging the ability to store, process, and access large volumes of data quickly, cheaply, and wirelessly, IoT enables newfound, real-time access to data for software applications and intelligent devices. This has resulted in the proliferation of hardware and software that capitalizes on the building blocks of data storage, process power, and mobile platforms, to produce devices and services that improve quality of life, increase the speed of doing business, and give companies and individuals better information. Silicon Valley's strength in many of IoT's building blocks positions it to lead in technology development and implementation, and generate a wide range of associated jobs within the region in the process.

The Internet of Things: An Emerging Next Wave of Innovation

Over the past 60 years Silicon Valley has been a dominant force in innovative breakthroughs, leading the world from Defense, the Integrated Circuit, and the Personal Computer to the Internet, Social Media and now, potentially, an emerging next wave, IoT.[5]

While the regional economy is prospering now, due in large part to an expansion of social media companies, Silicon Valley must be prepared to support regional businesses and workers to help prepare for this next wave. If the past is any indication, the leveling off of social media jobs and the rise of IoT will cause disruptions in the local economy that impact all levels of companies and the region's vast technology workforce. Moving into the sixth wave, Silicon Valley's ability to pivot and capitalize on this next opportunity will be critical for Silicon Valley to remain a global center of innovation.

The Evolution of Silicon Valley
1950-2015



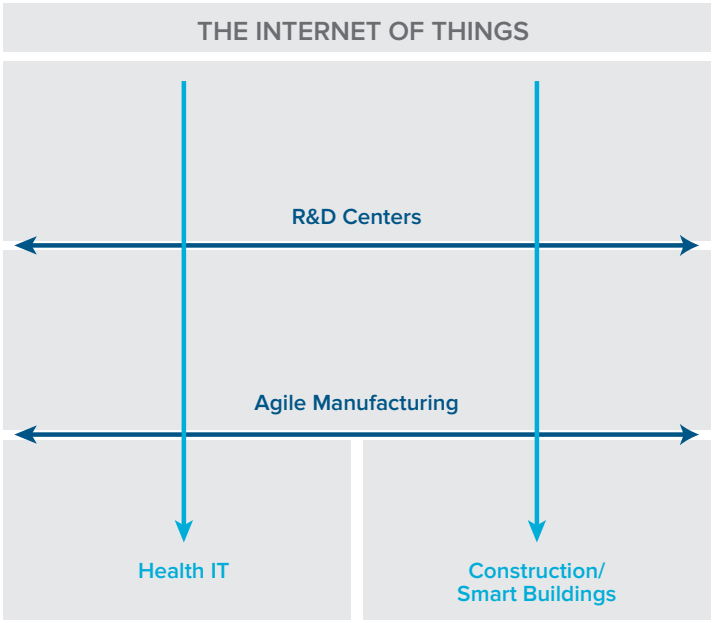
Source: Adapted from *The Silicon Valley Edge*

4. CB Insights' International Venture Capital trends show Social Media funding on the decline since 2010 and IoT funding rising steadily over the same time period.
5. Malone, Michael S. "The Purpose of Silicon Valley." Technology Review. Jan. 30 2015.

Applying the Internet of Things to the Regional Economy

IoT makes new degrees of efficiency possible and has cross cutting implications for many industries. IoT does not just affect high-tech companies and workers, its concepts and technology platforms are being implemented into sectors such as health care, construction and transportation. Further, the implications for industrial sectors, such as high-tech contract manufacturing are significant. Across industries and skill levels, IoT will have an impact on regional businesses and workforce, so understanding its application in the Silicon Valley specifically, is a critical next step in REDI. In this initial REDI report, we have identified four important areas that influence IoT growth in Silicon Valley at present, and hold additional growth opportunities as IoT demand and applications continue to expand.

The Internet of Things



R&D Centers: Technology anchor firms and R&D Centers are currently performing R&D activities focused on connecting technology and devices to a variety of industries including transportation, health care, wearables, and smart buildings. This newest wave of IoT innovation is driven by software (and some hardware) from Silicon Valley's R&D centers. This encapsulates global tech companies, as well as startups and academic research coming from the region's universities. Silicon Valley's R&D activity has long been connected through a series of informal and formal networks. The relatively "open" nature of research in the Valley is one of its critical characteristics.[6]

Agile Manufacturing: R&D centers developing new hardware innovations often turn to important partners: regional contract manufacturers. Contract manufacturers in Silicon Valley provide prototyping and early production runs of new hardware so tech companies can actualize their innovations with greater speed. Throughout the interviewing process, companies underscored that in addition to fabricating products, they are often also critical design partners, employing high-level engineers and designers who work collaboratively with R&D partners to produce new products. Further research revealed that in addition to working with R&D partners, many contract manufacturers also work with each other to agilely respond to new orders from large customers and are connected horizontally across their industry.[7]

Health IT: The integration of IT, personal hardware, and big data with health services presents an enormous opportunity for health care providers. Better real-time data helps health care systems operate more efficiently, whether it is scheduling patients on MRI machines or evaluating the success of various treatment regimens.[8] Additionally, new access to information helps patients make better decisions about their health. This has led to a market that is being strongly influenced by two major forces. On the one hand, health care organizations have an up-close look at how demand for health care is changing under a new set of payment and reimbursement incentives coming from major insurance providers.[9] On the other hand, R&D (and by extension, manufacturing) firms are actively marketing new products outside of the traditional realm of health care, influencing what consumers demand from their health care providers. To navigate these new products, markets, and demands, health care organizations are and must be connected to their supply chains.

6. Lee, Chong-Moon, William Miller, Marguerite Gong Hancock, and Henry S. Rowen. The Silicon Valley Edge. Stanford, CA: Stanford University Press, 2000.
7. East Bay Advanced Manufacturing Sector Partnership notes, 2014.
8. McKinsey & Company. "Healthcare's digital future." Insights and Publications, McKinsey & Company. Jul. 2014.
9. Move to Value Based Purchasing Model for Health Care Organizations. See definition: http://www.nbch.org/Value-based-Purchasing-A-Definition

Smart Buildings: Consumers are increasingly concerned about energy savings both in terms of money and for reducing their carbon footprint. Silicon Valley Smart Buildings companies are responding to this market demand by creating and integrating smart technologies and sustainability into building construction and operations. Companies in Silicon Valley are applying the region's technology strengths to building products to help customers save energy while also enabling more connected buildings through integrating software technologies with devices. These products are not only designed in the Silicon Valley, such as Nest's smart home thermostat, but regional companies are also manufacturing energy efficient products, such as Xicato's LED modules. Local R&D facilities are enabling businesses to innovate, such as Lawrence Berkeley National Lab's new FLEXLAB that tests building efficiency technologies and Prospect Silicon Valley's connections to sites for real world demonstration. Smart Buildings represent the application of IoT in buildings across the value chain: producing cutting edge research, testing ideas, developing products, and implementing changes and products in building construction and retrofits.

What emerges from this picture is an economy that is experiencing growth opportunities across the horizontal industries that fuel IoT innovation and at the intersection of and along the vertical industries. IoT is a relatively new innovation and as such its impact on regional economies is not yet fully understood. It is critical now, on the cusp of this newest wave, to understand how IoT applies to the Silicon Valley ecosystem. For instance, how are the region's economic anchor companies responding to the emergence of IoT? Are they investing innovation resources (people, infrastructure), or are they moving on to other tech hubs across the globe? What makes Silicon Valley ripe for capitalizing on IoT, and what are the weaknesses? With major disruptive technologies that make humans and machines faster and better at completing tasks, what are the implications of IoT for Silicon Valley's already vulnerable low and mid-skill workforce?

Other global regions are taking advantage of their own relative advantages in the emerging IoT including: the greater New York region whose research and innovation assets include GE, IBM, Cornell Tech Campus/Jacobs Technion Cornell Institute; Boston where MIT's cutting edge research on Intelligent Machines, Robotics, and Big Data are providing thought leadership for the industry; Munich/Stuttgart the world headquarters for Siemens and BMW and home to the Fraunhofer Institutes; and Beijing whose municipal government has invested significantly in an Institute of Automotion in combination with the Chinese Academy of Science and Intel on a Joint Lab for the Internet of Things. Given these investments from real global competitors and the emergence of innovation leadership from around the globe, investigating Silicon Valley's relationship with IoT is particularly timely.

Much has been written about the implications of IoT for specific industries and the global economy, but to understand more deeply how IoT is impacting Silicon Valley, REDI's first phase included interviews with important Silicon Valley companies at all levels of the ecosystem and within all of the key industries. The following research briefs contain information from these interviews, analysis of regional labor market and venture capital data, and a synthesis of secondary research.

Research and Development Centers

R&D centers are a key growth area for Silicon Valley, leveraging the region's top-tier talent and vibrant and complex research community. In recent years, Silicon Valley has become the home of more than ten new R&D centers (see box),[10] including the Samsung R&D Center in San Jose,[11] Jabil's Blue Sky research facility in San Jose and the Johnson & Johnson California Innovation Center in Menlo Park.[12]

These new arrivals join Silicon Valley's robust group of corporate labs and private companies that have a strong R&D focus, as well as a large community of university, federal and contract research facilities.[13] These centers span a wide range of industries including information and communication technology, automotive, biotechnology and retail, as well as a diversity of companies, including global giants, startups, specialized research firms and institutional research centers. In particular, a confluence of automotive R&D, tech firms, and innovation transportation firms signal that the application of IoT to automotive is just around the corner and will have significant presence in the Bay Area (see map).[14]

Not only are R&D centers growing in the region, they also represent a strategic long-term driver of innovation for export-oriented industries and a source of employment across the skills and education spectrum. R&D centers employ a range of high- and medium-skill occupations requiring technical training.

Recent Additions to Silicon Valley's Research and Development Community

Samsung Research America Center, San Jose (Opening in 2015)
Jabil BlueSky Innovation Center, San Jose (2015)
Ford Research and Innovation Center, Palo Alto (2015)
Prospect Silicon Valley, San Jose (2014)
Hanergy Solar Product Development Group, Burlingame (2014)
Target R&D Office, Sunnyvale (2014)
Dell Internet of Things Lab, Santa Clara (2014)
Walmart 2nd eCommerce Center, Sunnyvale (2014)
Johnson & Johnson Innovation Center, Menlo Park (2013)
Nissan Research Center- Silicon Valley, Sunnyvale (2013)
Huawei R&D Center, Santa Clara (2012)

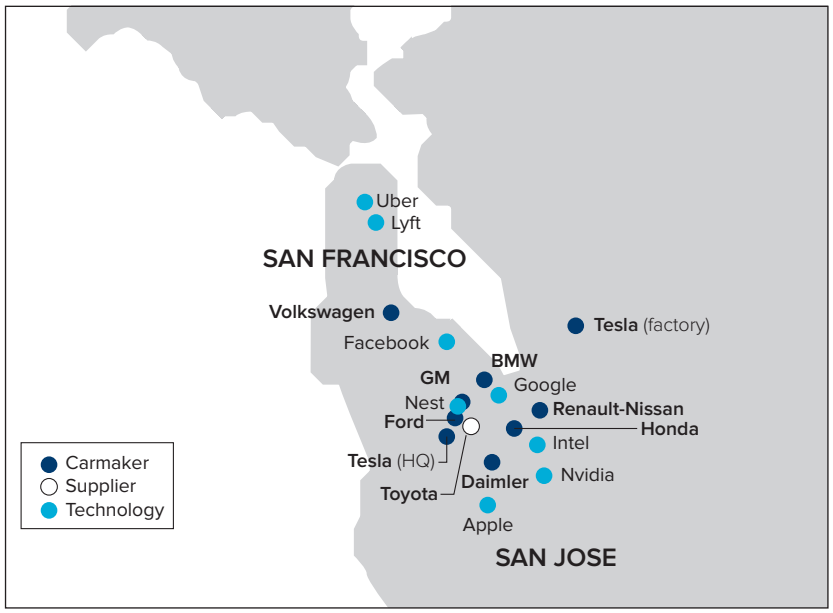
Historic R&D Centers

Xerox PARC, Palo Alto
SRI International, Menlo Park
Oracle Labs Headquarters, Belmont
BMW Group Technology Office, Mountain View
NASA Ames

What is Silicon Valley's edge?

Companies seeking locations for research, design and development activities are attracted to Silicon Valley's specialized science, technology, engineering and mathematics (STEM) talent pool, which is the most concentrated of the top innovation regions in the U.S.[15] and a critical driver of Silicon Valley's success as a technology development hub.[16] Between 2003 and 2013, the number of scientists (excluding computer

The Bay Area Convergence of Technology and Automotive R&D



Source: *Financial Times*

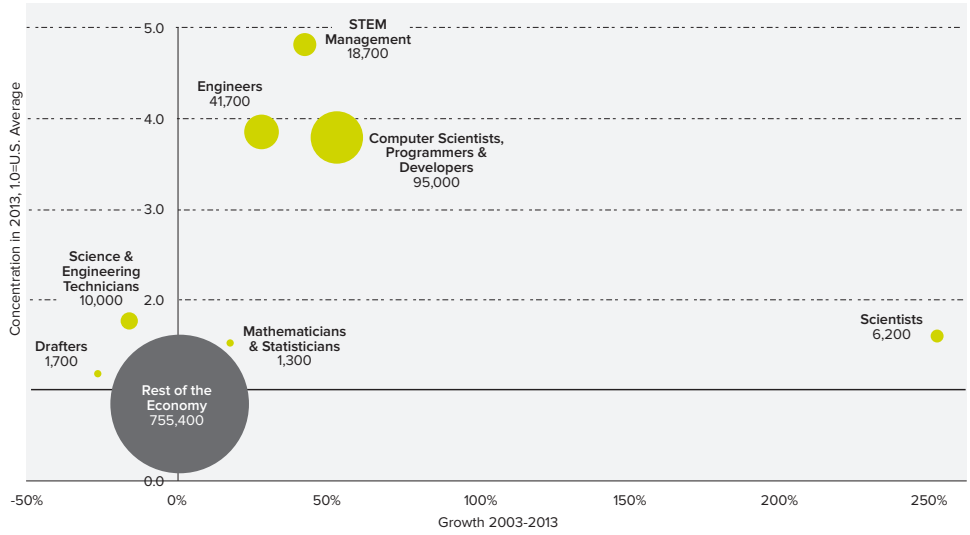
10. King, Rachel and Steven Rosenbush,. "Mining Silicon Valley's Culture." Wall Street Journal. Jul. 2013.
11. Wohlson. Marcus. "Samsung's Giant New Silicon Valley HQ Is Almost Complete." WIRED. Jan. 2015.
12. Price, Robert. "Johnson and Johnson Innovation Center – Opens Location in Silicon Valley." Global Entrepreneurship Institute. Jun. 2013.
13. Malone, Michael. "Why Silicon Valley Will Continue to Rule the Tech Economy: Human talent and research and design labs are arriving to dominate the new era of devices." Wall Street Journal. Aug. 22 2014.
14. Baker, David. "Automakers coming to Bay Area, steer future toward tech." San Francisco Chronicle, February 15, 2015.
15. Henton, Doug et al. Silicon Valley Competitiveness and Innovation Project -2015.
16. Wadhwa, Vivek. "Silicon Valley Can't Be Copied: For 50 years the experts have tried to figure out what makes Silicon Valley Tick. The Answer is People." MIT Technology Review. Jul. 2013.

scientists) in the region more than tripled. In addition, the share of STEM managers, engineers and computer-related professionals in the regional economy are 3.5 to 5 times higher than the U.S. average.

REDI project interviews underscored the importance of Silicon Valley's highly experienced, passionate and entrepreneurial talent pool as a key factor in companies' decisions to open and/or expand research activities in the Silicon Valley region. Interviewees noted that in Silicon Valley companies can find global specialists at the top of their fields in technical subjects such as materials science, microbiology or software engineering, with the opportunity to employ, consult or collaborate with them. The talent pool is deeper and denser than in many other regions around the world.

In addition to talent, Silicon Valley's vibrancy and institutional assets in the research community are another significant driver of the decision to locate or expand R&D activities in the region. Silicon Valley's R&D activity has long been connected through a series of informal and formal networks. The relatively "open" nature of research in the region encourages collaboration, mobility and flow of information, and is one of the region's key characteristics.[17] In addition, Silicon Valley is home to top-tier research universities, federal laboratories and private research institutions. Researchers are conducting both basic and applied research, with commercialization targets spanning from one year to 20 years. Because of this wide range in research stage and the diverse mix of industries conducting R&D in the region, interviewees cited R&D collaborations occurring frequently among companies or with universities and labs, as enhancing business competitiveness and product innovation.

Growth Trends in Research & Development Talent Pool, By Occupation
Total Jobs, Growth Rate and Concentration
San Jose Metro Area



Note: Numbers reflect the 2013 employment of each occupation.
Data Source: Bureau of Labor Statistics, Occupational Employment Statistics
Analysis: Collaborative Economics

What is the economic opportunity in Silicon Valley?

The number of R&D centers in Silicon Valley is already growing, and the region is in a strong position to accelerate this trend, based on its talent, institutional assets and vibrant research culture. Growth in this opportunity area would have direct impact on jobs, and longer-term potential impacts on investment, company revenue and indirect jobs.

R&D centers directly employ workers from a range of skills and educational backgrounds. While STEM professionals with a bachelor's degree or higher are typically associated with these centers and do comprise a substantial portion of employment, other roles require less education. Science and engineering technicians and IT staff, for example, are a crucial part of the functioning of R&D centers, and are generally middle-income occupations requiring an Associate's degree. Administrative, sales, quality control and maintenance staff are also essential roles for these facilities, and require a high school diploma and on-the-job training.

17. Lee, Chong-Moon, William Miller, Marguerite Gong Hancock, and Henry S. Rowen. The Silicon Valley Edge. Stanford, CA: Stanford University Press, 2000.

In addition to near-term jobs, R&D centers play a vital role in Silicon Valley's economy in the longer term as well. Silicon Valley is a region defined by its innovation and entrepreneurship, and R&D forms the pipeline for future products, services and companies. Conducting R&D activities within the region increases the likelihood that innovations will be commercialized and scaled locally, attracting investment, and generating jobs and tax revenue. This is particularly true for IoT technologies and services, which have massive market potential as traditional industries are infused with "intelligent" technologies, and will require additional R&D and likely spur growth in many companies in upcoming years.

Occupations in Research and Development Centers (based on NAICS 541710)*

San Jose Metro

Occupation	"Annual Earnings (Q1 2014)"	General Education Category	Additional Experience Required
Natural Sciences Managers	$189,368	●●●	▶▶▶▶▶
Computer and Information Systems Managers	$185,257	●●●	▶▶▶▶▶
General and Operations Managers	$150,054	●●	▶▶▶▶
Computer Hardware Engineers	$135,975	●●●	Ø
Computer and Information Research Scientists	$134,649	●●●●	Ø
Software Developers, Systems Software	$133,577	●●●	Ø
Electronics Engineers, Except Computer	$127,436	●●●	Ø
Medical Scientists, Except Epidemiologists	$124,745	●●●●	Ø
Electrical Engineers	$122,822	●●●	Ø
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	$122,303	●●●	▶▶
Administrative Services Managers	$116,009	●	▶▶▶▶
Mechanical Engineers	$110,763	●●●	Ø
Biochemists and Biophysicists	$110,044	●●●●	Ø
Market Research Analysts and Marketing Specialists	$103,979	●●●	Ø
Sales Representatives, Services, All Other	$90,918	●	▶
Microbiologists	$88,980	●●●	Ø
Accountants and Auditors	$87,797	●●●	Ø
Biological Scientists, All Other	$86,836	●●●●	Ø
Purchasing Agents, Except Wholesale, Retail, and Farm Products	$79,868	●	▶▶▶
Chemists	$78,337	●●●	Ø
First-Line Supervisors of Office and Administrative Support Worker	$67,296	●	▶▶▶▶
Electrical and Electronics Engineering Technicians	$66,014	●●	Ø
Executive Secretaries and Executive Administrative Assistants	$65,402	●	▶▶▶▶
Engineering Technicians, Except Drafters, All Other	$60,430	●●	Ø
Production, Planning, and Expediting Clerks	$58,689	●	▶▶
Life, Physical, and Social Science Technicians, All Other	$55,968	●●	▶▶
Medical and Clinical Laboratory Technicians	$55,209	●●	Ø
Mechanical Engineering Technicians	$53,712	●●	Ø
Biological Technicians	$51,638	●●●	Ø
Maintenance and Repair Workers, General	$48,997	●	▶▶
Inspectors, Testers, Sorters, Samplers, and Weighers	$46,350	●	▶▶
Chemical Technicians	$46,266	●●	▶▶
Secretaries and Administrative Assistants, Except Legal, Medical,	$43,308	●	▶
Office Clerks, General	$39,450	●	▶
Team Assemblers	$34,315	●	▶▶
Security Guards	$31,791	●	▶

General Education	
●	HS Diploma or less
●●	Associate's Degree
●●●	Bachelor's Degree
●●●●	Doctoral or Professional Degree
Additional Experience Required	
Ø	None
▶	Short Term
▶▶	Moderate
▶▶▶	Long-term
▶▶▶▶	1 to 5 years
▶▶▶▶▶	More than 5 years
Average Wage Levels	
$98,000 - up (Roughly 75th Percentile & Above)	
$55,000 - $98,000 (50th-75th Percentile)	
$30,000-$55,000 (25th-50th Percentile)	

*Example occupations identified from the largest 65 job occupations in NAICS 541710 at the national level.

Source: CA EDD LMI Occupation and Wage Statistics; BLS May 2013 National Industry-Specific Occupational Employment and Wage Estimates; BLS Education and Training Categories, By Detailed Occupation

Analysis: Collaborative Economics

Agile Manufacturing

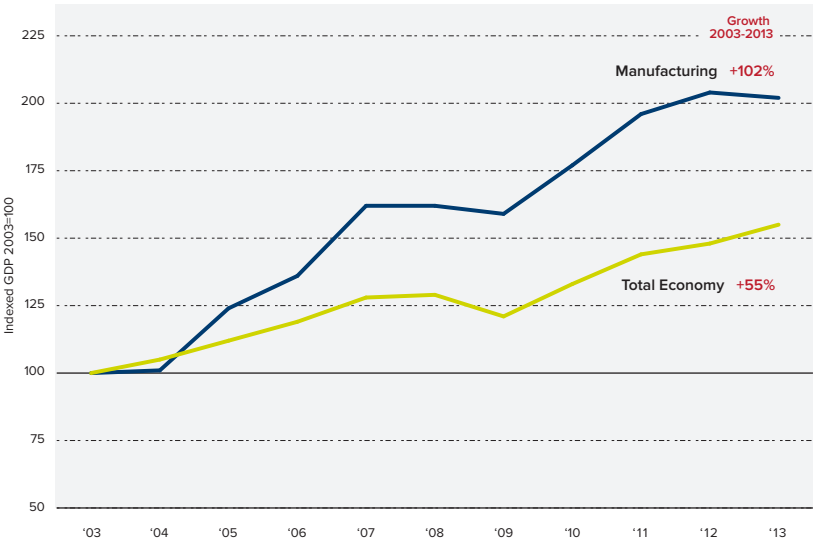
Manufacturing presents key opportunities in Silicon Valley, particularly around the prototyping and production of innovative products, such as those in IoT. Silicon Valley has one of the largest concentrations of manufacturing in high technology industries in the country; more than 75 percent of manufacturing jobs in the San Jose metro area were in "very" high technology industries, the highest proportion of any other metro area in the U.S.[18]

The strength in high technology manufacturing in Silicon Valley derives in part from connections between export-oriented companies and from specialized manufacturing companies who offer their services on a contract basis. The latter set of companies are known as agile manufacturers, and in Silicon Valley they typically offer first-run manufacturing and co-designing services to established Original Equipment Manufacturers and/or startup companies on products with high levels of engineering content. All ten of the Top 10 largest contract manufacturing companies (by revenue in 2010) have a location in or near Silicon Valley,[19] and roughly 90 Agile Manufacturing companies are located in Santa Clara County, with an average headcount of roughly 80 employees.[20]

What is Silicon Valley's edge?

Manufacturing industries accounted for 25 percent of the San Jose metropolitan area's total regional output, and manufacturing has exceeded growth in the rest of the economy since 2003. Agile manufacturers are a key driver of the continued growth in regional output in manufacturing, and a core opportunity area in Silicon Valley to generate jobs across a range of occupations.

Growth in Real Regional Output
San Jose Metropolitan Area
Index, 2003=100



Data Source: Bureau of Economic Analysis
Analysis: Collaborative Economics

While interviewees noted that Silicon Valley is not their primary location for large-scale or commodity manufacturing (the majority of which is located in Asia, or in mid-Western and Southern states in the U.S.), Silicon Valley offers key advantages for scaling production of innovative and highly engineered products. Silicon Valley's engineering talent pool is a crucial driver of this advantage. Proximity to startups and established technology companies seeking partners in scaling production of their new goods is another key advantage to locating in the region.

In Silicon Valley, agile manufacturers such as Foxconn and Jabil work closely with companies to engineer and adapt prototypes and production processes to fully commercialize products. Client companies frequently seek co-designing services and first runs in the agile manufacturers' Silicon Valley locations, and also sometimes request that larger-scale production occurs in Silicon Valley to control quality and adapt quickly.

18. Helper, Sue, et al. "Locating American Manufacturing." Brookings. 2012
19. BW Research Partnership. "Contract Manufacturing in Silicon Valley." Work2Future. Feb. 2012.
20. Ibid.

What is the economic opportunity in Silicon Valley?

While productivity gains, rising labor and real estate costs in Silicon Valley have narrowed the number of workers employed in conventional manufacturing industries, agile manufacturers reported workforce gains and positive employment projections in recent years[21] and in 2012 accounted for 7,600 jobs in Santa Clara County.[22] In addition, employment in manufacturing industries containing many agile manufacturers has risen; Semiconductors and Other Electronic Components Manufacturing employment increased by an average of 2.1 percent annually between 2010 and 2013, and Computer and Peripheral Equipment Manufacturing by 3.0 percent annually over the same period.[23] Agile Manufacturing presents a key opportunity to build on regional assets such as high commercialization activity around new products (particularly around IoT), and directly generate jobs across various skill and education levels.

As IoT technologies gain in strength and prominence, there will be increasing opportunities for agile manufacturers in Silicon Valley. Because of its entrepreneurial culture and history, it is likely that a new wave of companies will launch in response to opportunities in IoT, similar to technology waves in the past. However, unlike the Social Media wave, which was principally focused on software and internet technologies and had narrower implications for hardware, IoT will affect physical devices more broadly. Silicon Valley's agile manufacturers are positioned to collaborate with startups and established technology companies to prototype and scale new, highly engineered intelligent devices.

Mechanical, electrical and industrial engineers are critical to the success of agile manufacturers, and middle-skill technical roles are equally pivotal, including machine operators/technicians, designers and assemblers.[24] Growth in Agile Manufacturing could help to generate jobs in the region, particularly among workers that previously worked in conventional manufacturing industries.

21. BW Research Partnership. "Contract Manufacturing in Silicon Valley." Work2Future. Feb. 2012.
22. Ibid.
23. Muro, Mark, Jonathan Rothwell, Scott Andes, Kenan Fikri, and Siddharth Kulkarni. "America's Advanced Industries: What They Are, Where They Are, and Why They Matter." Brookings. Feb. 2015.
24. Ibid.

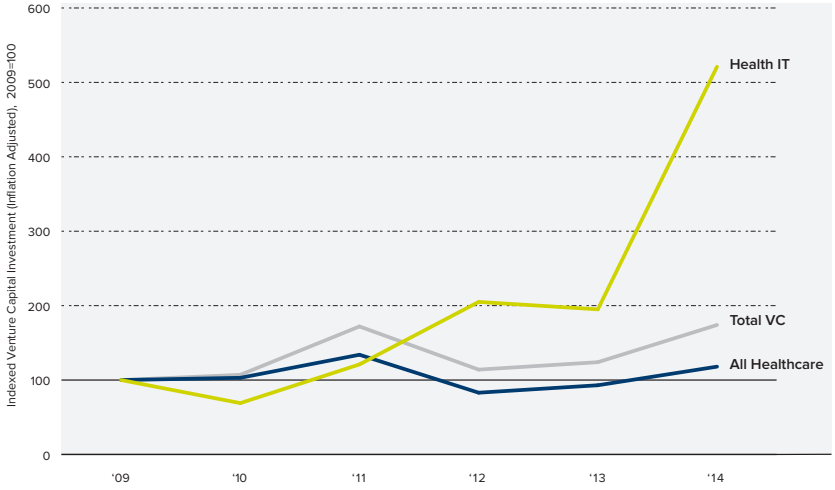
Health IT

The Internet of things is fundamentally about devices being connected with and contingent to other data; it is about making machines, and by extension humans, more knowledgeable, and capable of efficiencies due to better real time information, as well as predictive capabilities.[25] As IoT converges with traditional health care, the result is an advance in Health IT. Over the last five years, Health IT has evolved significantly in two major dimensions. One dimension is the transformation of health care organizational infrastructure. By employing large volumes of data and "smart" analytics, health care organizations are finding new ways to optimize operations.[26] The other dimension relates to branching into consumer-facing markets: creating phone apps and wearable devices that engage patients in their own health care goals.[27] Increased access to and prevalence of personal hardware, such as smart phones, has prompted demand for health care technology that is integrated into personal mobile devices.[28] The convergence of these two markets is key: how will health care systems harness the power of big data on the patient and institutional levels to decrease costs and increase the quality of care?

What is Silicon Valley's edge?

In Silicon Valley, there is a prevalence of major health care systems (such as Kaiser Permanente), health care startups capitalizing on the rich academic health and bioscience research, and an infrastructure of capital and culture that promote collaboration in the larger health field. This environment creates opportunity for a wide range of new medical devices and delivery systems that create efficiencies and improvements in patient care, as well as a number of novel wearables that promote health and connect patients to their health care providers, stimulating a growing consumer market. Large traditional tech companies are also involved in the health care space, providing important platforms for launching integrated health IT systems.[29]

Growth In Health Technology Venture Capital Investment
Silicon Valley
Index, 2009 =100



All Healthcare includes investments in Health IT, biotechnology, medical devices and all other healthcare technology startups
Data Source: CB Insights
Analysis: Collaborative Economics

Venture investment in Health IT in Silicon Valley has been growing rapidly since the recession, a sign that the venture capital community sees Health IT as a viable investment. Growing five-fold since 2009, investment in the region's Health IT startup companies is growing much faster than traditional health care and faster than all venture capital funding combined. Since the beginning of 2013, total investment in Health IT is estimated at more than $3 billion with significant participation from major investors such as Greylock Partners and Kleiner, Perkins, Caulfield and Byers, as well as established companies looking to make strategic investment such as Apple, Qualcomm and IBM.[30] Investments in the Health IT space span the dimensions mentioned above: from personal, wearable devices made for consumers to larger institution-oriented platforms that manage and analyze huge volumes of data to optimize operations.

25.Hardy, Quentin. "Tim O'Reilly Explains the Internet of Things." New York Times Bits Blog. Feb. 4 2015.
26. Isaacs, Charles. "Salesforce Voice." Forbes. Sept. 3 2014.
27. McKinsey. McKinsey Insights and Publications. Latest Thinking on Healthcare. Jul. 2014.
28. Hardy, Quentin. "Cisco Makes Its Annual Predictions on Mobile Data Traffic." New York Times Bits Blog. Feb. 3 2015.
29. Microsoft. "Transforming patient care with IoT." Microsoft Cloud Platform.
30. Byrnes, Nanette. "Can Technology Fix Medicine?" MIT Technology Review, Business Report. Jul. 24, 2014.

As the impact of IoT ripples through the Heath IT vertical in Silicon Valley, there will be more opportunities for cross-sector teams to work on industry innovations. Major health care providers see an opportunity to increase the quality of medical devices and improve patient participation in health care through new technology. At the same time startup companies involved in creating these new products are searching are looking for ways to promote their products and get them into the hands of both institutional and individual consumers.

Interview data revealed that local health care organizations have close relationships with the startup community. Established health care organizations play an important role in bringing new startup products to market by piloting new products, offering real time feedback on technology viability, and in some cases providing venture capital financing for promising ideas. Additionally, many of these startup companies being formed in the region are homegrown, coming from the region's prestigious core of universities. The connections between research hospitals and these universities serve to connect young, entrepreneurial STEM talent to real-world health care problems.

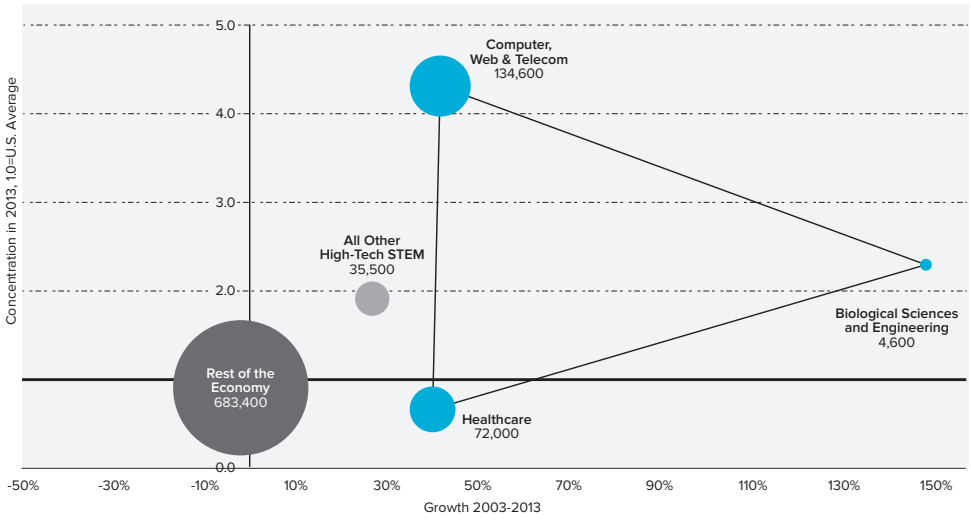
What is the economic opportunity in Silicon Valley?

Health care, traditional IT, and bioscience and engineering are all important industries in Silicon Valley, representing hundreds of thousands of jobs and exhibiting strong job growth. Health IT, as an industry, can capitalize on this, taking advantage of the prevalence of talent, the access to consumers (both at the level of industry and individual), and a diverse supply chain that provides access to manufacturing, research, and capital to execute on ideas.

Advances in Health IT directly impact the traditional health care workforce. As more and newer technology becomes ubiquitous in the health care sector, the opportunity for a technology-savvy workforce grows as well. Like many sectors, these advances in technology augment a worker's ability to do their job.[31] This means there is the potential for redundancy in old jobs as well as the possibility of new jobs.

The growth of the Health IT sector also impacts R&D and manufacturing firms. Important drivers in the supply chain, local technology and manufacturing are critical partners in bringing new devices to market. These industries, particularly manufacturing, also have the potential to engage and employ high-, middle-, and low-skill individuals in the production of medical devices, equipment and treatments. As the Health IT sector expands, ensuring that Silicon Valley remains a place where R&D and manufacturing functions can grow as well is critical to maintaining key elements of the ecosystem.

Growth Trends in Health IT Talent Pool, By Occupation
Total Jobs, Growth Rate and Concentration
San Jose Metro Area



Note: Numbers reflect the 2013 employment of each occupation.
Data Source: Bureau of Labor Statistics, Occupational Employment Statistics
Analysis: Collaborative Economics

31. Hardy, Quentin. "Tim O'Reilly Explains the Internet of Things." New York Times Bits Blog. Feb. 4 2015.

R&D and manufacturing firms interviewed for this project said that the high cost of labor and living in Silicon Valley incentivizes them to move lower-skill labor (which is easy to find in other parts of the country or world) out of the region as they scale operations. For health care providers who cannot export many of their middle- and low-skill jobs, high of cost of living and transportation infrastructure were also critical issues facing their workforce.

Silicon Valley has the necessary resources to make Health IT an important regional industry. There are established health care companies, a vibrant startup community, excellent research institutions and an active venture capital scene. But more than that, Silicon Valley's culture of connecting these assets gives it a natural advantage over other regions.

Smart Buildings

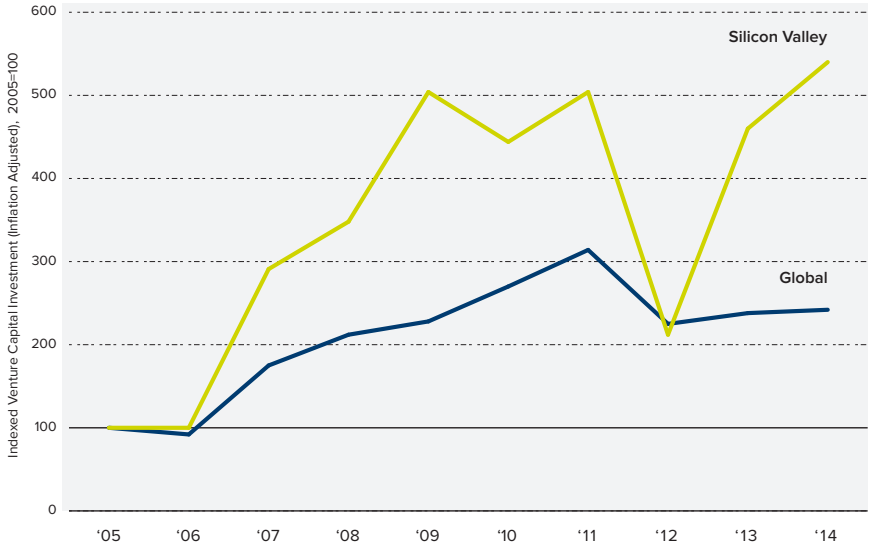
Smart Buildings includes companies that design, develop, manufacture, sell or install products that make buildings more efficient and sustainable. Smart buildings companies in Silicon Valley are active across the building life cycle, ranging from new construction or renovation to operation and maintenance. The Smart Buildings industry is gaining momentum as the public and private sector seek lower energy bills and healthier work and home space increases in the region and world. In addition, governments are establishing green building and energy efficiency standards that spur demand for these products and services, including regulations such as California's Title 24 energy use requirements and the City of San Jose's green building policy for municipal buildings and larger private sector projects.[32]

What is Silicon Valley's edge?

Silicon Valley has a regional advantage in Smart Buildings as the location of cutting-edge technology companies that are creating products and services for buildings that utilize a combination of connected hardware and software to optimize building operations. This proximity to companies producing technologies such as Bluetooth, energy and internet infrastructure, software, and semiconductors allow for early adoption into new products. Entrepreneurs and investors are increasingly active in this space. Venture capital investment in Silicon Valley Smart Buildings companies increased 2.5 times in the last two years (2012-2014), compared to a seven percent increase globally. Over the last decade, investment regional Smart Building companies increased over five-fold, reaching $555 million in 2014.

Silicon Valley is home to leading R&D facilities for entrepreneurs and companies to develop and test new building technologies. FLEXLAB, for example, is a new facility located at Lawrence Berkeley National Laboratory (LBNL) that is the most advanced building efficiency simulator in the world. The facility can test system-level technologies under real-world conditions to validate the technology performance before implementation at scale. The construction firm Webcor is using FLEXLAB to test plans for a new 250,000 square foot building for Genentech in South San Francisco. LBNL scientists are working with Webcor to measure the energy efficiency levels and comfort of the building before breaking ground.[33]

Growth in Venture Capital Investment in Smart Building* Companies
Silicon Valley and Global
Index, 2005=100



*Includes energy efficiency, green building and smart grid startup companies
Data Source: Cleantech Group i3; Bureau of Labor Statistics
Analysis: Collaborative Economics

32. City of San Jose. "City of San Jose Municipal Green Building Program."
33. Flexlab. "Now at Flexlab."

Prospect Silicon Valley is a San Jose-based nonprofit organization that is also working to help companies accelerate commercialization of smart building technology solutions. The organization opened a Technology Demonstration Center in San Jose to provide space for companies to test and demonstrate their products on a commercial scale, and connect companies with local building owners to provide real life test beds for new technologies. Prospect Silicon Valley serves as a broker, bringing together key partners, such as corporate strategists, building owners, and facility managers to help companies advance technologies that will benefit cities in Silicon Valley and beyond.[34]

What is the economic opportunity in Silicon Valley?

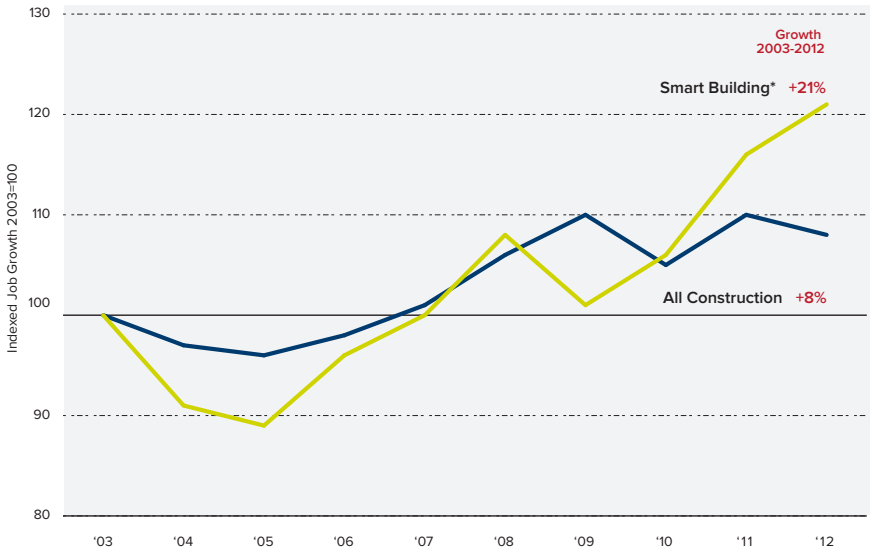
Smart buildings companies in Silicon Valley have an economic opportunity to advance innovation at the convergence of construction, technology, and manufacturing. Innovative companies are applying IoT technologies to buildings and capitalizing on regional technology strengths to create products such as light-emitting diode (LED) lights, intelligent glass, energy management devices and analytics software, and smart thermostats. Companies such as Nest, Xicato, View, AutoGrid, Bidgely, and BuildingIQ have smart building technologies that are helping customers improve tenant health and save energy, while also enabling buildings to be more connected to the Internet and devices via software applications.

In this shift towards smart buildings, the region's traditional construction industry is being called upon to change the way they design and construct buildings. Policies that promote the renovation and construction of better buildings require technology like sensors and integrated energy management software, in addition to materials and construction techniques that create a healthier space and conserve energy. To meet this demand, Silicon Valley's construction firms, trades association, and individual workers are upgrading their skills in order to be competitive. Smart building construction presents an opportunity for the construction industry to differentiate itself and add value to the end customer.

Silicon Valley's economy overall has rebounded following the recent recession, which also helped spur construction and renovation projects in the region. Companies are responding to the market demand for better buildings and are growing faster than the industry overall. Jobs in Smart Buildings, including energy efficiency retrofits and smart building products, grew 21 percent from 2003 to 2012. The traditional construction industry, in contrast, increased overall jobs only eight percent in the same time period.

The Smart Buildings industry in Silicon Valley presents a variety of job opportunities for regional workers across a range of skill levels. Occupations span from engineers and manufacturing technicians to construction laborers and electricians. Facility managers, in particular, are at the front line of exposure to smart building technologies and are be responsible for operation of new products and systems. As technology and buildings continue to be integrated, opportunities for jobs and training along the industry continuum will increase.

Jobs Growth in Smart Building and All Construction
Santa Clara and San Mateo Counties
Index, 2003=100



*Includes energy efficiency, energy infrastructure and green construction jobs
Data Source: 2012 Green Establishments Database, National Establishment Time Series
Analysis: Collaborative Economics

34. Prospect Silicon Valley. "Buildings and Energy Innovation Platform."

Silicon Valley's Next Act

Silicon Valley is on the cusp of another transformation and can learn much from its own history. In the early 1990s, the introduction of the Internet (the 4th wave of innovation) promised to be the next big opportunity should the region make necessary investments. Business and civic leaders organized around Smart Valley, raising over $20 million to promote the application of the Internet to schools (Net Day) and bring local government permitting processes online. The Smart Valley initiative also hired Marc Andreseen, then a graduate student from the University of Illinois, to apply his Mosaic browser to Commerce Net that was the first commercial application of the Internet and contributed to the dot.com explosion that created over 200,000 job in the region. This exemplary of Silicon Valley's ability to marshal regional businesses, governments, and community organizations to work together on and invest in issues that affect the entire region.

Today, facing the reality of yet another major wave of transformation, REDI is situated to help the Silicon Valley region capitalize on its significant assets and remain the innovation capital of the world. To promote the Internet of Things (the 6th wave of innovation) as an employment driver in Silicon Valley, REDI will focus on:

- **A regional marketing campaign** that promotes Silicon Valley's significant talent and supply chain assets; and,
- **Opportunities specific to assisting industries** such as R&D, Manufacturing, Health, Smart Buildings pivot, expand and capitalize on the next wave of innovation: the Internet of Things.

REDI will help provide a regional vision for this next wave of innovation, as well as a strong economic development marketing message. The next phase of REDI will bring together teams of leaders from the private and public sector to identify specific actions to address the requirements for success in each of these four opportunity areas. We will work with a regional network of business leaders and local governments to implement a strategy based on this vision.

Interviews in this first phase identified a few areas that these action teams might address in a collaborative action plan. For example, interviewees raised issues that were cross-cutting across industries, such as the high cost of living and long commute times, as well as industry-specific issues such as a dearth of technically skilled machine operators for local manufacturing firms. These concerns demonstrate that are potential action items that local employers might take on together along with critical public sector partners.

Silicon Valley is the center of innovation, but to remain globally competitive, regional actors must align and leverage their resources and build on regional assets. The opportunity within IoT is clear; the next step in REDI is to build business-led teams around these areas (R&D Centers, Agile Manufacturing, Health IT and Smart Buildings), to devise specific plans and implement them to ensure prosperity for the whole region.

Appendix A: Interviews

Thank you to the following individuals for participating in our interview process:

John Adams, Executive Vice President and Commercial Banking Group Head, Wells Fargo
Alex Andrade and Tiffany Chew, Economic Development, City of Mountain View
Michael Bangs, VP, Real Estate, Oracle
Paul Beaupre, CEO, Good Samaritan Hospital
Ted Bojorquez, Senior Vice President & Manager, City National Bank
Sean Brooks Economic Development Manager, City of Redwood City
Irene Chavez, Senior Vice President, Area Manager, Kaiser Permanente
Mike Ciesinski, CEO, FlexTech Alliance
Amir Dan Rubin, President and CEO, Stanford Health Care
Doug Davenport and Kelly Krpata, Prospect Silicon Valley
Beth Davies, Director of Training Programs, Tesla
Menko Deroos, CEO, Xicato
Alex Driskill-Smith and Chris Goodhart, Samsung Semiconductor International
Ted Dubbs, Senior Vice President, FoxConn
Cosme Fagundo, Entrepreneur and Investor
Michael Foulkes, Senior Manager, Government Affairs, Apple
Kelly Klein, Economic Development Director, City of Fremont
Bruce Knopf, Development Director,Santa Clara County
Scott Leatherman and Kellie Drenner, SAP Bay Area Marketing, SAP
Tarkan Maner, Chairman and CEO, Nexenta
Jim Morgensen, Vice President of Global Workplace, LinkedIn
Kathrin Nikolussi, VP Business Development, WellnessFX
Jonathan Noble, Government Affairs Manager, Microsoft
Randy Pond, Executive Vice President, Operation, Cisco
Mohammad Qayoumi, President, San Jose State University
Edith Ramirez, Principal Planner/Economic Development Manager, City of Morgan Hill
Ken Song, CEO, Ariosa Diagnostics
Connie Verecles, Economic Development Manager, City of Sunnyvale
David Wahl, Vice President Operations and General Manager, Jabil
Jacob Warwick, Marketing Manager, MyFitnessPal
Devin Whitney, Manager, State Government Relations, eBay

Appendix B: REDI Sponsors

San Jose Silicon Valley Chamber of Commerce
Santa Clara County
City of San Jose
Essex Property Trust
Devcon Construction
Divco West
Carl Berg
Arcadia Development
PG&E
Santa Clara & San Benito Counties Building & Construction Trades Council
Federal Realty
SAP
City National Bank
Campbell Chamber of Commerce
City of Morgan Hill
J.J. Albanese
Adobe
Cosmopolitan Catering
Kaiser Permanente
Robinson Oil
Silicon Valley Community Foundation