

San Jose State University

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San Jose State University based incubators: Loosely coupled elements in Silicon Valley's entrepreneurial system

Asbjorn Osland, *San Jose State University*
Burton V Dean



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San Jose State University's University Based Incubators: Loosely Coupled Elements in Silicon Valley's Entrepreneurial System

Abstract

The San Jose Redevelopment Agency (RDA) fostered and continues to nurture incubators. In partnership with the RDA, San Jose State University (SJSU), through its Foundation, operates four fairly autonomous loosely coupled university based incubators (UBIs). Their primary mission is to develop start-ups. They also provide excellent learning opportunities for students. What they have not done is commercialize university or faculty intellectual property. The incubator directors are experienced business people who have the business acumen to nurture start-ups successfully, which they have done. The RDA, SJSU, the UBIs, and the incubator directors are all part of the entrepreneurial system that characterizes Silicon Valley.

Introduction

In this paper we will briefly review the significant literature on UBIs. The main benefit of the literature, primarily derived from the articles written by Mian (1996a, 1996b, 1997), was to develop a framework, adapted based on our experience with incubators, and used to analyze the four UBIs affiliated with SJSU. Then we will describe the context of the current paper (i.e., Silicon Valley and San Jose State University), the four incubators and the RDA, a partner with SJSU in facilitating the development of the incubators.

A fifth incubator existed for three years under the name "Incubator Without Walls" (Dean, Burstein, Woodsmall, & Mathews, 2000). It was fully funded for three years by a HUD grant. Faculty-student teams engaged in service learning in projects designed to serve the needs of the 26 existing businesses and 67 potential businesses in the neighborhood surrounding the university. Business owners expressed satisfaction with the process. The incubator ceased operations when funding stopped.

We will conclude with our findings regarding the critical role of industry clusters, access to resources, organizational learning, social networks within the incubation industry, and the pivotal role of mentoring/coaching.

Literature Review

Business incubators typically provide office space, administrative support and equipment, and mentoring (Peters, Rice & Sundararajan, 2004). Small businesses can lease these spaces on flexible terms and at reduced rents as compared to the general market. Wiggins and Gibson (2003), in their analysis of the Austin Technology Incubator, conclude that successful incubators do the following: clearly measure performance, offer leadership to start-ups, provide needed services to tenants, use an effective selection process, and facilitate access to networks of needed resources, both financial and people.

University based incubators: Many of the UBI's are the result of science and technology research projects. Rensselaer's Incubator Program, founded in 1980, is one of the oldest U.S. incubators and the first U.S. incubator wholly sponsored and operated by a university (Retrieved September 12, 2004 from <http://www.rpi.edu/dept/incubator/homepage/>). Its accomplishments include the following:

- "Greater than 80% survival rate for participating companies.
- Over 180 companies served since 1980. Most have remained in the capital region of New York State.
- 43 current tenants; 230 jobs.
- Occupancy in the Incubator typically exceeds 95%.
- Over 2,000 jobs created.
- Annual sales of Incubator "graduates" exceed \$500 million.
- Approximately 2/3 of participating companies have evolved from research at Rensselaer or have been started by Rensselaer Alumni.
- Hundreds of RPI students have been employed.
- Recipient of NBIA's 1995 Randall M. Whaley Incubator of the Year Award.
- The Incubator has remained financially self-sustaining since its inception."

Other universities observed Rensselaer's success and founded their own incubators. Mian (1996a) in a study of university technology business incubators found that the university affiliation adds value to incubator client firms due to the university's image, laboratories and equipment, and student employees. Mian also listed the

characteristics one could use to describe and study UBIs: origins of facilities, objectives, organizational design, governance and policy guidance, tenant performance review, institutional support, staffing, funding sources, technologies and entrepreneurs targeted, strategic operational policies, services and their value added, and survival and growth of tenant firms. Mian performed two case studies of UBIs: Enterprise Development Inc. (EDI) at Case Western Reserve University (CWRU) and the Ben Craig Center (BCC) at the University of North Carolina. One interesting observation about the EDI and BCC was that there was relatively little interaction between students and faculty and the UBI. However, EDI managers claimed that the university affiliation enhanced EDI's status and prestige. In the case of the BCC, incubator managers believed that it enhanced the university's status in terms of economic development in the state. Tenants of the BCC valued the prestige associated with university affiliation. At the time of the study, only one professor in both had used the UBI for technology transfer from the university. When EDI tenants were asked to rank the importance of university related services, student employees was the most significant service. BCC tenants ranked student employees and faculty consultants as the university services they most valued.

Mian (1996b, 1997) did another, more extensive, research project where he included four UBIs, the two mentioned above and the Technology Innovation Center at Northwestern University and the Technology Advancement Program at the University of Maryland. The goal was to create a conceptual framework for assessing and managing UBIs. The dimensions used to assess the UBIs were the following: performance outcomes; tenant firm's survival and growth; contributions to sponsoring-university's mission; community-related impacts; goals, structure, and governance; financing and capitalization; operational policies; target markets; shared incubator services; and university-related services.

When assessing UBIs one could use the conceptual framework adapted from Mian's papers cited above. The elements have been slightly adapted to include the experience of the co-author of this paper, Burton Dean, a member of a UBI advisory board since 1994. The elements follow:

1. External resources: Government funding helps the incubator charge below market rents to tenants. Access to government and university resources (e.g., labs, students, faculty consultants, seminars, etc.) can be useful. Students appear to be the more commonly used and valued university resource.
2. Social networks: Networks with other incubators and people from government and industry are crucial for tenants. Collective learning flows from the incubation process, given the proximity of the start-ups to one another, particularly when clustered by industry.
3. Tenant services: Sound coaching, subsidized services to tenants, and allowing enough time to select the best tenants, as opposed to being rushed to fill incubator space and collect rents, are all vital to start-up success.
4. Clarity of objectives: The objectives of the UBI are important to understand. Commercialization of professors' innovations is a very different objective than incubating start-ups that are deemed promising regardless of their non-university origin.
5. UBI relationship to university: The organizational design, in terms of the UBI's relationship with the university and/or sponsoring government agency is crucial to understand. The UBI may function relatively autonomously of the university, as is SJSU's case, or it may be linked very closely. In the case of the SJSU, the four incubators are linked very strongly to the SJSU Foundation for provision of administrative and financial services. Governance and policy guidance vary from one UBI to another. Again, autonomy to manage the UBI to meet stated objectives is critical.
6. Key strategic operational policies: Tenant selection, graduation policies, IP policies and the like must be clear. Periodic tenant performance reviews ensure that incubation progress is maintained.
7. Performance measures are critical: Survival and growth of tenant firms are statistics that UBIs need to gather to show effectiveness. The UBIs need to contribute to the sponsoring-university's mission. Community-related impacts are assessed by government agencies. The UBI needs to demonstrate that it generates jobs and tax income.

Methodology and Sample

Dean and Osland interviewed the four SJSU UBI directors and the RDA director using a semi-structured format with interviews lasting 60-90 minutes in the respondents' offices from July through September 2004. We corresponded with former SJSU President Caret and Foundation Chief Operating Officer (COO) Mary Sidney via e-mail in late September 2004.

Context of SJSU UBIs

SJSU: The University was founded in 1857 and is the oldest public institution of higher education West of the Mississippi River. SJSU has more than 134 bachelor's and master's degrees (<http://www.sjsu.edu>). As a metropolitan university, SJSU serves the surrounding area in terms of socio-economic development.

SJSU is a large state university attended primarily by commuters. Currently, the State of California is experiencing a budgetary shortfall that limits resources allocated to the university system, including SJSU. This is important because faculty have to bootstrap all activities related to entrepreneurship.

In fall 2003 the total SJSU enrollment was 28,932. Demographics of the student body follow:

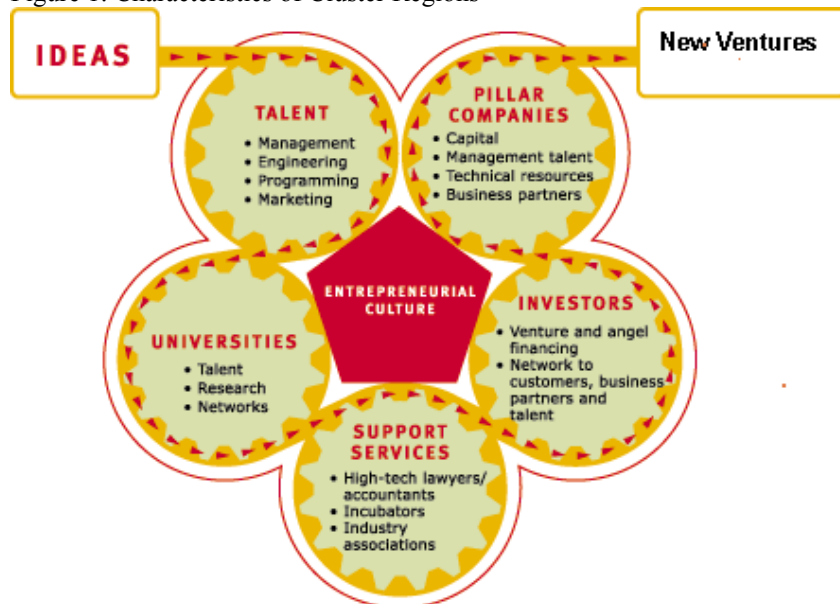
- Overall median age was 26.2 years, 23.9 for undergraduates and 32.9 for graduate students
- 21,396 undergraduate students, 7,536 graduate students (others were working on a second baccalaureate or seeking needed credentials).
- 65% were full-time
- Ethnic profile: African American 4%, American Indian/Alaskan 0.5%, Asian 31.7%, Filipino 7%, Mexican American 9.5%, Other Hispanic 3.6%, Pacific Islander 0.6%, White 26.3%, and not stated 16.8%.
- SJSU is ranked 10th nationally in the number of bachelor's degrees awarded to minority students in 2002-03, according to a "Top 100" list of colleges and universities compiled by Black Issues in Higher Education (June 3, 2004) and based on data from the U.S. Department of Education. In addition, SJSU ranked 7th nationally in awarding bachelor's degrees to Asian Americans" (personal communication, Nancy Stake, SJSU Media Relations Officer, September 14, 2004).
- 92% of the 5,774 College of Business students were undergraduates.

Silicon Valley: Some of the world's foremost clusters of varied industries are located in Silicon Valley. Harvard's Michael Porter described industry clusters as follows:

"Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, and associated institutions in a particular field that are present in a nation or region. Clusters arise because they increase the productivity with which companies can compete. The development and upgrading of clusters is an important agenda for governments, companies, and other institutions. Cluster development initiatives are an important new direction in economic policy, building on earlier efforts in macroeconomic stabilization, privatization, market opening, and reducing the costs of doing business." (Retrieved September 12, 2004 from <http://www.isc.hbs.edu/econ-clusters.htm>).

Silicon Valley contains the elements shown in Figure 1 and is located in the San Francisco Bay Area, which had an estimated 6.7 million people (<http://census.abag.ca.gov/bayarea.htm>) in 2002, a huge market. Start-ups tend to occur in large urban agglomerations that offer a high density of potential entrepreneurs, highly educated population, a large market, and knowledge from local universities (Todtling & Wanzelbock, 2003). In the case of Silicon Valley, two of world's finest research facilities (i.e., Stanford University and UC Berkeley) have doctoral technical programs that foster innovation. However, more of those employed in Silicon Valley come from SJSU than any other university. Though SJSU is clearly not at the level of Stanford or Berkeley in terms of research, it is listed within the top 200 research universities in the nation (http://www.sjsu.edu/about_sjsu/).

Figure 1: Characteristics of Cluster Regions



Adapted from Internet Cluster Analysis, 1999; A. T. Kearney analysis (Retrieved September 27, 2004 from <http://www.jointventure.org/initiatives/edt/svcluster/Cluster.pdf>)

San Jose is located within Silicon Valley. The City of San Jose lists the following facts (<http://www.sjeconomy.com>) which describe how the area depends on innovation and establishes a climate conducive to entrepreneurship:

- “One-third of all venture capital invested in the United States is invested in companies in the San Jose area—\$5 billion in 2003 alone.”
- “San Jose leads the nation in patent generation, and is home to more patent holders than San Diego and Los Angeles combined.”
- “The San Jose area is home to the largest concentration of technology expertise in the world—more than 7,300 technology companies employing more than 300,000 people.”
- “San Jose is the most diversified of any innovation-based community; specializations span seven technology fields and foster innovation across disciplines.”
- “More than 85% of new job growth in the region comes from companies less than 10 years old.”

The elements shown in Figure 1 complement one another to create a cluster. The term “pillar companies” needs clarification: these are significant companies that contribute to the creation of a network of suppliers, a strong labor pool, and a regional identification associated with a certain industry. In semiconductors, examples would include Intel, AMD, IBM, National Semiconductor and many others.

Business Incubation: Silicon Valley, with its entrepreneurial spirit and industry clusters, fosters innovation. However start-ups often fail for a variety of reasons. Incubation provides crucial support and mentoring for start-ups. It is a vital follow up to business plan competition winners and SJSU has more such incubators than any university in the nation (personal communication, Barbara Harley – International Business Incubator Director, August 26, 2004). The four incubators are administratively housed in SJSU’s Foundation (<http://www.sjsufoundation.org/>), a 501(c)(3) non-profit corporation; three are located in downtown San Jose and one is in South San Jose. The four incubators are the following: Software Business Cluster (SBC), Environmental Business Cluster (EBC), International Business Incubator (IBI) and the San Jose Bioscience Incubator and Innovation Center (SJBIC), which opened in June 2004. The first three were developed from 1994-1996.

This emphasis on business incubation is the result of a partnership between the SJSU Foundation and the RDA and the incubators. The incubators are led by experienced business people who have the skills and experience to know how to assist start-ups. The incubators function relatively autonomously.

The Foundation is a 501(c)(3) non-profit corporation that has annual revenues of \$64 million. Its entrepreneurial management structure supports the university's mission of serving the surrounding area as the metropolitan university of Silicon Valley. The Foundation enables the university to implement instructional and service activities not normally supported by the state budget, such as the four incubators that are the focus of this paper.

UBI descriptive information and accomplishments

Table 1: UBI Descriptive Information

Incubator	Director	When founded	Square footage	Web site
SBC	Chuck Erickson	1994	18,000	http://www.sjsbc.org/
EBC	Jim Robbins	1994	6,000	http://www.environmentalcluster.org/
IBI	Barbara Harley	1996	14,700	http://www.ibi-sv.org
SJBIIC	Kathleen Imhoff	2004	36,500	http://www.wtc-sf.org/biosanjose.html (using Women's Technology Web site)

UBI accomplishments are listed below for the SBC and EBC:

Software Business Cluster:

- National incubator of the year in 2000
- The SBC companies have attracted more than \$475 million in investment, primarily spent in San Jose.
- Over 75% of incubated companies establish themselves in San Jose, upon graduation (Silicon Valley Business Link, 2/8/2002).
- 2,500 jobs have been created as a result of the SBC graduates.
- The city made its original investment back in three years.
- The SBC has had four start-ups that went through IPOs.
- Firms have created 130 new products.

Environmental Business Cluster:

- The EBC supports new for profit companies developing products or services that will have a positive impact on the environment.
- The EBC was the first environmental incubator in the U.S. when it was formed in 1994.
- Caldwell (July 5, 2004) reported that the EBC had worked with 70 companies in ten years, plus another 20 that were being incubated in mid-2004.
- Almost 50 businesses have graduated from the EBC.
- 85% of the companies incubated by EBC were still in business in mid-2004.

International Business Incubator:

The IBI is different from the SBC and EBC in that it does not provide the typical incubation services for start-ups. Barbara Harley, IBI director, saw that many international companies came to the Bay Area but started in San Francisco, Palo Alto and Berkeley – not San Jose. She proposed the IBI to the mayor, but the mayor's office saw it as controversial because some tenant jobs were held by foreigners. Tapin Moore of PG&E, a large public utility, supported the idea and helped Barbara get it started. Many foreign companies want IBI to help set up a sales office in Silicon Valley and contact IBI. Barbara stated: "We're not a job creation incubator. We're an inward investment tool. We receive money from abroad that is spent locally... Sales tax revenue is a big contributor locally. Companies want to come to Silicon Valley. We get them to set up in San Jose."

IBI's clients tend to be roughly evenly distributed between Europe and Asia with a smattering of others from Canada, Mexico, and Brazil. She said the IBI clients from Scotland described IBI as providing a "soft landing," in that it made things easier for people new to the area. The principal benefit IBI provides to foreign companies is that it is the first home for companies coming from abroad. They can "plug and play." IBI gives them advice and helps them decode Silicon Valley. IBI gives them orientations including how to give quick value proposition presentations. IBI provides relocation support – e.g., Israelis were directed to live in Palo Alto because it has a

larger Jewish population than the South Bay. Companies that use IBI are able to avoid some of the large deposits that are required of companies – e.g., \$800 phone deposit.

IBI has other programs that generate revenue from additional services to resident clients. Other programs include the IBI International Delegations & Visitor's Program, with U.S. government agencies; Introduction to Incubation, a two or four hour training program; Company Visit with local experts and professionals on incubation; Management/Development Training, a 20 to 24 hour program for assessing a community and its potential for operating a business incubator; Comprehensive Business Incubation Training, a one to two week program; and Consulting Services.

IBI has created six foreign trade offices in Silicon Valley, and has been asked to create an incubator in Bangalore. SJSU is now interested in El Salvador and IBI is uniquely capable of training people to develop international incubators. IBI has incubated incubators for Belgium, Japan, India, Scotland, Singapore, and Korea.

IBI receives an average of 12 visiting groups monthly, from more than 60 countries, which sometimes results in favorable media coverage for IBI in the home countries of the various delegations.

IBI also provides opportunities for international business interns and international volunteers. Some student interns come from abroad while others are local. IBI has a Market Research Lab which uses students, some from SJSU, to conduct research for foreign companies. Canadian companies have contracted with IBI for this service. IBI is comfortable working with foreign students, many of whom serve as unpaid interns.

Another important IBI project is the iDISC Grant, a World Bank grant, part of the infoDev Incubator Initiative for Developing Countries, that "is designed to encourage, advise, and link business incubator projects and encourage them to participate in the application of Information and Communications Technology (ICT) broadly throughout small business and underserved populations" (www.ibi-sv.org). The grant was jointly awarded to Brazil and IBI with IBI serving as a sub contractor under Amprotech, its Brazilian partner.

San Jose Bioscience Incubator and Innovation Center:

SJBIIC (Retrieved September 12, 2004 from <http://www.wtc-sf.org/biosanjose.html>) provides world-class laboratory space in addition to the customary office space provided by incubators. The intent is to work with companies for an average of one to two years. The wet labs and dry labs include tissue culture facilities and a common equipment room. The equipment list includes the following:: Laminar Flow Hood, Autoclave/Sterilizer, Milli-Q, DI Central System, Dishwasher, Ice Machine, Dry Ice Chest, Centrifuge, LAN cabling and T1 Services.

Companies receive the following services: Quarterly Assessment and Roadmaps, Customized Coaching, Skills & Resources (i.e., basic business start-up needs); Networks and Funding. Facilities services include Environmental Health & Safety Management and Hazardous Materials coordination. The SJBIIC also wants to provide an entrée to U.S. capital and business resources for foreign companies.

SJBIIC, a joint project involving Building Blox Solutions and the Women's Technology Cluster, began in June 2004. SJBIIC therefore cannot report any significant achievements as yet aside from having two tenants already (Cytolution, Inc. and Manoa Medical, Inc) and six others are in negotiations (as of October 2004). There is space for 20 companies. Cytolution relocated from northern Virginia to South San Jose and is developing a new cervical cancer diagnostic device. "San Jose's Innovation Center gives us instant access to critical resources we need to grow," said Cytolution founder and CEO Urs Wiederkehr. "Legal, regulatory and marketing experts, experienced executives, venture capitalists and other investors, and many other key business resources will be at our fingertips." Manoa Medical is focused on new technology for breast cancer surgery. "The San Jose center is an outstanding space that includes access to support and equipment that a life science start-up company needs right at the beginning," said founder and CEO Roberta Lee (Retrieved September 24, 2004 from <http://www.biotechfind.com/news/news-Bioscience-Incubator-3735.htm>).

The 1% warrant in the SJBIIC firms that reach the IPO stage is allocated as follows: 40% for the Foundation, 30% Business Blox Solutions and 30% Womens's Technology Cluster.

Application of elements adapted from literature review to assess UBIs

External resources: The critical ongoing government assistance the UBIs have received has been rental subsidy. The RDA (personal communication, Ruani Weerakoon, the Director of the Industrial Division of the RDA, September 2, 2004) is the largest in California in terms of revenues. Since the mid 1970s the RDA has fueled economic development. One objective of the incubators is to foster the development of companies that employ people in San Jose. The expectation is that incubators would spawn jobs and taxes, including sales and Transient Occupancy Tax, a tax on short term visitors to San Jose who reside in a hotel or apartment. The RDA has provided the following financial information on the first three UBI incubators:

Table 2: RDA Rent Support

Incubator(s)	Cumulative through 2003-2004	2004-2005 Appropriation	2005-2006	Total
IBI	\$2,497,457	\$317,940	\$242,000	\$3,057,397
SBC – EBC	\$6,768,297	\$408,600	\$395,000	\$7,571,897

(Retrieved September 1, 2004 from <http://www.sjredevelopment.org/>)

Ruani believes the incubators benefit the university by making it more attractive to the community, and also the city needs to work with the university to create opportunities.

The successful history of the incubators helped set the stage for the bio science incubator. The city budgeted an investment of \$6.5 million (\$500K in the design, \$5.5 million for the construction and \$500K as an operation subsidy), of which \$800K has been spent, in SJBIIIC. The mayor and the city council authorized the SJBIIIC during a difficult budgetary time.

In the case of the SJBIIIC, the developer of the facility is Mission West Properties, which has real estate totaling 7.9 million square feet in the Silicon Valley area. Its CEO, Carl Berg, of Mission West Properties, worked closely with the RDA on the development of the incubator.

RDA also helps the IBIs get into print, become involved with the entrepreneurship exhibitions, and meet with potential customers.

Role of the SJSU Foundation and Relation to the University:

Perspective of former president: In 1994, Dr. Robert Caret, then president of SJSU, asked Jim Robbins, then director of the EBC/SBC, to start an incubator with SJSU. However, rather than start a new incubator, Jim suggested that SJSU work with the two existing incubators (EBC/SBC). President Caret wanted to have SJSU students and faculty involved in service to the community, part of the metropolitan model he envisioned for the university.

We asked former President Caret, who had since returned to Towson University in Maryland to assume the presidency there, about his motivation in linking the university to incubators. He responded (via e-mail on September 24, 2004) that he thought a university should develop incubators because they:

1. Contribute to a culture of entrepreneurship.
2. Provide new educational and experiential opportunities for students, including student internships.
3. Enable Business, Science, and Engineering faculty to become involved with start-up companies.
4. Increase opportunities for leading edge faculty research and technology transfer.
5. Contribute to the economic development of the region.
6. Add to university revenues in the case of successful IPOs generating income through equity warrants held by the university.

He added:

“At the core of my philosophy for the role of public universities is a belief that they have a tri-focal mission: education, economic development/vitality and social good. Incubators provide a valuable vehicle to help in the achievement of all three of these missions and goals.

I was very interested in establishing an incubator when I first arrived at SJSU. I found quite quickly that we were already involved in two incubators in the region through the efforts of two of our faculty, Burton Dean (Environmental Business Cluster) and Michele Bolton (Software Business Cluster). We quickly linked the institution more aggressively with these two centers and began to develop a much broader array of efforts that were mutually beneficial. Full partnerships with the university resulted. In time that led to the development of a third incubator---- partnership with the international business incubator. All three of these relationships continue today to the benefit of the institution and the community.

As an aside, I am in the process of establishing an international business incubator here at Towson University and have called on the SJSU center for help which they have graciously provided.”

Perspective of Foundation COO: The most significant resources the university has provided to the UBIs are the prestige of university affiliation and student interns. Mary Sidney, COO of the SJSU Foundation that oversees the incubators, was quoted (Caldwell, July 5, 2004) as saying: “Also important is the opportunity to expose our faculty and students to the cluster. For the client companies, students provide high energy, great ideas and they’re usually relatively low cost. For the students, it’s the exposure, the experience working with start-ups. They can do things like market research. It’s not ‘go-fer’ work. It’s substantive work with clients.

Mary offered additional comments via e-mail (personal communication, September 27, 2004). When asked “What were the key advantages and advantages for SJSU of such SJSU-based incubators?” she responded: “The incubators have brought excellent opportunities to expose faculty and students to start-up business challenges and strategic planning issues. SJSU faculty serve on each of the incubator boards, and student interns have provided various services, especially in the area of market research, for incubator companies. The incubator directors also provide real-world experience for SJSU students as they have been guest lecturers in a number of classes.”

When asked “What were the associated issues with housing the incubators in the Foundation that needed to be addressed?” she replied, “Key issues were to clarify the benefit to SJSU, legal liability and fee structure. For example, we needed to demonstrate to the CSU (auxiliary auditors) that there was a “mission fit” and clarify the benefit to SJSU. In assessing risk management, we determined that their employees needed to be Foundation employees since they were not separately incorporated, however we needed to be sure that our administrative fees cover the personnel and other legal liability associated with employment and their other services and activities. We also needed to ensure shared goals for the incubators with the SJ Redevelopment Agency who subsidizes most of their lease payment.”

When asked, “Were there any other university-based incubators that were appropriate models for the SJSU-based incubators?” she stated, “Not that we were aware of at the time.”

When asked, “What did you envision would be the role of the SJSU Foundation in this endeavor?” she said, “The Foundation provides the administrative and legal infrastructure for the incubator program.”

She added, “For students with ideas of starting their own business, I think the incubator environment is rich with learning opportunities.”

When asked, “Describe your role, and that of other SJSU administrators, in establishing and assisting the SJSU-based incubators” she responded, “The incubators were already here when I was recruited to my position. I do know that President Caret played a critical role in bringing the incubators to SJSU. Today, the Foundation and the City of San Jose continue in partnership to co-sponsor the incubators, and annually review their impacts to assure a good return on investment in terms of economic development for the region (i.e., attracting new businesses to SJ, jobs, and sales tax revenue).”

SJSU doesn’t commercialize IP through incubators: One thing which has not occurred is that faculty have not used the incubators as an opportunity to commercialize intellectual property developed by them. However, some faculty have provided consultation and two serve on the advisory boards, one on the SBC and another on the EBC. SJSU students have also served as interns in the incubators. Currently the SJBIC is seeking to fill four internships using the SJSU MBA/MS graduate students

According to Jeri Carmo, Director, Office of Sponsored Programs of the Foundation (personal communication, October 6, 2004), “The university's current IP portfolio does not contain any software patents or patents specific to environmental business. That is not to say that faculty and students have not developed such software, but if they have there have not been any formal disclosures or indications of software copyright established.”

When asked why there had been so little contact with the engineering faculty, Jim Robbins and Chuck Erickson responded together (personal communication, October 4, 2004):

“We have had some contact, but it is limited. Both the SBC and EBC have worked with some of the engineering faculty over the years. For example, at this time the EBC is working with the engineering faculty and some of their students on a project to bring Silicon Valley technology to clean energy start-ups.

We are using 10 student interns for the project in Phase 1, maybe more in phase 2. We have used some IT engineering students for web design and assistance on software development from time to time.

However, the interaction is very limited. Nothing in many years. The reasons:

- First, the Foundation seems to be the official ‘clearing house’ for University developed IP and I do not believe that anyone ever looks at potential product ideas with an eye for creating a company, they look more towards finding grants for further development and then focus on licensing or some other form of revenue generation that is not necessarily entrepreneurial. So most faculty on campus do not know that Incubation exists as a channel for moving their ideas into the market, and furthermore, the ‘conventional wisdom’ is that the only way they can ‘go out’ with their potential product is to take the idea to the Foundation.
- Having said that, the second facet is that from time to time I have had faculty at SJSU talk to me about the process of starting a company, but they seem to lose interest when they get the details of what might be involved. They are convinced that there is no University support (time off, money, other recognition) for commercializing their idea and the realization that starting a company is hard work in arenas that they are not familiar with seems to be a turnoff. And there seems to be an underlying stigma about thinking of ‘doing something’ with ideas without going to the Foundation.
- And then thirdly, I have been contacted on two occasions by faculty who have an idea for a product but the ideas were not ‘mature’ and when they are questioned about the real world applications of their technology they do not seem to be willing to ‘bend’ to fit the idea to the need, they prefer to act as if the need should bend to fit their idea. This is a not uncommon attitude of technologists but is one that can frequently be overcome with sufficient coaching and mentoring.
- It is clear that the focus of the University is on teaching and not on ‘research’ or technological development. But if those elements are to be added to the existing focus then I believe what is needed is an ongoing process of fostering entrepreneurship for faculty, that constantly encourages the exploration of ideas with an eye for commercialization, provides resources for guiding the analysis of the validity and applicability of their solutions, and teaches and encourages them to think entrepreneurially.
- Also, there was no entrepreneur focus at SJSU until recently. Finally, most start-ups around the country do not come from recent students or faculty. They come from experienced technology and business types coming out of established companies or other start-ups. They do often hire SJSU engineers and business majors to work in their companies. We do have numerous SJSU alums working in companies at the SBC and EBC.”

IBI’s role is not incubation and it would not serve as a channel for faculty or university IP. However, it has entered into an arrangement with SJSU’s International & Extended Studies (i.e., international and community continuing education) to offer an international course on incubator development and management, scheduled for early 2005.

Administrative support: The UBIs benefit from administrative support provided by the SJSU Foundation. It acts as the fiduciary agent for the UBIs. SBC, EBC and IBI personnel are employed by the Foundation. Access to state benefits through the Foundation is perceived as important to the three UBI directors.

The SJBIC has a different arrangement with the Foundation. Rather than employing the director, the Foundation contracted with Building Blox Solutions and the Women's Technology Cluster of San Francisco. Building Blox Solutions "is a life science consulting firm specializing in bioscience facility development and operational services. The team is comprised of top professionals who bring an average of 20 years of life sciences experience to resolve biotechnology facility and operational issues" (www.bbloxsolutions.com). The Women's Technology Cluster is an incubator for information technology, life science and social entrepreneurs. Out of the more than 1,500 companies that have applied to the WTC, only 150 were accepted. These companies have raised more than \$375million and 75% are still in business (www.wtc-sf.org/).

Other benefits of the SJSU affiliation include:

1. There are opportunities for joint funding and access to data base on potential grants.
2. Access to university facilities (e.g., library).
3. The entrepreneurship focus of the SJSU's College of Business, along with its Silicon Valley Center for Entrepreneurship (SVCE), is also an advantage. The incubators provided some motivation for the creation of SVCE.
4. The SJSUF has been willing to carry the incubators through periods where cash flow was a problem. The SJSUF allowed the EBC/SBC to run a \$50,000 deficit during lean times. Barbara stated, "We're a pain in the Foundation's neck. We don't fit in all the boxes of the Foundation. We make their accounting difficult." Sometimes the Foundation has to carry IBI such as the time they lost Korean companies during the economic crisis in that country. They also lost some clients after 9-11. "Our peaks and valleys are sharper than most other incubators."

The UBIs are projects of the SJSU Foundation. UBI expenses are paid by the Foundation with money that the incubators raise. They pay a 10% overhead charge to the Foundation. The business relationships and deals flow from the community at large and not SJSU. The incubators are not bogged down by the politics of SJSU or San Jose.

The university holds equity warrants for new IPOs. It could make 1% but only four businesses that have been incubated went through the IPO process.

The IBI is not that close to the SJSU colleges and relates more directly to the provost and director of its continuing education and international programs division. Though it would be easier administratively if IBI were an independent 501(c)(3), given the complications of Foundation bureaucracy, the university relationship is comforting to foreign clients. The lack of interest in international programming at SJSU has been a problem, in spite of the efforts of several senior administrators to promote international programs.

The UBIs could function without the Foundation's administrative umbrella. IBI, EBC, and SBC started prior to their involvement with SJSU. Their directors were experienced business people who found a calling in the incubator movement. University faculty or administrators generally do not have comparable experience in incubators. One could say that because the three incubators were established and then absorbed administratively by SJSU, they had successfully established operational practices and policies that allowed them to function autonomously of SJSU, thereby profiting from the prestige of the university and access to student interns while continuing to successfully incubate start-ups, in the case of SBC/EBC, and serve international companies wanting to establish a presence in Silicon Valley, in the case of IBI.

Parts of entrepreneurial system: The system in which the UBIs function is shown in Figure 1. The open system in which the incubated start-up must survive is entirely different than that of a large bureaucratic state university. To mentor such start-ups, the UBI director must have the autonomy to serve responsively in the hyper competitive environment that characterizes Silicon Valley. SJSU Foundation's approach of allowing the UBIs autonomy is characteristic of a loosely coupled (Weick, 1976) learning organization (Senge, 1990).

Social networks:

The center of the incubation network in Silicon Valley has been Jim Robbins and his organization, Business Cluster Development. Jim worked for Digital Equipment Corporation (1985-1993) as a business manager for Northern California. In an intrapreneurial role, he started 25 groups within DEC that functioned autonomously. His interest in incubators was triggered by an article he read in an airplane magazine. He encouraged DEC to donate a building in Palo Alto in 1993 for an incubator. He ran the incubator and worked with DEC's hardware and software

technologies. This incubator position with DEC enabled Jim to transition into incubator work full time outside of DEC, and he began working with cluster development in 1993. He had read about business clusters – e.g., textiles in Italy and finance in New York. Jim, an authority on incubation, reported (Aragon & Landry, 2000) that the “real value comes from encouraging interaction between companies in the cluster of offices.” Robbins has contributed to the development of 11 incubators.

Susan Hammer, San Jose Mayor from 1990-1998, wanted to make it the software capital of the world. However, in 1994, there were only five significant software companies located in San Jose at the time. Jim suggested that rather than trying to attract companies from elsewhere that it should develop them through an incubator. Jim contacted the San Jose RDA, which provided strong support as shown above in Table 1. Jim Robbins was allowed to use a vacant FMC building for a two year period, 1993-95. Subsequently, Jim relocated this incubator in downtown San Jose. Now San Jose has 91 software companies that are located in the downtown San Jose area, due to the incubators and the presence of large pillar companies like Adobe.

The RDA’s Industrial Director, Ruani Weerakoon described Jim Robbins in very favorable terms (Caldwell, July 2, 2004): “I couldn’t have accomplished what we did here in San Jose without Jim. What Jim brings to the process is an amazing amount of knowledge and expertise and connections in the incubator world. He knows people. He knows the best practices. He is committed to small business start-ups.” She said he is “gentle but determined and forceful because he has the expertise behind him and he’s very open to ideas.”

When asked about Jim Robbins, Mary Sidney, COO of the SJSU Foundation, said Robbins is “the quintessential entrepreneurs’ coach” and that he’s able to make introductions to venture capitalists and angel investors.

Jim thought that one could take business cluster principles and apply them to the incubator. EBC was the first incubator based on the cluster concept. Jim chose to work with environmental issues because it is his passion. Jim’s association with Barbara Harley is also reflective of the social network of incubation in Silicon Valley. They worked together on the SBC prior to Barbara launching the IBI. Jim’s Business Cluster Development, a consulting firm he co-leads, was hired to help develop the SJBIC.

The various incubators and associated institutions (i.e., SJSU Foundation and RDA) are linked in the social network with overlapping memberships on the incubator advisory boards. IBI is separate from the SBC/EBC but Jim sits on its advisory board. The SBC advisory board includes several people from SJSU, Joe Giglierano, a SJSU marketing professor who specializes in entrepreneurship, and Mary Sidney, the director of the SJSU Foundation, which provides fiduciary services for the incubators. Other advisory board members include Barbara Harley of the International Business Incubator and Jim Robbins, SBC founder who is the Executive Director of both the Environmental Business Cluster and the SBC. Another important member of the advisory board is Ruani Weerakoon of the RDA. Burton Dean, a SJSU management professor, sits on the EBC advisory board.

Ruani maintains close contacts with real estate developers, VCs, and the business community. She is a strong believer in establishing and maintaining these good relationships. Fifteen years ago, Ruani received her M.A. in Economics from SJSU. Upon graduation, she began working at the RDA but appreciates her ties to SJSU.

At an industry level, industry clusters are also social networks established because of the relationships described above in Figure 1. Collective learning flows from the incubation process, given the proximity of the start-ups to one another, particularly when clustered by industry. Bill Paseman, founder of Calico, one of the SBC’s four successful IPOs, continues to provide crucial support to SJSU’s entrepreneurship center and mentoring for start-ups.

Membership in networks involving other incubators is also vital. SJBIC is linked to Building Blox Solutions and the Women’s Technology Cluster through a management contract. Jim serves at the national level as a member of the board of directors of the National Business Incubator Association and also serves as vice chair of the Pacific Incubation Network. Barbara Harley is also active in various professional associations for business incubation and is part of a large World Bank project to promote business incubation in Brazil. Ruani, of the RDA, is involved with all four UBIs and provides a crucial link to other government agencies and most importantly to the private sector, such as the developer Carl Berg who provided strong financial and real estate support for the SJBIC.

Chuck Erickson values his flexible schedule that permits him to do volunteer work in addition to managing the SBC. This is characteristic of Jim and Kathleen as well in that Jim spends a considerable amount of time with his consulting company (Business Cluster Development) and Kathleen continues to work for Building Blox Solutions' other projects. Barbara Harley is involved with regional, national and international incubators and the World Bank. Such activities enable them to expand their networks and learn from others' best practices for the incubators.

Tenant services

The customary reduced rent facilities and office support are provided to tenants but most important is the mentoring and coaching for start-ups received from the UBI directors. The current SBC Managing Director is Chuck Erickson, who also serves as the Assistant Director of the Environmental Business Cluster. He has worked for the SBC since 1999. He began with the SBC as a volunteer in 1997. He helped an incubated company raise \$3.2 million in non-venture capital funds. A former advisory board member took note of his success and recommended him for the job of SBC Managing Director. Chuck mentioned the importance of business knowledge to incubators. One must know how to assist start-ups. This requires hands on experience. Early in his career he worked as a product design engineer, then as a CEO-entrepreneur and now as managing director of an incubator. One has to be a seasoned business leader to serve as a mentor to start-ups but incubators typically cannot pay enough to attract such senior people.

He provides instruction for clients who need to learn how to hire and fire people, make that first sale, and other such basic business practices. Companies come in with different needs. SBC doesn't have a common program but it does teach all how to make an investor pitch in twenty minutes with ten power point slides. The investor pitch is a daunting task because one must define and focus on the business proposition. The final slide asks and explains why one should invest in the company and not someone else.

From a psychoanalytic perspective, when one listens to Chuck speak of providing assistance to start-ups one is reminded of Erik Erickson generativity stage of adult development where one wants to mentor and provide guidance to others based on one's knowledge and experience. Generativity is care that is given regardless of reciprocation. This stage reflects one's desire for a legacy (Erikson, 1975). From a Rankian perspective (i.e., Otto Rank, a student of Freud), one could say one seeks immortality through activities that leave a legacy such as mentoring provided to the start-ups (Becker, 1975).

Chuck Erickson emphasized that successful incubators are run by business people who understand business. University faculty or bureaucrats from city government don't usually run incubators very well, in his opinion.

Barbara Harley likes business incubation but was discouraged by national meetings. Women incubator heads came out of government and social service and not private enterprise. She has been impressed by incubators in Germany where the heads are Ph. D.s with strong technical backgrounds.

Another critical aspect of incubation is selecting suitable start-ups. Kathleen Imhoff, the director of the SJBIC, emphasized the importance of taking the time to fill the incubator with tenants that have strong potential as opposed to simply filling empty rental space to meet one's revenue target. This is a clear advantage of the subsidized not-for-profit incubator over the for profit incubator.

Clarity of objectives

None of the SJSU UBIs are under any pressure to serve a role in technology transfer of SJSU intellectual property. Instead, their objective is clearly to serve start-ups aside from IBI, which works with established foreign firms wanting to establish a presence in Silicon Valley.

Through the National Business Incubation Association Chuck meets university based incubator directors. Problems include the perception of the incubator as real estate (i.e., revenues derived from tenants) or using incubators as a showcase for technology – an “ego trip” for the university. SJSU isn't as concerned about these matters. SJSU supports incubators because of their economic focus, which is part of its mission as a metropolitan university.

Key strategic operational policies

Tenant selection is critical and depends on good business sense, which can only be developed through experience. Graduation policies in the SBC/EBC require that progress be made and firms can reside in the incubators around 24

months, though there is flexibility in tenure. Intellectual Property is retained by the companies but SJSU holds 1% equity warrants in the event of an IPO. Tenant performance reviews are ongoing.

Performance measures are critical

Unlike some incubators that can only afford to work with profitable companies, the SJSU UBIs can afford to take a chance with marginal companies. Specific measures are not used for the companies incubated in the SBC/EBC.

Summary and conclusions

\$17 million has been either spent or committed by the RDA to the UBIs, which was crucial to their creation and continued functioning. RDA director Ruani Weerakoon has been pivotal to the process. The City of San Jose has benefited from the creation of jobs, companies, tax payments and also from further systemic development of the entrepreneurial culture (see Figure 1) that characterizes Silicon Valley.

The primary supports provided to the UBIs by SJSU have been UBI legitimacy due to university affiliation, the use of student interns, civil service benefits for UBI personnel, fiduciary support through the Foundation's accounting system, cash flow support during downturns, and involvement in the system that nurtures entrepreneurship (see Figure 1).

The incubators have brought excellent opportunities to expose faculty and students to start-up business challenges and strategic planning issues.

What has not yet occurred at SJSU, but is common with UBIs, is technology transfer or commercialization of university or faculty intellectual property. Although SJSU is one of the top 200 research universities in the nation, it does not have doctoral programs, which are the province of the University of California system. Faculty teach heavy loads, with four courses per semester the norm, and do not have the research assistance of doctoral students.

SJSU Foundation had the foresight to focus on commercialization of start-ups rather than see the UBIs as technology transfer channels for SJSU or faculty intellectual property.

The day-to-day functioning of the incubators is left to the experienced business people needed to run incubators. The autonomy enjoyed by the UBIs has enabled them to respond to the demands of the commercialization process without the political or bureaucratic influence of the university. This autonomy has enabled the UBIs to maintain a loosely coupled arrangement with the Foundation and develop as learning organizations.

The Foundation and the City of San Jose are in partnership to co-sponsor the incubators, and annually review their impacts to assure a good return on investment in terms of economic development for the region (i.e., attracting new businesses to San Jose, jobs, and sales tax revenues).

Figure 1 depends heavily on the social networks that are part of the entrepreneurship culture of Silicon Valley. The center of the incubation network has been Jim Robbins. As mentioned earlier Jim is knowledgeable, involved in the appropriate networks that support entrepreneurship, and is an excellent coach and a mentor for technology based start-up firms. Selection of high potential start-ups is fundamental but coaching is the key to start-up success. The directors have to be experienced and knowledgeable people who are at the "generativity" stage of life where they want to express themselves through helping others in the start-up process.

The entrepreneurial system of Silicon Valley is described in Figure 1 and functions as a loosely coupled system of interdependent and complementary elements. Individual autonomy of the various elements permits them to respond to market forces in the commercialization process.

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