Regional Strategies for Building High Tech Clusters: The Role of Innovation Capacity in Regional Economic Development

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Global CONNECT

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Why Regional Innovation Capacity Matters

- In a knowledge-driven economy, new job and wealth creation derive from the accelerated commercialization of innovative, world-class technological breakthroughs.
- A region’s accumulated research and innovation assets is the “seed corn” that enables the growth of entrepreneurial science-based enterprises in that region.
- Every region’s research assets (“seed corn”) differs (Are you growing “soybeans” or “wheat”?)
- “Seed Corn” that is tossed on infertile growing conditions will not generate a rich harvest of jobs or wealth.
Mapping The Characteristics of Innovative Regions

- **World class research institutions** as sources of intellectual capital
- **Appropriate business assistance programs** to accelerate technology commercialization
- **Seasoned senior managers with entrepreneurial “know-how”** that can work in tandem with scientists and engineers on teams to jump-start enterprise creation
- **Sources of “intelligent” startup capital** beyond what “sweat equity/boot-strapping” and “family and friends” capital can provide
- **Active entrepreneurial networks** that can support all the players involved in enterprise creation activities
- **Institutions of higher learning** that can train and quickly upgrade the skills of a world-class workforce for the region’s growing high tech companies

All of these regional assets must be integrated for the entire eco-system to work!
Some Regional Case Studies of Biotech Clusters

- San Diego
- St. Louis
- Philadelphia
I. San Diego’s High Tech History

1955 - General Atomics
1956 - Scripps Clinic & Research Center
1960 - UCSD Founded
1963 - Salk Institute
1968 - Linkabit
1970 -

Series of Catalytic Events

1978 – Hybritech

1980 –

VC Funding

1985 – UCSD CONNECT and Qualcomm Founded
1990-93 – 63,000 Jobs Lost
1995 – New Boom

1960 –

1970 –

1980 –

1990 –

2000 –
Key Elements of a Technology Cluster

San Diego Technology Cluster

- Research
- Money
- Talent
- Infrastructure
Federal Funding to San Diego’s Research Base ($947.5 Million, 2002)

By Agency
- HHS: $436.9M
- DOD: $286.8M
- NSF: $96.6M
- NASA: $25.2M
- DOE: $27.9M
- DVA: $50.3M
- Other: $23.8M

By Technology Sector
- Life Sci. & Biotech: $499.4M
- Defense: $287.1M
- Envir. Tech.: $41.2M
- Adv. Computing: $34.4M
- Energy: $17.8M
- Aerospace: $14.4M
- Other: $53.0M

Source: RaDiUS
Effective Tech Transfer Processes

**UCSD**
- 120 start-ups with UCSD licensed technology

**Scripps**
- 40 companies since late 80’s

**Salk**
- 20 companies have been founded using Salk technology

**Burnham**
- 4 FDA-approved products, 6 in clinical trials

Source: *Nature*, UCSD, TSRI, Burnham, Salk
Federal SBIR Funding to San Diego High Tech Companies

<table>
<thead>
<tr>
<th>Tech Sector</th>
<th>FY2002 Funding ($M)</th>
<th>% of Funding</th>
<th>No. of Companies</th>
<th>% of Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life Sciences &amp; Biotech</td>
<td>28.87</td>
<td>77%</td>
<td>183</td>
<td>60%</td>
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<tr>
<td>Aerospace</td>
<td>4.02</td>
<td>11%</td>
<td>25</td>
<td>8%</td>
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<tr>
<td>Other S&amp;T</td>
<td>2.00</td>
<td>5%</td>
<td>21</td>
<td>7%</td>
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<tr>
<td>Energy</td>
<td>1.78</td>
<td>5%</td>
<td>17</td>
<td>6%</td>
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<tr>
<td>Environmental Tech.</td>
<td>0.39</td>
<td>1%</td>
<td>5</td>
<td>2%</td>
</tr>
<tr>
<td>Transportation</td>
<td>0.37</td>
<td>1%</td>
<td>2</td>
<td>1%</td>
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<tr>
<td>Agricultural</td>
<td>0.20</td>
<td>1%</td>
<td>4</td>
<td>1%</td>
</tr>
<tr>
<td>Advanced Computing</td>
<td>NA</td>
<td>NA</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>Defense</td>
<td>NA</td>
<td>NA</td>
<td>46</td>
<td>15%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>37.62</strong></td>
<td><strong>100%</strong></td>
<td><strong>305</strong></td>
<td><strong>100%</strong></td>
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Note: DOD SBIR funding is unavailable at this time.

Source: RaDiUS
Other Regional Capital Sources to Fuel Company Formation and Growth

- Bootstrapping
- Family and Friends
- Business Angels (Tech Coast Angels)
- Institutional and Corporate Venture Capitalists
- Public Markets
San Diego Venture Capital Funding Trends

Historical Venture Capital Funding Trends in San Diego
(in $Millions)

Year


$Million 1985-CONNECT Founded
VC & Corporate Investors in San Diego

- Amgen Ventures
- Ampersand Ventures
- Avalon Partners
- Biogen Idec
- Enterprise Partners
- Forward Ventures
- Forrest Binkley Brown
- Hamilton BioVentures
- Hamilton Technology
- Inglewood Ventures

- Johnson & Johnson
- Mission Ventures
- ProQuest
- Shepherd Ventures
- Sorrento Ventures
- Timeline Ventures
- Ventana Capital
- Windamere Partners
- Windward Ventures
- QUALCOMM Ventures
Leveraging Regional Inputs to Build San Diego’s Industry Clusters

Regional Integrator

- Intellectual Capital
- Human Capital
- Financial Capital
- Industry Cluster
- Industry Cluster
How CONNECT Got Started

- High unemployment and loss of bids to host federally funded industry consortiums (Sematech, MCC) motivated regional leaders to pursue new approaches to economic growth.

- The early entrepreneurial successes of IMED, IVAC and Linkabit suggested entrepreneurial science-based companies might be the key to future prosperity.

- Community and university leaders worked together to develop an approach to implementing change, which built on knowledge about the early successes in the region.

- The change model was to create a new community of entrepreneurs, scientists and business service providers who had deep knowledge of where science and technology were going and had ready access to the distinctive business competencies needed in entrepreneurial companies.

- The UCSD Program in Technology and Entrepreneurship (soon branded “UCSD CONNECT”) was a program dedicated to achieving the above.
CONNECT’s Financial Support

- Self-supporting through memberships and sponsorships
- Receives no outside funding from the university, federal, state or local government
- Business and community leaders volunteer: business plan review, mentoring, coaching
Springboard Program

- Entrepreneur assistance for 6-10 weeks
  - Formulate business plan and presentation

- Graduation
  - Investor presentation to a customized panel of domain experts, CEO’s, investors, and service providers

- 20-30 companies graduate each year
  - About 25% of total applicants

- 200 companies have graduated since program’s 1993 inception

- $550 million raised by Springboard companies

- 58% survival rate 10+ years out
Technology and Life Sciences Financial Forums

- Two annual forums:
  - Technology Financial Forum (1985-present)
  - Life Sciences Financial Forum (1989-present)

- Forums showcase 30 innovative, fundable companies to capital providers

- Companies are pre-qualified by competitive review process

- 400 attendees, 100+ capital providers per event

- Presenting companies have raised $6.8 billion

- Over 400 companies have presented
Most Innovative New Product (MIP) Awards

- Annual competition honoring the vision and perseverance that transform ideas and technologies into products
- Judges review hundreds of applications and select winners
- MIP Awards benefit San Diego!
  - Innovative companies get recognition and exposure
  - Showcases San Diego’s emerging technologies
  - Builds community excitement and celebrates regional success
How We Measure Success

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All companies founded by prior firm's personnel except:
- **BUYER** Firm acquired all or part of prior Linkabit-related company
- **MERGER** Formed by merger of Linkabit successor with other firm
- **RENAMED** Same as prior company, but a new name
- **SPINOFF** Official corporate spinoff from prior Linkabit-related entity
- **TECHI** Startup based on technology from Linkabit successor
San Diego’s First Biotech Company (1978)

Hybritech
Some More Recent CONNECT Success Stories

- Immusol
- Tarari/Intel
- Egea Biosciences
- Zyray Wireless
- Innercool Therapies
- Global CONNECT’s Australian Bridge Program
  - TASKey
II. St. Louis’ Regional Assets

- **Home to world-class universities and research institutions**
  - Washington University
  - St. Louis University (School of Medicine)
  - Missouri Botanical Gardens
  - University of Missouri in nearby Columbia, MO

- **Established healthcare industry**

- **New push to establish ag-biotech**

- **Established wealth in region**
  - St. Louis has US’ 2nd largest population of wealthy inhabitants who live off trust funds!

- **Population (2.7 Million) not growing, young moving away**

- **Missed out on the Internet Boom of the 1990’s**
1995-2005 BioBelt Initiative Outcomes

- Coalesced extensive community support for Initiative
- Danforth Foundation, Monsanto Fund and Missouri State funding to create the Donald Danforth Plant Sciences Center (1998)
- RCGA embarked on multi-million dollar marketing campaign to promote the St. Louis BioBelt region (2000 onwards)
- RCGA created Technology Gateway, St. Louis’ Science & Technology Council, “modeled on CONNECT” (2000)
- Land set aside for science parks next to Monsanto/Danforth Plant Sciences Center
- Washington U. Skandalaris Center for Entrepreneurship created (2001, 2003 received Kauffman support)
  - Olin Cup business plan competition for Wash. U. students
  - The Hatchery and Bear Cub Seed Funds
  - IdeaBounce

Result? St. Louis is still struggling to build its biotech cluster…
Road Map for Collaboration:
Global CONNECT’s Engagement with Wash. U.’s Skandalaris Center for Entrepreneurship Studies, January 2006

- St. Louis region receives $837 Million/yr in research funding from federal sources *(almost all received by Boeing and Washington Univ.)*
- St. Louis’ strength lies in genomics, healthcare informatics and disease management, **not plant sciences**
- Genomics research at Wash. U. focused on human, mouse, nematode and zebrafish sequencing *(382 Million, 1993-2003)*
- Donald Danforth Center’s Consortium on Maize Genomics is a minor fraction of total genomics research to St. Louis region *(3.95 Million 1993-2003)*
- Plant sciences & agricultural research represent a small base of federally funded research to region *(6.72 Million in 2003)*
- SBIR funding has risen significantly in past decade but funding is still woefully inadequate *(14.1 Million over 11 years)*
- SBIR funded firms scattered all over St. Louis’ metropolitan region despite regional efforts to consolidate cluster geographically
- **Despite Wash. U.’ pre-eminence in genomics research, few genomics firms have been spun out…WHY?**

Source:
Documenting Wash. U.’s Rise in Genomics

Keyword="genom*" Funding Trends to Greater St. Louis, MO
(Total=$389.1 Million, 1993-2003)
Why So Little Commercialization Activity in Genomics?

- NIH’s Human Genome Sequencing Project conceived to put human genome sequence in public domain
- Scientists involved opposed private sequestering of human genome mapping results
  - Bob Waterston at Wash. U. was one of key critics of Craig Venter
  - Waterston was a proponent of public advancement of genomic knowledge
- Disengagement between St. Louis’ regional leadership and scientific leadership about spinning off technologies related to human genome sequencing project
  - RCGA too focused on promoting/branding region as plant sciences hub
  - Technology Gateway, modeled after CONNECT did not link business & academic community
- In 2002, Bob Waterston moved from Wash. U. to become Chair of Dept. of Genomic Sciences at the Univ. of Washington in Seattle taking his research team with him...
Finally, Leadership Matters…

Helping researchers commercialize technology isn’t the university’s mission, [Chancellor Wrighton] said. It is a fundamental research institution, charged with attracting the most talented teachers and providing the best possible education.

Wrighton dismisses the suggestion that star researchers with an entrepreneurial bent are repelled by the university’s conservative culture. He disagrees with business supporters who say the community is missing out as researchers are discouraged or delayed in commercializing.

--St. Louis Post-Dispatch (2/26/2006)
III. Philadelphia (2001)

- **Land-locked urban campuses**
  - U. of Pennsylvania located in downtown Philadelphia
  - Other universities (Drexel Hahnemann, Temple Univ.) also located downtown
  - Incubator park next to U. of PA’s campus populated by mid/large sized companies, few start-ups

- **No proximity effect between academic research institutions and emerging companies**
  - Available land for new company formation in suburbs and exurbs
  - Pattern of SBIR funded firms clustered around second “ring road” highway, 30-60 miles outside of Philadelphia, near corporate research centers (Merck and others) on road between NYC and DC
Philadelphia (cont.)

- Small No. of SBIR funded awards, mostly Phase I funding, relative to R&D funding base

- Disengagement between universities and regional economic dev. authorities
  - Very few spin-offs from U. of PA and other corporate research centers
  - Innovation Philadelphia, a networking organization to seed cross-talk and encourage new business creation, founded in 2001
Philadelphia County Life Sciences SBIR Firms (71 total firms)

- Universities
  - University of Pennsylvania
  - Thomas Jefferson University
  - Drexel University
  - Hahnemann
  - Princeton University
  - University of Delaware

- Life Sciences Firms
Summary of Lessons Learned

- Each region’s innovation capacity (“regional DNA”) differs
  - Every region has its unique path to building its cluster
  - Scientific expertise concentrated in a region is distinct from other regions
  - Regions need to understand what they truly have as assets

- Must couple world-class scientific with business smarts for successful tech. commercialization
  - Synergy in a cluster depends on functional social structures between technologists and business community
Summary of Lessons Learned (cont.)

- Research capacity asset mapping is a tool
  - engages regional leadership in an initial dialogue
  - in depth understanding of regional assets

- Social networks that can accelerate business transactions are a necessary part of the “soft” infrastructure to any successful region

- Collaborative institutions are not built overnight
  - Must engage ALL stakeholders (inclusiveness)
  - Trust building before transactions is key
For Additional Information:

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“Successful regions do not rely on chance, but rather seek to institutionalize the innovative process...to create continuous innovation and entrepreneurship.”

—Michael Porter

Clusters of Innovation Initiative, 2001
Some Useful References

Michael Porter/US Council on Competitiveness’ Regional Innovation Project
- [http://www.compete.org/nri/clusters_innovation.asp](http://www.compete.org/nri/clusters_innovation.asp)

Books about the Silicon Valley Phenomenon

Recent Journalists’ Accounts of Particular Regions and Industries
Some Useful References (cont.)

Richard Florida’s work on “knowledge workers”

Social Networks and Reaching Critical Mass