The Diverse Roles of Universities in Regional Innovation Ecosystems: Case Studies from University of California Campuses*

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Prepared for
Plan of Talk

• California knowledge economy
• University-industry relations
• The linear and other tech transfer models
• The reality in other domains
• Who starts firms
• Commercialization vs. engagement
• Concluding remarks
California’s Knowledge Economy
California’s Share of USPTO Patents Is Growing

Patents Filed at US PTO by Nation and State, Selected Years, 1963-2012
Global Top 50 Universities*

• CA: Stanford, UCB, CalTech, UCLA, UCSD, UCSF, UCSB, UCI, USC, UCD (10 total)
• UK (5 total)
• New York (4 total)

* Shanghai Jiaotong University AWRU 2014
University-Industry Relations
First Principles -- U.S. Universities

• Bulk of funds come from four sources:
  – Tuitions
  – Research (Federal government)
  – Services such as academic medical center hospitals
  – Endowments
Licensing Income as a Percentage of University R&D Expenditures, 2007

Source: U.S. National Academy of Sciences, 2010: 23
The Private Sector Does Not Support R&D!

- Federal government
- State/local government
- Industry
- Academic institutions
- All other sources

NSF 2014
Benefits Flow from Core Missions – Research and Teaching

• Research and training dwarfs formal “transfer” activities

• Licensing income is far less than that from sponsored research and philanthropy

• University extension can be an important contributor to local industry
The Linear and Other Tech Transfer Models
The Linear and Biotech Models

**Biotech Model**
- University Lab
- Patents → Tech Transfer Office
- VC-Funded Start-Up
- Time Horizon – 8-12 years

**Vannevar Bush Model**
- Basic Research
- Applied Research
- Development
- Product
- Direct license To big pharma
- New Drugs

**Big Pharma**
Reality in Other Technologies
The Engineering and Scientific Instruments Model

Engineering Model

Academic Research

Open Source

Results

Firms

Product

Time Horizon – 2 years

Scientific Instruments Model

Basic Research

Scientific Instrument

Boot-Strapped Firm

Product

Time Horizon – Sell what is made

Open Source
UCB EE&CS Case Study

- Students in industry continuing relationship w/ professors
- Consulting bi-directional tech and problem transfer
- Professors hired from industry
- Professors take sabbaticals in industry
- Industry researchers take sabbaticals at university and vice versa
- Industry contributes software, money and equipment to university
- Importance of open source

Source: Kenney et al. 2014
Berkeley Unix – The Simplified Version

Software developed at Bell Labs

UCB Ph.D. student takes BSD and founds Sun Micro

UCB provides version to public for free

UCB Grad student Intern etc. at Bell Labs

Basis for Linux

Basis for Apple OS 10

SendMail Program

Adapted from Kenney and Mowery 2014

Not Biotech Model
No Patents
Wine Industry – UC Davis and Napa

• In early years industry leaders had little formal knowledge
  – UC Davis provided the practical tools
  – Even ran wine tasting events at State Fair

• Later industry became more capable needed less practical training

• University scientized and continued to develop new techniques

• 2012 study of Napa winery websites showed almost 80% claimed winemaker trained at Davis.

Source: Lapsley and Sumner 2014
UC Davis – Napa Valley
Interactions Evolve

• Napa $6 billion in wine and tourism revenue
• Deep interaction – mutual learning
• Trained students critical
• Technology Transfer Office plays no role

Not Biotech Model
No Patents
Who Starts Firms?
<table>
<thead>
<tr>
<th>Companies</th>
<th>University</th>
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<tr>
<td>Dell</td>
<td>University of Texas*</td>
</tr>
<tr>
<td>Microsoft</td>
<td>Harvard*</td>
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<tr>
<td>Facebook</td>
<td>Harvard*</td>
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<tr>
<td>Linkabyte//Qualcomm</td>
<td>UCSD</td>
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<td>Broadcom</td>
<td>UCLA</td>
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<td>Biogen</td>
<td>Harvard</td>
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Red = Unlicensed
Yellow Star = Students
Universities as Industry Seeders

- Personnel leaving university are knowledge carriers
  - Many disciplines – Statistics – SAS and Quintiles

- Entrepreneurial cascades (Klepper 2009)
  - Universities creates the seeds
  - The cascade comes from already operational firms
Commercialization Versus Engagement
Engagement Vs. Commercialization

• Bi-directional
  – Importance of interacting with local industry

• People as conduits

• Consulting as learning

• Porous boundaries

• Patenting and licensing are only complements to university research and training missions
But!!

• Universities can act like patent trolls
  – Sue their own professors
  – Reward professors who have valuable inventions not great research

• Professors with firms can act unethically
  – Withhold information
  – Stop contributing to information commons
  – Exploit students
  – In worst cases, lie, cheat, etc.
University and Social Good

- Train great employees?
- Increase the social knowledge base?
  - Upon which commercialization can occur?
- Commercialize research and earn money for university?
- Provide private sector with patentable knowledge?
- Be an economic development pole?
- Educate aware and engaged citizens?
Most Important

In a knowledge society we cannot force the multifaceted role of university into one small narrow box need to encourage experimentation
Questions?