Rethinking Academic Capitalism: Understanding the Commercialization of University Research

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Plan of the Talk

- Introduction
- The context
- The linear model
- The biotech model

My Biases and Lack of Knowledge

- U.S. Centric with California bias
- Concerned about U.S. public universities
- Was completely against

  Now agnostic
- Aware that the university, while slow-moving has always adjusted

What Is Academic Capitalism?

- "The involvement of colleges and faculty in market-like behaviors" Slaughter and Rhoades 2009)
- "Patent-Grant Institution" (Rhoten and Powell 2010)
- "Entrepreneurial University" (e.g., Clark 1998; Etzkowitz 2003)
- Something else
- Nothing new?

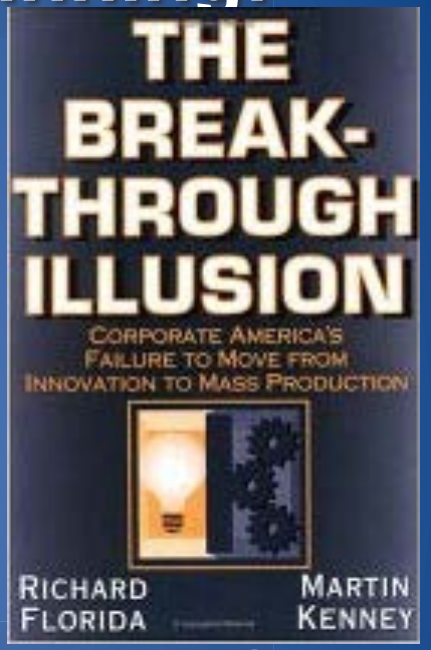
University and Social Good

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

Context

A New Trajectory – The 1980s

- **Ronald Reagan elected 1980 beginning:**
  - **Deregulation**
  - **Increase in debt**
  - **Globalization**
  - **Destruction of unions**
  - **"Greed is good"**
- **U.S. mfg begins its long slide/ globalization**
- **U.S. shifts to competing on the basis of knowledge (Florida&Kenney 1990)**
  - **U.S. universities enlist**
- **Shifting patent enforcement (Jaffe&Lerner 2006)**



The Tech Entrepreneurship Economy*

- 1976-79 Liberalization pension funds rules for VC investing (massive inflow of capital) (Kenney 2012)
- 1971 NASDAQ formed but really takes off at end of 1970s
  - Firms going public Intel 1971 on NASDAQ
- Early 1980s massive increase in tech firms being funded and going public

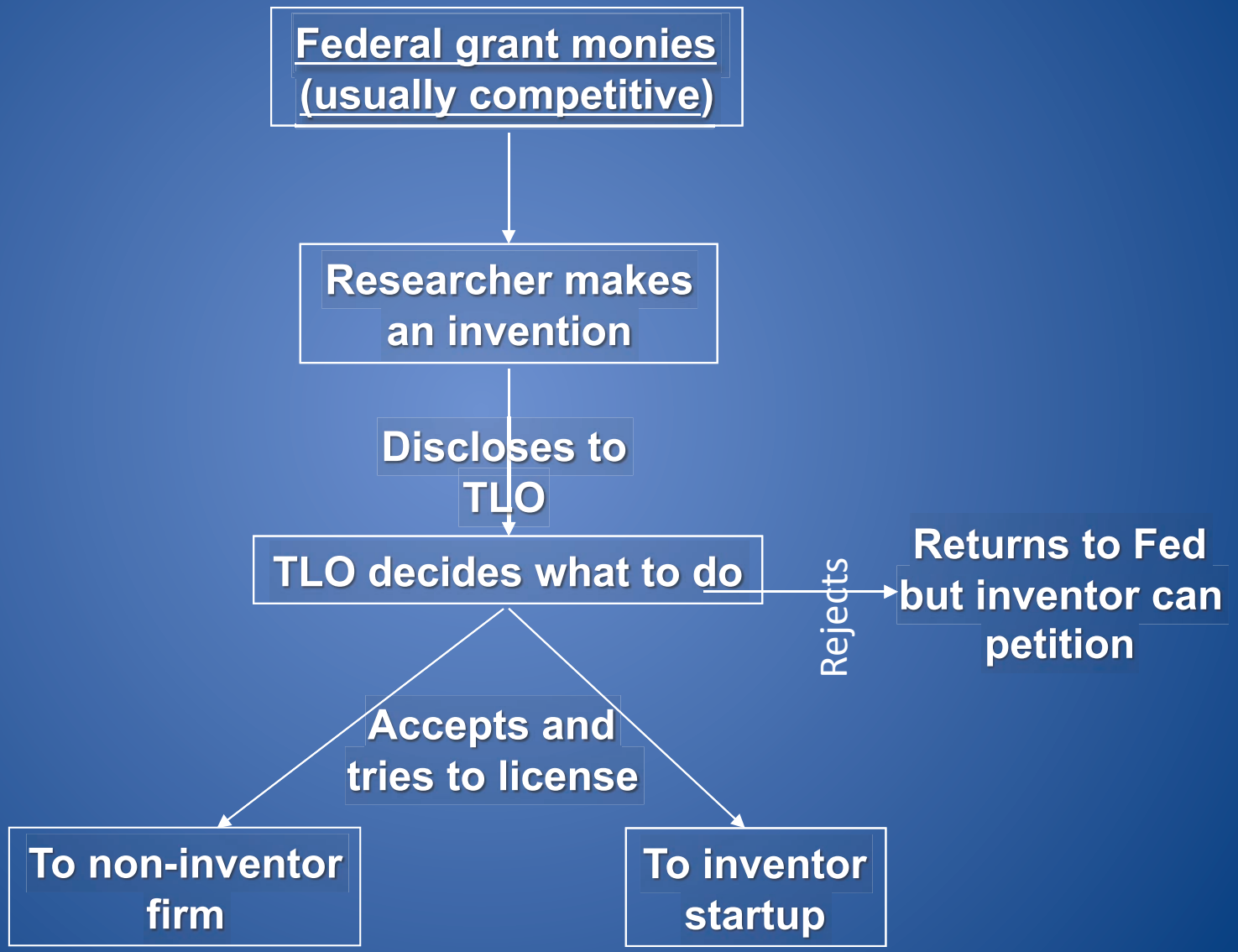
Biotechnology 1980 – New University Commercialization Model

- 1980 Bayh-Dole – university ownership (Berman 2012)
- 1980 Diamond v. Chakrabarty
- 1979 Cohen-Boyer patent Stanford/UC $255 M
- 1980 Genentech IPO and then a wave of other firms (e.g., Kenney 1986)

A Belief that Enormous Wealth Could Be Tapped

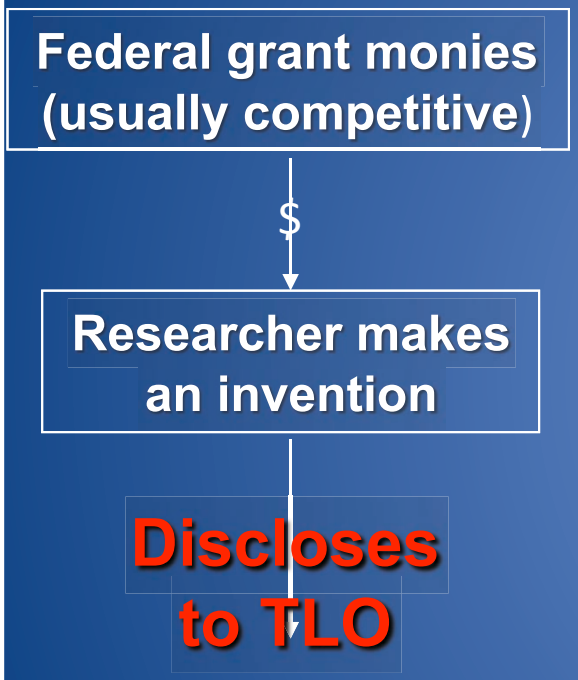
Biotech University Commercialization Model Illustrated

The Model*



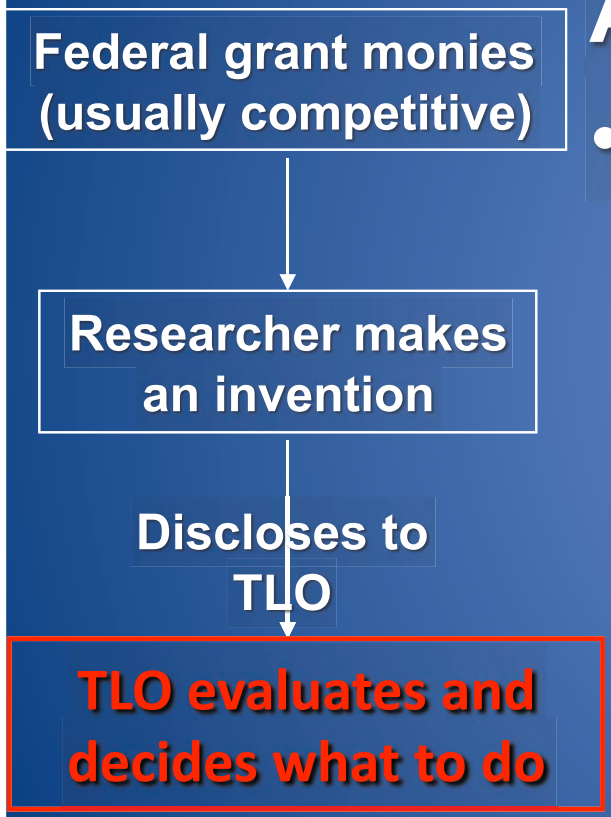
Kenney and Patton 2009; 2012

The First Step



- Inventor must disclose to TLO
  - Requires investment of inventor's time & resources.
    - TLO needs to be educated

TLO Evaluates



* TLO owns the invention

Assumes:

- **Is competent to evaluate the technology, knows market, etc.**
  - **If not inventor must educate them (time & resources)**
  - **Most TLOs have a bio-centric view**
  - **Has sufficient time and resources**
  - **Inventions often time-sensitive**

If these are missing problems

Invention Rejected

Do TLOs have clear policies on this?

- Under what conditions?
- How quickly?

Rejects

Returns to Fed but inventor can petition

Now free to petition Federal govt.

– Not much research on how easy this is, but anecdotally not too difficult

TLO Decides to Commercialize

TLO evaluates and decides what to do

Accepts and tries to license

To non-inventor firm

- Does the TLO know the value of the invention, potential licensees, technology, competition?
  - If not, might "give away" or overcharge and not license
- If risk-averse -- rational choice
  - Overcharge not license
  - Large up-front fees favor large firms (next slide)!
- Often need inventor to assist
  - Solved by giving %
    - Can inventor trust TLO?

TLO Commercializes

TLO evaluates and decides what to do

Accepts and tries to license

To non-inventor firm

- The licensee usually understands the value of the technology better than the TLO

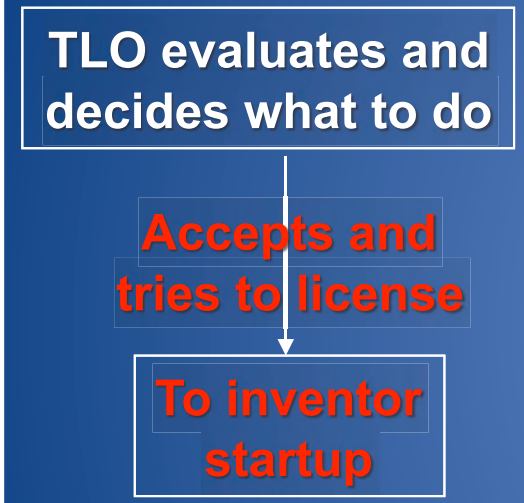
  E.G.

  – Get the license for defensive purposes, so not practice

  – Change corporate directions, return license

- Is the TLO competent and motivated to maintain the patent?

Inventor Entrepreneurship



- Researcher has divided loyalty
  - TLO cannot trust researcher, but needs them
- If relationship with TLO is troubled
  - Firm is handicapped
  - Inventor in difficult situation of trying to get control of their own invention from their employer

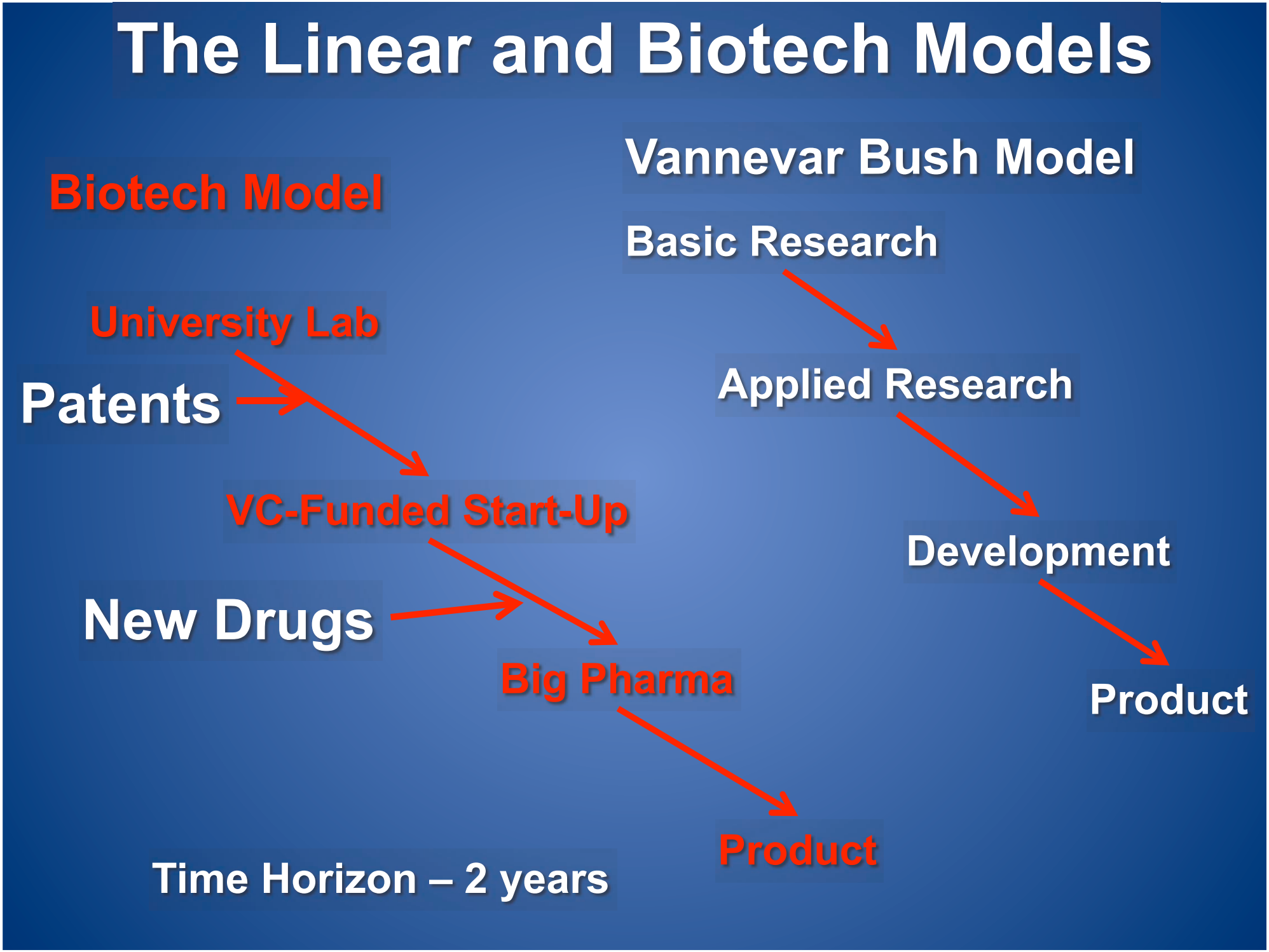
Situation Today Simplified

- Policies differ, but ever more restrictive
- University owns patents (software programs, even databases) developed in the process of conducting Federal grants
- TTO manages commercialization
  - Not Technology Licensing Offices but rather Technology Transfer Offices

The Linear Model and Biotech:

And Other Worlds

The Linear and Biotech Models



The Linear Model

Engineering Model

Academic Research

Commercializable Results

VC-Financed Firm

Product

Time Horizon – 2 years

Physical Science Model (Mody 2013)

Basic Research

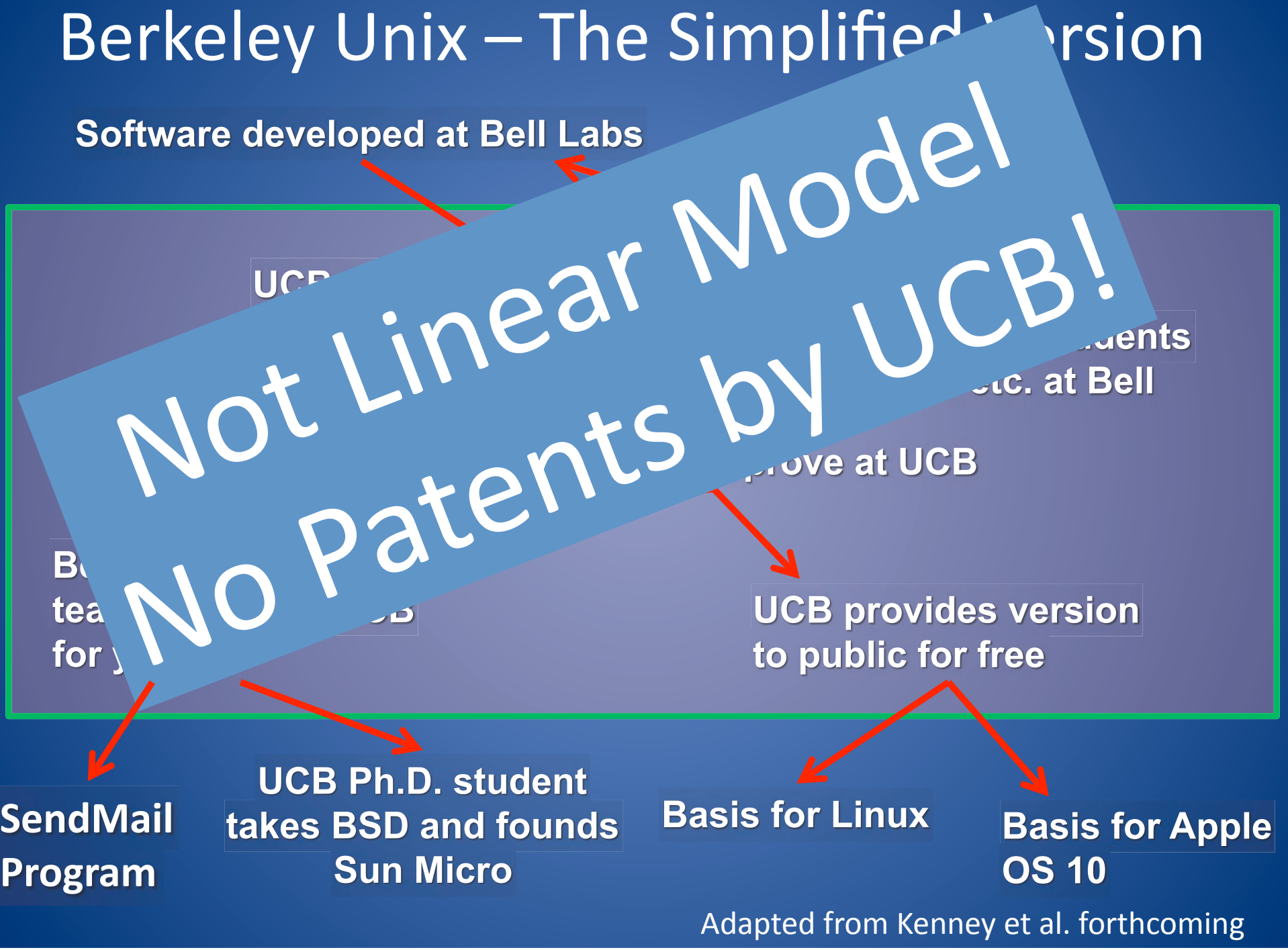
Scientific Instrument

Boot-Strapped Firm

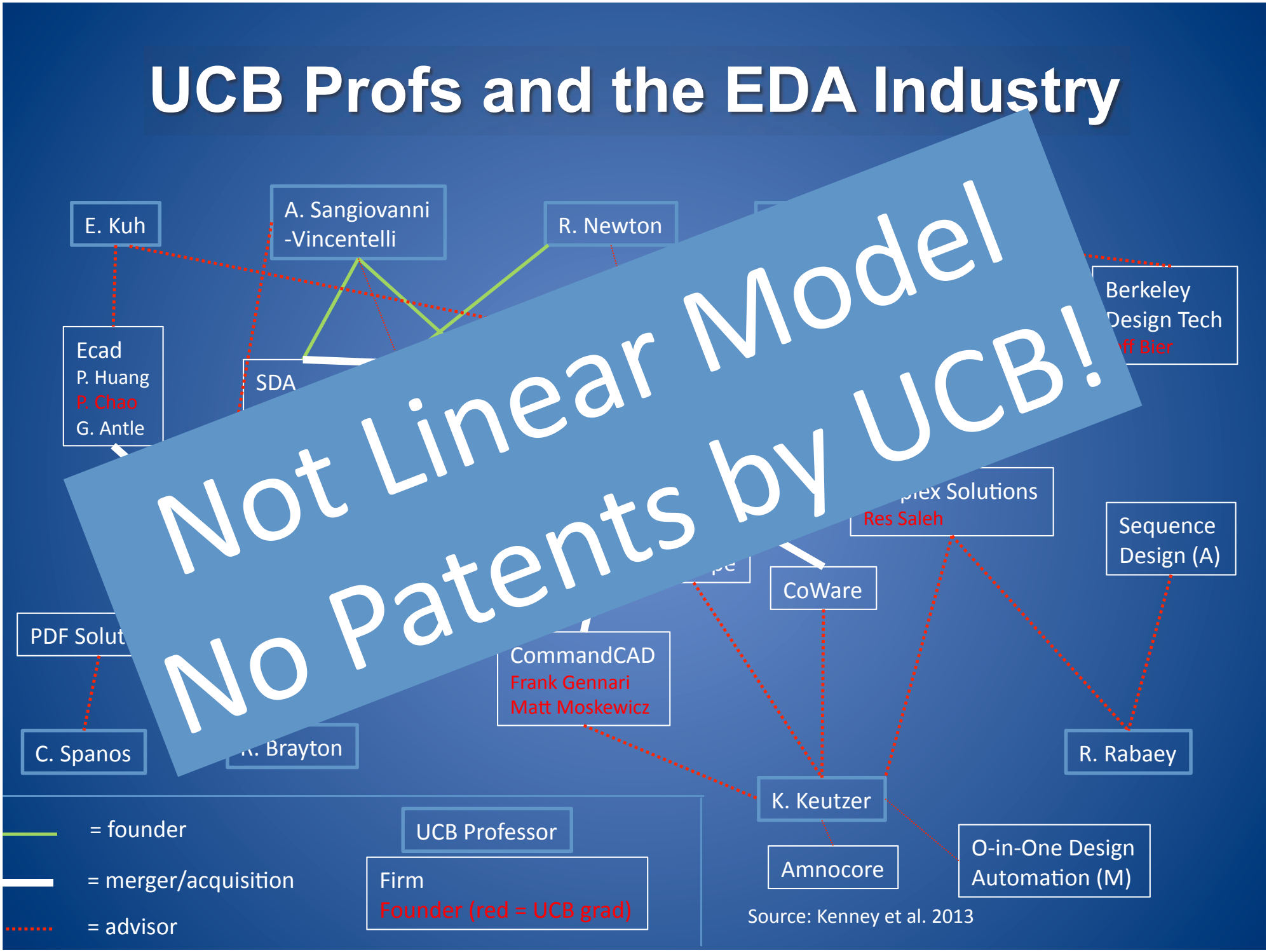
Product

Time Horizon – None sell what is made

Berkeley Unix – The Simplified Version



Adapted from Kenney et al. forthcoming


UCB Profs and the EDA Industry
Not Linear Model
No Patents by UCB!
E. Kuh
A. Sangiovanni
-Vincentelli
R. Newton
Berkeley
Design Tech
ff Bier
Ecad
P. Huang
P. Chao
G. Antle
SDA
plex Solutions
Res Saleh
Sequence
Design (A)
CoWare
PDF Solut
CommandCAD
Frank Gennari
Matt Moskewicz
C. Spanos
R. Brayton
R. Rabaey
K. Keutzer
Amnocore
O-in-One Design
Automation (M)
= founder
= merger/acquisition
= advisor
UCB Professor
Firm
Founder (red = UCB grad)
Source: Kenney et al. 2013

UC Davis – Napa Valley Interactions Evolve*

- 1950-1970s – research on cultivars, provision of rootstock, contests, etc.
- 1970s – increased producer research, UCD moves upstream
- 1970s – UCD trained students become winemakers transfer technology
- 1980s – increasing joint research, UCD helps address new problems
- 1990s-2000s– major gifts, Mondavi -- $35M, Rossi family – $11M, Rodgers -- $3.5 M, $10M – Shrem

*Lapsley 2013

UC Davis – Napa Valley
Interactions Evolv

- Napa $6 billion in wi
  revenue
- Deep i
-
- ffice plays no role

Not Linear Model
No Patents by UCB!

Technology-Based Entrepreneurship at Six Universities

University Spin-offs, Number and % Licensed by University and Technology Category, 1957-2010

	Biomedical		CS&EE		Other Eng and Phys Sci		Total	
	Total	% license	Total	% license	Total	% license	Total	% license
UWM	78	47.3%	43	14.0%	19	36.8%	140	35.7%
UMAA	37	67.6%	38	39.5%	13	38.5%	88	51.1%
UIUC	8	87.5%	40	35.0%	24	58.3%	72	48.6%
UCD	26	30.8%	6	33.3%	8	37.5%	40	32.5%
UCSB	12	8.3%	17	29.4%	8	25.0%	37	21.6%
Total	161	48.4%	144	29.2%	72	43.1%	377	40.1%

R&D Expenditures in $Millions, Total and Per Spin-off by University and Technology

	Biomedical	CS&EE	EPS	Total
UWM	2,199	104	866	3,169
	(274.9)	(20.8)	(216.5)	(186.4)
UMAA	2,056	193	647	2,896
	(228.4)	(32.2)	(323.5)	(170.4)
UCD	1,810	57	386	2,253
	(452.5)	(14.3)	(77.2)	(173.3)
UIUC	642	440	766	1,847
	(642.0)	(88.0)	(127.7)	(153.9)
UCSB	91	173	388	652
	(15.2)	(43.3)	(194.0)	(54.3)
Waterloo	71	97	212	381
	(71.0)	(6.1)	(26.5)	(15.2)
Total R&D	6,869	1,064	3,265	11,198
2005-2008 Spin-offs	29	40	27	96
R&D $Millions per Spin-off	(236.9)	(26.6)	(120.9)	(116.6)

Kenney and Patton 2011, data from 2005-2008

University and Technology Field, Number of Faculty and Faculty per Spin-offs

	MBS	CS&EE	EPS	Total
UWM	1,385	155	655	2,195
	(173.1)	(31.0)	(163.8)	(129.1)
UMAA	1,790	172	1,231	3,193
	(198.9)	(28.7)	(615.5)	(187.8)
UCD	1,396	99	543	2,038
	(349.0)	(24.8)	(108.6)	(156.8)
UIUC	1,023	276	821	2,120
	(1023.0)	(55.2)	(136.8)	(176.7)
UCSB	148	89	322	559
	(24.7)	(22.3)	(161.0)	(46.6)
Waterloo	232	165	566	963
	(232.0)	(10.3)	(70.8)	(38.5)
Total Faculty	5974	956	4138	11068
2005-2008 Spin-offs	29	40	27	96
Faculty per Spin-off	(206.0)	(23.9)	(153.3)	(115.3)

Spin-offs 2005-2008; number of faculty 2006 except Waterloo which is 2011

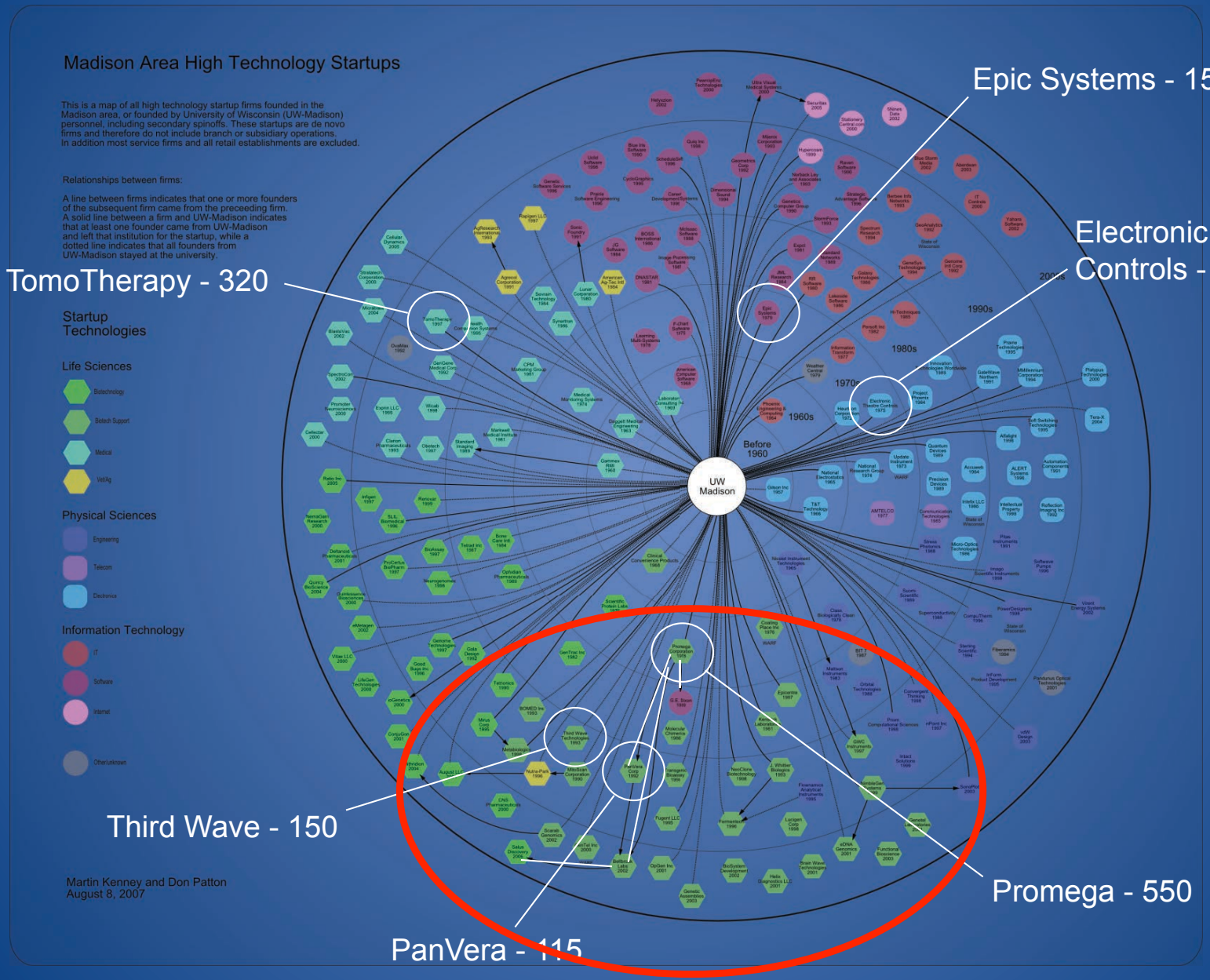
University Entrepreneurship

- Importance of engineering
- Lack of importance of licensing
- Universities differ dramatically in terms of culture and ecosystems

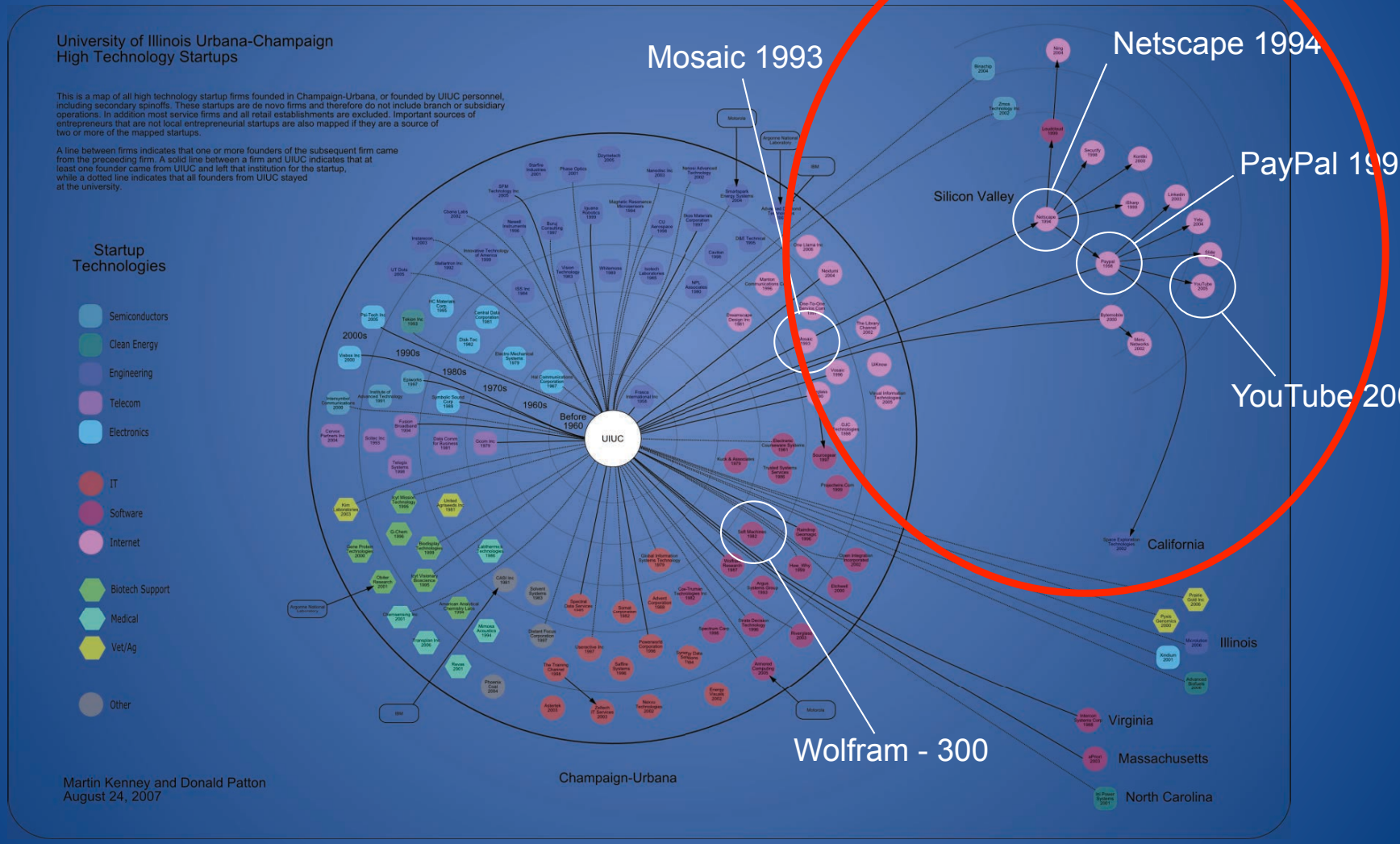
Universities as Industry Seeders

- Entrepreneurial cascades (Klepper 2009)
  - Universities can create the seeds
  - But the cascade comes from already operational firms
- Personnel leaving university as knowledge carriers

UW Madison, 2007



Urbana Champaign, Illinois, 2007



TLO's Dilemmas

- **Must evaluate disclosures:**
  - **From a variety of fields (much greater than any firm)**
  - **Which are usually underdeveloped**
- **Pay is lower than the private sector**
- **Little control over the faculty**
- **A small operation in a large institution**
- **Superiors have little knowledge or interest in their operation AS LONG AS IT MAKES MONEY?**
- **What metrics evaluate their performance?**
  - **Net revenues**

The Motivation of TLO Professional

- **How they are judged will motivate**
  - **How many patents – lots of patents**
  - **How much money – maximize income**
  - **How inventors like them – friendly (competent?)**
  - **How administrators like them – obsequious**

Are any of these useful?

If ambitious, then generating the most licensing income will be most important

Issues w/Current Model

Appropriating Knowledge

- Assumes that patenting maximizes the social good
- Patent university increasingly aims to control the flow of knowledge
- Professors and students as "employees" not colleagues
- Universities as patent "trolls" (Lemley 2008)
- Universities suing professors and vice versa

Biotech Model Reframes University

- Hire professors that have commercial potential
- Reward professors for commercialization
  - Change tenure rules
  - Count patents as publications
  - Raising venture capital is same as getting grants
- Universities hire commercialization staff, spend on incubators, etc.

Academic Capitalism:
University Knowledge in Society

- Underestimates because it measures:
  - Patents
  - University-recognized startups
- And not
  - Open source knowledge
  - Consulting
  - Student developed firms