Regions, Industries, and the University Role in Economic Development

Prof. Richard K. Lester
Industrial Performance Center
Massachusetts Institute of Technology

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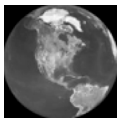
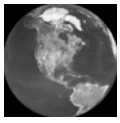
The core questions

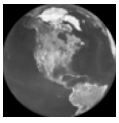
How can we make globalization and rapid technological change work for our society?

What choices do we have to build an economy that is productive and competitive, and that provides opportunities for people in all parts of society to do well?

Three kinds of competition

FIRMS 

PLACES 

 PEOPLE

Different rules; different strategies

The Globally-Integrated Enterprise

"A globally integrated company locates operations and functions anywhere in the world based on the right cost, the right skills and the right business environment . . . . . .

Work flows to the places where it will be done best . It's like water finding its own level. The forces driving it are irresistible. The genie's out of the bottle, and there's no stopping it."

-- IBM CEO Sam Palmisano

As the competition between **firms** globalizes . . . .

. . . . the competition between **places** intensifies.

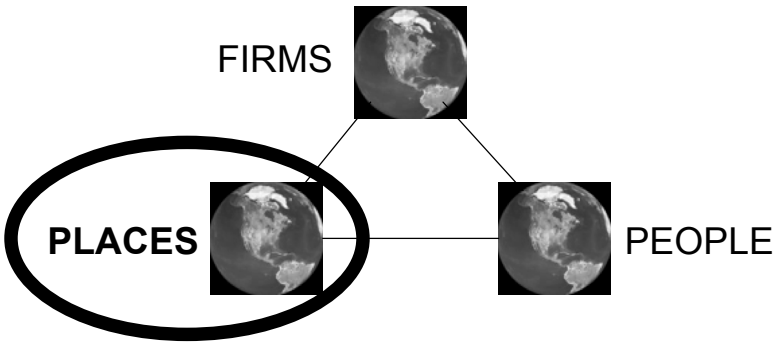
The IPC's research agenda

How **FIRMS** compete to sell products and services.

How **PLACES** compete for the most desirable economic activities.

How **PEOPLE** prepare to compete, through education, skill development, etc.

Today's topic



How can local economic communities prosper in the rapidly changing, increasingly open global economy?

Two competing innovation scenarios

'Hollowing-out'

- Local companies reaching farther afield to tap into the global network of ideas and skills, and eventually moving out altogether.

'Agglomeration'

- Local companies strengthening their local ties
- Local/regional economy emerging as a center of new knowledge creation and application, stimulating and attracting new enterprise.

What will determine the outcome?

Focus on universities as 'engines' of local economic development

- For national and local governments
  - Universities are a source of key assets in the innovation economy (skilled people, ideas, etc.)
  - They attract other key economic development resources (educated people, firms, VC, etc.)
  - They don't move!
- For firms
  - universities can provide key inputs into innovation process (also possibly at lower cost)
- For universities themselves
  - A new source of revenue
  - . . . . and also new challenges

" . . . the bell towers of academia have replaced smokestacks as the drivers of the American urban economy."

-- Initiative for a Competitive Inner City/ CEOs for Cities

‘Standard model’ of university engagement in the local economy

- University-initiated technological entrepreneurship.
  - Laboratory research
  - Discovery/invention
  - Disclosure
  - Patenting
  - Licensing
  - Spinoffs
- But the model is incomplete.
- University role isn’t just about ‘tech transfer’.

Myth #1: Economic significance of university spin-offs

- New business formation around university technology, though increasing, is still a small contributor to the total number of business starts (2-3% or less in the U.S.)

	U.S. universities	U.S. total
Startups	400-500/yr*#	550,000/yr
Patents	~ 3700/yr	~ 150,000/yr

*Startups licensing university IP

#Total number of university-related startups: 8,000-10,000/yr

Top U.S. Patent Award Recipients -- 2006

1.	IBM	3621
2.	Samsung	2451
3.	Canon	2366
4.	Matsushita	2229
5.	Hewlett-Packard	2099
6.	Intel	1959
7.	Sony	1771
8.	Hitachi	1732
9.	Toshiba	1672
10.	Micron Technology	1610
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.		.
127.	MIT	139
.		.
153.	Caltech	116

Source: U.S. Patent and Trademark Office, March 2007

Myth #2: Payoff from university technology transfer

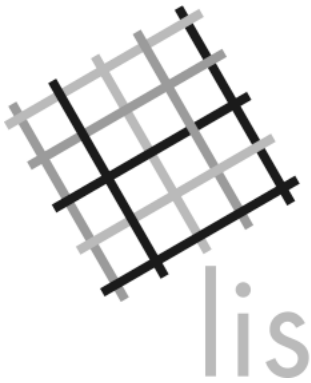
- Total licensing revenue to universities is -- and will remain -- a small fraction of research revenues (4-6% in U.S.)
- **Don't expect licensing to transform the finances of the university.**

Myth #3: Role of patenting & licensing in university tech transfer

- Licensing university patents is only one of several mechanisms that firms use to access university-developed science and technology
- Indirect mechanisms may be more important (e.g., industry hiring of university graduates)

"The most important contribution Stanford makes to Silicon Valley is to replenish the intellectual pool every year with new graduate students."

-- Gordon Moore, Chairman Emeritus, Intel



Local Innovation Systems Project

LIS Project Team

[redacted]

The LIS Project: An international, interdisciplinary collaboration

Sponsors
Alfred P. Sloan Foundation
National Science Foundation
TEKES
Norwegian Research Council
Cambridge-MIT Institute (UK)
UTRI (Japan)

Research Units
Industrial Performance Center, MIT
SENTE, University of Tampere
Helsinki University of Technology
Center for Business Research, University of Cambridge
Rogaland Research Institute
University of Tokyo

Disciplines
Management science
Entrepreneurship studies
Economics of innovation
Engineering systems
Urban and regional studies
Political science

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An innovative region is innovative because of . . .

Strong local generation of new technologies

Low resistance to adoption of new technologies (from all over)

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‘Outside-in’ perspective on university role

How can universities strengthen the abilities of local firms to ***take up*** and ***apply*** new technological and market knowledge productively?

(This is a broader question than just asking: how well are universities transferring their technology to industry?)

LIS Case Portfolio

Country	*Location*	*Industry/technology*
USA	Rochester, NY	Opto-electronics
USA	Akron, OH	Advanced polymers
USA	Allentown, PA	Opto-electronics/steel
USA	Boston, MA	Bioinformatics
USA	New Haven, CT	Biotechnology
USA	Charlotte, NC	Motor sports
USA	I-85 Corridor, NC/SC	Autos
USA	Alfred-Corning, NY	Ceramics
USA	Youngstown, OH	Steel/autos
USA	Morgantown, WV	Biometrics
Finland	Tampere	Industrial machinery
Finland	Turku	Biotechnology
Finland	Seinajoki	Industrial automation
Finland	Pori	Industrial automation
Finland	Helsinki	Wireless
Finland	Oulu	Medical
UK	Central Scotland	Opto-electronics
UK	Aberdeen	Oil and gas
UK	Cambridge	Bioinformatics
Taiwan	Taipei-Hsinchu	Electronics
Taiwan	Taipei-Hsinchu	Software
Japan	Hamamatsu	Opto-electronics
Japan	Kyoto	Electronics
Norway	Stavanger	Oil and gas

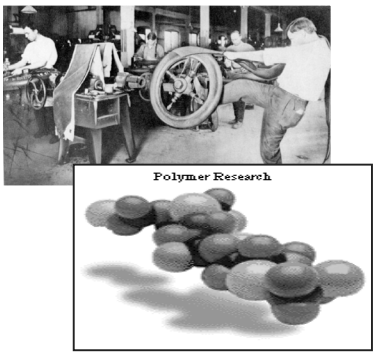
LIS Interviews

	Number of interviews
United States	308
Finland	238
United Kingdom	103
Japan	84
Norway	31
TOTAL	764

An additional 117 interviews were carried out in Taiwan.

Akron, Ohio

"Out of the Ashes"



- From car tires to advanced polymers
  - From mass production to customized production

Researcher: Sean Safford

Charlotte, North Carolina

"Unplanned combustion"

- From a backyard hobby to a multi-billion dollar NASCAR motor sports/entertainment complex
  - From mechanical crafts to mechanical engineering science

Researchers: Carlos Martinez-Vela and Kimmo Viljamaa

Tampere, Finland

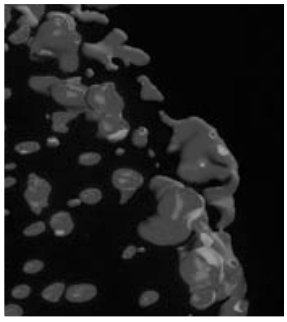
"From 'old-tech' to 'high-tech"

- How the mechanical engineering industry was infused by ICT

Researchers: Carlos Martinez-Vela and Kimmo Viljamaa

Cambridge, Massachusetts

"High-tech synthesis"



- How the integration of computational science, biology, and medicine is creating a new industry.

Aberdeen (UK) & Stavanger (Norway)

"From 'black gold' to 'human gold'"

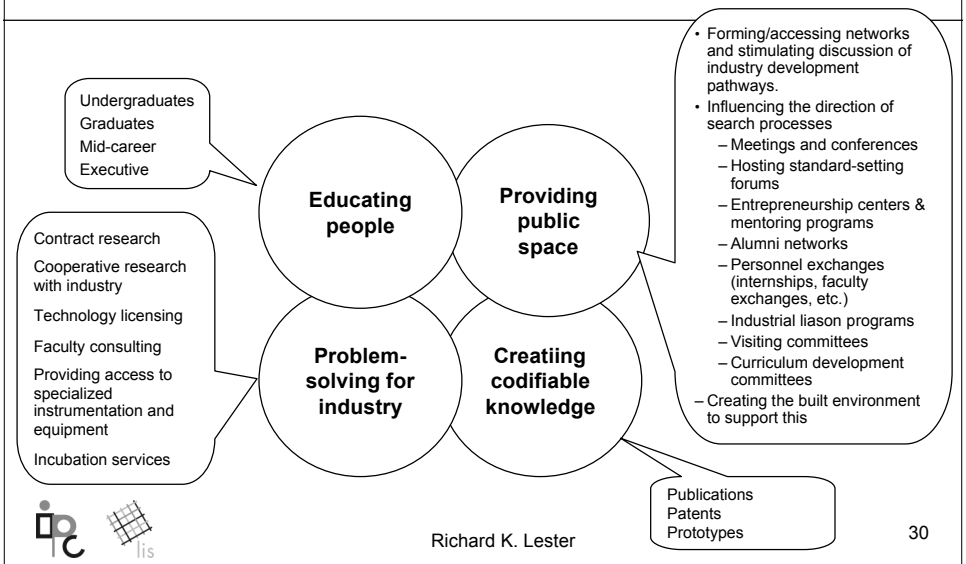
- Transitioning from a resource-based to a knowledge economy.

Researchers: Sachi Hatakenaka, Martin Gjelsvik, Richard Lester, Petter Westnes, & Wei Gao

Finding I: Multiple university roles in the local economy

- Create
- Attract
- Unlock
- Adapt
- Combine

Finding I: Multiple university roles in the local economy



Finding II: Firms seek different inputs from different universities

- **Help with specific problems ('analytical')**
- **Staying current; participating in ongoing conversations about the direction of technologies, markets, curricula ('interpretive')**

Four pathways of regional innovation-led growth

I. Indigenous creation of new industry
   Silicon Valley: Personal computers
   Boston: Systems biology

II. Transplantation of new industry into region
   I-85 corridor (NC/SC): Automotive industry
   Taipei-Hsinchu corridor (Taiwan): Electronics industry

III. Diversification of existing industry into new
   Akron, OH: Tires ➔ Advanced polymers
   Rochester, NY: Cameras, copiers ➔ Opto-electronics

IV. Upgrading of existing industry
   Tampere, Finland: Industrial machinery
   Charlotte, NC: Motor sports (NASCAR)

Type I: Indigenous creation of new industry	Type II: Transplantation of new industry	Type III: Diversification of old industry into related new	Type IV: Upgrading of mature industry

- Success conditions (and failure modes) for each of these pathways are different.
- Patterns of innovation in each case are different
- Roles of educational institutions, financial institutions, government, and others for each pathway are different

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	TYPE I CREATING NEW INDUSTRIES		TYPE IV UPGRADING EXISTING INDUSTRIES
Financing	**Angel/venture capital (private and public); active asset management**	⟷	**Internal financing, supplier financing, govt. financing for demonstrations**
Innovation culture	**Science-driven; entrepreneurial**	⟷	**Customer-driven; TQM; continuous improvement; 'best practice'**
Local anchors	**Research universities Government labs**	⟷	**Lead firms Lead customers/users**
Education and training	**Ph.D.-level scientists and engineers; entrepreneurial business education**	⟷	**BS/MS-level engineers; faculty-student knowledge of industry practices and business problems. Internships, rotations.**
Leadership in the public space	**Creating an identity ('evangelism'); standard-setting**	⟷	**Participate in regulatory processes; global scanning for best practice; 'foresight' exercises**
Technology transfer	**Proactive tech transfer from universities & gov. labs; startup-oriented**	⟷	**Long-term relationships between universities and established firms**

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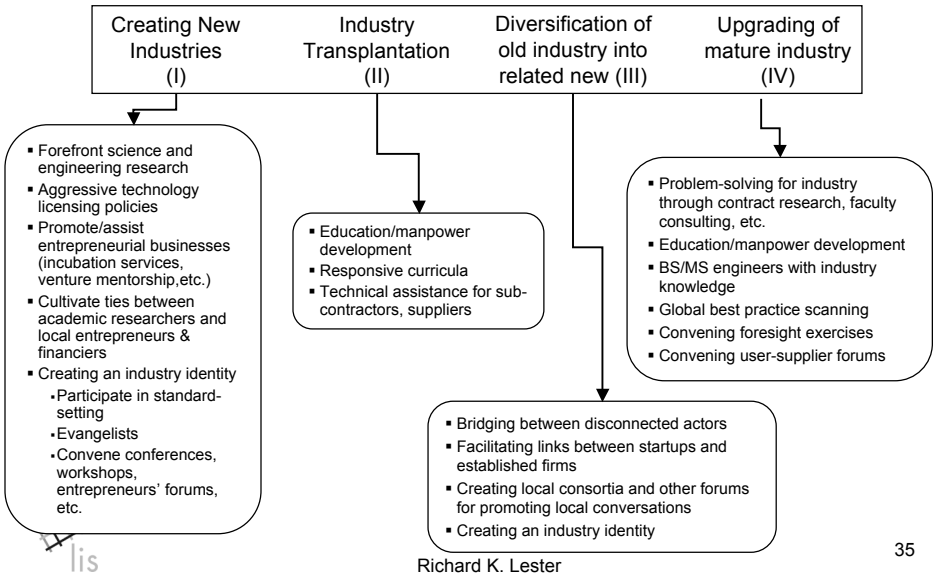
Finding III: University role in local innovation system depends on industry development pathway



To sum up . . . . .

- Not all regions are like Silicon Valley.
- Not all industries are like biotech and software.
- Not all universities are like Stanford.

New perspectives, new strategies

- From technology transfer to technology take-up
- From universities as problem solvers to universities as public space
- From ‘fountains’ to ‘forums
- From clusters to hubs

Conclusions

- ***The standard model of the economic role of the university is too narrow.*** Universities have many different ways to contribute to local innovation processes.
- ***Avoid a one-size-fits-all approach to the economic role.*** Different industries, and different development pathways, demand different kinds of university participation in local innovation processes.
- ***Universities can -- and should -- approach their role in local innovation processes strategically.*** This means aligning university efforts with what is actually happening in the local economy.

For further information see:

Richard K. Lester, “Universities, Innovation, and the Competitiveness of Local Economies”, MIT Industrial Performance Center Working Paper 05-010.

(available at http://web.mit.edu/ipc/publications/pdf/05-010.pdf)