# Social Networks, Universities and Local Economic Development:
## Preliminary thoughts on Science Parks

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# Universities as 'engines' of 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 the innovation process (also possibly at lower cost)

## For universities

- A new source of revenue
- .... and also new challenges

# "Standard Model" of University's Role in Economic Development

University-initiated technological entrepreneurship

- Inventions
- Patents
- Licenses
- Spin-offs
- Local SMEs
- Spillovers

... But the model is incomplete. University's role is not just about tech transfer.

# Myth #1: Spin-offs are where the action is

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

- Start-ups that license university intellectual property: 400-500/yr
- Total university-related start-ups: 8000-10,000/yr
- Total rate of new firm-starts: ~550,000/yr

- Patents issued to US universities: 3700/yr
- Total US patents granted: 150,000/yr

# Myth #2: Universities get rich off tech transfer

Total licensing revenue to universities is (and will remain) a small fraction of research revenues.

- 4-6% in the US

A few highly remunerative licenses…

- But only 125 university licenses out of >20,000 total yield more than $1million/yr

Estimated that half of US Tech Licensing Offices in the US are estimated to make a negative contribution to university finances.

There are, of course, side-benefits (e.g., culture of entrepreneurship)

But don't expect licensing to transform the finances of the university.

# Myth #3: Licenses and patents as routes of university tech transfer

Licensing university patents is only one of several ways companies access university technology.

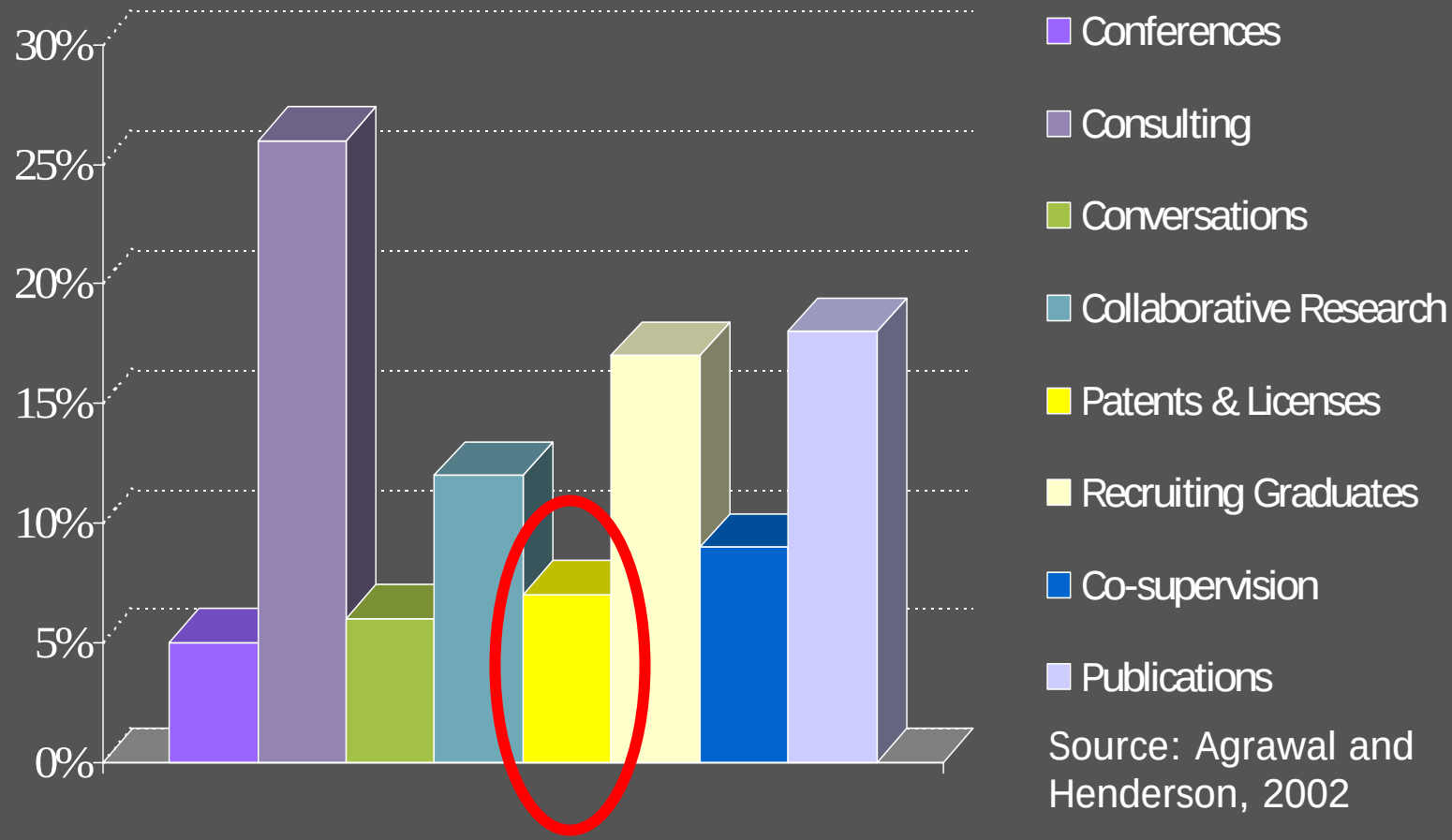
Other mechanisms include:

- Applying university research found in publications
- Using university scientists as consultants to apply research conducted at their own universities
- Collaborating with academic scientists to apply university research developed elsewhere.

Indirect mechanisms may be more important.

In most industries, patents are not the primary basis of competition.

# Myth #3: Licenses and patents as routes of university tech transfer




Source: Agrawal and Henderson, 2002

# Outside-In Perspective

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

# 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 | Ceramics |
| USA | Youngstown, OH | Steel/autos |
| 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 |

# Four Pathways of Innovation-Led Growth

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

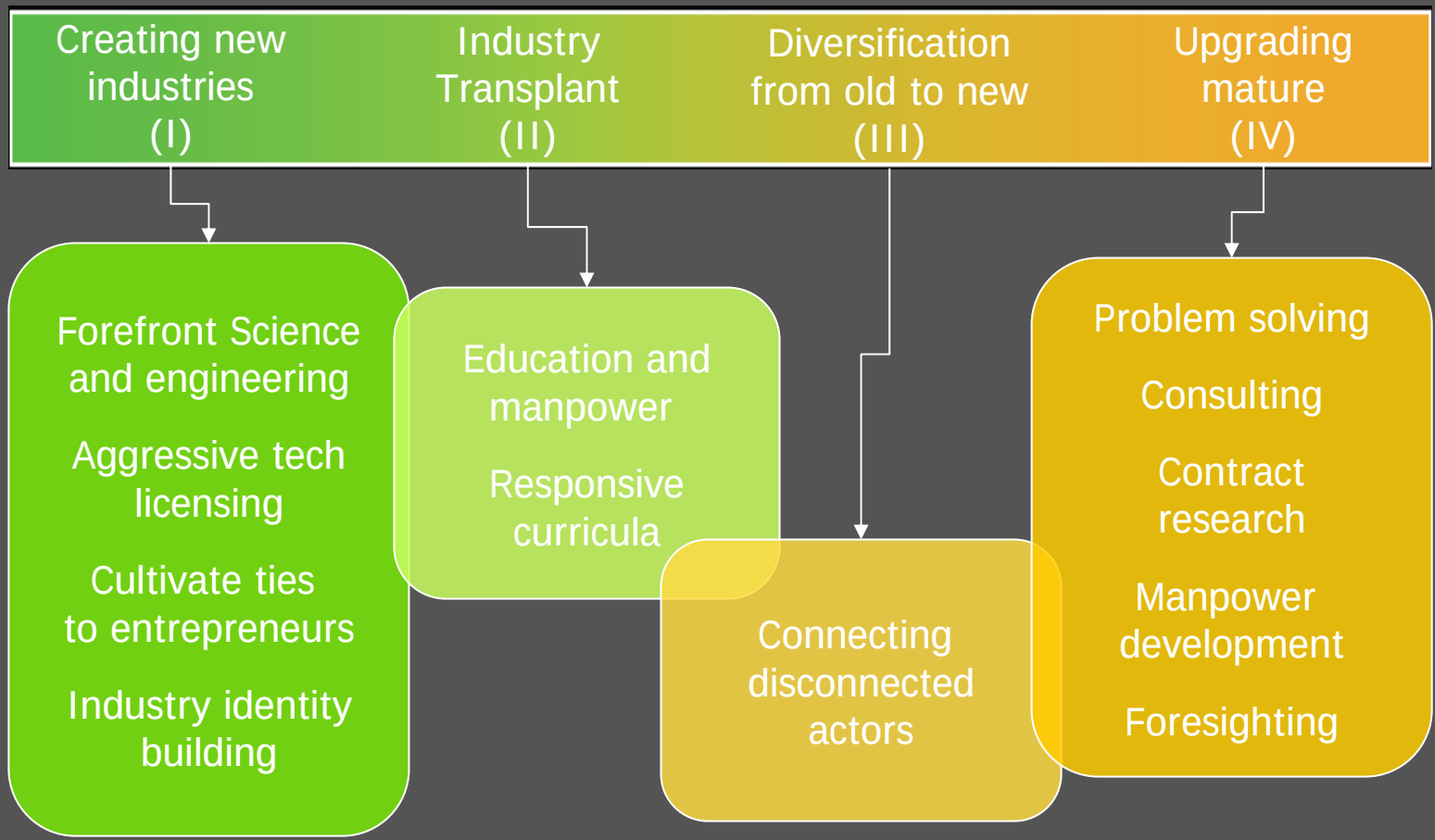
II. Transplantation of new industry
- I-85 Corridor (NC/SC): Automotive
- Taipei-Hsinchu corridor (Taiwan): Electronics

III. Diversification of existing industry
- Akron, OH: Tires → Advanced polymers
- Rochester, NY → Cameras, copiers → optoelectronics

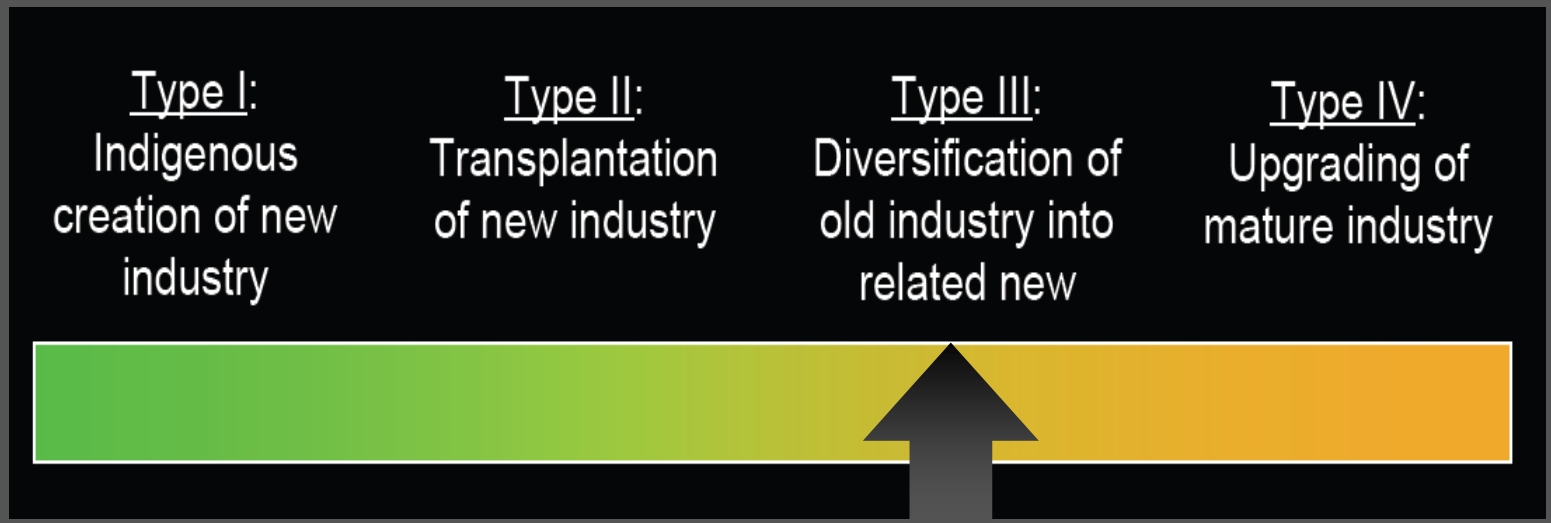
IV. Upgrading of existing industry
- Tempere, Finland: Industrial Machinery
- Charlotte, NC: Motor Sports

| | Type I | | Type IV |
|---|---|---|---|
| | Creating new industries | | Upgrading old industries |
| Financing | Active asset management | ⟷ | Internal and government financing |
| Innovation culture | Science-driven; entrepreneurial | ⟷ | Customer-driven; continuous improvement |
| Local anchors | Research universities; government labs | ⟷ | Lead firms; lead customers |
| Education and training | PhDs, engineers; Entrepreneurial leaders | ⟷ | BS/MS engineers internships, rotations |
| Leadership | Identity building, evangelism | ⟷ | Scanning & foresighting Regulatory reform |
| Technology transfer | Proactive transfer from universities and gov. | ⟷ | Long-term university-industry relationships |

# Finding 3: University's role depends on development trajectory



# Typology of Regional Trajectories



# Silicon Valleys of the Second Industrial Revolution

# Silicon Valleys of the Second Industrial Revolution

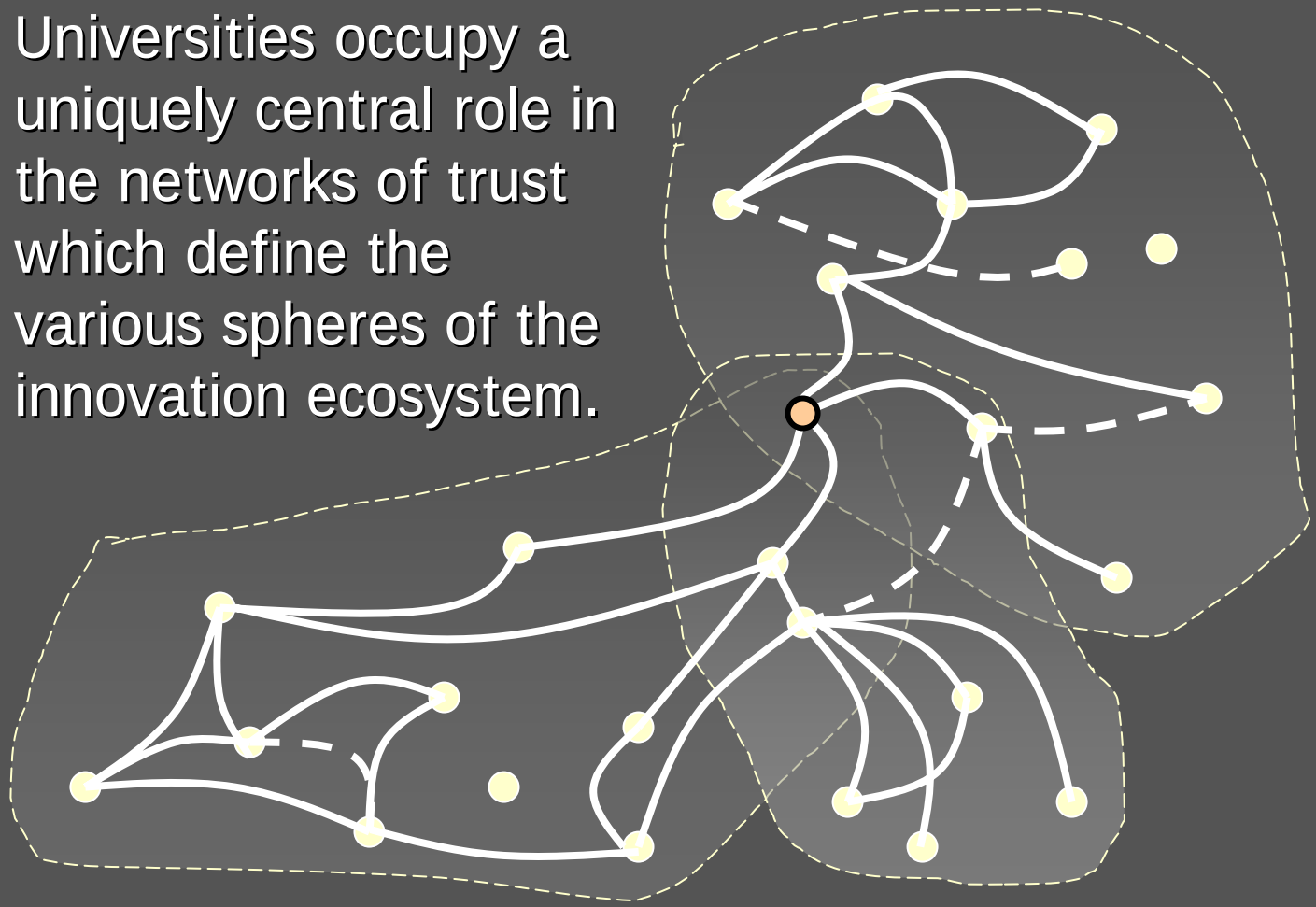



- By the 1980s, major companies had moved manufacturing to lower cost regions
- Broadened research and development beyond local area
- Shifted R&D toward advanced materials and applications.




# The Social Capital of the University

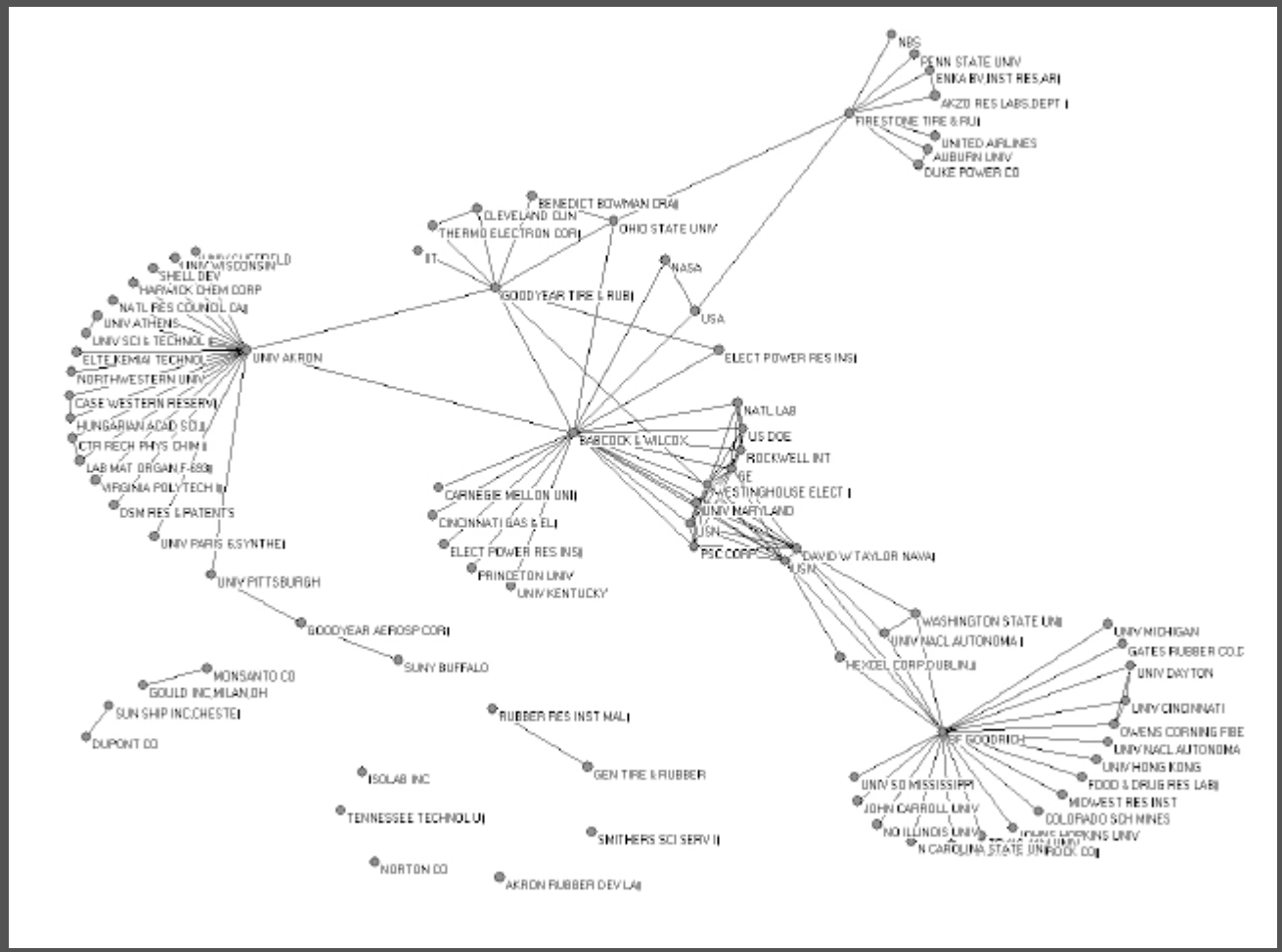
Universities occupy a uniquely central role in the networks of trust which define the various spheres of the innovation ecosystem.



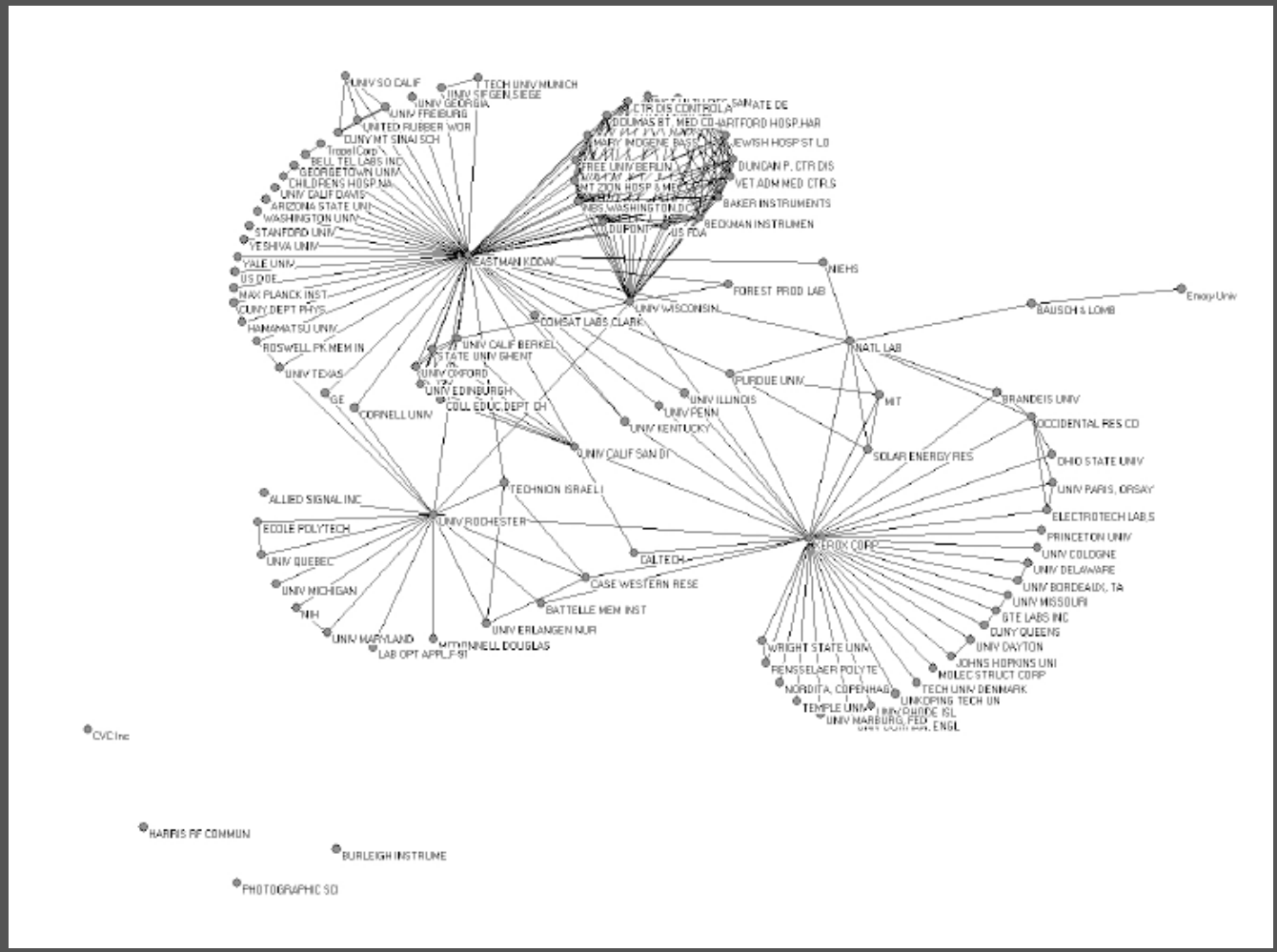
# Akron: Fountain Approach

# Rochester: Forum Approach

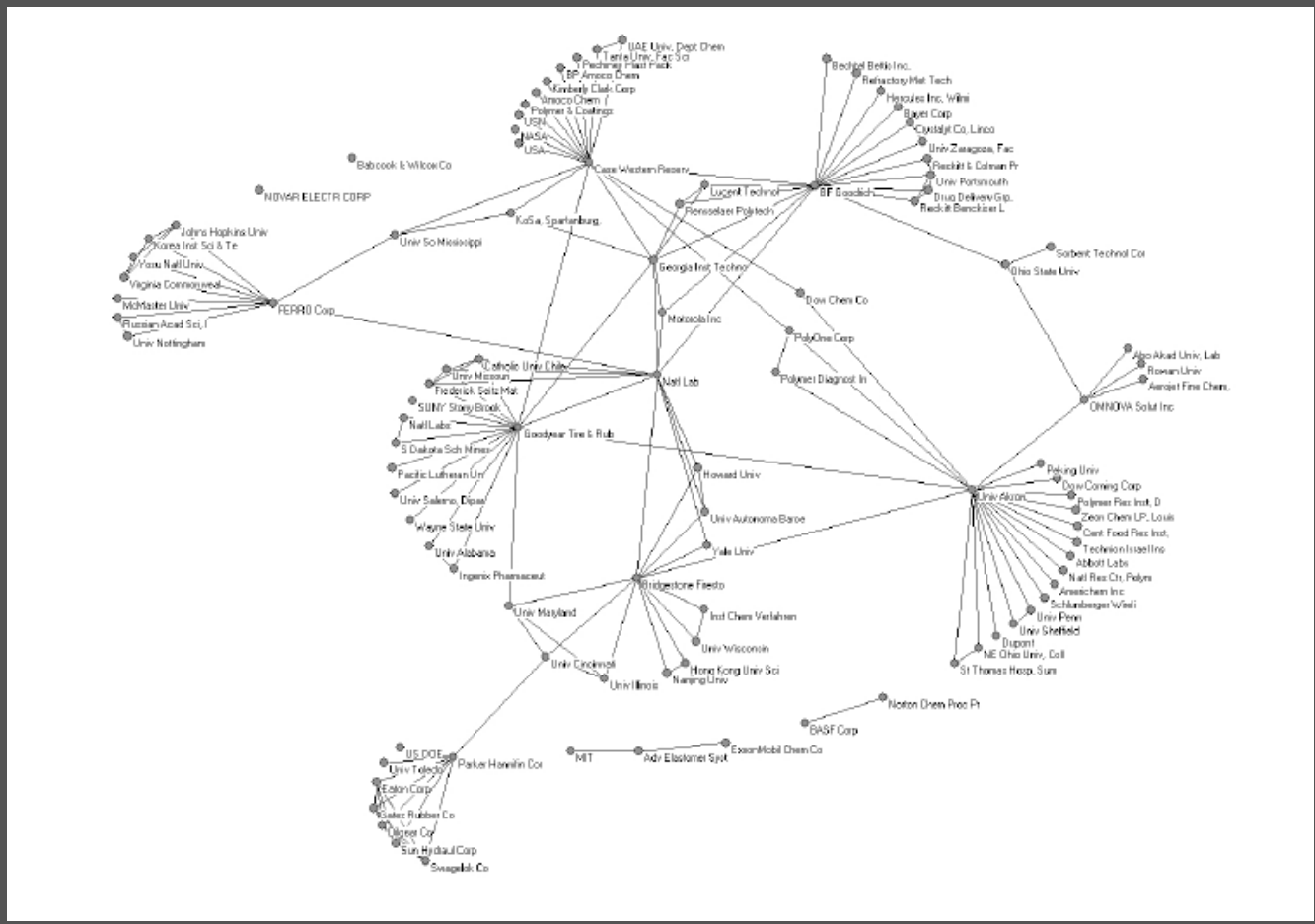
# Akron 1982-1983



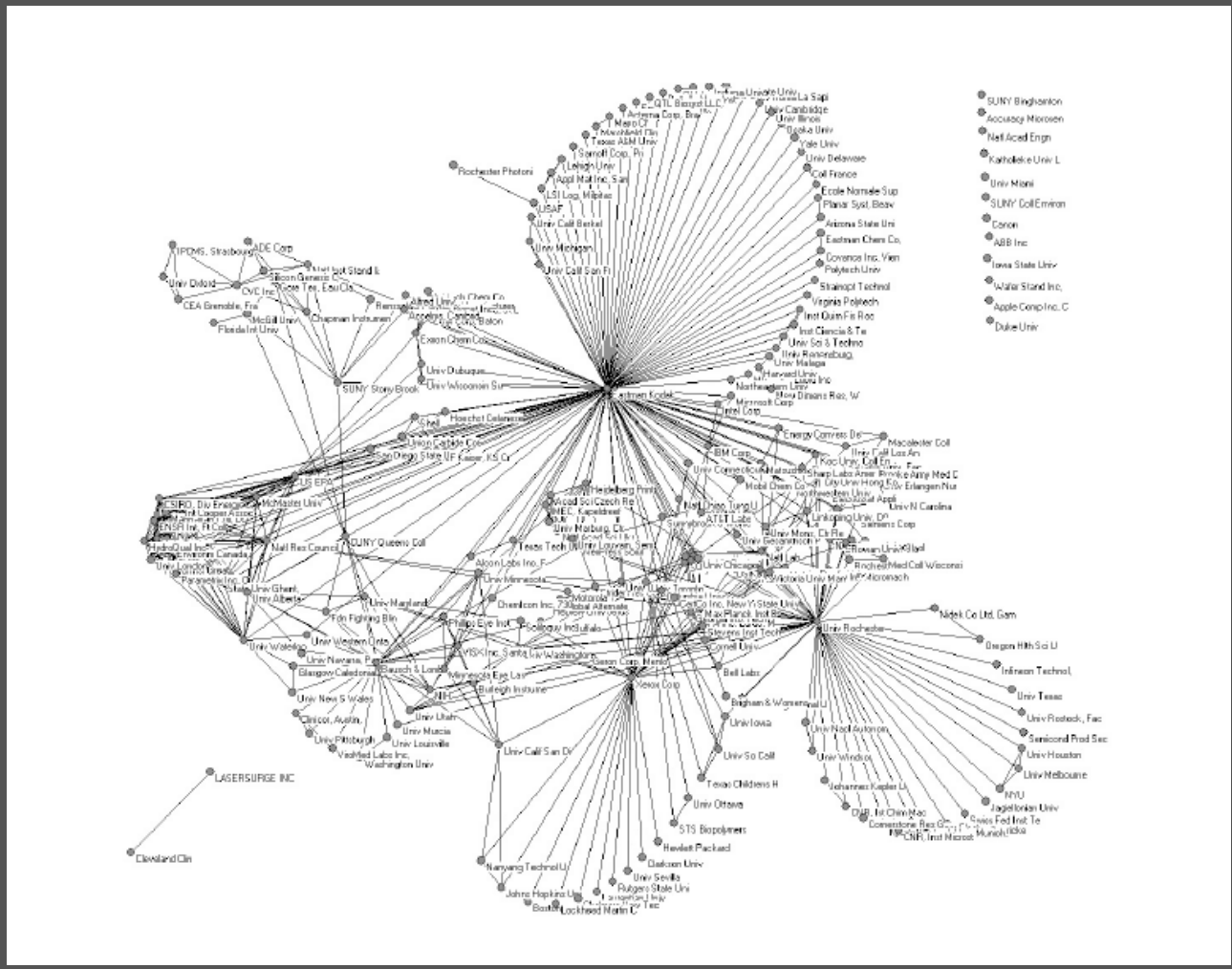

# Rochester 1982-1983




# Akron: 2002-2003



# Rochester 2002-2003




# Adjusting to the New Rules: Akron

**Table 9.a** **Akron 1980-1982: Truncated Block Model**

| | Local Multinational | Local Tech Firms | Local Universities and Labs | Non-Local Multinational | U.S. Tech Firms | U.S. Universities and Labs | Non-U.S. Tech Firms | Non-U.S. Universities and Labs | n | $\chi^2$ d.f. |
|---|---|---|---|---|---|---|---|---|---|---|
| Local Multinationals | 86.1% ♦ | 0.1% | 0.4% | 0.8% | 2.5% | 9.5% | 0.2% | 0.5% | 1277 | 5 |
| Local Tech Firms | 1.7% | 95.0% ♦ | | | | 3.3% | | | 60 | 5 |
| Local Univs and Labs | 2.4% | | 77.6% | 1.0% ♦ | 2.4% ♦ | 8.1% | 1.0% | 7.6% | 210 | 5 |
| Category Total | 71.4% ♦ | 3.7% ♦ | 10.9% ♦ | 2.4% ‡ | 9.0% ♦ | 0.3% ♦ | 0.3% ♦ | 1.5% | 1547 | 5 |
| Group Total | | 86.0% ♦ | | | 12.2% | | 1.7% | | | 2 |

♦ — significantly different from Rochester

**Table 9.b** **Akron 2000-2002: Truncated Block Model**

| | Local Multinational | Local Tech Firms | Local Universities and Labs | Non-Local Multinational | U.S. Tech Firms | U.S. Universities and Labs | Non-U.S. Tech Firms | Non-U.S. Universities and Labs | n | $\chi^2$ d.f. |
|---|---|---|---|---|---|---|---|---|---|---|
| Local Multinationals | 62.3% ‡ | | 3.7% | 5.2% | 8.1% | 10.6% | 3.1% ♦‡ | 7.1% | 621 | 5 |
| Local Tech Firms | | 64.8% ♦‡ | 6.0% | 3.8% ♦ | 3.3% ♦ | 17.3% ♦ | | 4.9% | 369 | 5 |
| Local Univs and Labs | 2.1% | 2.0% ♦‡ | 77.1% | 5.3% ♦‡ | 3.5% | 6.2% | 0.5% ♦ | 3.2% | 1091 | 5 |
| Category Total | 19.7% ♦‡ | 12.5% ♦‡ | 42.6% ♦‡ | 5.0% ♦‡ | 4.8% ♦‡ | 9.5% | 1.2% ♦‡ | 4.7% | 2081 | 5 |
| Group Total | | 74.8% ♦‡ | | | 19.3% ♦‡ | | 5.9% ♦‡ | | | 2 |

‡ — significant change from 1980-1982
♦ — significantly different from Rochester

# Adjusting to the New Rules: Rochester

**Table 9.c** **Rochester 1980-1982: Truncated Block Model**

| | Local Multinational | Local Tech Firms | Local Universities and Labs | Non-Local Multinational | U.S. Tech Firms | U.S. Universities and Labs | Non-U.S. Tech Firms | Non-U.S. Universities and Labs | n | $\chi^2$ d.f. |
|---|---|---|---|---|---|---|---|---|---|---|
| Local Multinationals | 66.7% ♦ | 0.3% | 2.8% | 1.6% | 2.4% | 21.8% | 0.1% ♦ | 0.1% | 1359 | 5 |
| Local Tech Firms | 8.5% ♦ | 57.4% ♦ | | 6.4% | 6.4% | 21.3% | | | 47 | 5 |
| Local Univs and Labs | 2.9% | | 77.1% | 1.6% ♦ | 0.1% ♦ | 15.5% | | 2.8% | 1310 | 5 |
| Category Total | 34.9% ♦ | 1.1% ♦ | 38.6% ♦ | 1.7% | 1.3% ♦ | 18.7% ♦ | >0.1% ♦ | 3.5% | 1547 | 5 |
| Group Total | | 74.7% | | | 21.8% | | 3.6% | | | 2 |

♦ — significantly different from Akron

**Table 9.d** **Rochester 2000-2002: Truncated Block Model**

| | Local Multinational | Local Tech Firms | Local Universities and Labs | Non-Local Multinational | U.S. Tech Firms | U.S. Universities and Labs | Non-U.S. Tech Firms | Non-U.S. Universities and Labs | n | $\chi^2$ d.f. |
|---|---|---|---|---|---|---|---|---|---|---|
| Local Multinationals | 68.2% | 1.3% | 7.6% | 1.3% | 2.1% | 11.3% | 0.3% ‡ | 7.8% | 2847 | 5 |
| Local Tech Firms | 7.0% ♦ | 62.3% ♦ | 8.0% ‡ | 0.6% ♦ | 0.8% ♦ | 16.1% | 1.1% ♦ | 4.2% | 528 | 5 |
| Local Univs and Labs | 8.3% | 1.6% ♦‡ | 77.7% | 1.2% | 1.1% ‡ | 5.1% ‡ | 1.1% ♦‡ | 3.8% | 2575 | 5 |
| Category Total | 36.9% ♦ | 6.9% ♦‡ | 37.9% ♦ | 1.2% ♦ | 1.5% ♦ | 9.1% ‡ | 0.7% ♦‡ | 5.7% ‡ | 5950 | 5 |
| Group Total | | 81.7% ♦‡ | | | 11.8% ♦‡ | | 6.5% ‡ | | | 2 |

‡ — significant change from 1980-1982
♦ — significantly different from Akron

# General Research Questions

1. What makes a region “innovative”?
2. To what degree is innovation local?
3. Is there any evidence that policies have impact?
4. Under what conditions do regions actually capture the benefits of the innovations they generate?
5. To what degree to the answers to these questions depend on the trajectory of technology in the region?
6. To what degree do research parks contribute to each of these?

# Questions Specific to Research Parks

- How do networks among technology focused research parks differ from those with a mix of technologies?
  - Among tenants of the park?
  - Between tenants and local actors (e.g., universities, existing companies)?
  - Between participants and key suppliers, customers and research partners globally?
  - Are “dense” networks desirable? Are “entrepreneurial” networks possible?
- What is the role of intermediaries and brokers?
  - Active facilitation of information, people, financial resources between companies, university departments, internal and external?
  - “Match-making”; party hosting
- Labor market circulation
  - Serial entrepreneurs, serial tech-start-up employees
  - Student career trajectories
  - Star scientists

# Data collection

- Contextualized case studies
  - Differences-in-differences
  - Natural experiments
  - Matched Pairs
- Network data
  - Job histories (key would be identifying a pool of potential recruits)
  - Patent co-authorship
  - Paper co-authorship
  - Licensing