

# Implications of Research Networks: Collaboration, Alliance, Convergence, Transfer, or What?

*Presented at*

*2007 Technology Transfer Society (T<sup>2</sup>S) Conference  
“Entrepreneurship and Technology Commercialization”*

*University of California, Riverside Palm Desert Graduate Center  
Palm Desert, California  
October 25, 2007*

---

**Yongsuk Jang, Ph.D.**  
**Senior Research Scientist**  
**Center for International Science and Technology Policy**  
**The George Washington University**  
**Email: [jang@gwu.edu](mailto:jang@gwu.edu)**



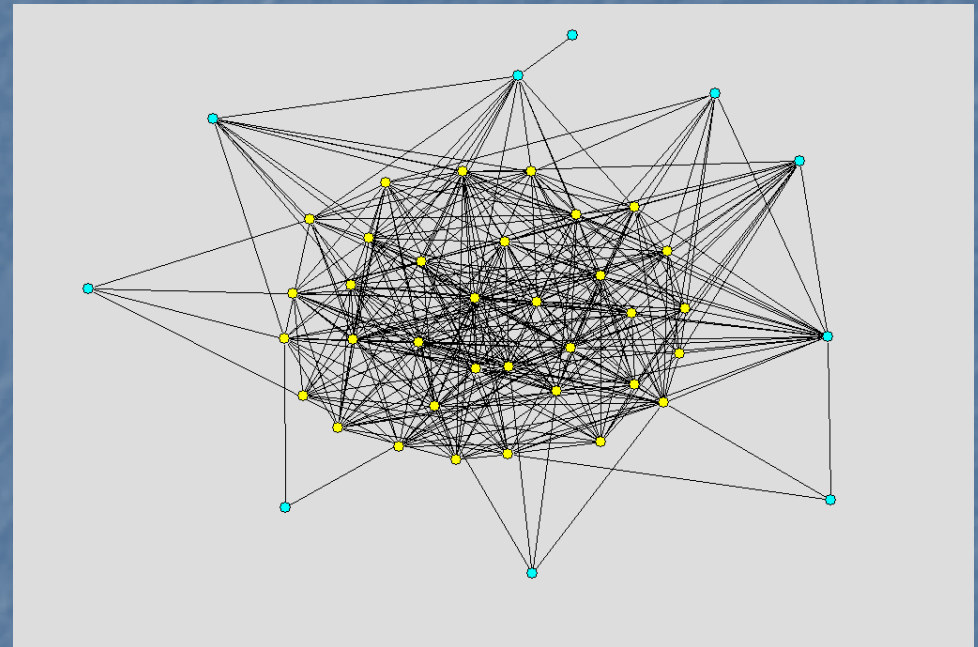
# Research Networks

**Interactions (including Collaboration) for R&D**



**Research Networks**

- View from Various Characteristics of Interactions
  - Individual Researchers
  - Institutes
  - Countries
  - Disciplines
  - Technological Areas
  - Knowledge Components
  - Industrial Interactions
  - or, What?



**Which Networks are Good or Bad?**

# 'Entrepreneurial' Research Networks

- “A person who organizes, operates, and assumes the risk for a business venture.” (American Heritage Dictionary)
- “Person who takes on the risks of starting a new business.” (Barron's)

## **Key Characteristics**

- **Risk-taking**
- **New Trials**

**Research Interactions that try Experimental (New) Forms even at Higher Risks**

# Methodology: Theoretical Ground

---

**David Teece, Richard Rumelt, Giovanni Dosi, Sidney Winter (1994),  
“Understanding corporate coherence: Theory and evidence”**

## *Survivor Principle*

“Economic competition eliminates relatively inefficient organizational forms over time.”

- Applied to the research network analysis, the survivor principle assumes that related characteristics (e.g., technologies) will be more frequently combined through research networks.
- In other words, for instance, if a certain pair of technologies is frequently observed throughout each database, it can be assumed that these two technologies are highly related.
- Conversely, technologies rarely or never combined are unrelated.”

# Methodology: Technological Relatedness

---

- No. of IRC in both technologies

$$J_{ij} = \sum_k C_{ik} C_{jk}$$

- Expected Value

$$P_r[X_{ij} = x] = \frac{\binom{n_i}{x} \binom{K - n_i}{n_j - x}}{\binom{K}{n_j}}$$

- with Mean &

$$\mu_{ij} = E(X_{ij}) = \frac{n_i n_j}{K}$$

- Variance

$$\sigma_{ij}^2 = \mu_{ij} \left(1 - \frac{n_i}{K}\right) \left(\frac{K}{K-1}\right)$$

- Measure of Technological Relatedness

$$t_{ij} = \frac{J_{ij} - \mu_{ij}}{\sigma_{ij}}$$

# Methodology: Technological Coherence

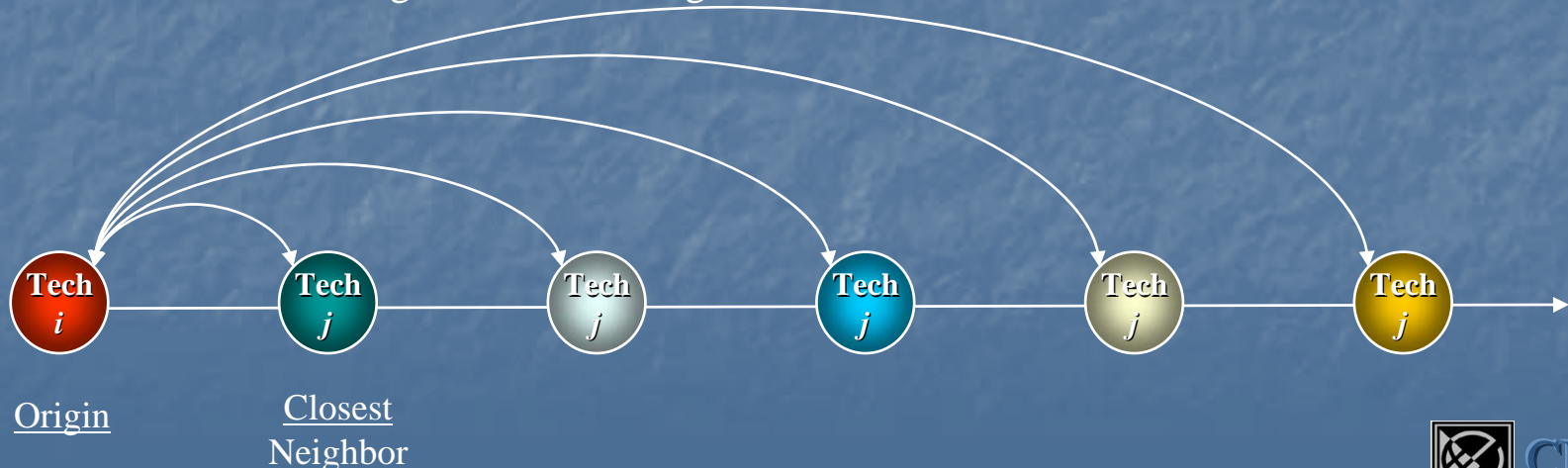
Weighted Average Relatedness to all neighbors (WAR)

$$WAR_i = \frac{\sum_{j \neq i} t_{ij} p_j}{\sum_{j \neq i} p_j}$$

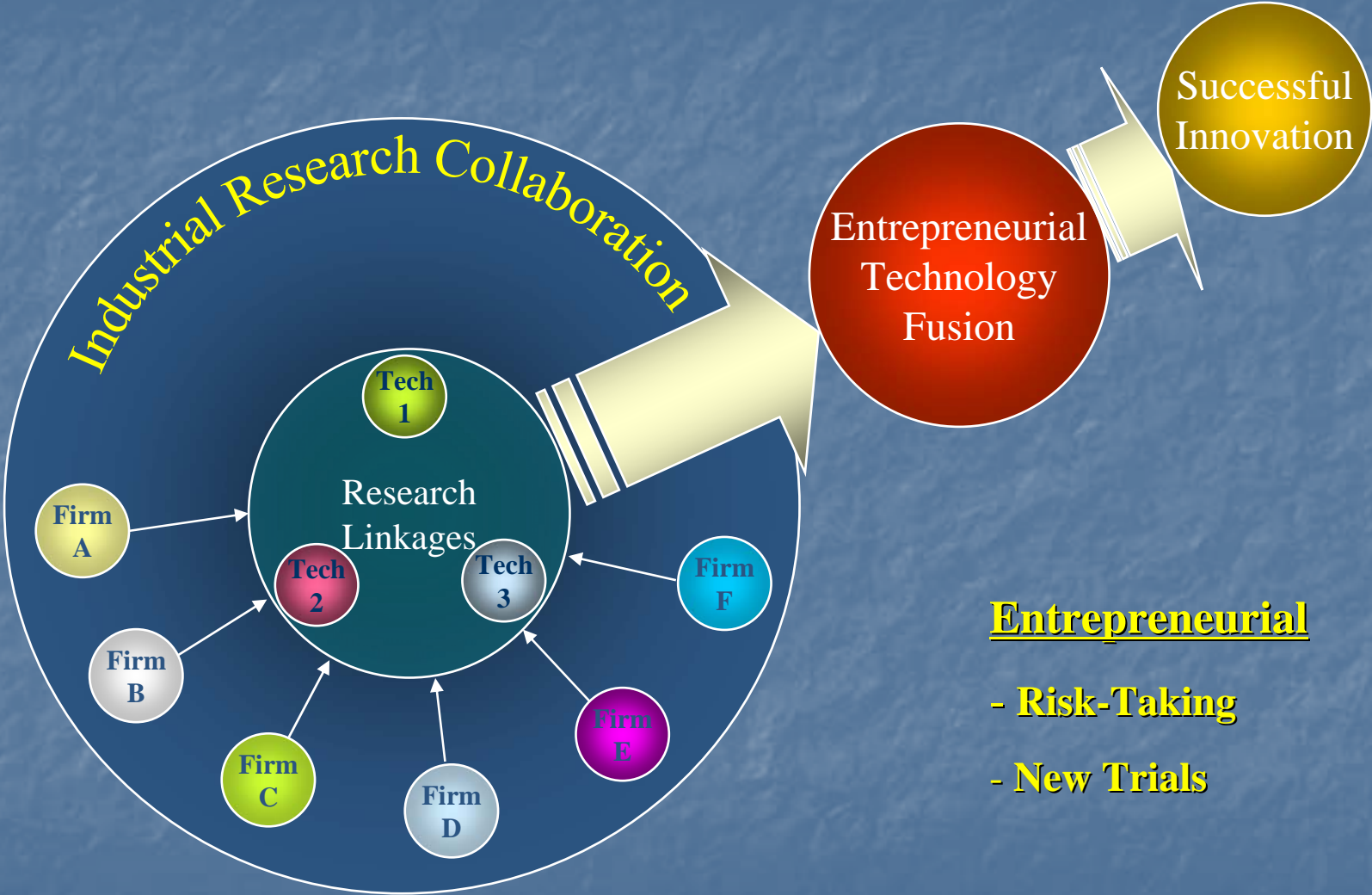
Weighted Average Relatedness to the closest Neighbor (WARN)

$$WARN_i = \frac{\sum_{j \neq i} t_{ij} p_j \lambda_{ij}}{\sum_{j \neq i} p_j \lambda_{ij}}$$

“..... A useful analogy would be to a residential neighborhood, where  $WARN_i$  measures the inverse of the average distance from a house to its neighbors, and  $WAR_i$  measures the inverse of the average distance from a house to all other houses in the area. As the area covered is increased, the distance to nearest neighbors does not change, but the average distance to all other homes does rise. In the industrial landscape, one sees that in a more diverse firm, just as in a larger neighborhood, the average distance to other technologies increase, but the average distance to neighbors does not.”



# Foreboding Technology Fusion



# Other Implications of Research Networks I

---

- **Interdisciplinary Research**

- Analytical Unit: Major Disciplines of Researches
- Data: SCI Publications or Funded Basic Research

- **Technological Convergence**

- Analytical Unit: Technological Areas
- Data: Patents or Engineering Compendex

- **Triple Helix**

- Analysis Unit: Organizational Types of Participants
- Data: Various Research-related Interactions among University, Industrial Firms, and Government

# Other Implications of Research Networks II

---

- **Research Diversification**

- **Analysis Unit: Technical Areas of Researches in which Industrial Firms involve**
- **Data: Research Joint Ventures**

- **Industrial Collusion**

- **Analytical Unit: Business Lines of Industrial Firms**
- **Data: Research Joint Ventures & Business Diversification**
- **Vonortas & Jang (2004), Collaborate to Collude?**

- **Technology Transfer**

- **Analytical Unit: Various Characteristics**
- **Data: Various Data Sources**
- **In Demand: Vector of Technology Flows**

# Other Implications of Research Networks III

---

- **International Research Cooperation**

- **Analysis Unit: Nationalities of Research Collaborators**
- **Data: International Research Projects**

- **Regional Clustering**

- **Analysis Unit: Regional Bases of Researchers**
- **Data: Various Data Sources**

- **Or, What?**

- **Analytical Unit: ?**
- **Data: ?**
- **In Demand: ?**

## Conclusion

---

- **Various Terminologies for such research interactions depending on research foci or available data**
- **Can be interpreted, however, within Research Network Framework**
- **Network Analysis Methodology can be applied to all such research interactions**
- **A Limitation of Network Analysis – Value Neutral**
- **‘Entrepreneurial’ Research Network – A methodology to overcome such a limitation**
- **Need other dimensional interpretations and analytical methodologies on Research Network**

