

The Development of Hybrid and Electric Vehicles

Emergence and development of the patent network

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Introduction

- The consequences of “(open) innovation”



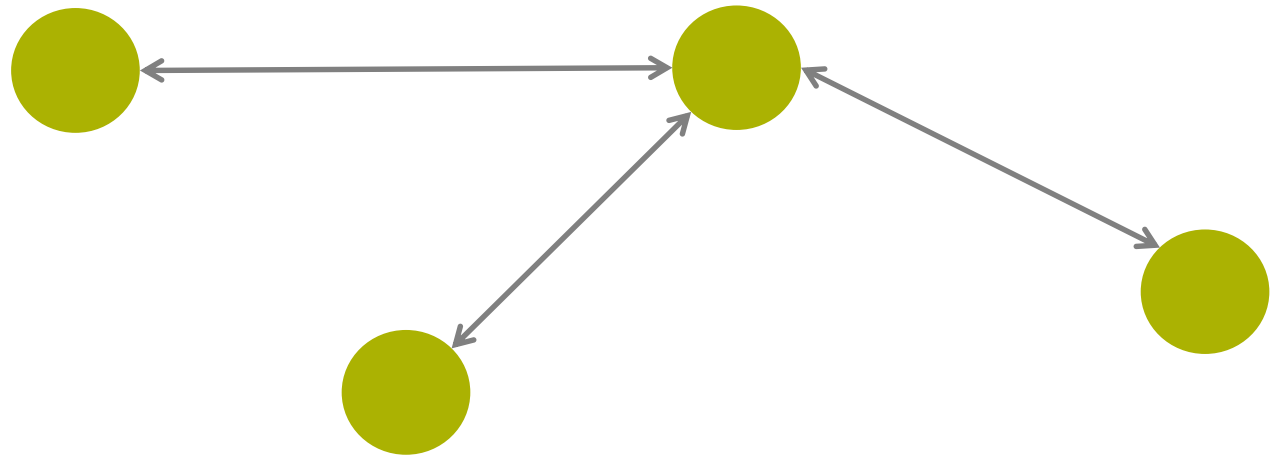
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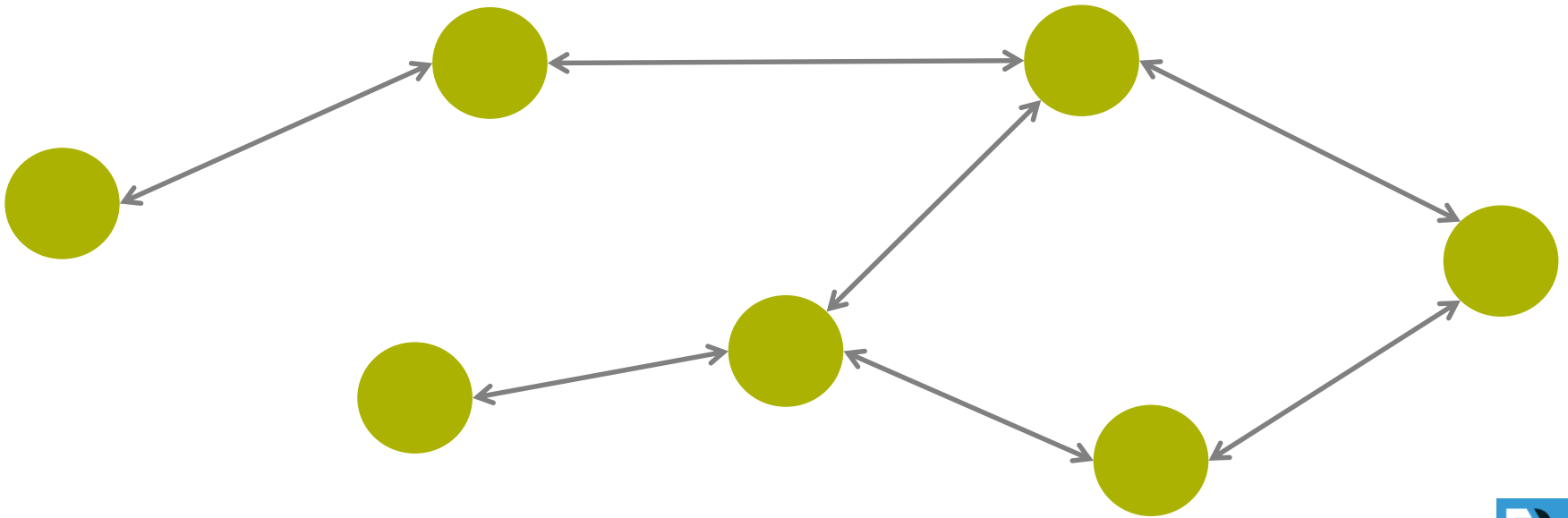
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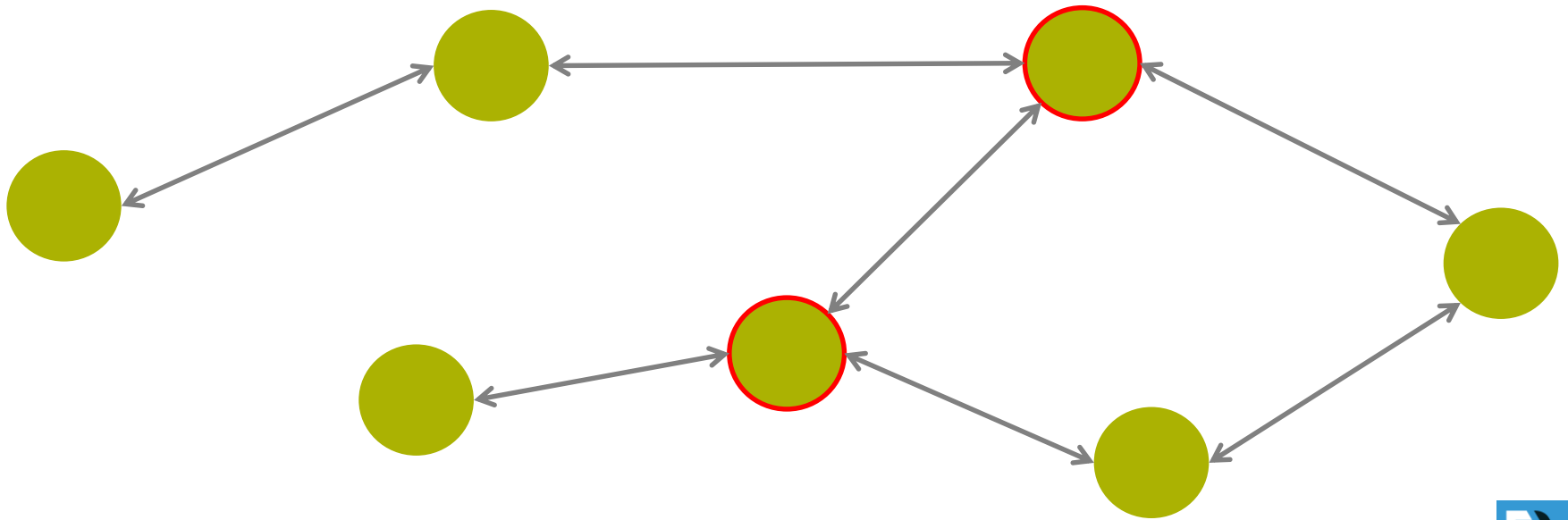
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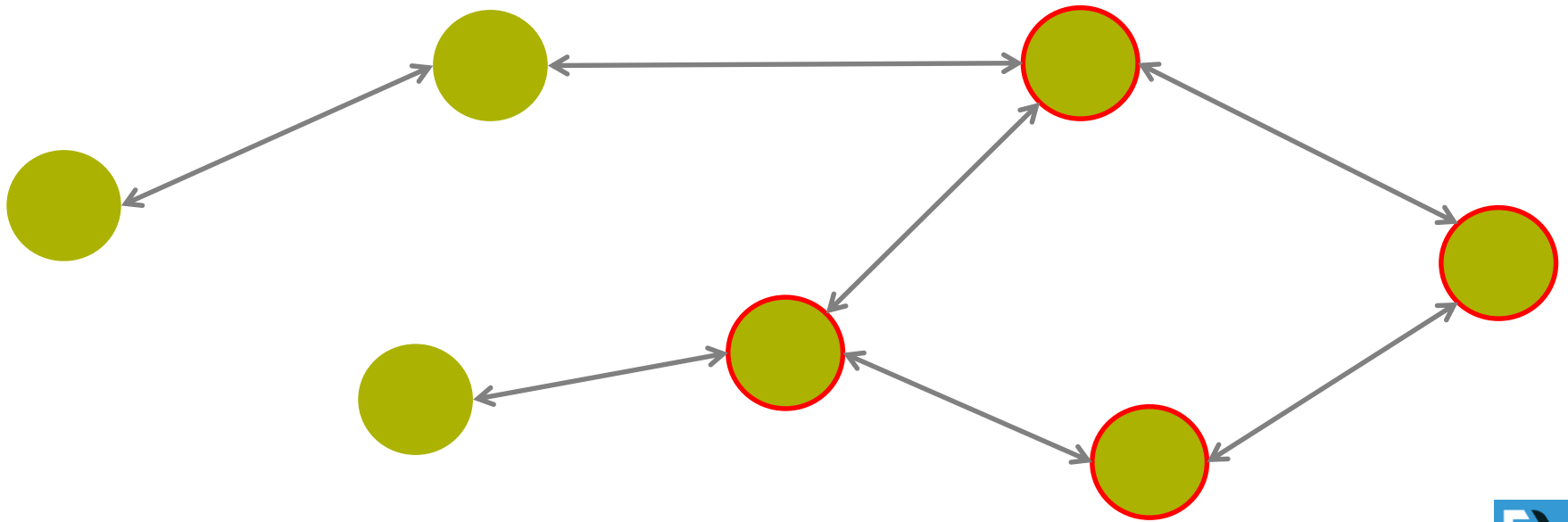
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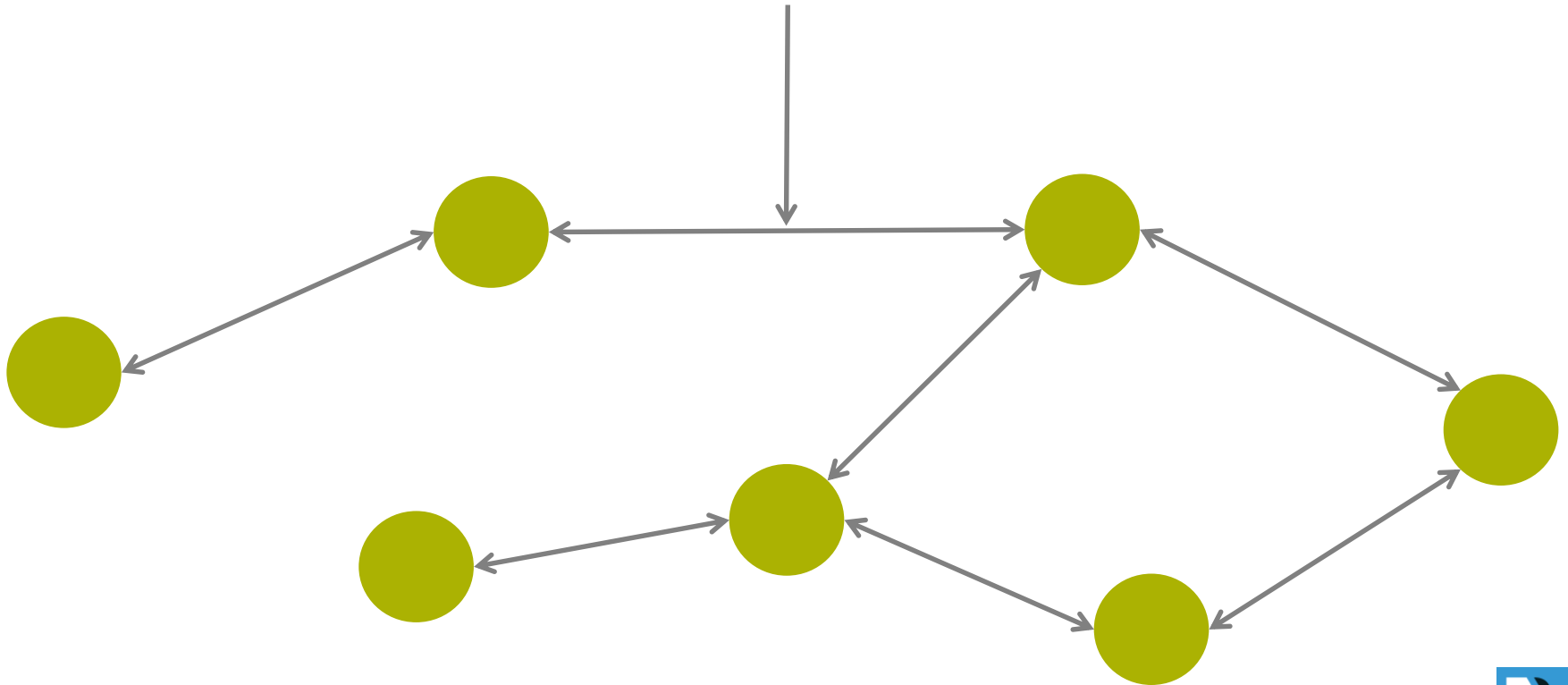
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Scope: Joint Patent Applications, Green Cars

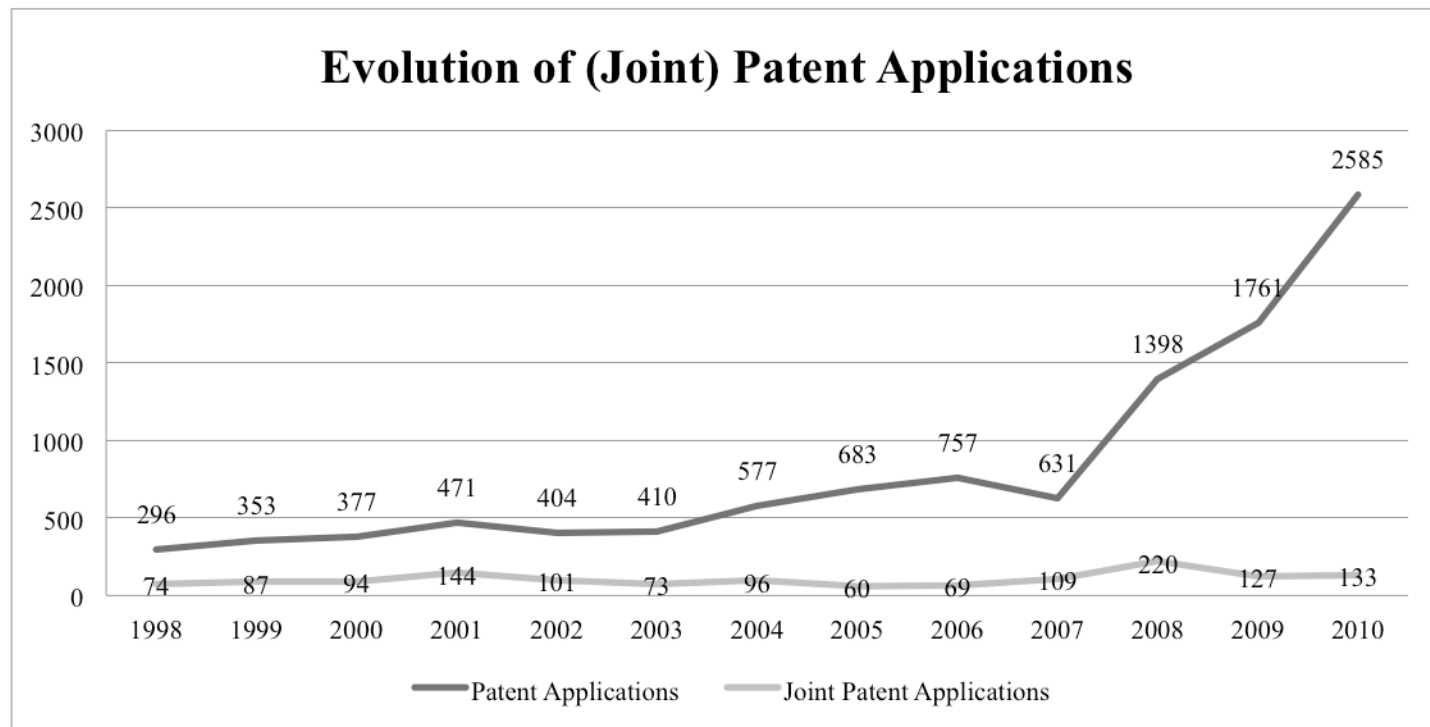


Introduction

- Research Questions
 - How did the R&D Network in the (H)EV industry evolve during the first decade of the 21st century?
 - Which are the central and powerful Organizations in the (H)EV R&D network?
 - How easy can knowledge flow between the organizations within the R&D network?

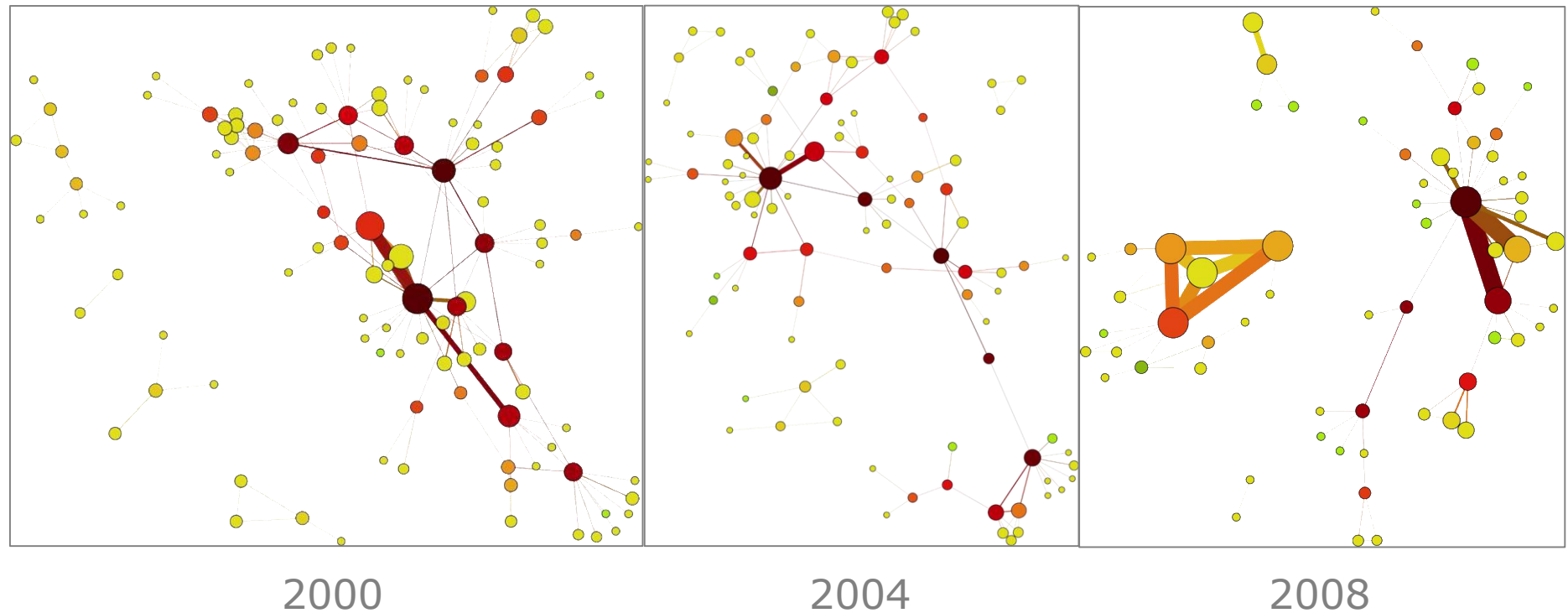
Data

- All “Green Vehicle” Patent Applications
- Period: 2000 – 2010
- N = 10,703 (family representatives)



Evolution of the R&D Network

Case: The Japanese Network



Evolution of the Network

R&D Network	2000	2004	2008
# Nodes	109	97	65
# Edges	161	123	82
Avg. Path Length	3.57	4.60	3.21
Avg. Clustering Coefficient	0.57	0.49	0.62

Central and Powerful Organizations

- (top 15 in paper)
- Toyota, Toyota, Toyota
- Powerful organizations create powerful organizations
- Universities “easily” become powerful organizations
- International entrants in powerful positions due to a merger of networks from 2008 on
- Large, diversified companies are still powerful players
- Shake out of utility companies

Knowledge Flows

- R&D network studied is conducive to knowledge flows
- R&D network characteristics are in favor of incumbents
- (Keiretsu's)

Conclusions, Limitations and Implications

- Conclusions
 - The R&D network tightens and favors incumbents
 - The role of universities
- Limitations
 - It is just the patent network, performance is only partly explained by network position
 - Robustness check
- Implications
 - Strategic networking
 - Tool development



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