



Sloan 2004 Annual Conference

# **Strategic Research Connections: *Implementing Funding Policy in a Dynamic Network***

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**Session 2, Part I Track D**

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# Applied Interest in Network Theory

- phone-book experiments that produced the term “six degrees of separation,”
  
- Not just a game anymore
  
- ‘small world’ studies
  - ✓ Grannovetter: 1973, job search
  - ✓ Watts: 1999, viral disease spread
  - ✓ Emphasis is on TASK as efficient *navigation* through a network

# Field Work / Analytic Tools Divide

- Wealth of Network Data
- Sophisticated Data Collection Protocols
- Sophisticated *Descriptive* Tools (Strogatz)
- Few Proactive Analytic Tools to Directly USE the data collected
  - ✓ All Dressed Up and No Where to Go

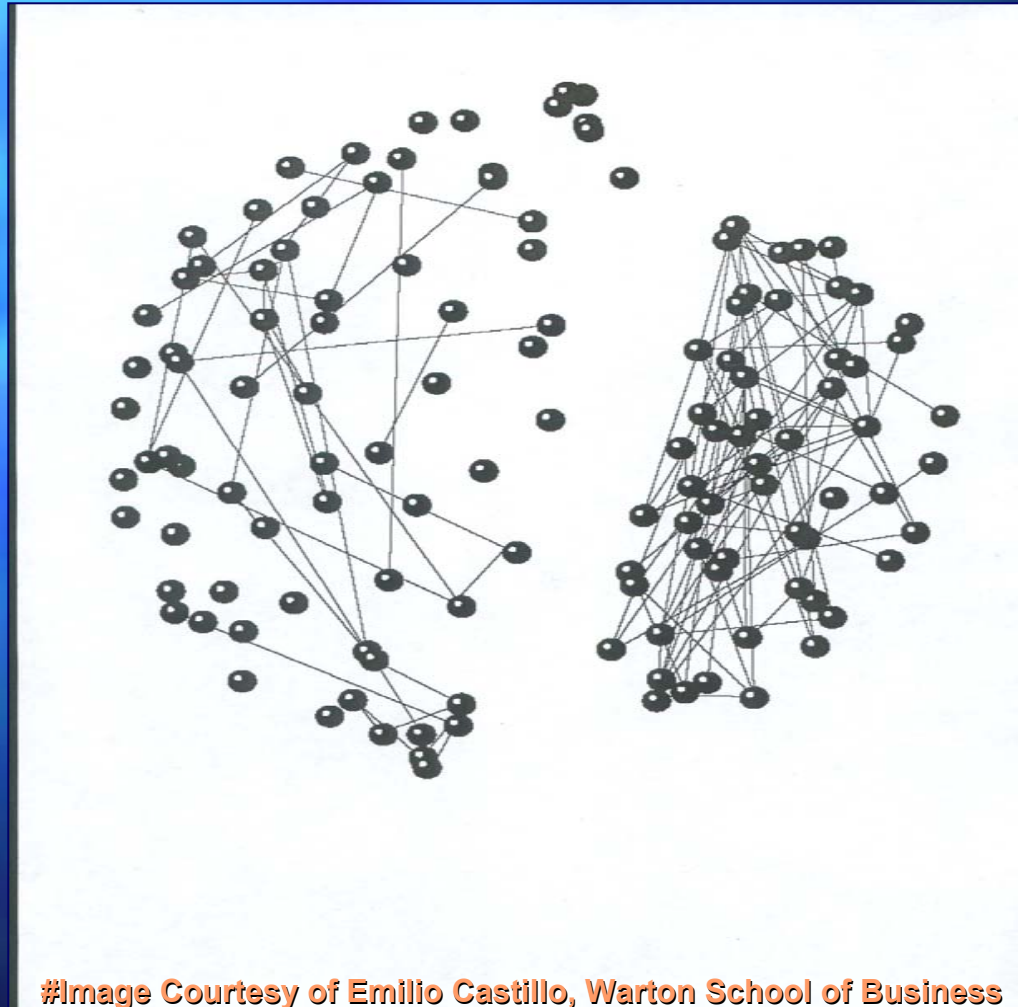
# Outline

- **Programming Problems for Social Sciences**
  - ✓ **Many Sophisticated Small World descriptors emerging from physics**
  
- **Venture Capital Network Simulations**
  - ✓ **Task Path Simulation of Small World Policy**
  
- **Preview of Black Liquor Gasification Strategic Research Design**

# Programming Problem

- First, few competent to program recursive Bellman Systems
  - ✓ yet may be good at data collection and applied problem articulation
- Dynamics themselves somewhat unreliable
  - ✓ Estimated by random parameters logit.
  - ✓ Further out, less reliable yet B.E. requires well defined end point conditions
- Need rules robust to likely rules of dynamics
  - ✓ Advantage of simple cellular automata

# Collaboration among Silicon Valley Venture Capitalists



# Strategic Connections Based on Direct Optimization

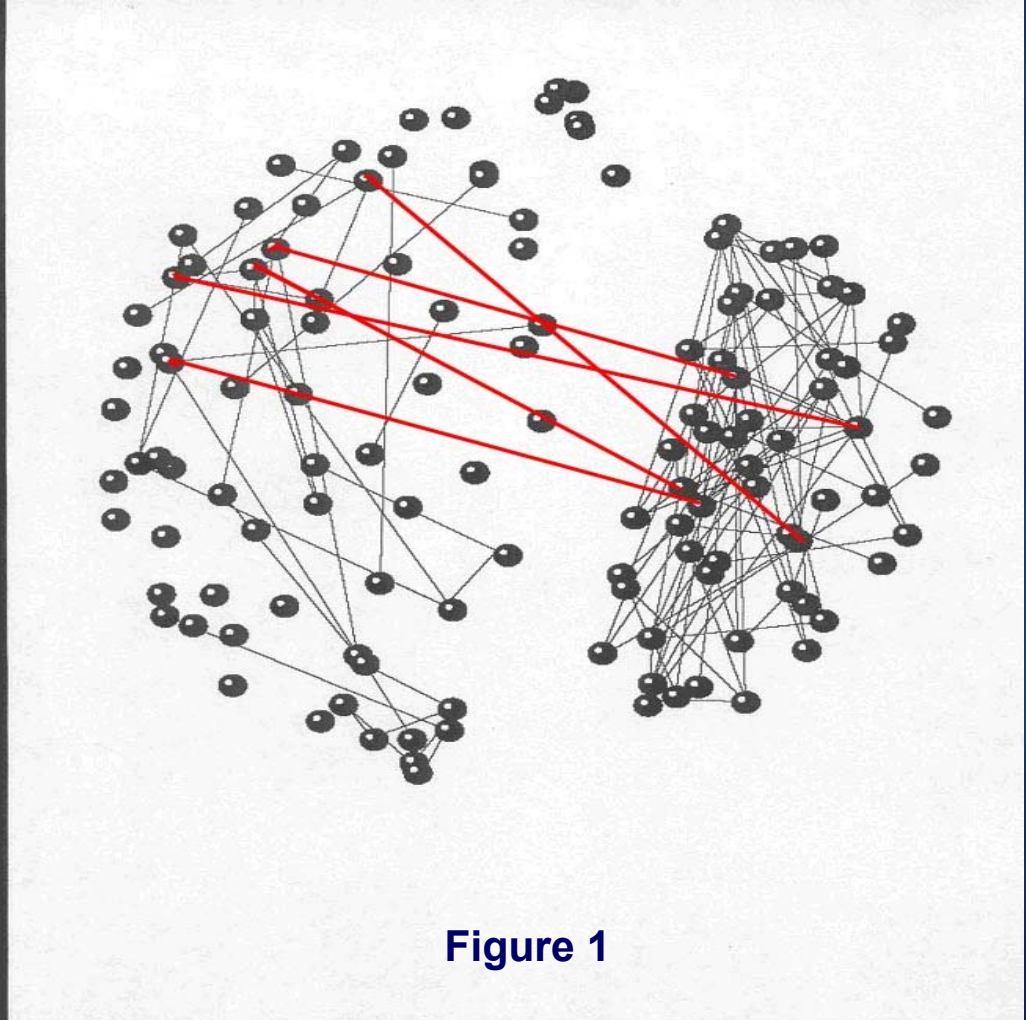


Figure 1

# Strategic Connection Based on Smart Small World

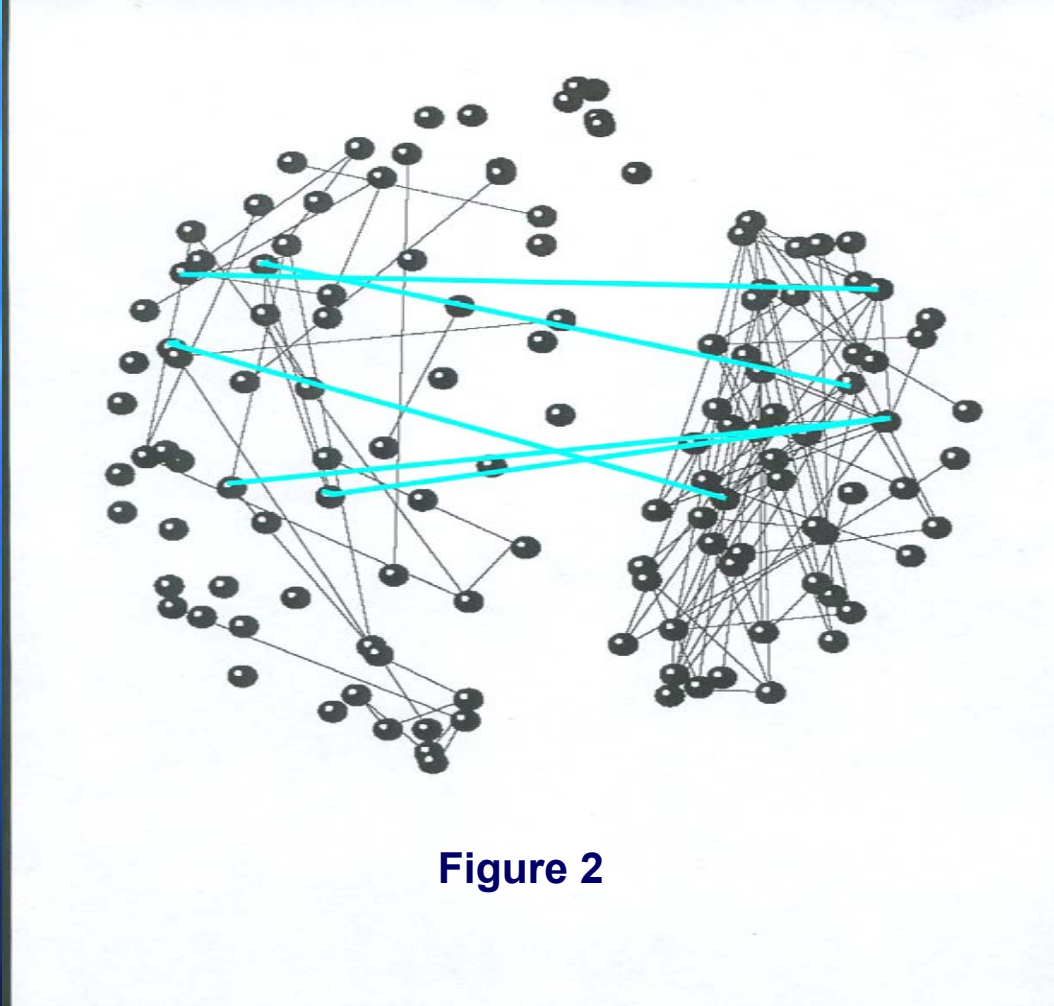
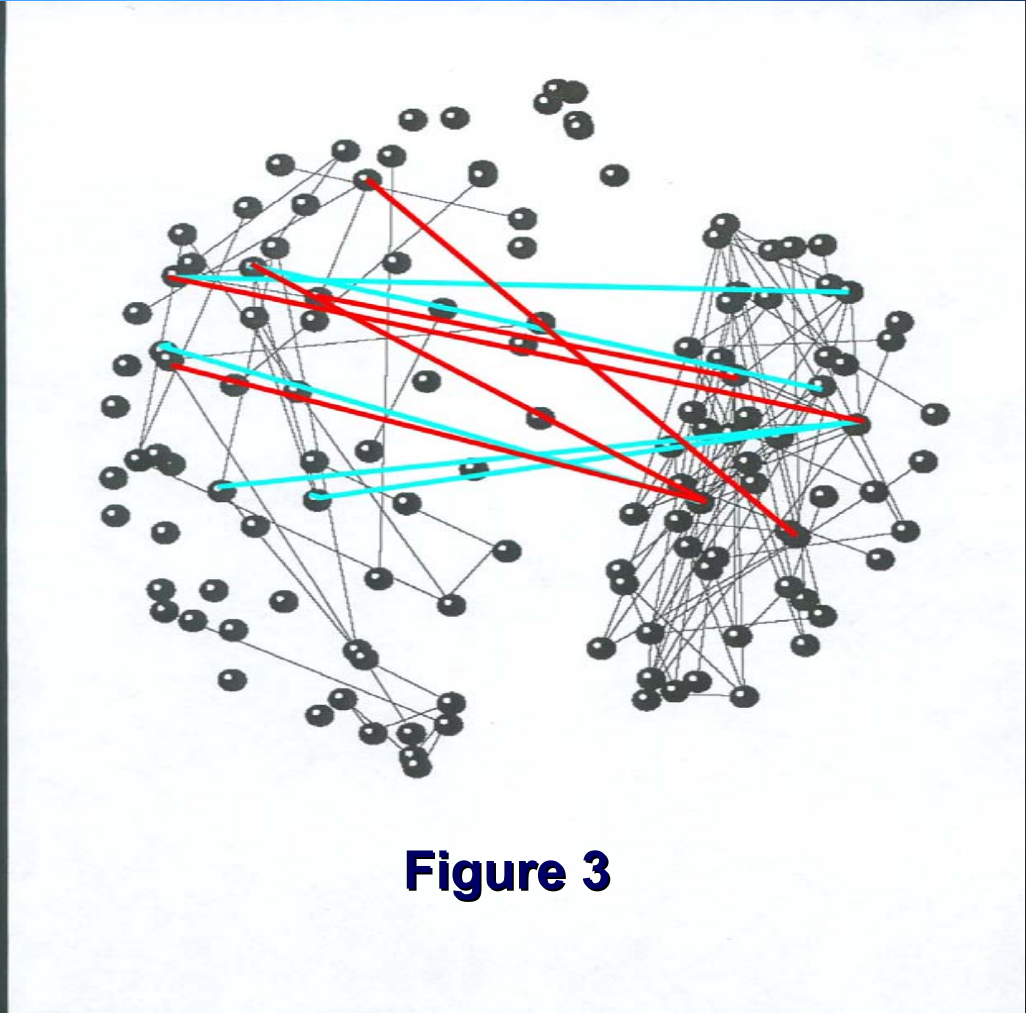


Figure 2



# Comparison of Connections: *Direct Optimization versus Smart Small World*



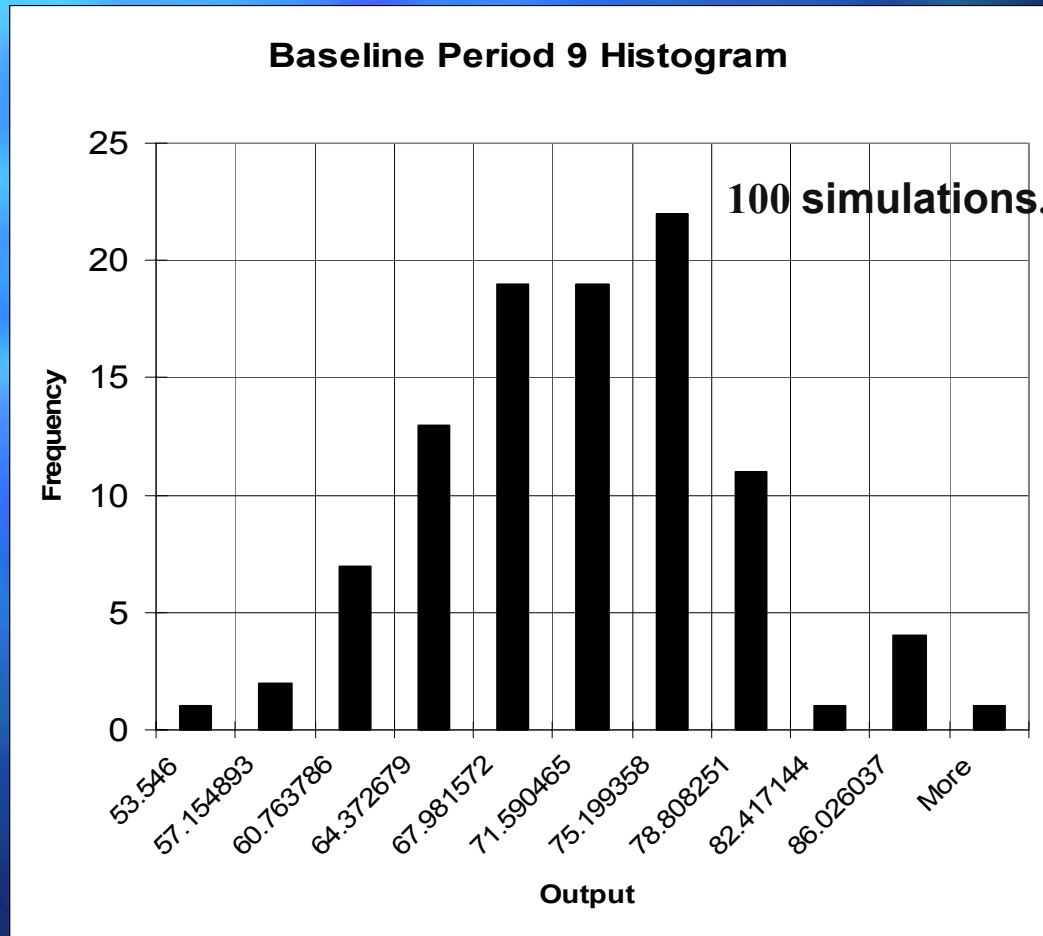
# Policy Selection Rules

- **Direct Output Optimiztion**
  - ✓ **Links up best *STATIC* outcome**
  - ✓ **Connects Best performers to Best performers**
  
- **Smart Small World**
  - ✓ **For any node not an isolate, Links up to Maximize Minimum two steps away**
  - ✓ **Goal is to increase overall navigatability to achieve a task**
  - ✓ **Nice Fairness Properties: bets on emerging performers**

# Rules Cellular Automata

- **Rigged in Favor of Existing Cluster Hierarchy**
  - ✓ **Two successes in three periods – add a node**
  - ✓ **Two failures in three periods – nodes removed**
  - ✓ **Dense / Clustered Network Advantage**
  
- **Two different probability of success**
  - ✓ **Every connection has equal shot**
  - ✓ **Increasing returns, those at center: each connection does better than single connection of others**
  
- **Three Policy Injections**
  - ✓ **Standard Policy Cycle**
  - ✓ **Observes Implementation in Public Policy**

# Total Output of Baseline

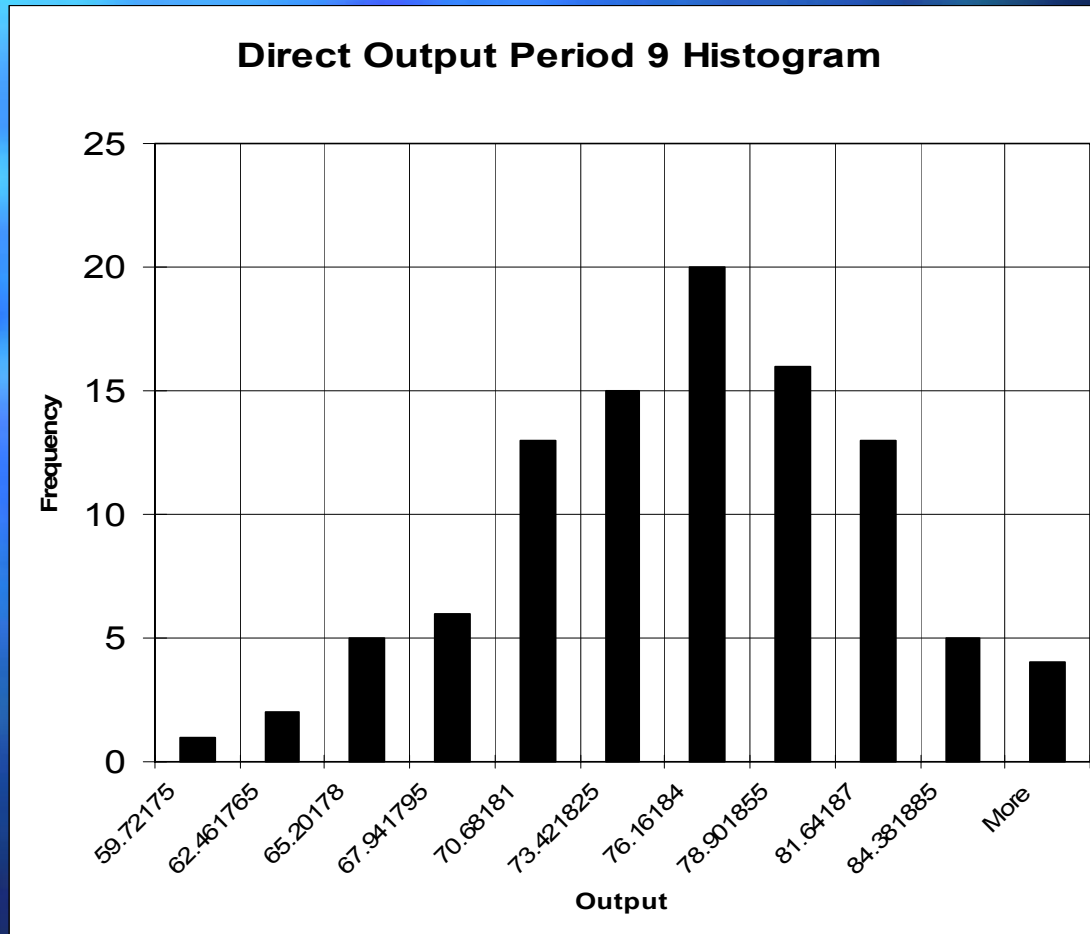


**Figure 4**

**Mean=69.34046**

**Median=69.9748**

# Total Output of Direct Optimization Policy



**Figure 5**

**Mean=74.20167**

**Median=74.22736**

# Total Output of Smart Small World Policy

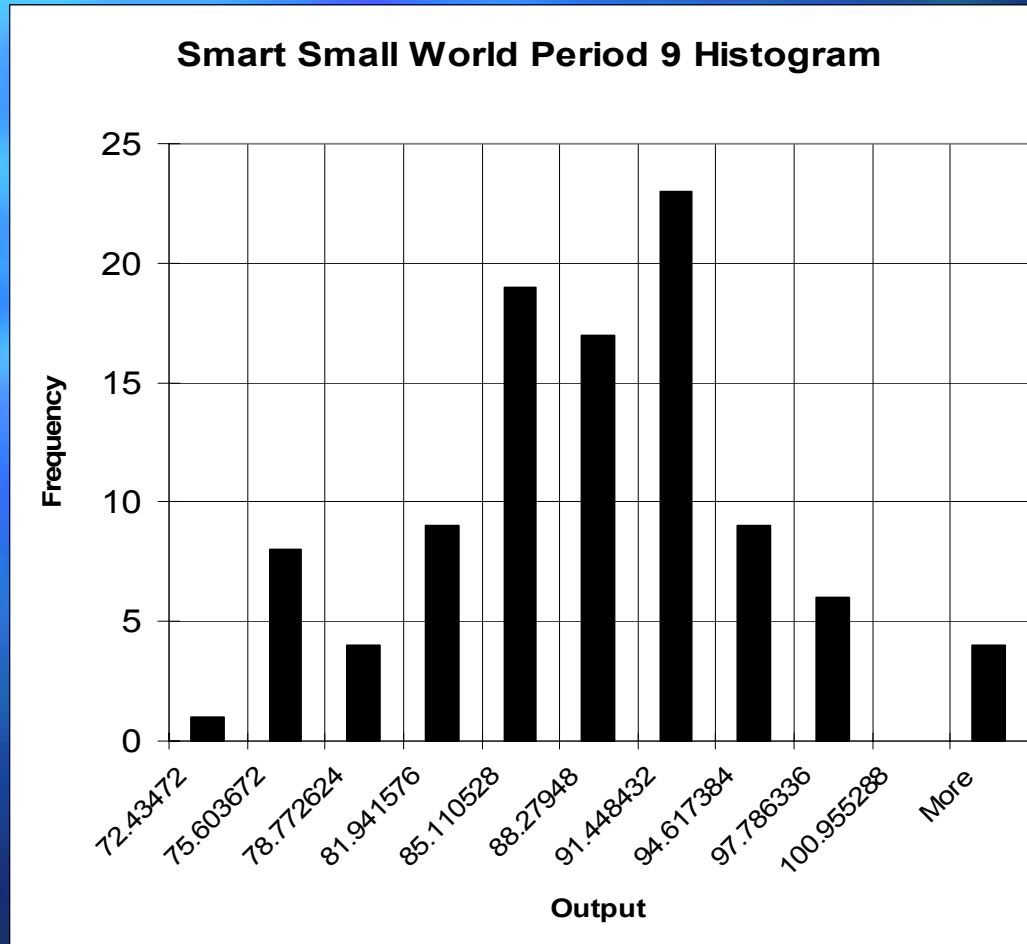


Figure 6

Mean=86.426

Median=86.354

## Comparison Of Output

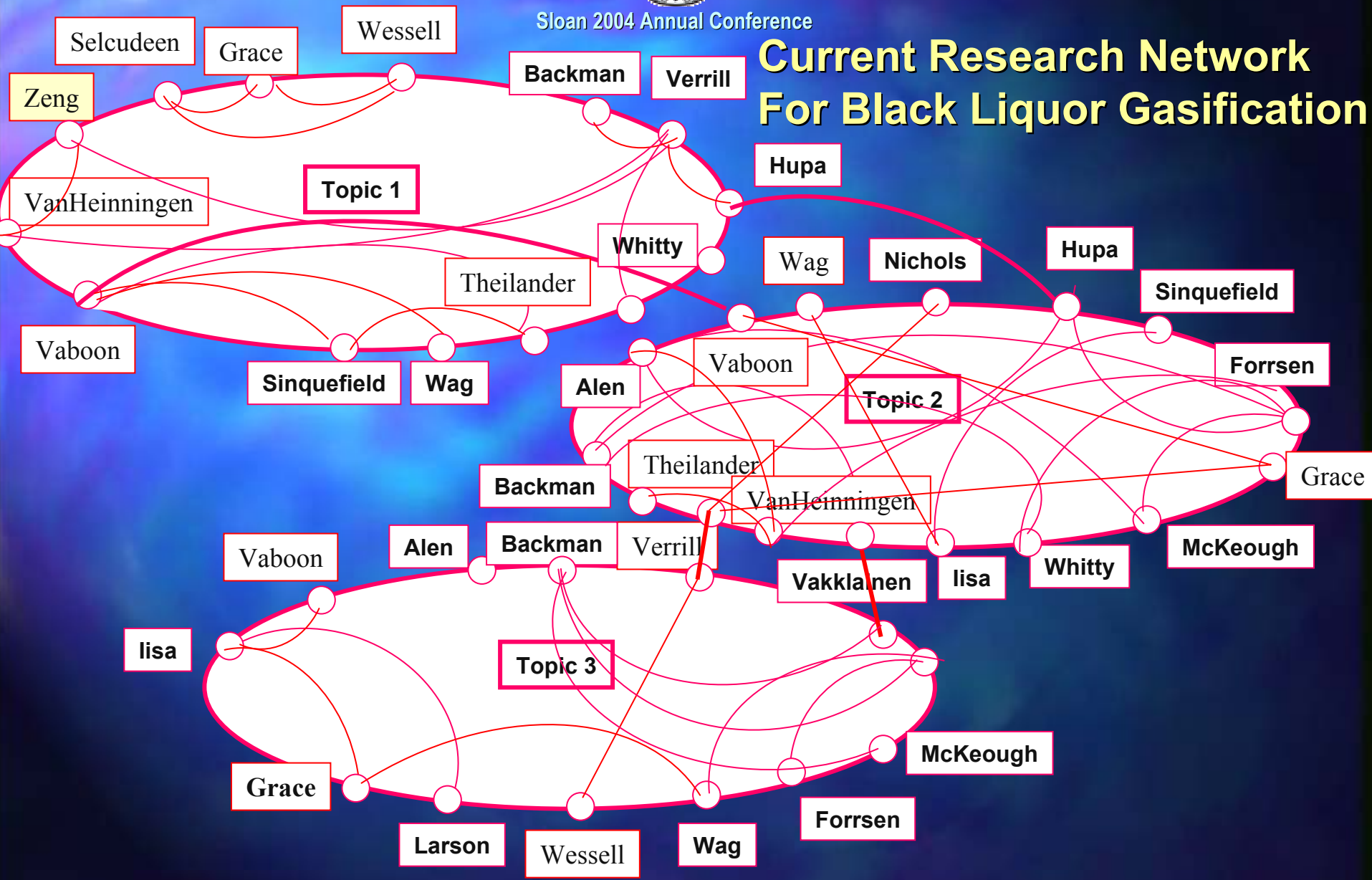
<b>Total Output of Baseline</b>	
<b>Mean=69.34</b>	<b>Median=69.97</b>

<b>Direct Optimization Policy</b>	
<b>Mean=74.201</b>	<b>Median=74.22</b>

<b>Smart Small World Policy</b>	
<b>Mean=86.426</b>	<b>Median=86.354</b>

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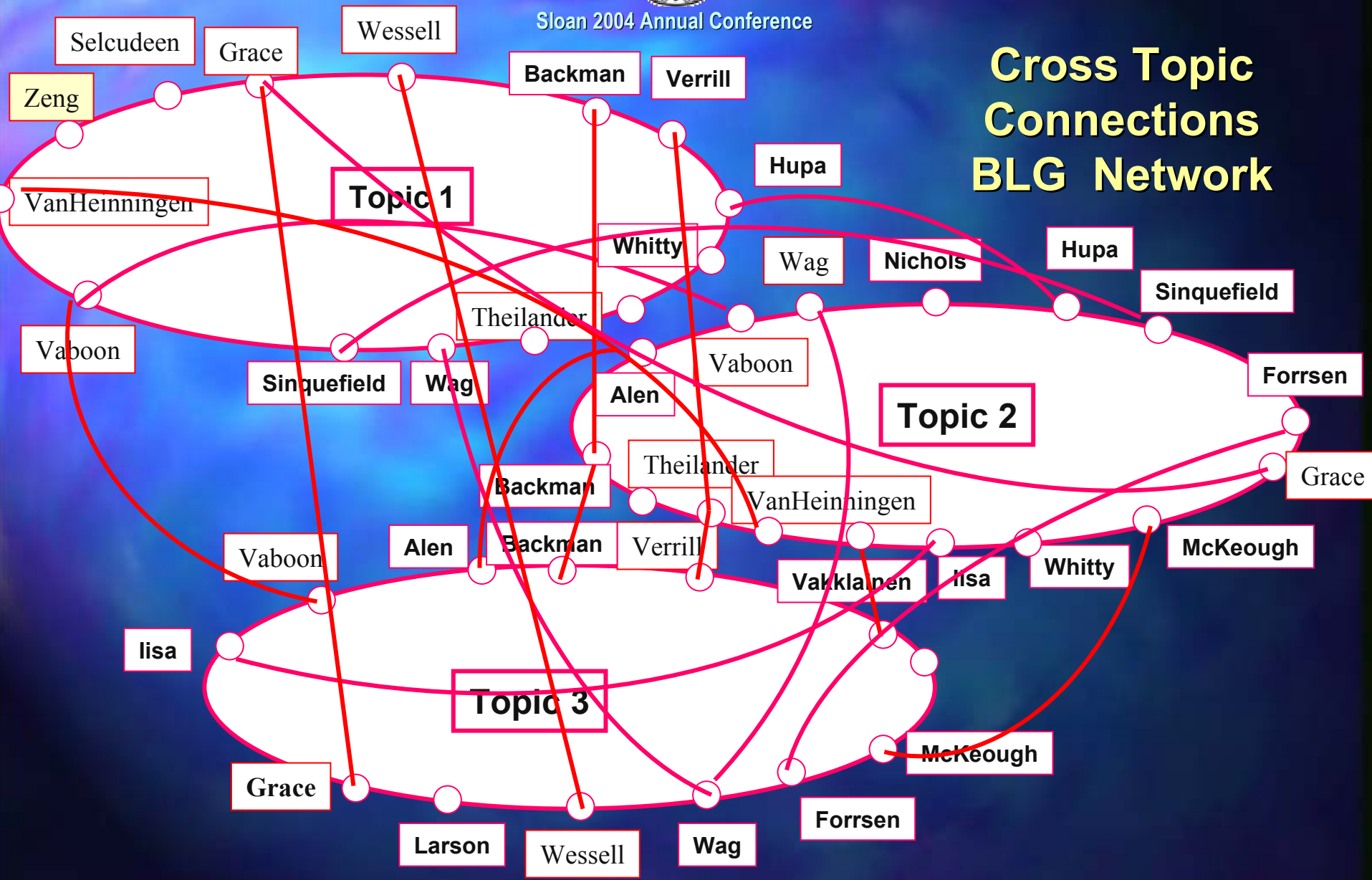
# Current Research Network For Black Liquor Gasification

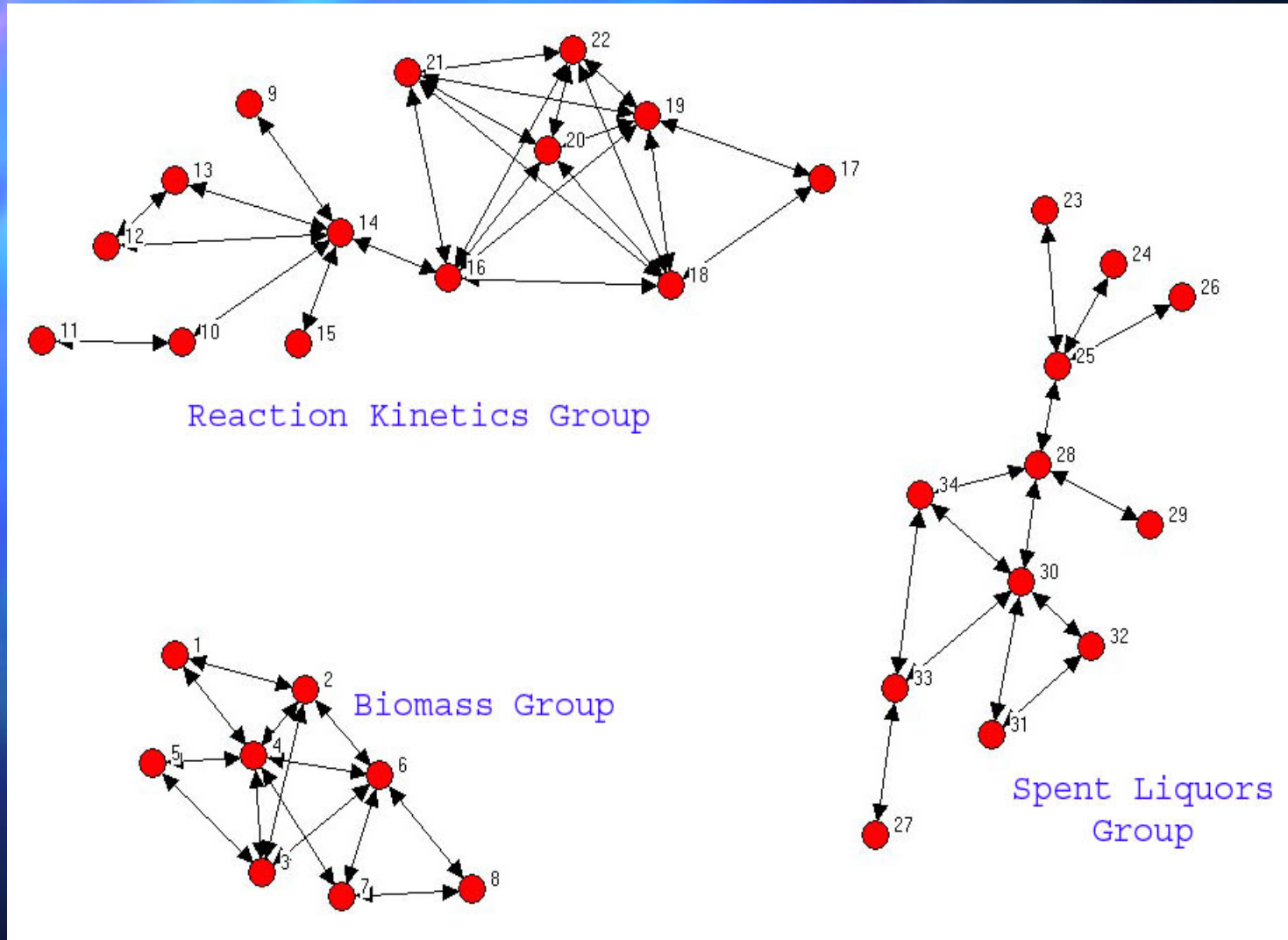




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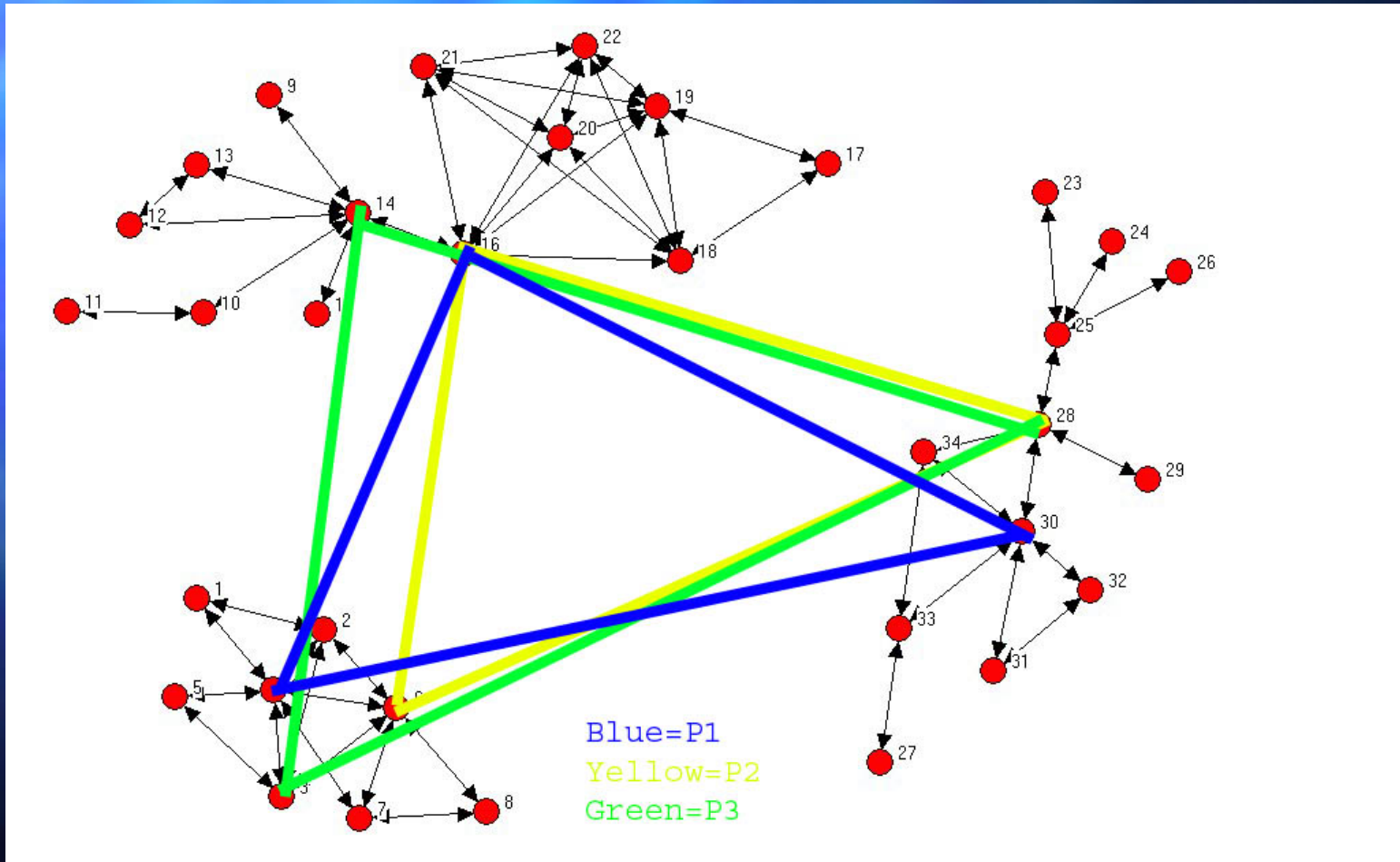
# Cross Topic Connections BLG Network





**Clusters of Researchers in Biomass, Reaction Kinetics, and Spent Liquors.  
#Figure Generated with UCINET, NetDraw, and Adobe Photoshop**

# Comparing Three Policies



# Comparing Output

## ■ Constant Returns

- DO = 20.1
- BL = 15.7
- Fair= 20.8
- **SW = 20.9**

## ■ Increasing Returns

- DO = 31.9
- BL = 27.3
- Fair= 34.2
- **SW = 36.9**

## ■ Decreasing Returns

- DO = 15.2
- BL = 14.7
- **Fair= 15.3**
- SW = 15.0

# Grant & Research Team Information

**Funding Source & Project Name**  
(e.g. DOE:Causticization)

**Dates of Research**  
(e.g. 2001 - 2003)

**Amount**  
\$

**List P.I.'s & Affiliate**  
during grant period

**List Non-P.I.'s - Core Research Team Members**  
(and Affiliation during grant period)

1) Was there a project that brought *you* into the field of BLG research?  
List Grant?

2) Concerning your *Core Research Team Members* for various projects, can you identify if a project that brought them into the field of BLG and led to future studies in this arena? List person and Grant if you can?

# Random Coefficients Logic

- Goal is set of IVs that:
  - ✓ Match funding on a given to success over several topics.
  - ✓ Extract Shadow Price for latent collaboration
  - ✓ Define some simple dynamic rules for the evolution of the network.
  - ✓ Locate researcher specified critical needs
  - ✓ Search Related Literature (coal gas.; metallurgy; nanotechnology).
  - ✓ Individualize success prediction by person, institution and connection.

# Concern for Small Numbers

- DV: prop success of task  $i$  for connection  $j$  – normalized to \$100K resource injection
  - ✓  $\text{Prob}[i = 1; j] = \Pi(\text{IVs}; \Theta, j)$
  - ✓ Concern for matrix Inversion: exploring simplification by Bayesian option since problem of task well defined but functional form is not
  - ✓ Consistent with Choice of Cellular Automata from the Start