
Supply Chains & Social Network Analysis

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> The 3-Old-Hats-Theorem

❖ The 3-Old-Hats-Theorem:

When you present three old hats in a seminar, at least one of them will be new for some in the audience!

❖ The corollary:

When you present one new hat in a seminar, it certainly will be an old hat for some in the audience!

I will be presenting a hat that is new to me!

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> Introduction

❖ Metaphors

- Supply chain
 - * *chains: something best left in the care of ironmongers*
- *Supply network*
- *Net chain*

❖ Models

- Krugman:
 - ".. the influence of ideas not embalmed in models soon decays"***

❖ Purpose of the paper:

Embalming SCA with SNA models!

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> Introduction > Contents

Contents:

1. Introduction
2. Why supply chain management needs quantitative models
3. What is SNA?
4. Elements of network models and their uses for SCM
5. Network data
6. Potential of SNA for SCA/SCM
7. SNA modeling software
8. Close

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> Why quant. Models for SCM?

- ❖ **Supply networks:**
emergent stable patterns in the relationships between specialized agents

- ❖ Coordination questions in SN:
 - Who are the key members?
 - What processes should be linked?
 - What level of integration?
 - *a shared network "map" may cause diverse perceptions to dovetail*

- ❖ Why numbers?
 - the *magic* of precision
 - pretense of objectivity
 - no progress without measurement

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> What is SNA?

- ❖ SNA: *a branch of sociology which studies collections of individuals and the linkages among them*
- ❖ Insignia of academic respectability
 - standard texts: Wasserman & Faust; Scott
 - specialized journals: Connections; JoSS; Social Networks
 - academic organization: INSNA
 - regular conference: Sunbelt Social Network Conference
 - graduate programs & courses in reputable universities
- ❖ Application in economics
 - impact of networks on technology adoption (in ag. & elsewhere)
 - study of corporate networks
 - impact of networks on small farmers' ability to bear risks
 - trade relationships among islanders in the Oceania

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> Elements of Social Network Models

- ❖ Mathematical foundation: **Graph theory** (Frank Harary)
- ❖ A social network is defined by:
$$S = \{N, L, G_d, \mathbf{A}, \mathbf{C}\}$$
- ❖ **N**: nodes represent the actors in a social network
- ❖ **L**: links or ties represent the relationships among actors
- ❖ **G_d**: sociograph or drawing of the nodes & links
- ❖ **A**: quadratic ($n \times n$) adjacency matrix with elements a_{ij} representing the links between the nodes i and j
- ❖ **C**: a rectangular ($n \times l$) matrix with l characteristics for the n actors

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> Network Data

- ❖ Limits of the network?
- ❖ How to identify the actors in the network?
- ❖ SNA is data intensive
 - number of data for a network with **n actors** and **l actor characteristics** :
$$(n \bullet l) + (n \bullet n) = n (l + n)$$
 - an adjacency matrix is required for each type of relation between actors; for a network with **r relations**:
$$DV = (n \bullet l) + r (n \bullet n) = n (l + r \bullet n)$$

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> Potential of SNA for SCA/SCM

❖ SNA

- provides workable models of networks
- relates network attributes to measures of network outcomes
- provides a framework for collecting & organizing data
- provides network managers with essential tools
 - * network diagrams
 - * quantitative measures of network related attributes of network members
 - * quantitative and qualitative measures of the whole network

❖ SNA benefits from spill-ins from graph theory

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> Diagrams & Measures

❖ Network diagrams

- have no dimensions
- obey several conventional norms & rules

❖ Measures of network attributes

- (network) attributes of individual agents
 - * degree - closeness - betweenness
- attributes of the network
 - * completeness - diameter - density
 - * cup points - cut sets - k cores

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> SNA Modeling Software

Tab. 1: Scores for selected software packages

	Fuctionality					Support		User- friendliness
	Data	Visual- ization	Descript- ion	Proces- sing	Stat- istics	Manual	Help	
MultiNet	+ -	+	+ -	+	+ -	+ -	++	+
NetMiner	++	++	++	++	+ -	+	+	++
Pajek	+	++	+	++	0	-	0	+ -
StOCNET	+ -	0	+ -	0	++	+	+	+
STRUCTURE	-	0	+ -	++	+	++	0	+ -
UCINET	++	+ ⁽¹⁾	++	++	+ -	+	+	+

(1) The programm NetDraw for network visualization is distributed with UCINET.

Source: Huisman and van Dujin 2005), p. 311.

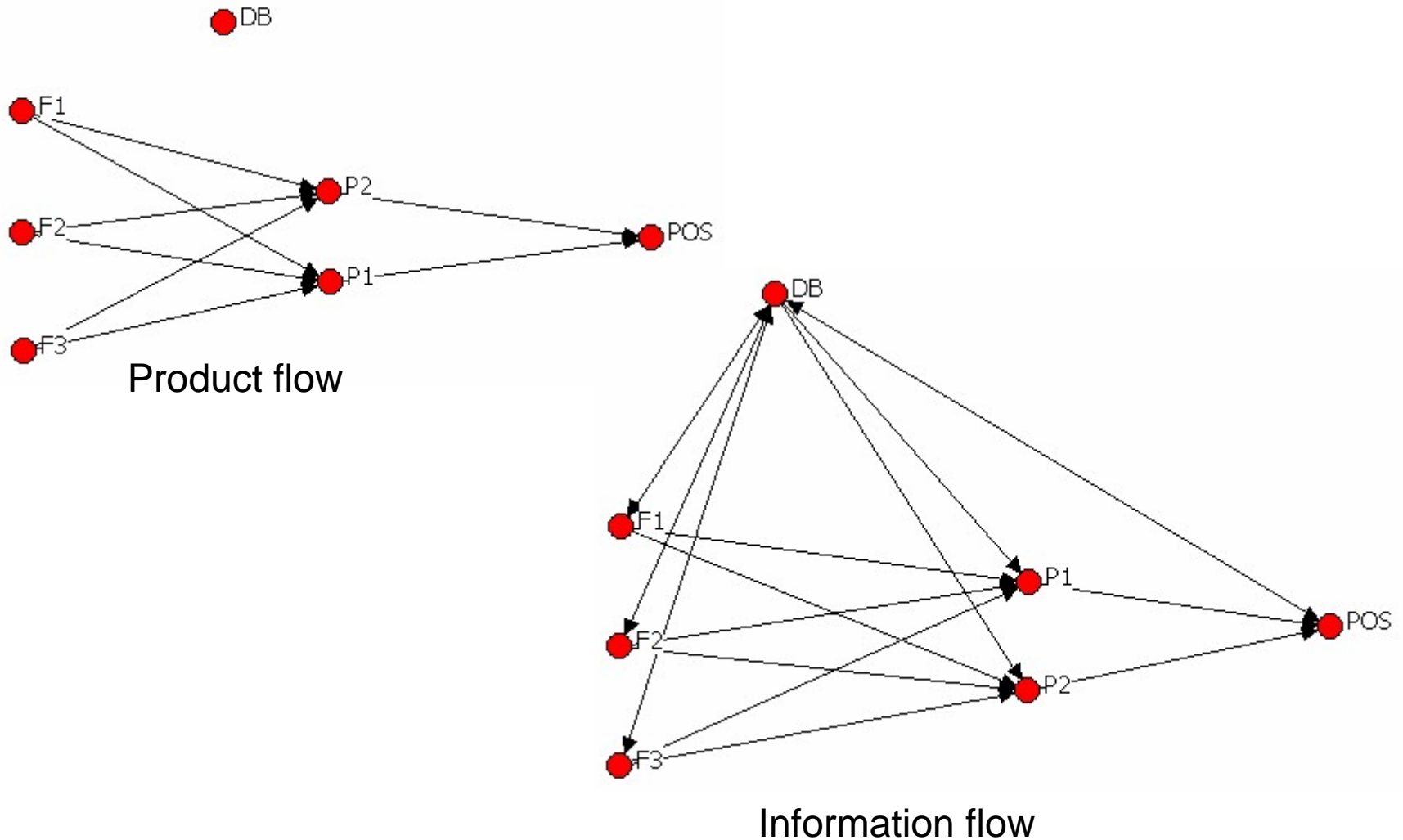
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> Close

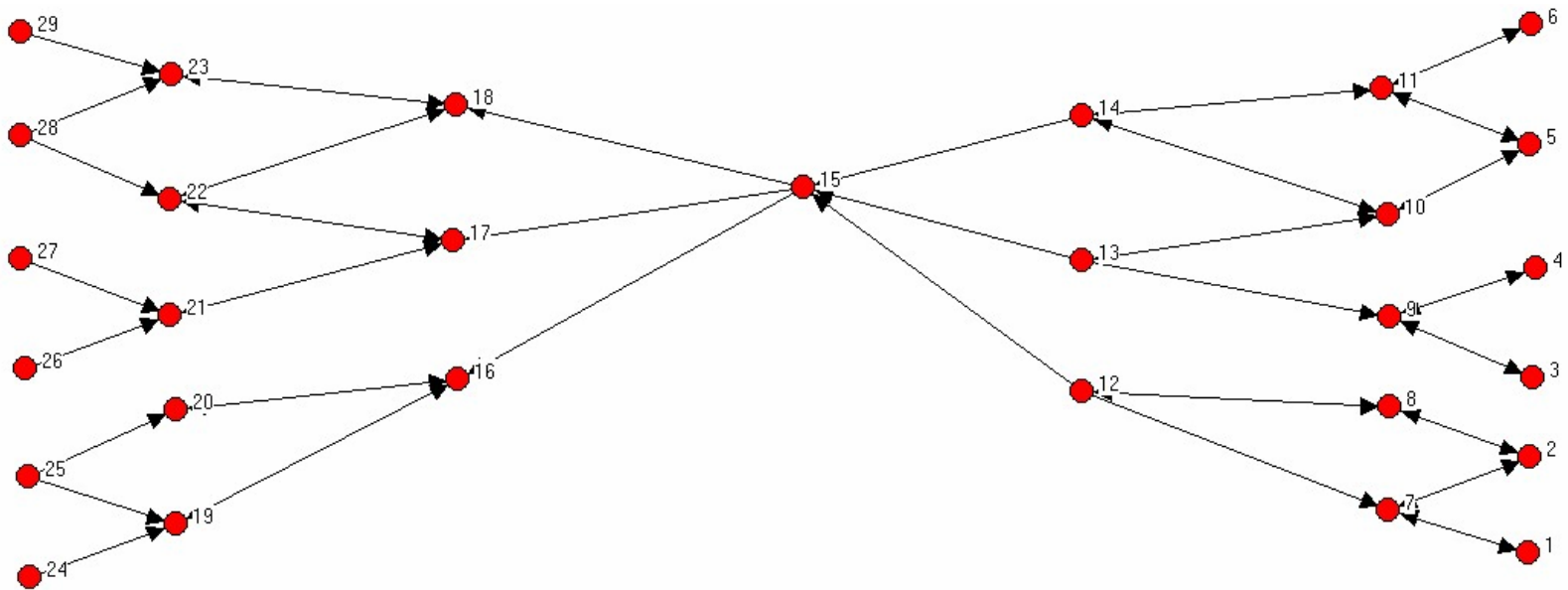
- ❖ Metaphors stimulate – models discipline
- ❖ Metaphors get attention – models get published
- ❖ give SNA modeling a chance
 - apply – assess – improve or discard

Thank you very much for listening!

Two views of a supply chain

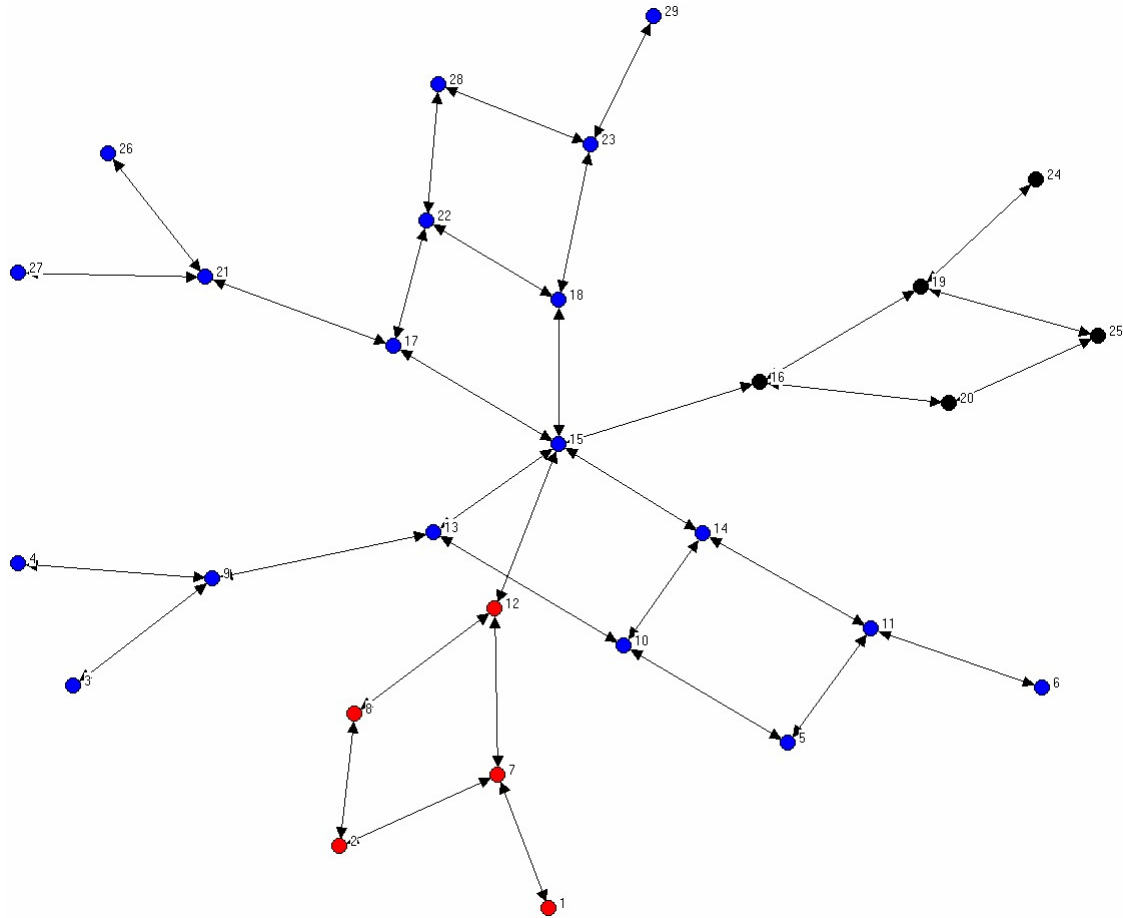


Which graph is best? This?



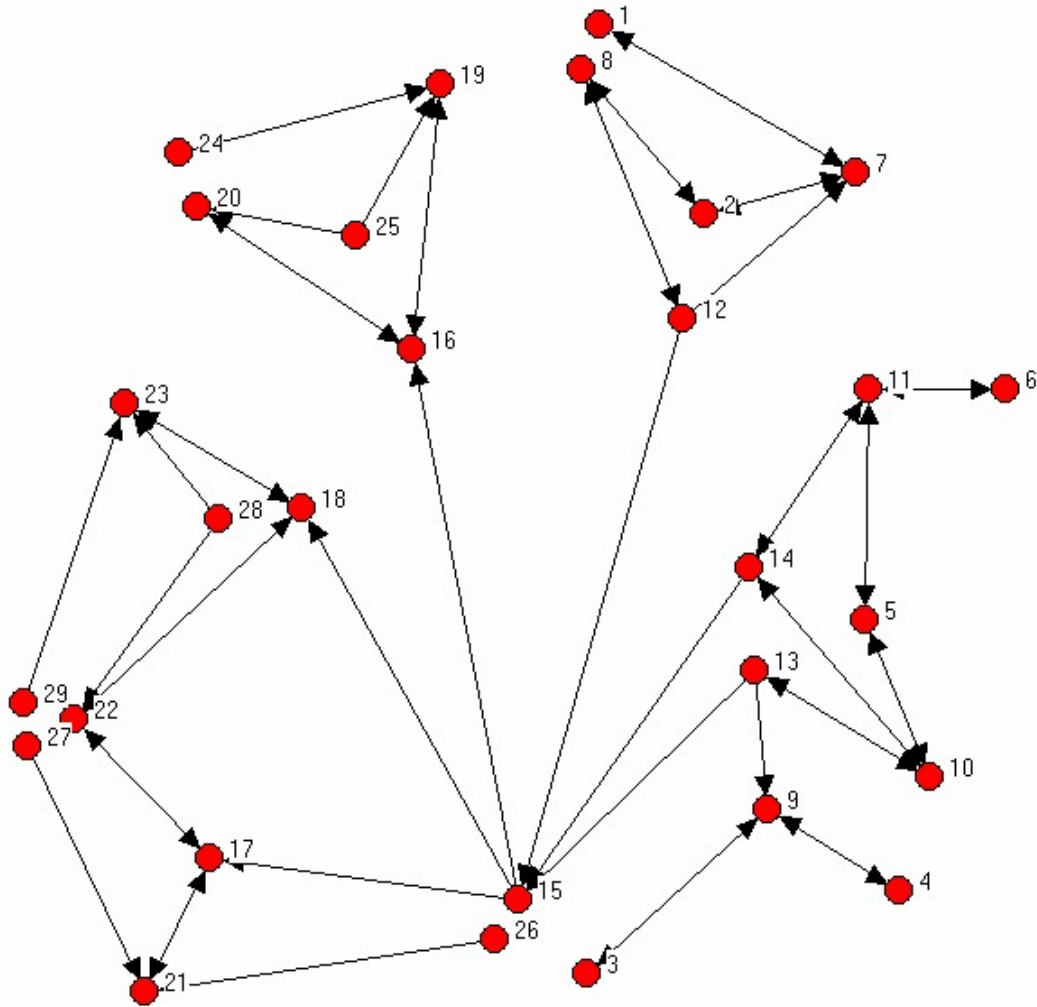
original layout

Or this?

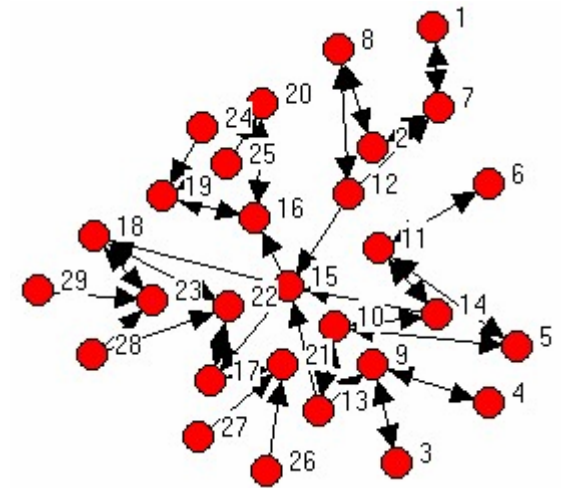


cluster

Or one of these?



at random



at random