

# Quantifying the Difficult to Quantify: Measuring the Value of Relationships in Decision-Making through Social Network Integration

Tina Wakolbinger

Isenberg School of Management

University of Massachusetts at Amherst

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# VITA

- Born in Hellmonsoedt, Upper Austria
- Matura, Schule der Kreuzschwestern, Linz
- Magister, “International Economic and Business Studies” in Innsbruck
- Project Manager, Upper Austrian Foodcluster of the Upper Austrian Chamber of Commerce
- PhD Student, University of Massachusetts, Amherst

# Support

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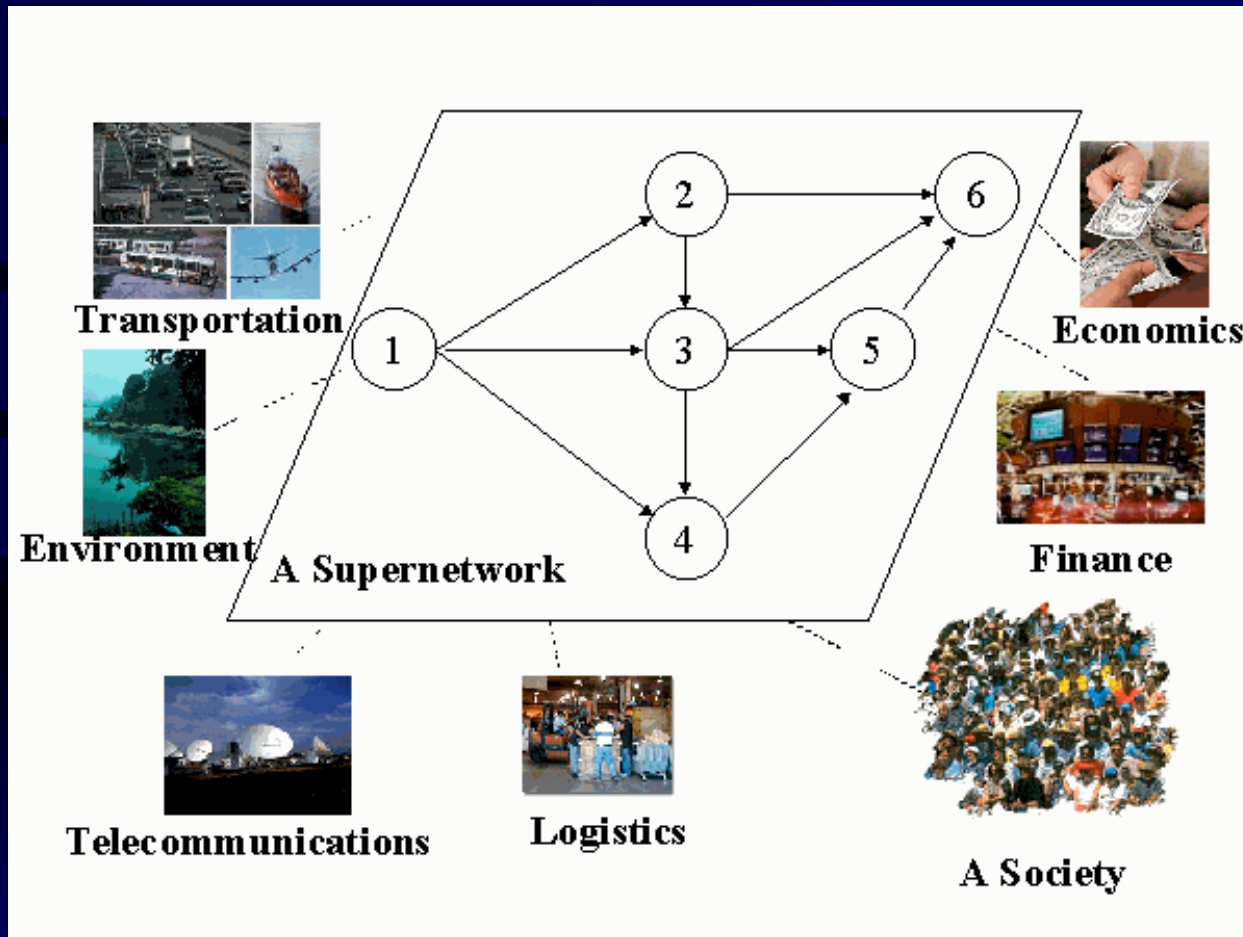
# Definition of Social Networks

- “A social network is a set of actors that may have relationships with one another. Networks can have few or many actors (nodes), and one or more kinds of relations (edges) between pairs of actors.”  
(Hannemann, 2001)

# Novelty of Our Research

- Supernetworks show the dynamic co-evolution of economic (product, price and even informational) flows and the social network structure
- Economic flows and social network structure are interrelated
- Network of relations has a measurable economic value

# Supernetworks



# Tools That We Have Been Using

- Network theory
- Optimization theory
- Game theory
- Variational inequality theory
- Projected dynamical systems theory (which we have been instrumental in developing)
- Network visualization tools

# Supernetworks Integrating Social Networks with Other Networks

- We have formulated and analyzed supernetworks consisting of:
  - Supply chain and social networks
  - Financial and social networks
  - International supply chain and social networks
  - International financial and social networks



# Supernetwork Integrating Social Networks with Supply Chains

- Wakolbinger, T., and Nagurney, A. (2004), "Dynamic Supernetworks for the Integration of Social Networks and Supply Chains with Electronic Commerce: Modeling and Analysis of Buyer-Seller Relationships with Computations," *Netnomics* 6: pp 153-185

# Supernetwork Integrating Social with Supply Chain Networks

- Decision-makers in the network can decide about the relationship levels  $[0,1]$  that they want to establish.
- Establishing relationship levels incurs some costs.
- Higher relationship levels
  - Reduce transaction costs
  - Reduce risk
  - Have some additional value (“relationship value”)

# Supernetwork Integrating Social with Supply Chain Networks

Dynamic evolution of

- Product transactions and associated prices on the supply chain network
- Relationship levels on the social network

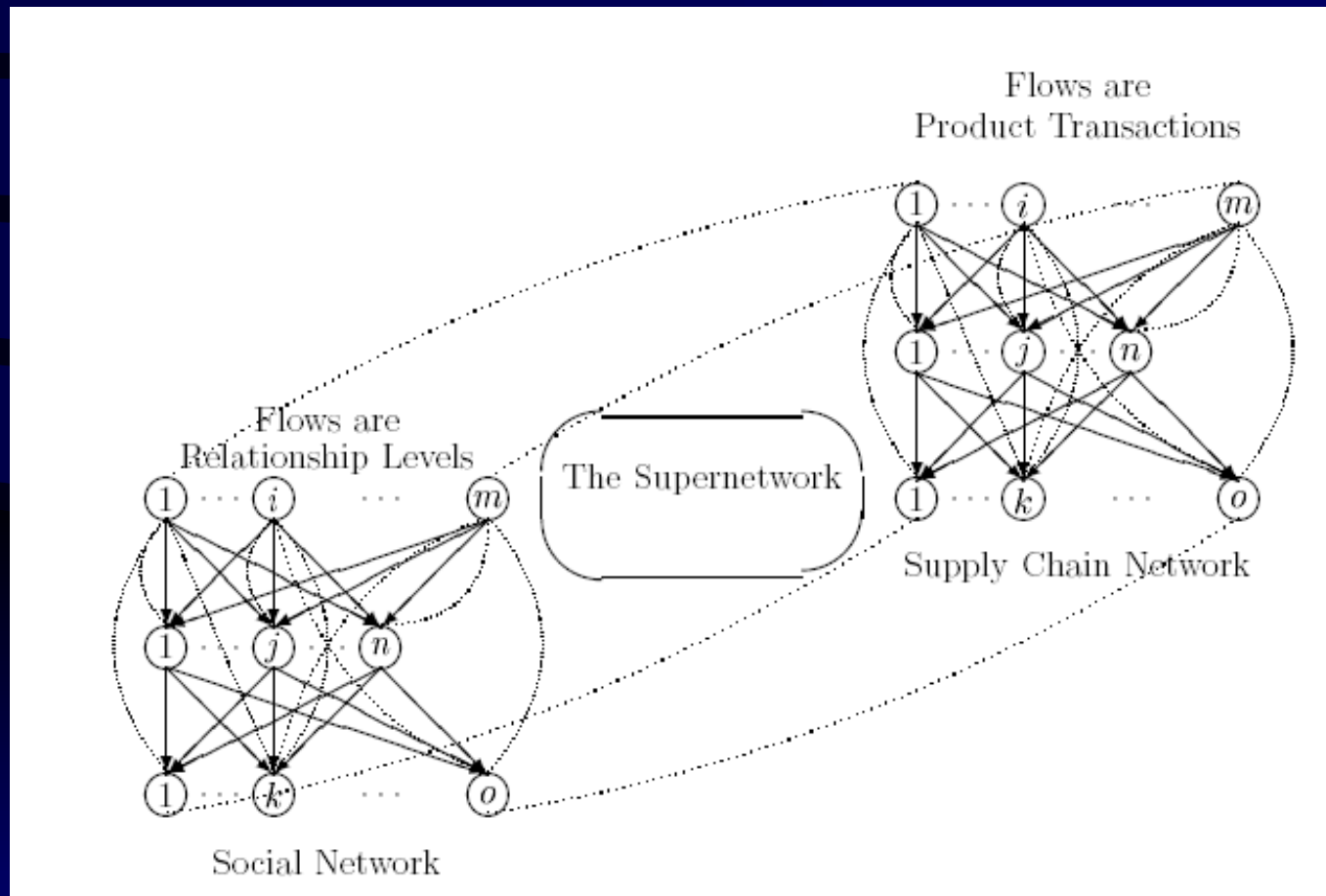
# Features of the Model

- Models the interaction of supply chain and social networks
- Captures interactions among individual sectors
- Includes electronic transactions
- Incorporates transaction costs and risk

# Assumptions of the Model

- Manufacturers can transact either physically or electronically with the intermediaries.
- Manufacturers can transact directly with the demand markets via Internet links.
- Retailers can transact through physical links with demand markets.

# Supernetwork Structure: Integrated Supply Chain/Social Network System



# Multicriteria Decision-Makers

- Manufacturers and Retailers try to
  - Maximize profit
  - Minimize risk
  - Maximize relationship value
  - Individual weights assigned to the different criteria

# Qualitative Properties

We have established

- Existence of a solution to the VI
- Uniqueness of a solution to the VI
- Conditions for the existence of a unique trajectory to the projected dynamical system
- Convergence of the Euler method



# Types of Simulations

- We can simulate
  - Changes in production, transaction, handling, and relationship production cost functions
  - Changes in demand and risk functions
  - Changes in weights for relationship value and risk
  - Addition and removal of actors
  - Addition and removal of multiple transaction modes

# Summary

- We model the behavior of the decision-makers, their interactions, and the dynamic evolution of the associated variables.
- We study the problems qualitatively as well as computationally.
- We develop algorithms, implement them, and establish conditions for convergence.
- We have studied to-date "good behavior." Fascinating questions arise when there may be situations of instability, multiple equilibria, chaos, cycles, etc.

The full text of the papers can be found  
under Downloadable Articles at:

<http://supernet.som.umass.edu>



Eugene M.  
**Isenberg**  
School of Management

**Virtual Center for  
Supernetworks**

*Thank you!*



Eugene M.  
**Isenberg**  
School of Management

**Virtual Center for  
Supernetworks**