

Nuove metodologie per la ricerca in economia, ecologia e sociologia

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Indice del seminario

- *valutazione dei fenomeni multicriteriali*
- *social network analysis*
- *modelli di simulazione ad agenti*
- *applicazione della social network analysis al commercio internazionale*

No epistemological Manicheism

Choose the right methodology
for the specific problem

There is not a single methodology
appropriate for any problem

**Be multi-methodological: use different
methodologies in conjunction and/or in
recursion**

Multi-criteria decision making (MCDM)

**The correct methodology to make
multicriteria decisions**

or

**To evaluate multicriteria problems
(phenomena)**

Multicriteria “traditional” framework for alternative investment choices

	Criteria	
Alternatives	Risk	Return
Inv 1		
Inv 2		
Inv 3		
Inv 4		

Multicriteria current framework for alternative investment choices

	Criteria					
Alternatives						
Inv 1	$g_1(inv_1)$	...	...	...	$g_5(inv_1)$	
Inv 2	...	...	...	...	...
Inv 3	...	...	...	...	...
Inv 4	$g_1(inv_4)$	...	...	...	$g_5(inv_4)$	
weights	x_1	x_2	x_3	x_4	x_5	100

Traditional *wrong* solution

Alternatives						Values
Inv 1	$g_1(\text{inv}_1) * x_1$	...	...	...	$g_5(\text{inv}_1) * x_5$	V 1
Inv 2	...	...	...	...	...	V 2
Inv 3	...	...	...	...	...	V 3
Inv 4	$g_1(\text{inv}_4) * x_1$	...	...	...	$g_5(\text{inv}_4) * x_5$	V 4

Hence, optimizing {V} by selecting the maximum or the minimum

Implications

$$V_{inv_1} = g_1(inv_1) * x_1 + \dots + g_5(inv_1) * x_5$$

...

...

...

$$V_{inv_5} = g_1(inv_5) * x_1 + \dots + g_5(inv_5) * x_5$$

$$U(x) = w_1 g_1(x) + w_2 g_2(x)$$

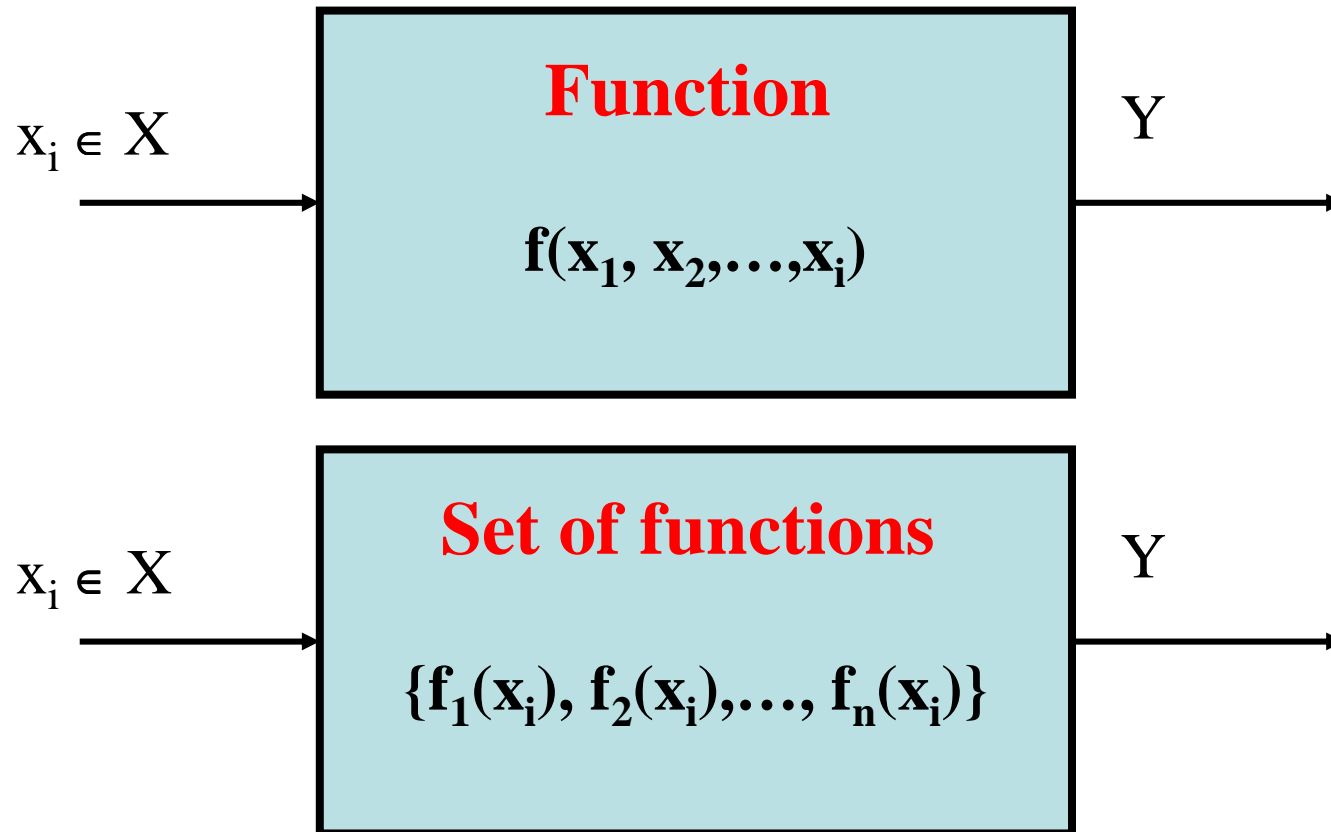
$$U = w_1 g_1 + w_2 g_2 = w_1 (g_1 - 1) + w_2 \left(g_2 + \frac{w_1}{w_2} \right)$$

1. weights are constant substitution rates;
2. weights are totally compensatory;
3. weights are “shadow prices”.

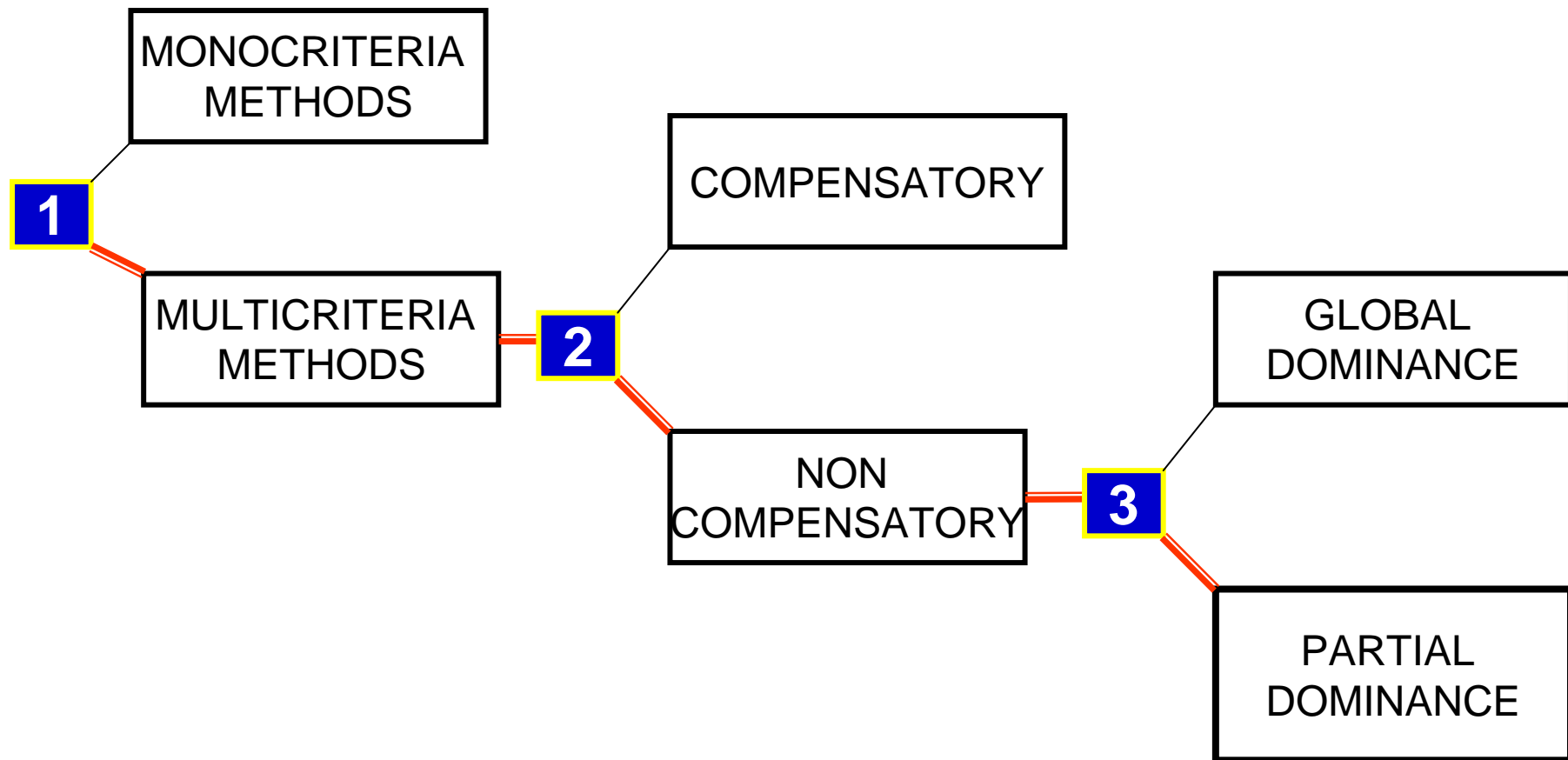
Fictitious Methods

- Naive: transforming (considering) $n-1$ criteria into constraints
- Maut: supposing marginal rates of substitution among criteria
- Mlp: assigning weights to each criterion and multiply
- Gp: minimizing deviations among criteria through weighted goals

Difference between a function and a set of functions



Choice (or Evaluation) Tree



What about criteria?

True multicriteriality means coping with *at least two independent and conflicting* criteria of choice (or of evaluation)

The more democratic and complex is the society, the more multicriteria are the choices and evaluations of its decision makers
(see *sustainability science*)

Multicriteriality

- It is a key feature of most decisions and evaluations
- It adds a peculiar characteristic of complexity independent on bounded rationality
- It occurs also for individuals' decisions
- Group decisions add further complexity
- Future (intelligent) society will make ever more complex (multicriteria) decisions

Which is the correct methodological support for decision makers?

- Fictitious methods cannot work out MCDM
- ***Outranking methods*** can do that
- They are fully consistent with evolutionary and cognitive economics
- They are based on satisfying rather than optimizing approaches to decision making

(Social) Network Analysis (SNA)

Characteristics of mainstream in graph theory

- Attribute-free nodes
- Random networks
- Fixed size
- Reciprocal connections

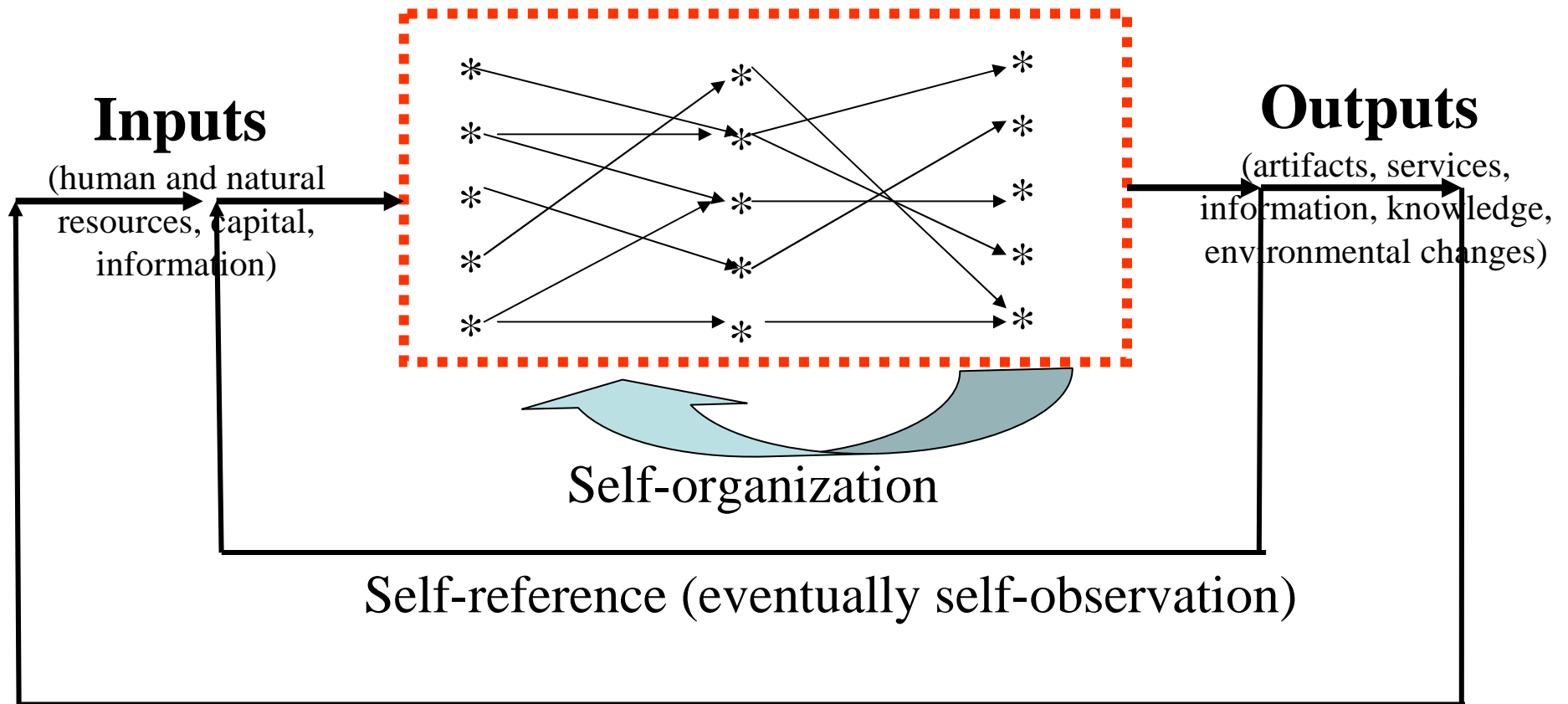
Initial main purposes of SNA

- Attribute-free properties of nodes and networks
- Micro-analytical structures: opening the black-box
- Alternative approach to systems theory
- Incompatibility with standard statistics

More recent main purposes

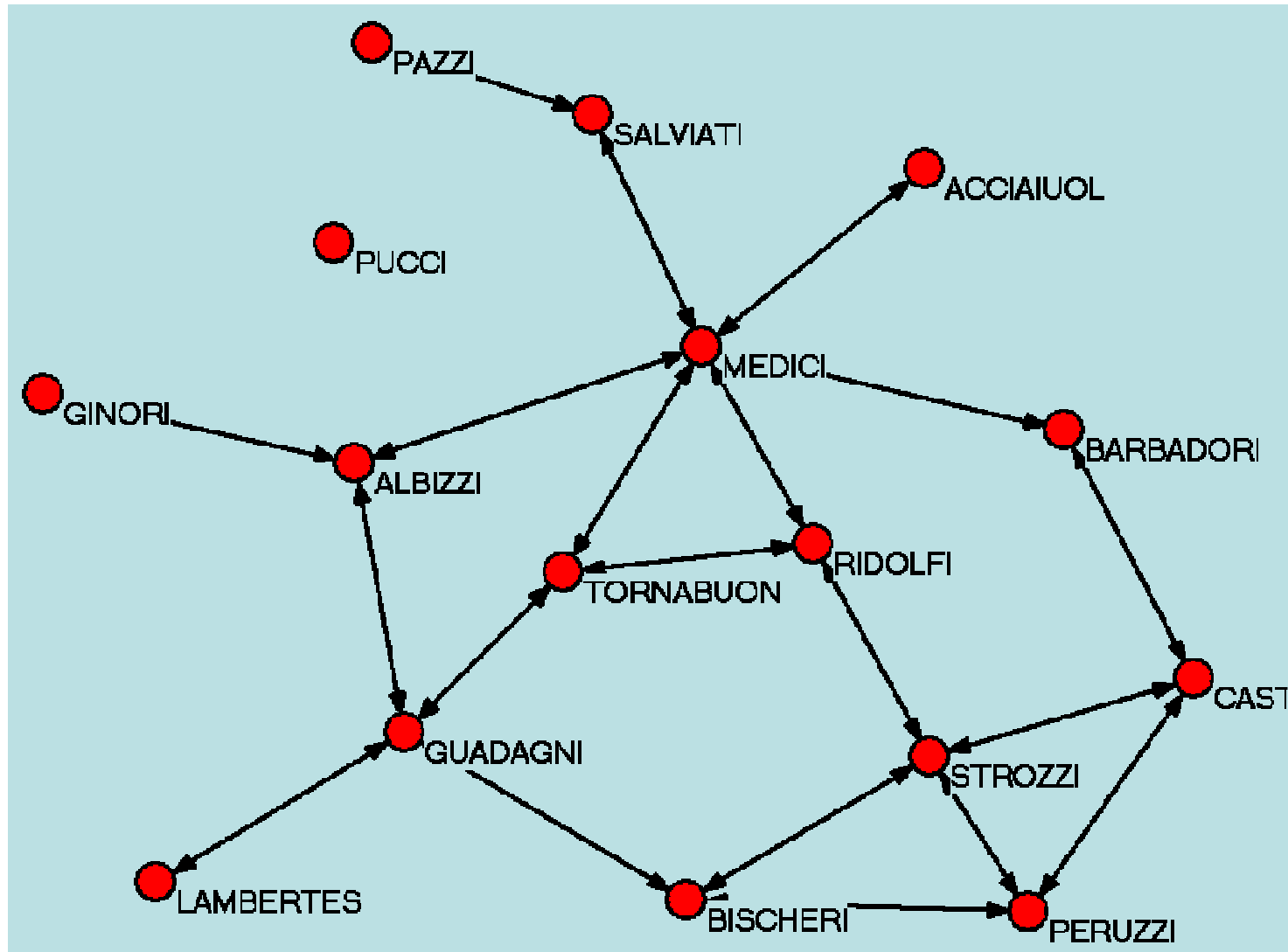
- Mix attributive and positional data
- Complementarity with systems theory
- Development of specific statistical tools

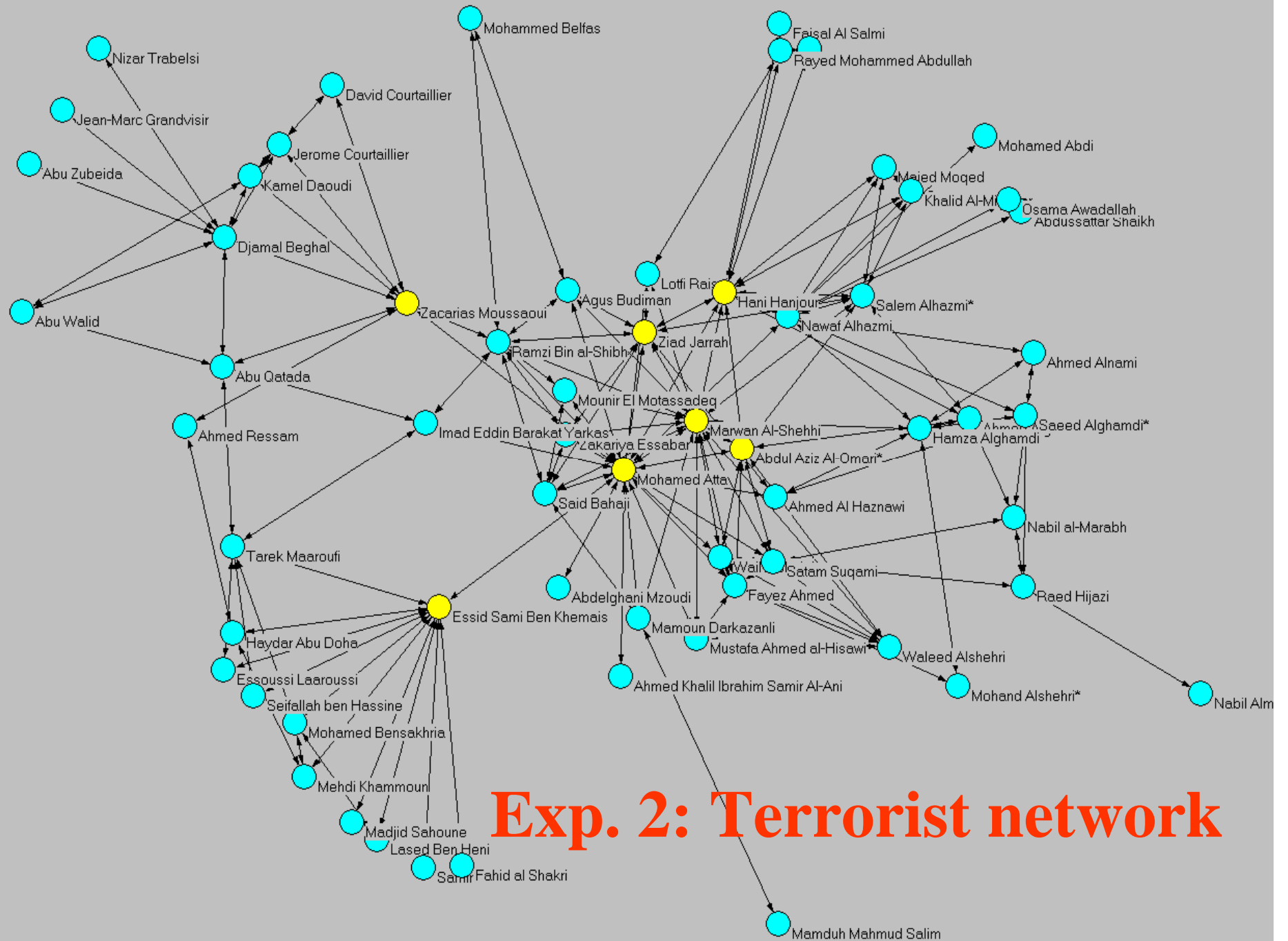
The system/network dualism



Inter-organizational connections (system/environment interactions)

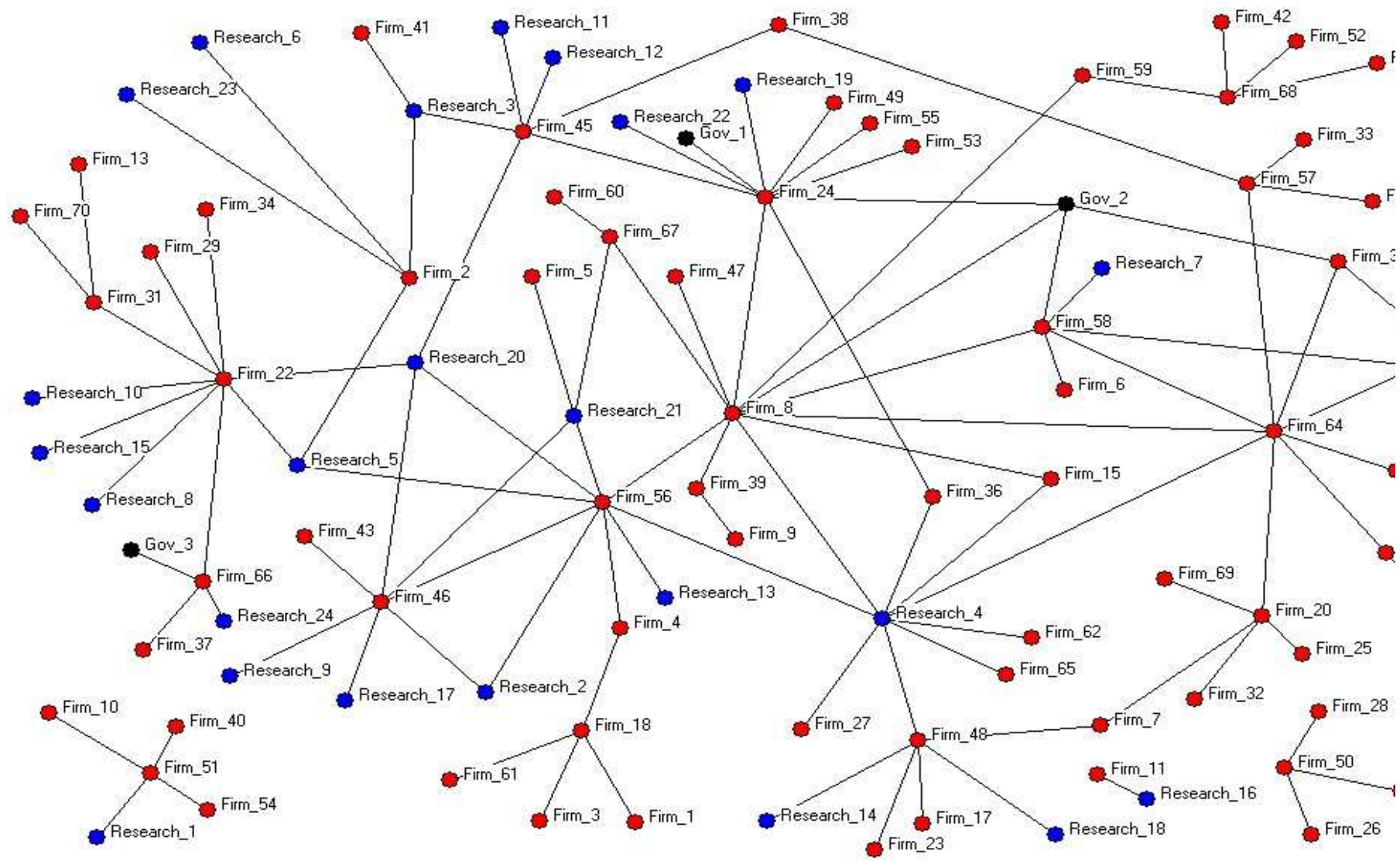
Example 1: marriage relationships among among Florentine aristocratic families in XVI cen.





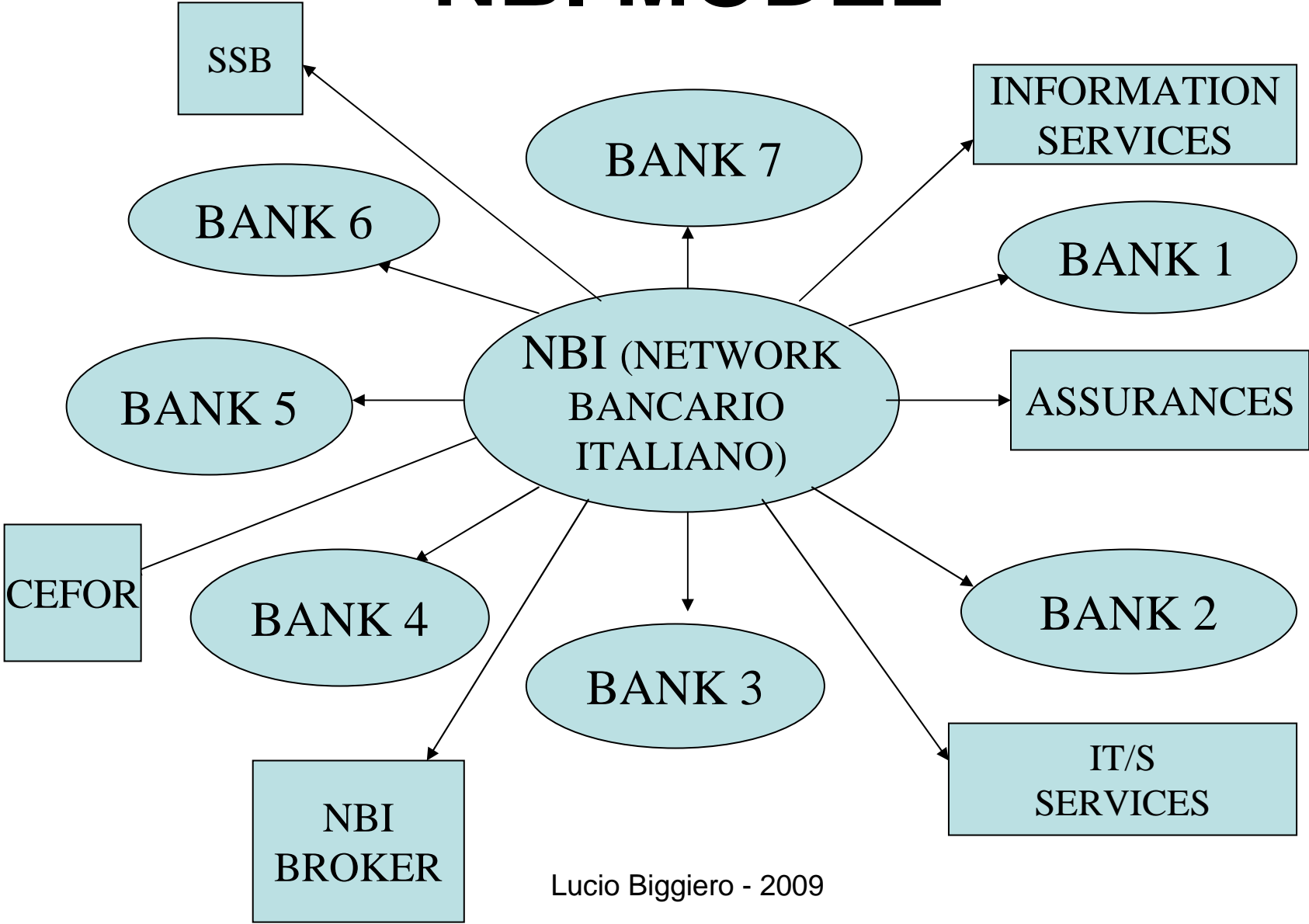
Exp. 2: Terrorist network

The network of collaborations for innovation in the AS IC of Lazio Region (IT)

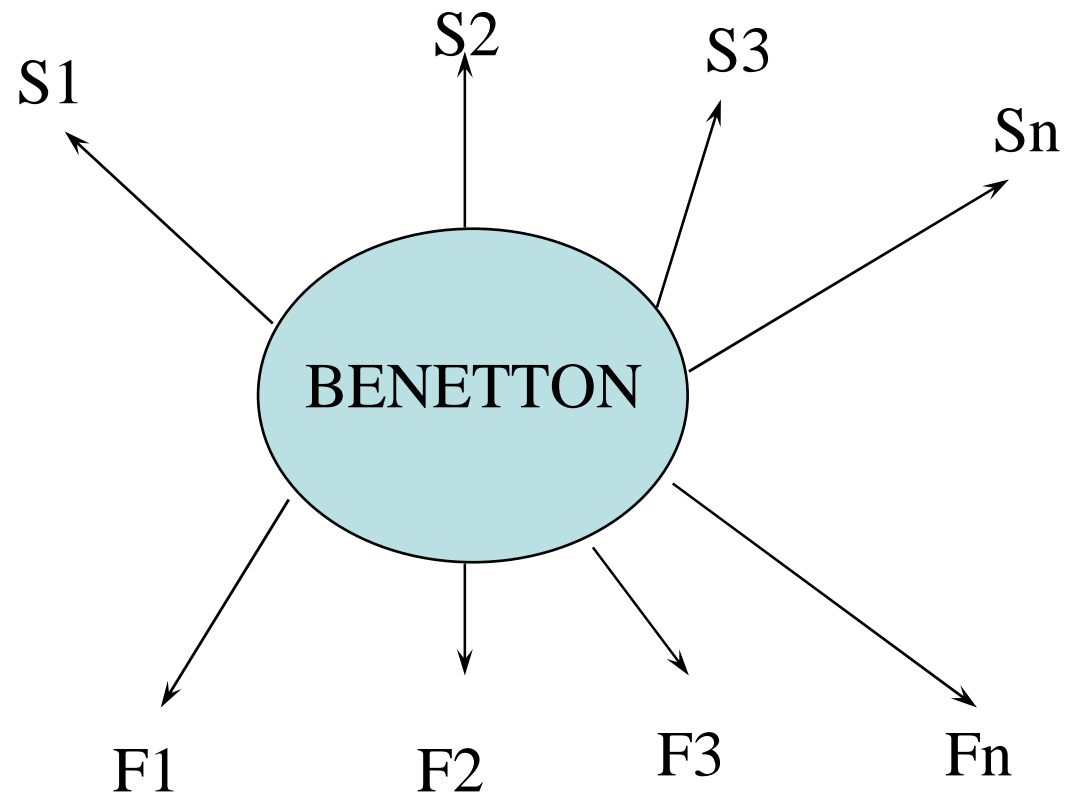


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red = industry; blue = university & research centres; black = (local) government

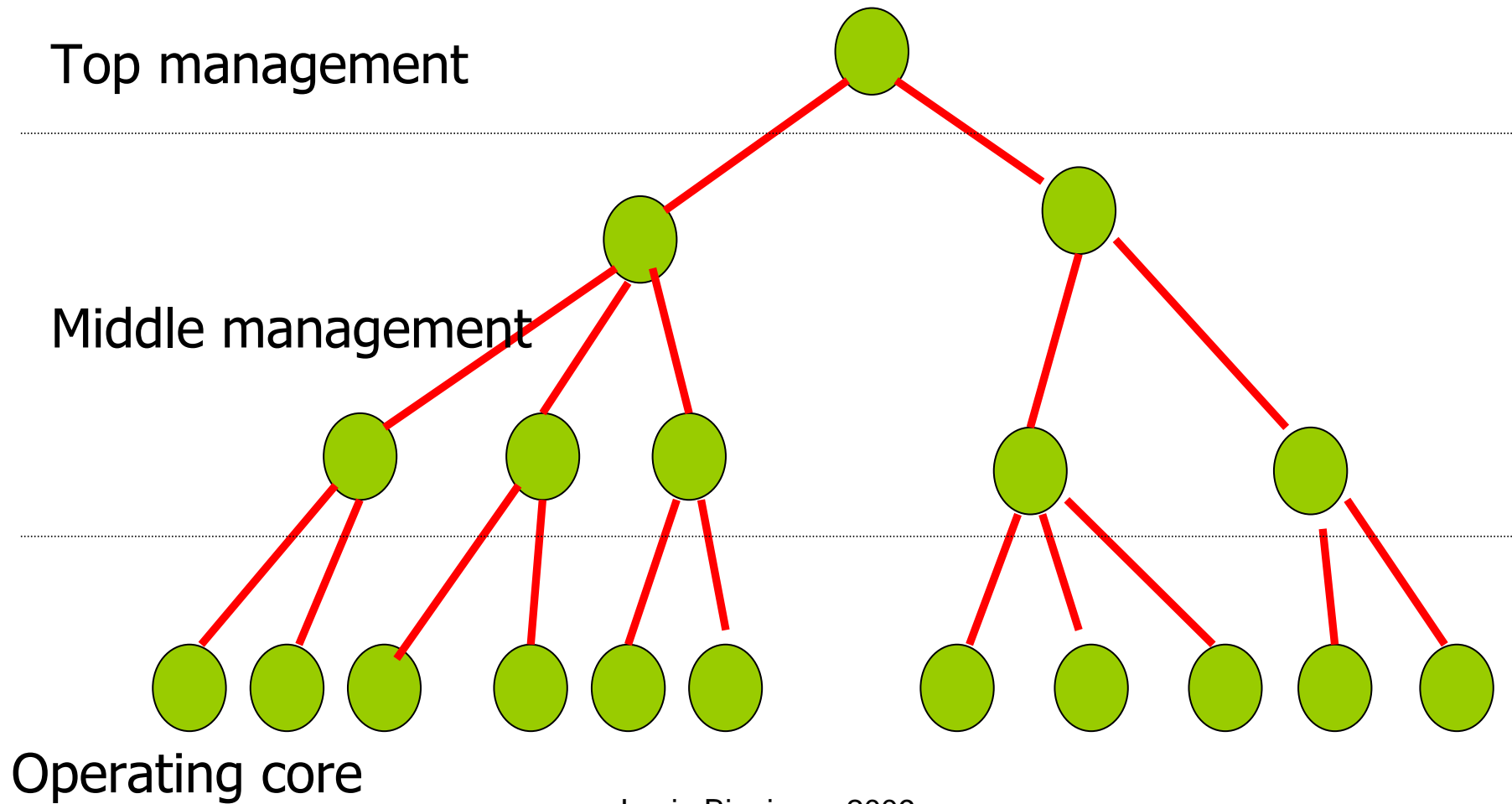
NBI MODEL



Benetton's network structure



Organizational hierarchy



How does network topology evolve?

- *Preferential attachment:*
- * the more connected the better; and thus,
- * the older the better.
- Do they follow a power law?
 - *Average degree of separation = $\log N / \log k$*
- Once they enlarge they collapse

Diameter (average path length)

- World social system (6 billion nodes): six degrees
- Internet (hundreds thousands nodes): 10 degrees
- WWW (1 billion nodes): 19 degrees
- Food chains: 2 degrees
- Scientific citations in mathematics (71000 nodes): 3/6 degrees
- Molecules within a cell: 3 degrees

Continue...

- Board members of 1000 Fortune companies: 10100 positions covered by 7682 individuals
- 79% belong to just 1 board
- 14% belong to just 2 boards
- 7% more than 2
- In the main component (6724 nodes) the degree of separation is 4,6

Effects of small world topology

- **Nodes hierarchy**
- WWW: 90% of nodes < 10 indegree, while
- 5 nodes > 1 million
- Power law distribution: **scale invariance**
(no any scale (representative)
node/centrality)
- (Topological) **robustness to random perturbations**

Preferential attachment mechanisms

- In many social/economic/technological phenomena it is not true that network externalities are so important as in WWW or Internet, and *the older is not the better*

Limits of SNA

- Static analysis: longitudinal analysis is NOT a dynamic analysis
- Poor attributes of nodes
- Poor attributes of connections
- Network size (a): being characterized by combinatorial properties, most algorithms face with computational intractability
- Network size (b): it is terribly hard gathering squared empirical data of large phenomena

Agent-based simulation Models (ABSM)

What ABSM are

- Artificial laboratories for generative experiments
- Computer programs, that is more or less complex algorithms
- They are more than tools: they are theories/models
- They are experimental laboratories that can provide social scientists with the same tools of natural scientists

General Traits of ABSM

- They can be theory laden
- They can be data laden
- They can be empirically testable
- **ABSM Are Theories in Action into the Virtual World**
- ***ABSM lead social sciences from dogma and doxa to episteme***

They “reproduce” reality

- In principle, they have no limit to reproducibility
- In practice, every model should be purposefully built, and its complexity seriously hinders its viability
- Its algorithmic nature guarantees for the internal consistency

The principle of generative explanation (Epstein, 2006)

- If (1) the model of a given macro-phenomenon can be implemented through plausible theoretical hypotheses concerning agents, their interactions and environment;
- If (2) there is likelihood between the simulation outcomes and the empirical findings;
- Then those theoretical hypotheses can be considered as sufficient conditions to explain that phenomenon

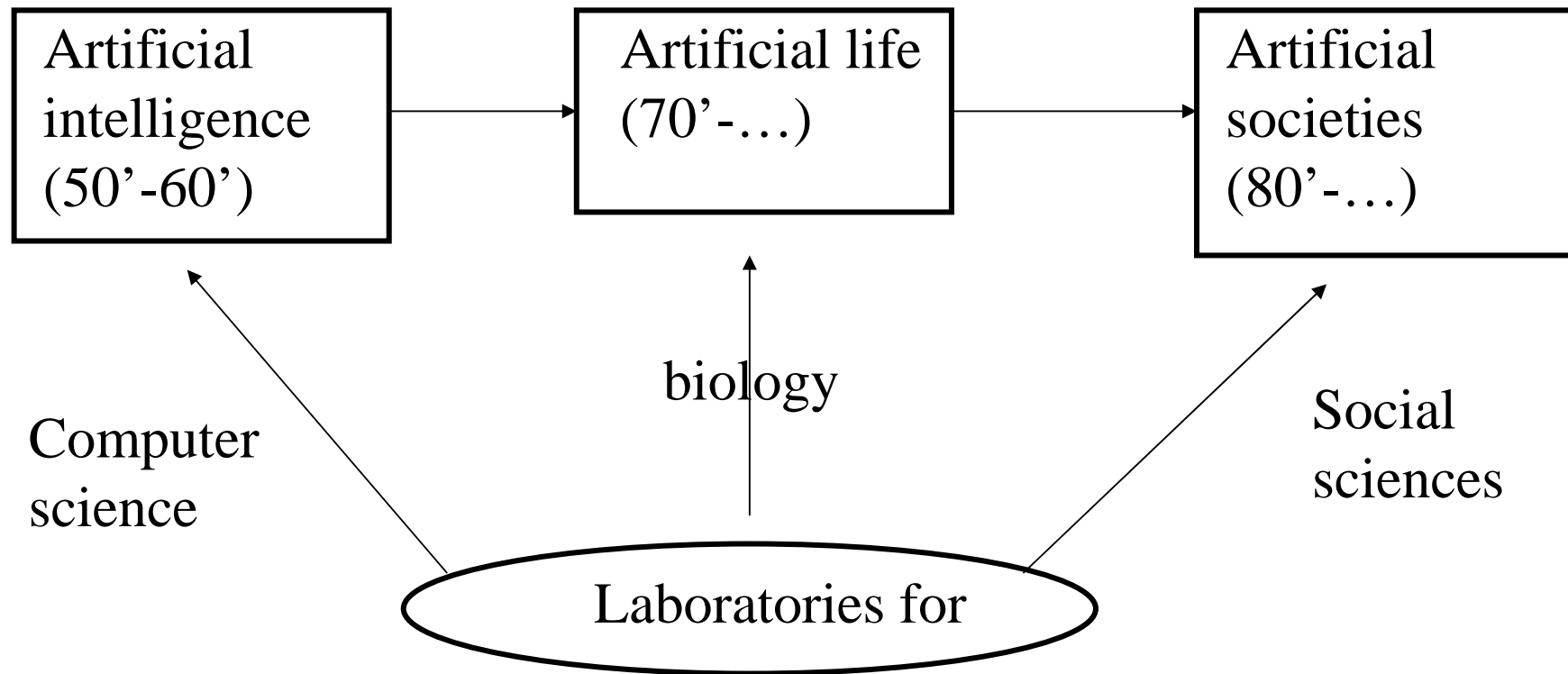
Epstein & Axtell (1996)

**If you can re-generate it,
then you can explain it**

Types of ABSM

- Three broad categories of ABSM:
- 1) case studies;
- 2) middle range models;
- 3) abstract models.

A historical perspective



Ideal methodological process

