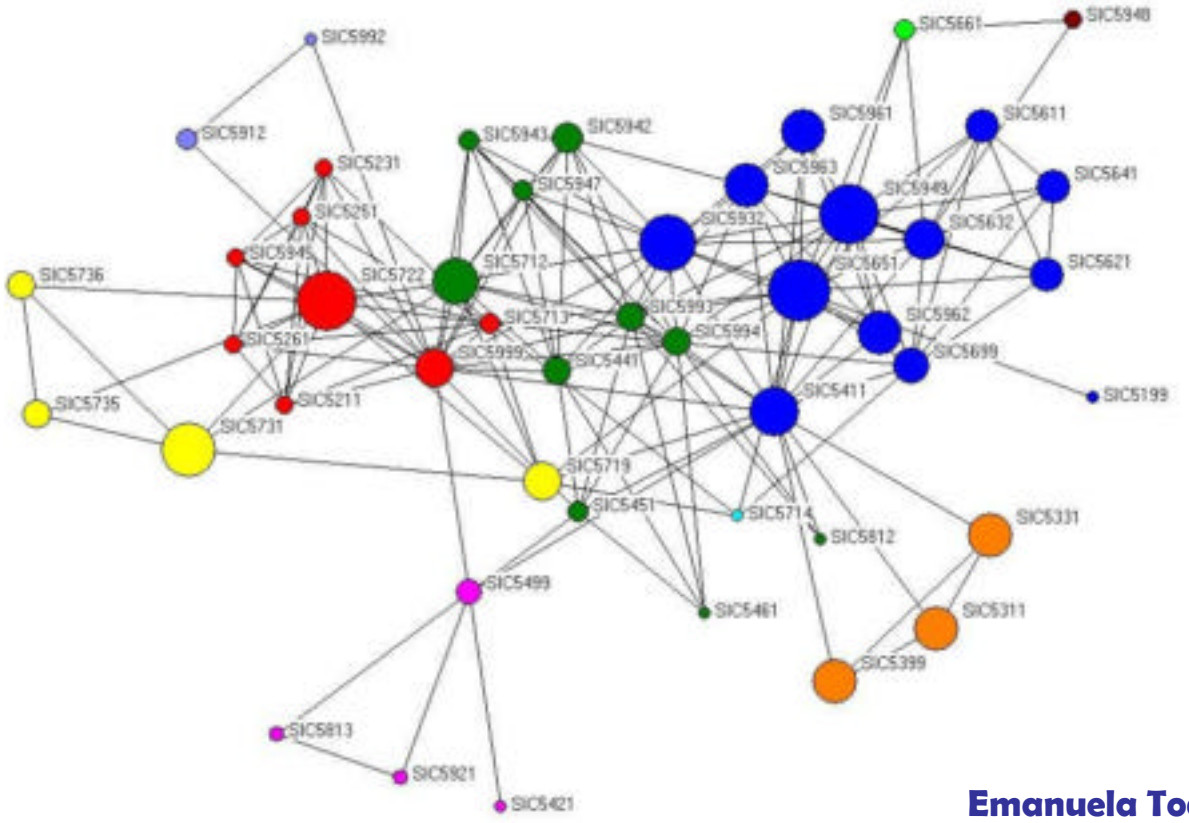
Clusters, Boundaries & Regional Development



Emanuela Todeva

In pursuit of a long-term research agenda

- Clusters
  - Business Networks
    - Strategic Alliances
      - Partnerships & Collaborative Relations in International Business Context

- Cluster boundaries
- Cluster dynamics
- Strategic choices of firms, value chains, global commodity chains, foreign direct investment & its impact on economic development
- Network analysis and cluster methodologies
- Global commodity chains across regions and cluster specialisation

Definition of Clusters

- **E. Todeva (2006) – clusters are agglomerations of firms co-located in a geographic area, connected by *value-adding activities* and with access to benefits from *input/output markets, from infrastructure and from environmental coordination* via institutions and policies.**

Definition of Clusters

- **OECD – Clustering is the tendency of vertically and horizontally integrated firms in related lines of business to concentrate geographically**
- **M. Porter (1998) – Geographically proximate groups of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities.**
- **Bergman & Feser (1999) - A group of business enterprises and non-business organisations for whom group membership is an important source of individual competitive advantage. Buyer-supplier relationships or common technologies, distribution channels or labour pool bind the cluster together.**
- **Reolandt & den Hertog (1999) – Networks of production of strongly interdependent firms, linked to each other in a value adding production chain. In some cases they encompass strategic alliances with universities, research institutes, knowledge-intensive business services, bridging institutions (i.e. consultants, brokers) and customers.**

Key Problems with Cluster Research

- Lack of common definition
- Lack of common methodology for identifying clusters and cluster boundaries
- Lack of methodology and/or procedure for verifying clusters or innovation in them
- Clusters are inherently different
- Conceptualising clusters as variation and selection environments for firms
- Every country/region has a unique cluster blend
- There is no ideal type of cluster
- Industrial clusters may transcend various geographic areas
- 'High-tech' clusters tend to be more global, 'Low-tech' clusters tend to have more complex and advanced innovation processes.

Positioning of the Project

- DTI & Clustering of the UK Economy
- SEEDA & Regional Economic Development
- Porter & Sources of Competitiveness
- OECD & Sources of Innovation
- IMD – World Competitiveness Yearbook *(59 countries, incl. Catalonia, Bavaria, Ile-de-France, Rhone-Alps, Lombardy, 320 competitiveness criteria, incl. economic performance, government efficiency, business efficiency, infrastructure)*
- EU Innovation Scoreboard
- Porter – Cluster Meta-study (39 countries, 22 states in US, bibliography of studies + cluster template)
- Cluster Initiatives Greenbook *(260/500 cases)*

The Cluster Project

Funding – SoM and UniS

Participants -

Donka Keskinova

Stages –

Building the database

Developing the cluster methodology

Cluster maps

Support to cluster research

Comparisons of clusters

Database

- **Amadeus Business Database (September 2002, 5 mln. firms)**
- **SEE – 9 sub-regions, 182 cities, 187.418 firms**
- **Full registration details, Employment, Revenue, and Industries of operation for 2001 (US & UK SIC codes)**
- **Entire population of firms for the region US SIC codes for industries**
- **951 industries (by US SIC code)**
  - **12% of population have declared <1 UK SIC code (2-9)**
  - **76% of population have declared <=2 US SIC codes**
  - **12% of population have declared <=13 US SIC codes (55)**
- **Total employment 3.159.302 (80% of the statistically registered actual employment for the region, declared by 7% of the population**
- **Total revenue US$ 676 bln. (declared by 30% of the population**
- **Including all potential cluster members without any division between *traded*, *local* and *resource-based* agglomerations.**

Existing Cluster Methodologies

- **Employment location quotien (*Trend Business Research, 2001*)**
- **Input-output tables (*Feser & Bergman, 2000*)**
- **Interviews and questionnaire with experts (*Porter, Trend Business Research, Competitiveness Group*)**
- **Multi-stage Cluster Methodology with Industry Data (*Todeva & Keskinova, 2005*)**

Multi- stage Methodology with Industry Data for Cluster Mapping

- First stage - clustering with K-means method in SPSS 12.0 – at level 400 (120.350 firms in 83 independent clusters)
- Second stage – regrouping of 83 clusters according to their core SIC profile, exhibited in 100% of member firms
  - cluster labels of 23 clusters
- Third stage – K-means re-clustering of all remaining firms (small clusters (4.197 firms) at level 50, and 'dirty' clusters (18.756) at level 200
  - creation of new clusters and association of all new 3rd level clusters of firms
  - association of firms with only 1 SIC code (9.725 firms)
  - association of firms with only 3-digit Primary code (34.405 firms)
- Fourth stage - final clustering by K-means at level 50 and association of clusters where possible. All ultra-diversified firms with cluster centres in more then one cluster were grouped into the final cluster & labelled 'ultra-diversified'
- Fifth stage - clustering of firms by UK SIC codes – led by the DTI methodology; divided the population in 2 groups – firms with 1 SIC code and firms with or more codes
  - K-means clustering at level 400 and frequency analysis
- Sixth stage – comparing clusters between the two methods – 91% overlap
  - Constructing new clusters in US for 'Marine Technology' and 'Pharmaceuticals'; recombining 'Business and Management Consulting Services' with 'Investment and Business Data Services'

US SIC	Total overlap	Total US firms	% overlap
1_Agriculture & Farming	1586	1767	90%
2_Food Processing, Beverages & Tobacco	973	1369	71%
3_Oil & Gas Extraction, Refining & Mining	301	355	85%
4_Construction	13271	14676	90%
5_Chemicals & Allied Products	820	1116	82%
6_Pharmaceuticals	230	285	93%
Perfume & Toiletries	**195**		
7_Industrial Machinery, ICT Equipment & Metal Products	1332	5406	77%
Industrial Machinery	983		
ICT Electronic Equipment	1840		
8_Instrumentation	605	1027	59%
9_R& D	3677	3948	93%
10_Transport Equipment, Aircraft & Space Vehicles	138	356	39%
11_Marine Technologies Equipment & Services	536	586	91%
12_Motor Sport, Automotive Trade & Repair	3109	3437	90%
13_Furniture, Fixture & Wood Products	772	1254	62%
14_Miscelleneous Consumer Products	1648	2042	81%
15_Utilities	108	305	71%
Environment Services	732		
16_Communication Services	1336	1540	87%
17_Software & Computer Services	23040	23989	96%
18_Publishing	2775	3013	92%
19_Finance & Insurance	1796	1912	94%
20_Real Estate	18459	18894	98%
21_Investment, Business & Management Consulting Services	35126	38406	91%
22_Transportation Services	3303	3583	92%
23_Trucking & Warehousing	346	425	81%
24_Wholesale Trade	4785	6113	78%
25_Retail	4714	6133	77%
26_Hotels & Restaurants	2705	3099	87%
27_Amusement & Recreation Services	4517	4988	91%
28_Health Services	1248	1473	85%
29_Miscelleneous Services	30165	30847	98%
30_Non-clasified Establishments	4497	4700	96%
31_Ultra diversified	4	374	1%

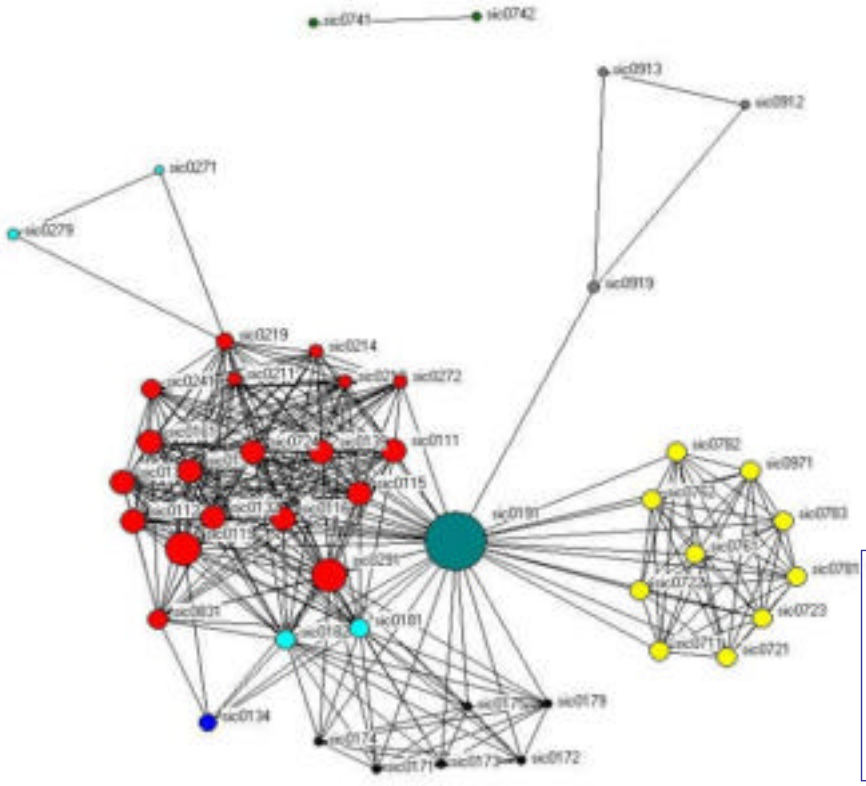
Methodology for Cluster Analysis

- **Allocation of all firms in clusters demarcating clear cluster boundaries with clear cluster centres (i.e. core SIC codes framing the cluster membership)**
- **Analysis of relationships between industries and clusters (developing a 2-mode matrix and calculating *chi*² for network analysis with UCINET)**
- **Cluster maps containing the industry composition of clusters**
- **Analysis of relationships between clusters**
- **Analysis of relationships between clusters and regions**

“AGRICULTURE & FARMING”

5% of ties (ties between industries, based on >27 firms)

N firms=1769
% overlap with UK=77%
employment 2001=104.396
revenue 2001=3.745.991(thUS$)

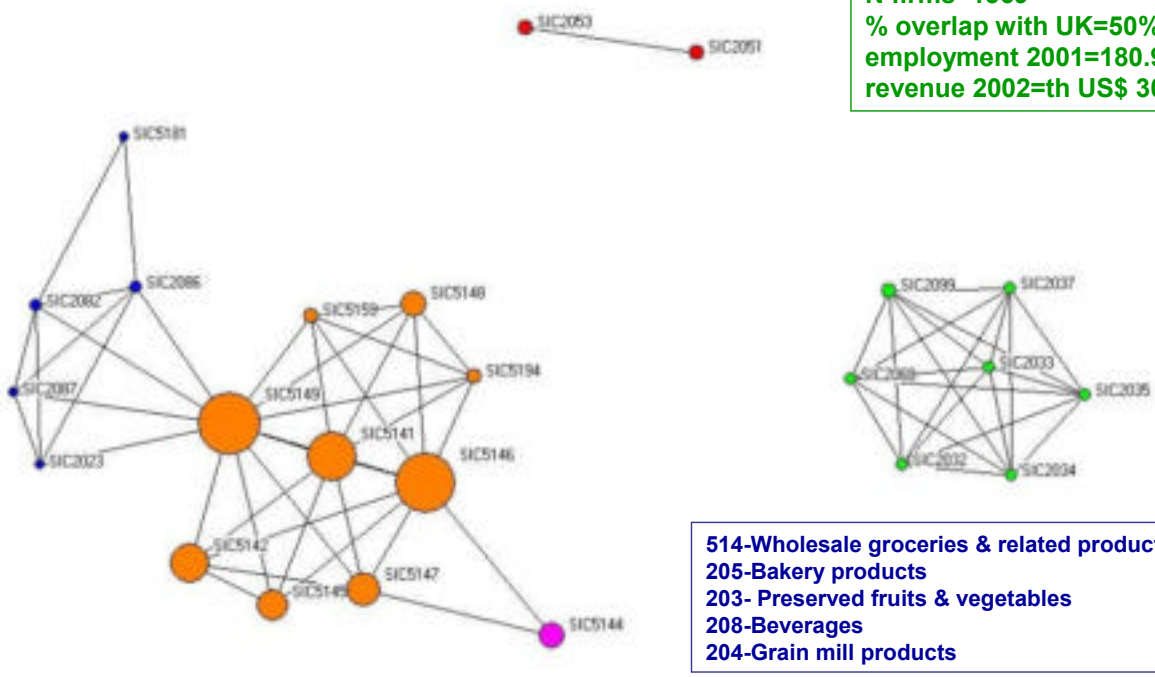


0191- General farms, primarily crop-71%
025 - Poultry & Eggs
027 – Animal Specialties
07 – Agricultural services
017 – Fruits & Tree nuts
011- Grains; 021- Live stock
074- Veterinary services
091- Commercial Fishing

"FOOD PROCESSING, BEVERAGES & TOBACCO"

5% of ties (ties between industries, based on >27 firms)

N firms=1369
% overlap with UK=50%
employment 2001=180.974
revenue 2002=th US$ 30.919.034



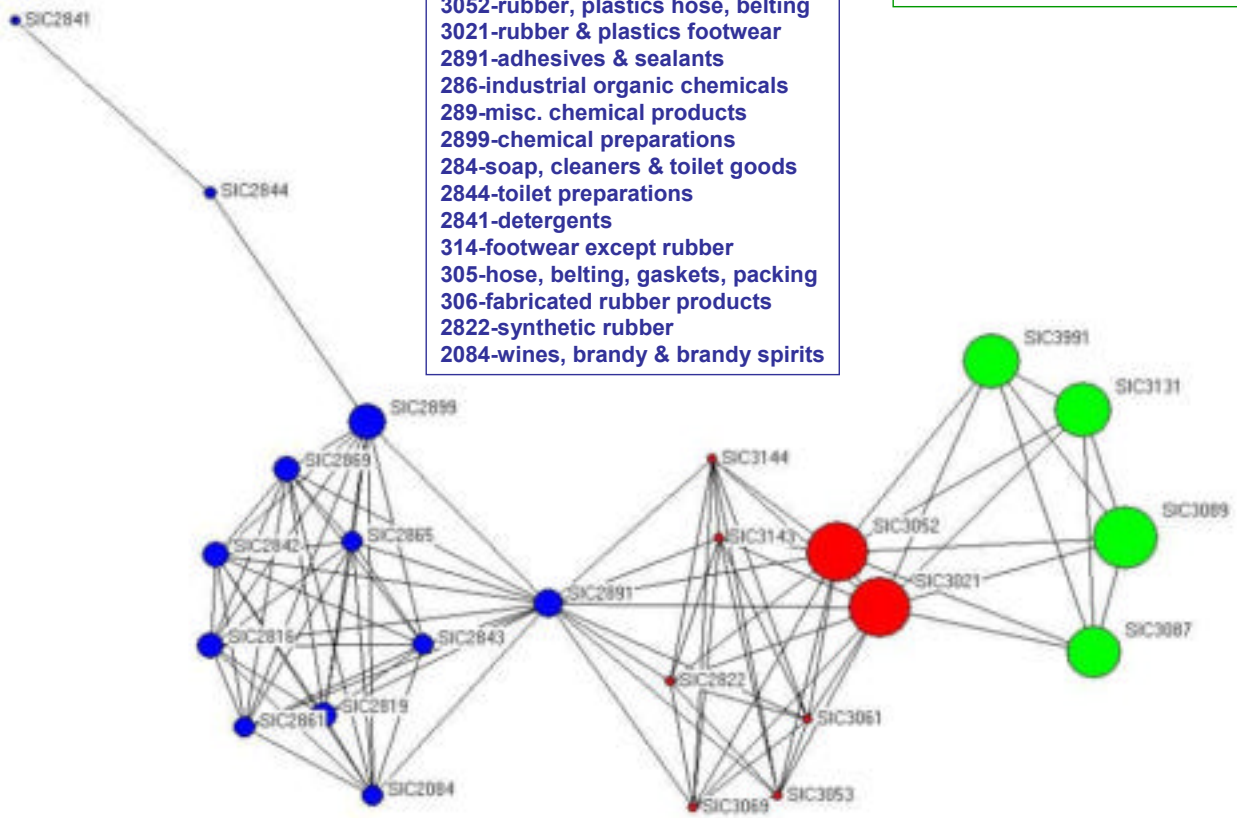
514-Wholesale groceries & related products-40-50%
205-Bakery products
203- Preserved fruits & vegetables
208-Beverages
204-Grain mill products

"CHEMICALS & ALLIED PRODUCTS"

5% of ties (ties between SIC codes based on >54 firms)

N firms=1116 firms
% overlap with UK=83%
employment 2001=70.850
revenue2001=thUS$19.110.496

3052-rubber, plastics hose, belting
3021-rubber & plastics footwear
2891-adhesives & sealants
286-industrial organic chemicals
289-misc. chemical products
2899-chemical preparations
284-soap, cleaners & toilet goods
2844-toilet preparations
2841-detergents
314-footwear except rubber
305-hose, belting, gaskets, packing
306-fabricated rubber products
2822-synthetic rubber
2084-wines, brandy & brandy spirits

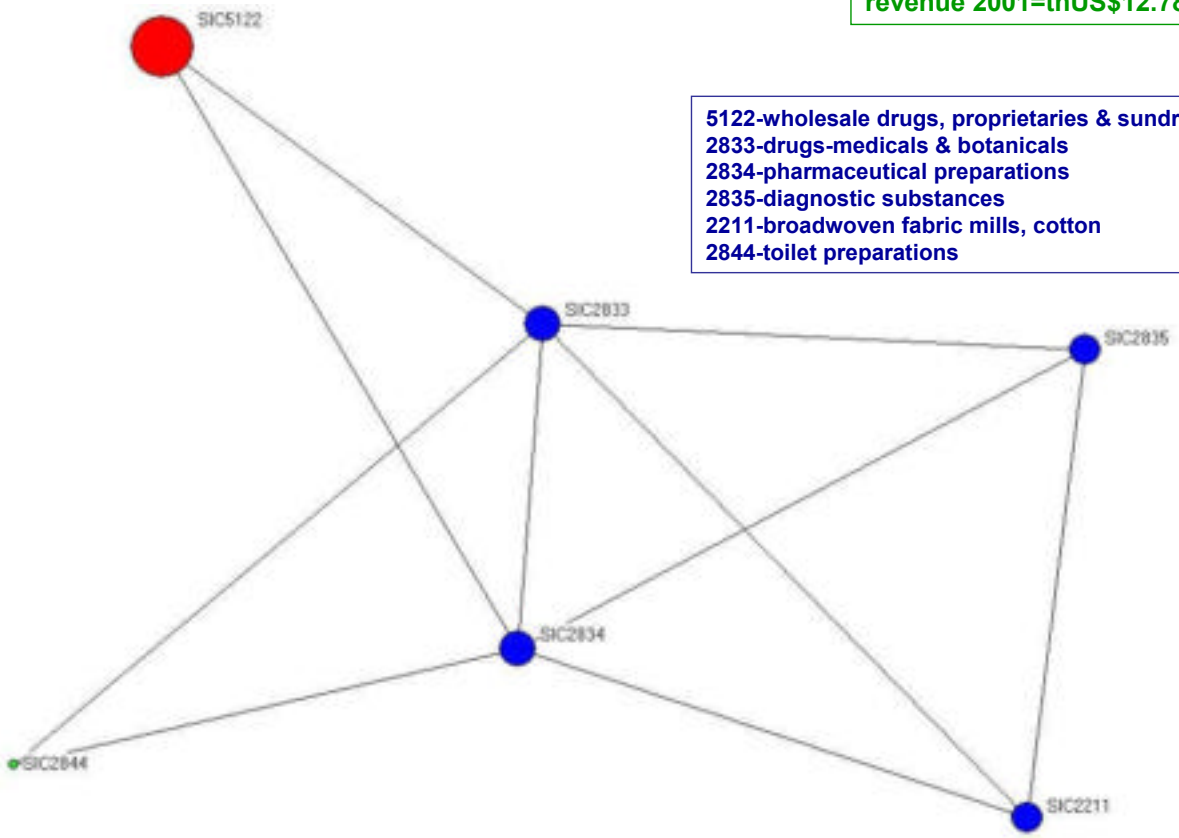


"PHARMACEUTICALS"

5% of ties (ties between SIC codes based on > 6 firms)

N firms=285 firms
% overlap with UK=66%
employment 2001=46.273
revenue 2001=thUS$12.780.275

5122-wholesale drugs, proprietaries & sundries
2833-drugs-medicals & botanicals
2834-pharmaceutical preparations
2835-diagnostic substances
2211-broadwoven fabric mills, cotton
2844-toilet preparations

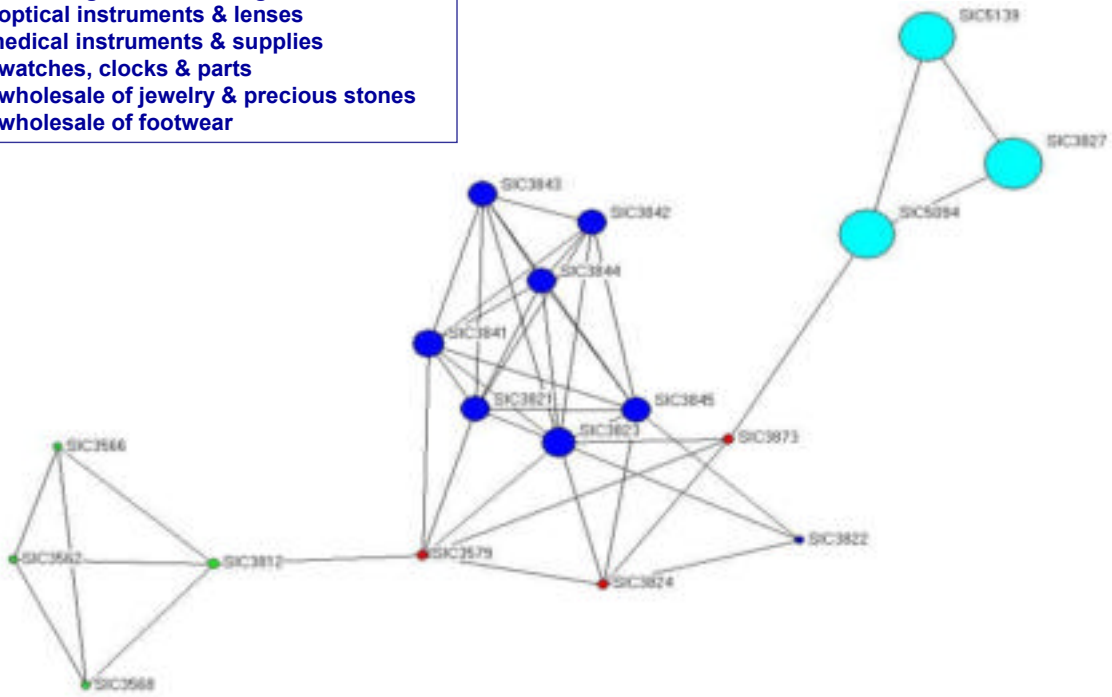


"INSTRUMENTATION"

5% of ties (ties between industries based on > 8 firms)

N firms=1.027
employment 2001=20.639
revenue 2002=th US$ 3.107.880

356-general industrial machinery
3579-office machinery
3812-search & navigation equipment
382-measuring and controlling devices
3827-optical instruments & lenses
384-medical instruments & supplies
3873-watches, clocks & parts
5094-wholesale of jewelry & precious stones
5139-wholesale of footwear

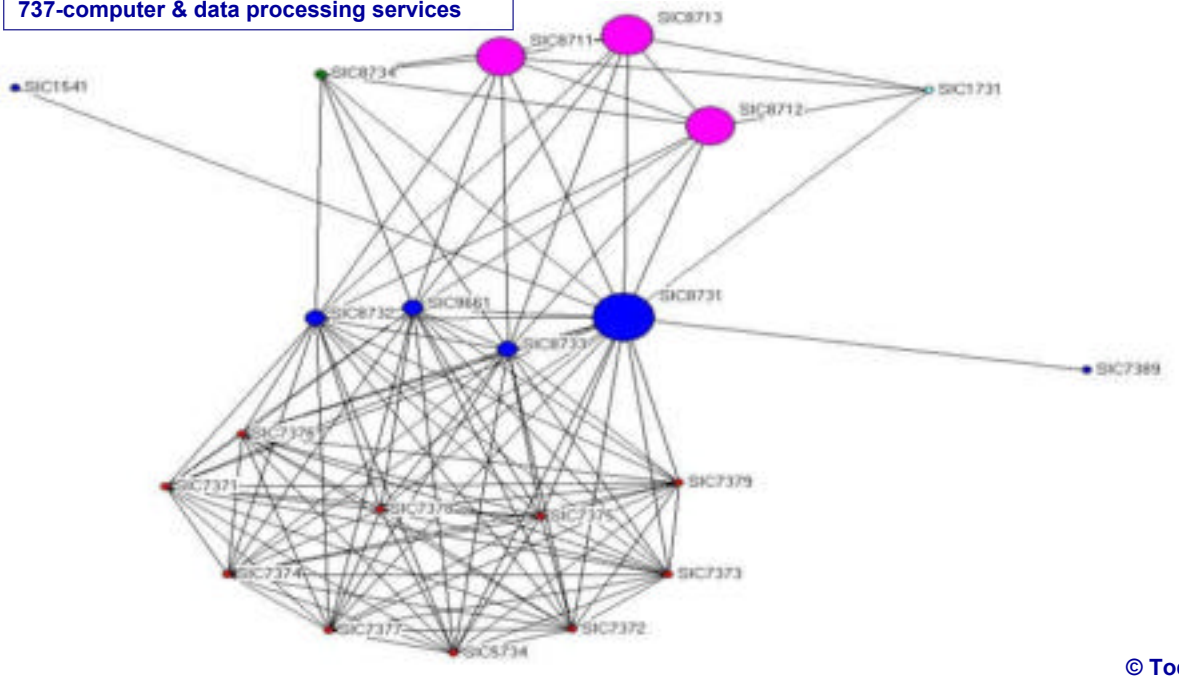


"R&D"

5% of ties (ties between industries based on >16 firms)

N firms=3.948
employment 2001=55.009
revenue 2002=th US$ 6.819.695

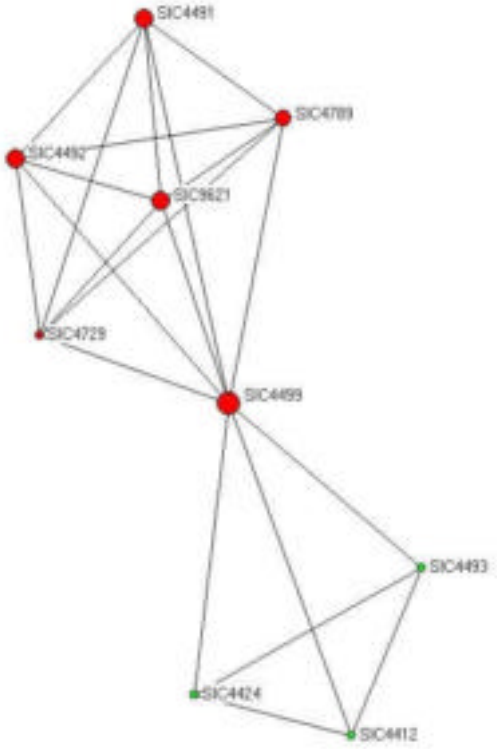
1731-electrical work
871-engineering and architectural services
873-research and testing services
8731-commercial physical research
8734-testing laboratories
7389-business services
9661-space research & technology
737-computer & data processing services

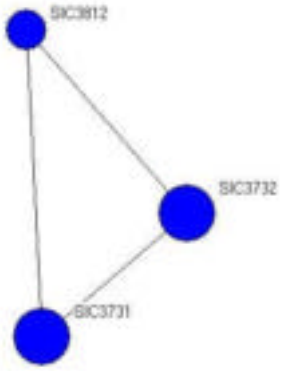


"MARINE TECHNOLOGIES EQUIPMENT & SERVICES"

5% of ties (ties between industries based on >11 firms)

N firms=586
employment 2001=22.987
revenue 2002=th US$ 3.238.289





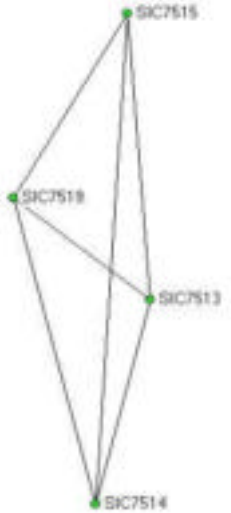
3731-ship building & repairing
3732-boat building & repairing
3812-search * navigation equipment
4412-deep sea foreign transportation freight
4424-deep sea domestic transportation freight
4492-towing & tugboat services
4493-marinas
4499-water transportation services
4729-passenger transportation arrangements
4789-transportation services
9621-regulation of transportation

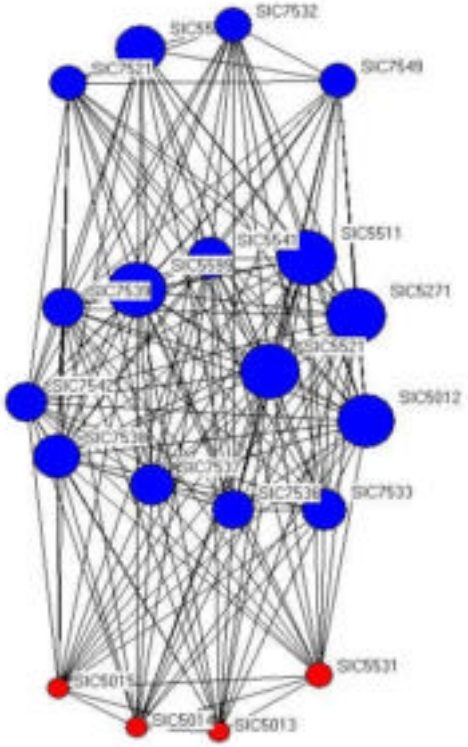
"MOTOR SPORT, AUTOMOTIVE TRADE & REPAIR"

5% of ties (ties between industries based on >142 firms)

N firms=3.437
employment 2001=80.598
revenue 2002=th US$45.228.677

5012-automobile wholesale
5271-mobile home dealers
55-automotive dealers & service stations
751-automotive rentals
753-automotive repair shops





"TRANSPORTATION SERVICES"

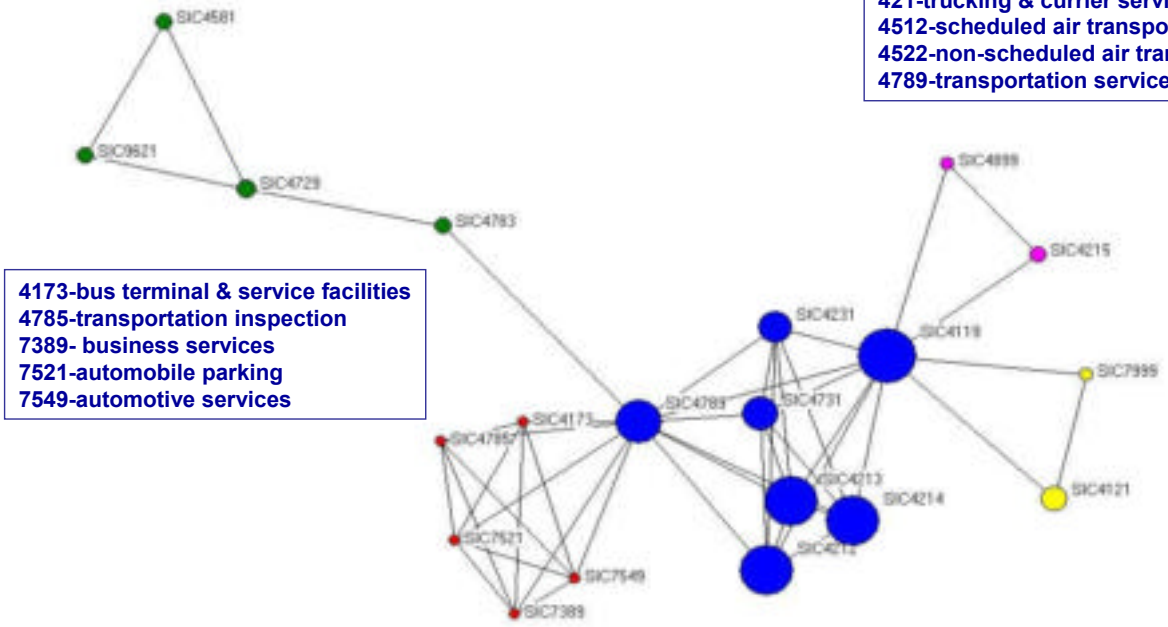
5% of ties (ties between industries based on >15 firms)

N firms=3583
employment 2001=71.085
revenue 2002=th US$15.372.020

4581-airports & flying fields
4729-passenget transport arrangements
4783-packing & crating
9621-regulation of transportation

4119-local passenger transportation
421-trucking & currier services
4512-scheduled air transportation
4522-non-scheduled air transportation
4789-transportation services

4173-bus terminal & service facilities
4785-transportation inspection
7389- business services
7521-automobile parking
7549-automotive services

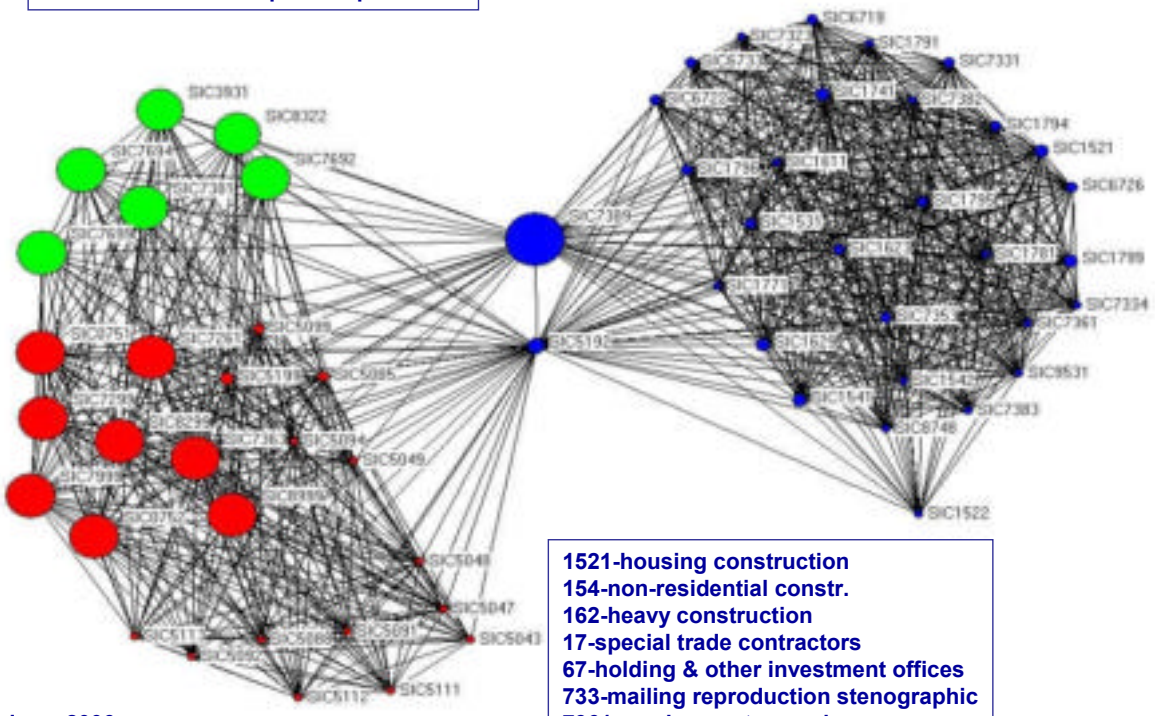


"ULTRA DIVERSIFIED"

5% of ties (ties between industries based on >35 firms)

N firms=374
employment 2001= 101.682
revenue 2002=th US$4.833.770

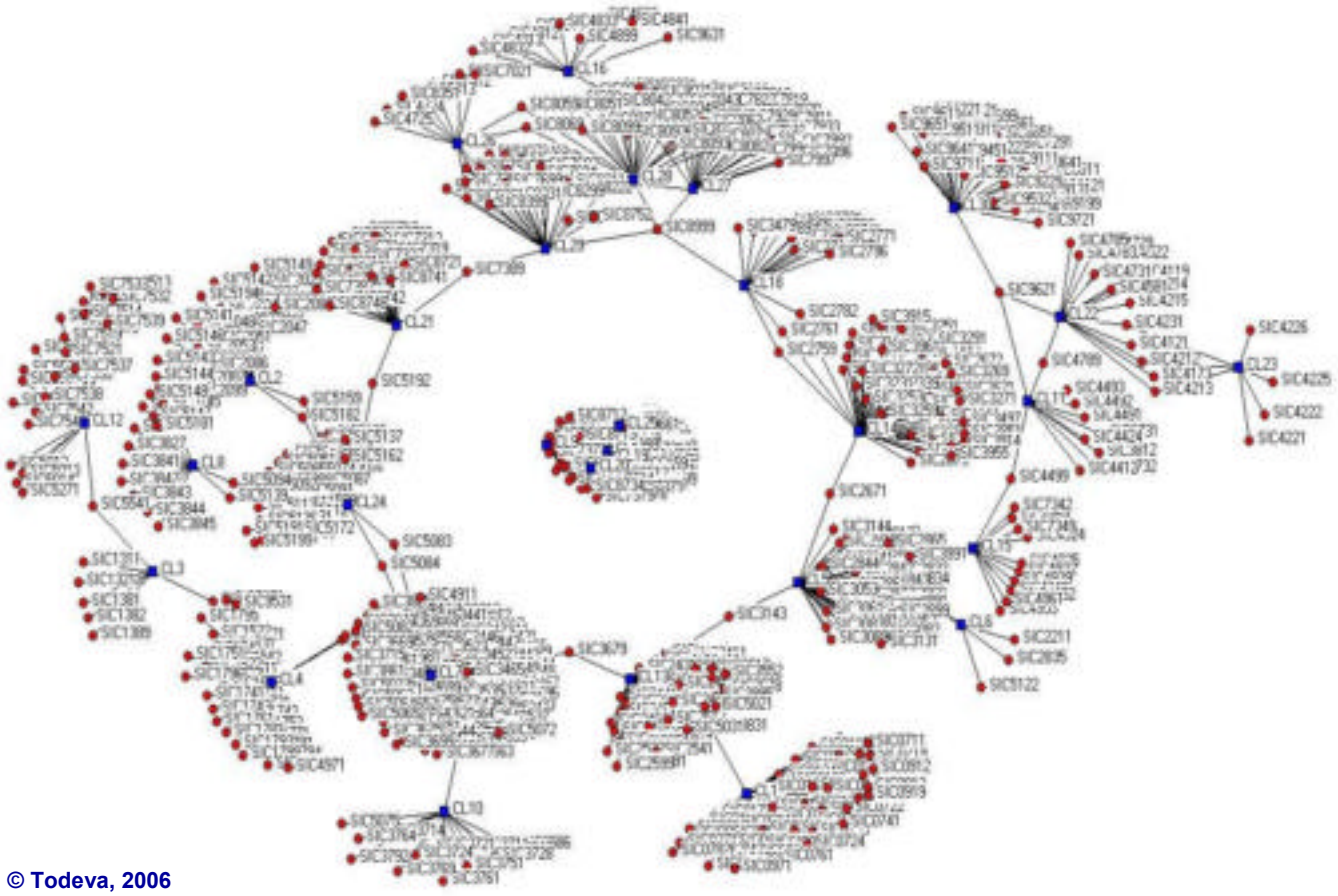
5192-wholesale books periodicals
7381-detective & armoured car services
7389-business services
769-miscellaneous repair shops



1521-housing construction
154-non-residential constr.
162-heavy construction
17-special trade contractors
67-holding & other investment offices
733-mailing reproduction stenographic
7361-employment agencies

Connected Clusters via Industries with Frequency > 20

(at strength of ties >10% measured by *chi*², delete isolates)



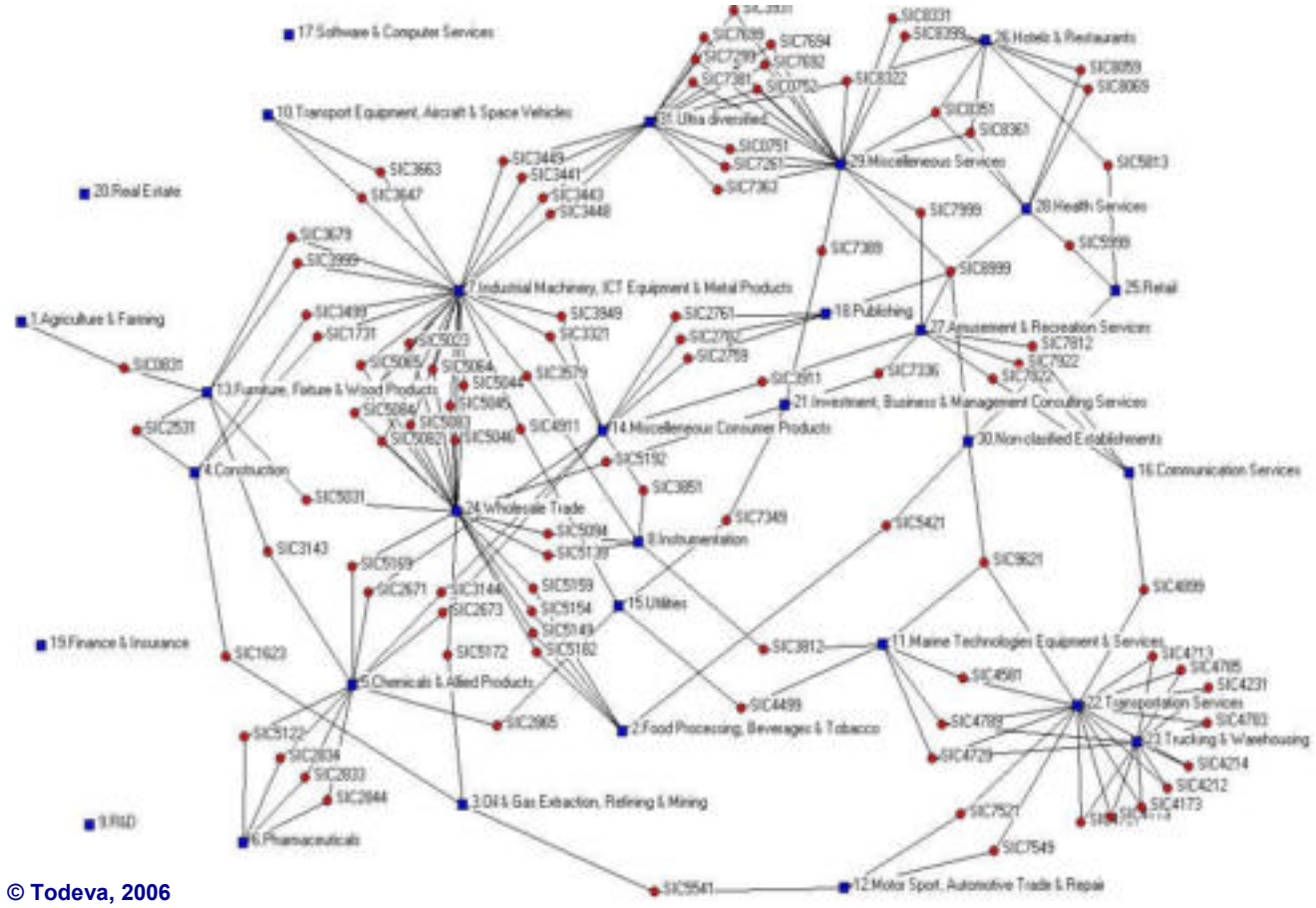
Connected Clusters via Industries with Frequency > 20

(at strength of ties>10% measured by *chi*², delete isolates and pendants)

3679-electronic components
3663-radio/TV communic. equip
3499-fabricated metal products
1731-electrical work
7389-business services

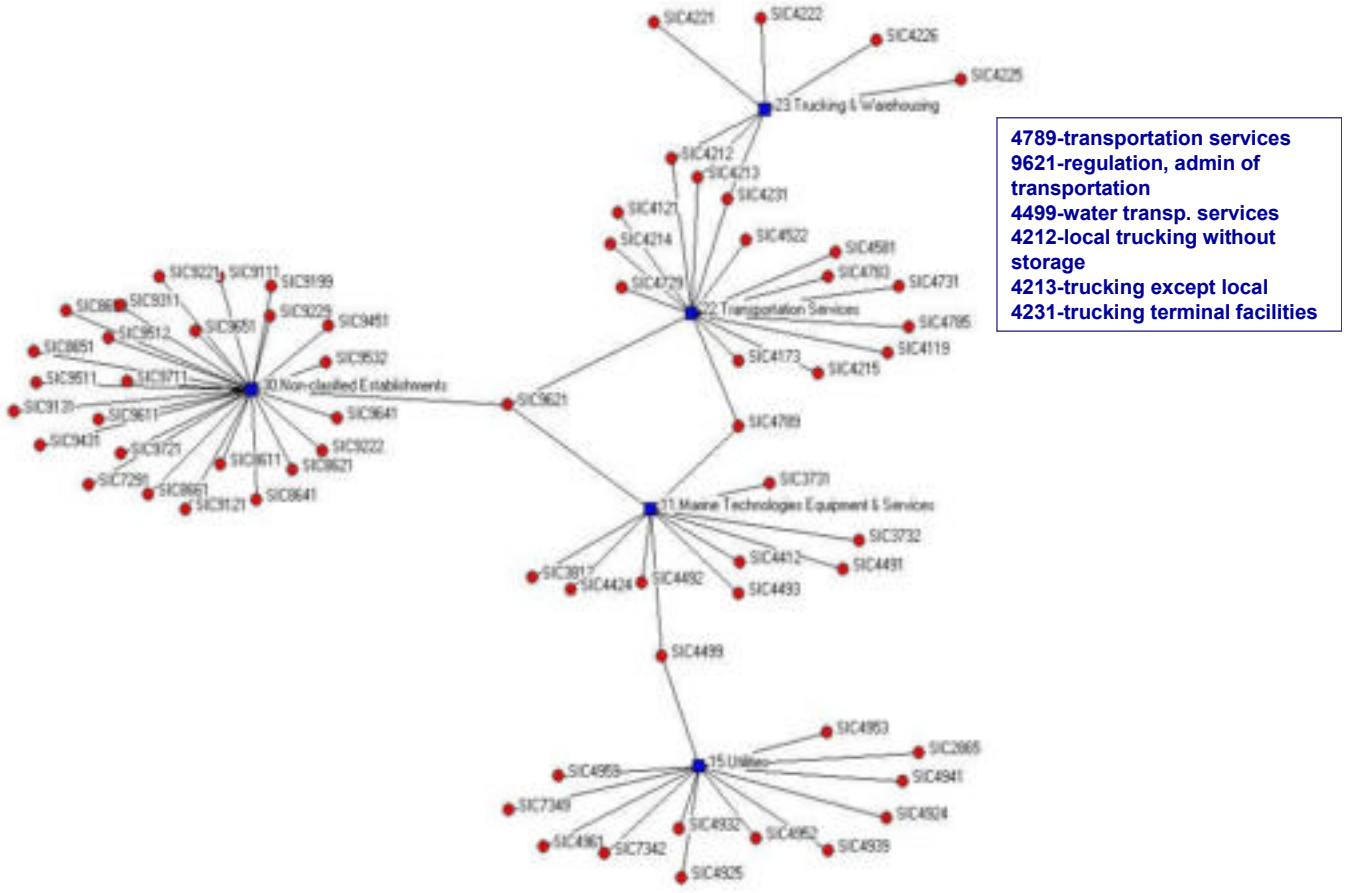
Connected Clusters via US SIC codes with frequencies > 20

(at strength of ties >12% measured by *chi*², delete isolates and pendants)



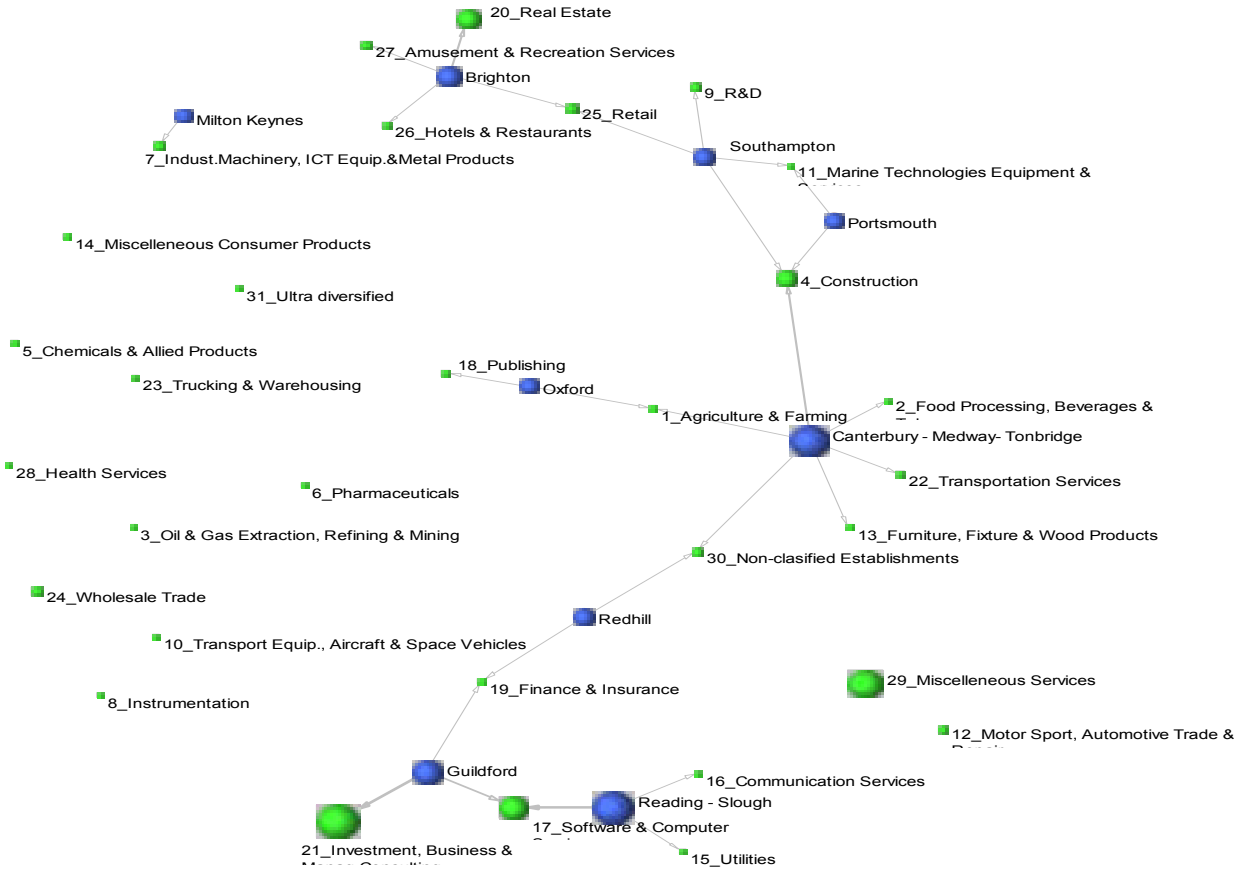
Extract from Fig. above: Connected Clusters via Industries with Frequency more then 20

(at strength of ties<12% measured by *chi*²)



4789-transportation services
9621-regulation, admin of transportation
4499-water transp. services
4212-local trucking without storage
4213-trucking except local
4231-trucking terminal facilities

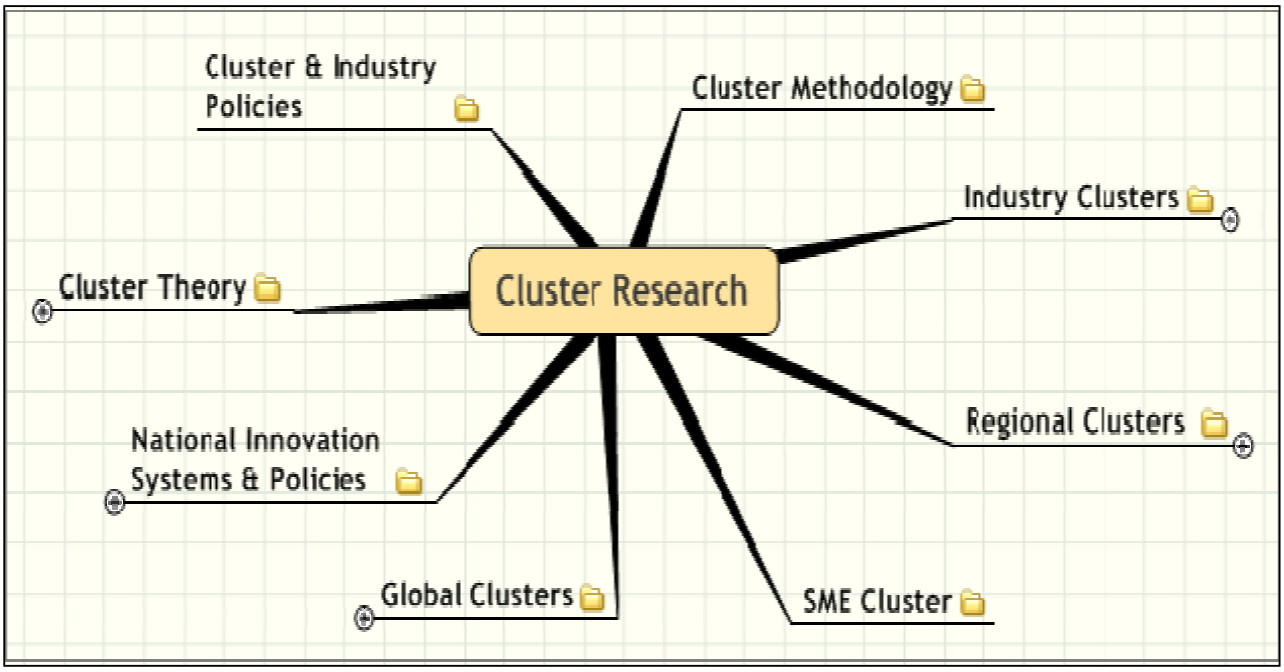
Ties Between Regions & Industries (10% of ties)



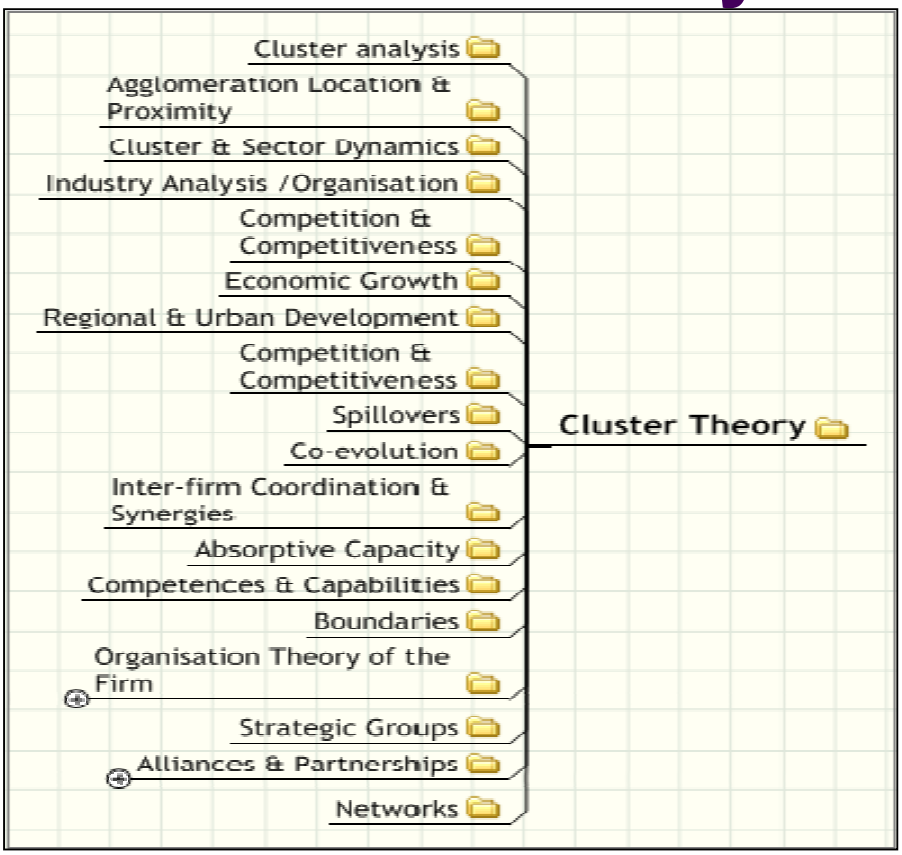
Databank

- **Over 160 Journals and academic sources**
- **Over 2000 publications**
- **In depth research of the UK cluster initiatives – all publications on clusters from all regional development agencies**
- **Collection of statistical data from the Interdepartmental Business Register (IDBR), UK Statistics Office, and International trade data - per UK regions**

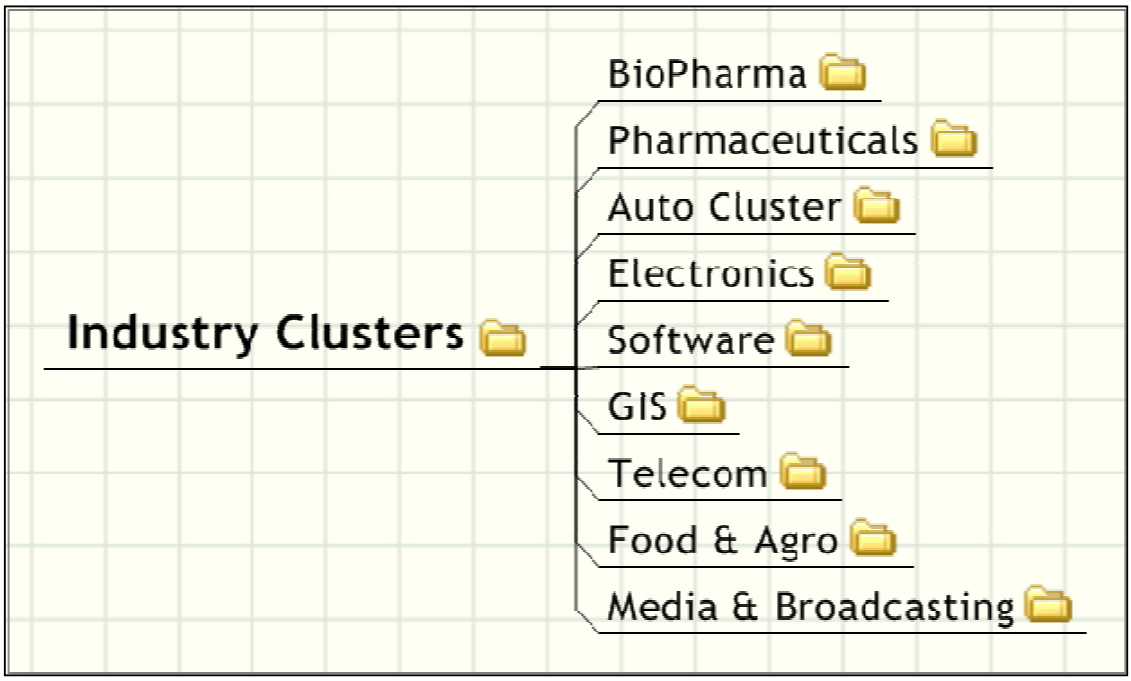
Cluster Research



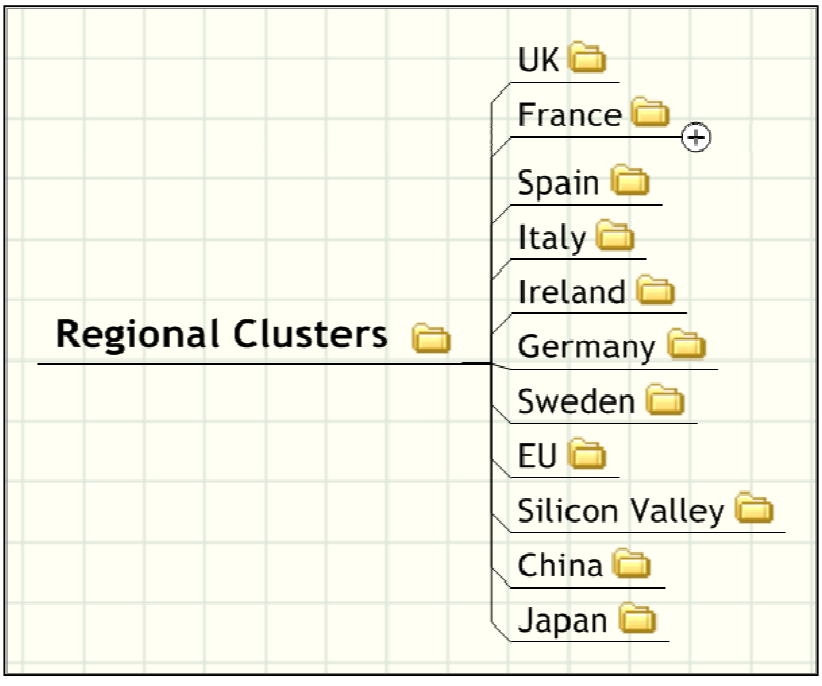
Cluster Theory



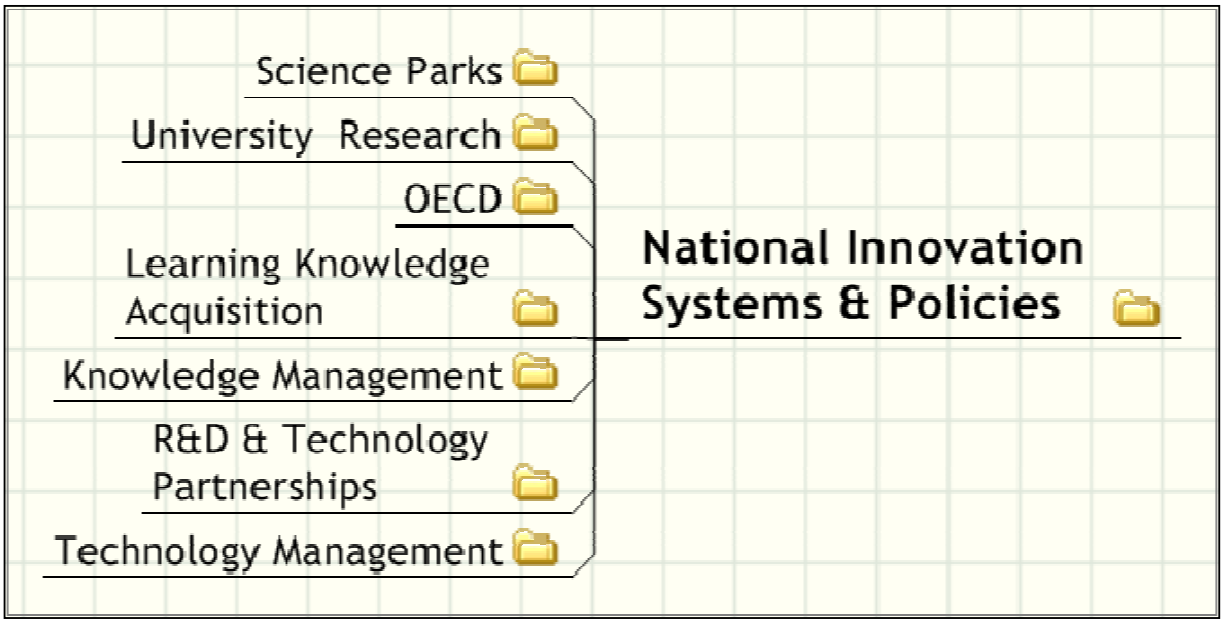
Industry Clusters



Regional Clusters



National Innovation Systems & Policies



Future Directions

- Cluster overlap and cluster concentration
- Compare with employment and revenue statistics
- The role of FDI in Cluster Dynamic
- The Globalisation of Clusters
- … looking for partnerships and collaboration….