

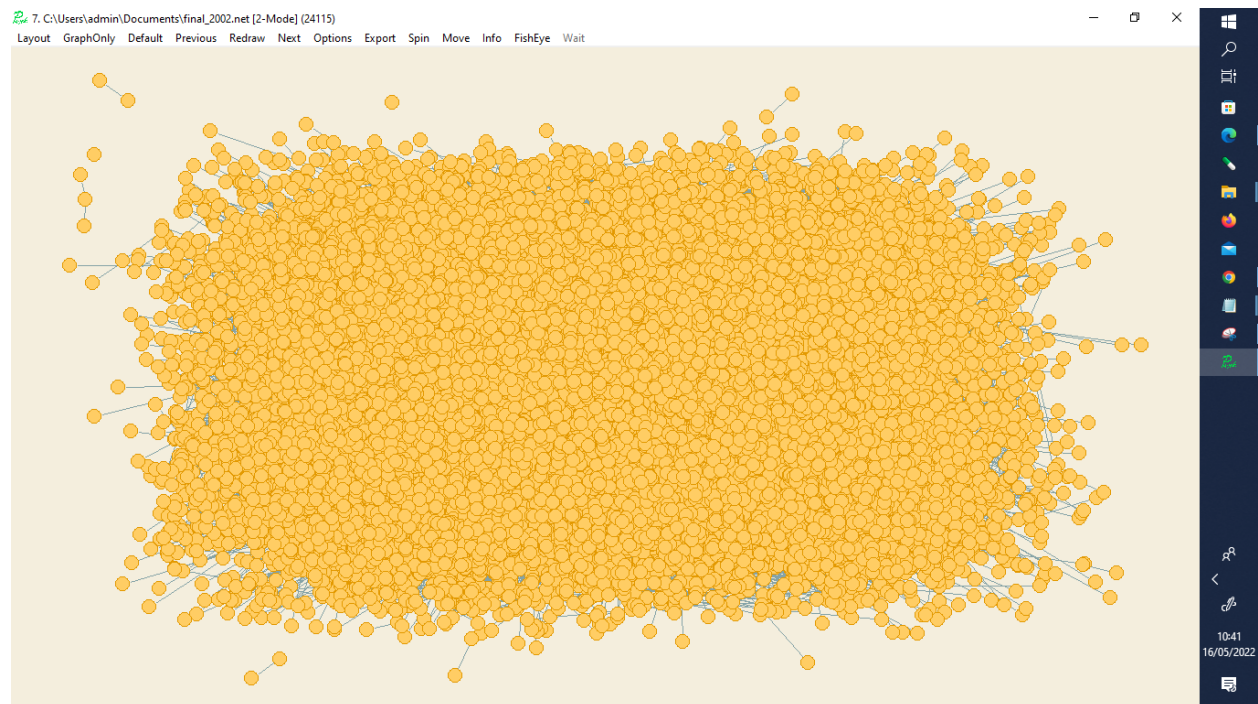
HS3100 Project Report

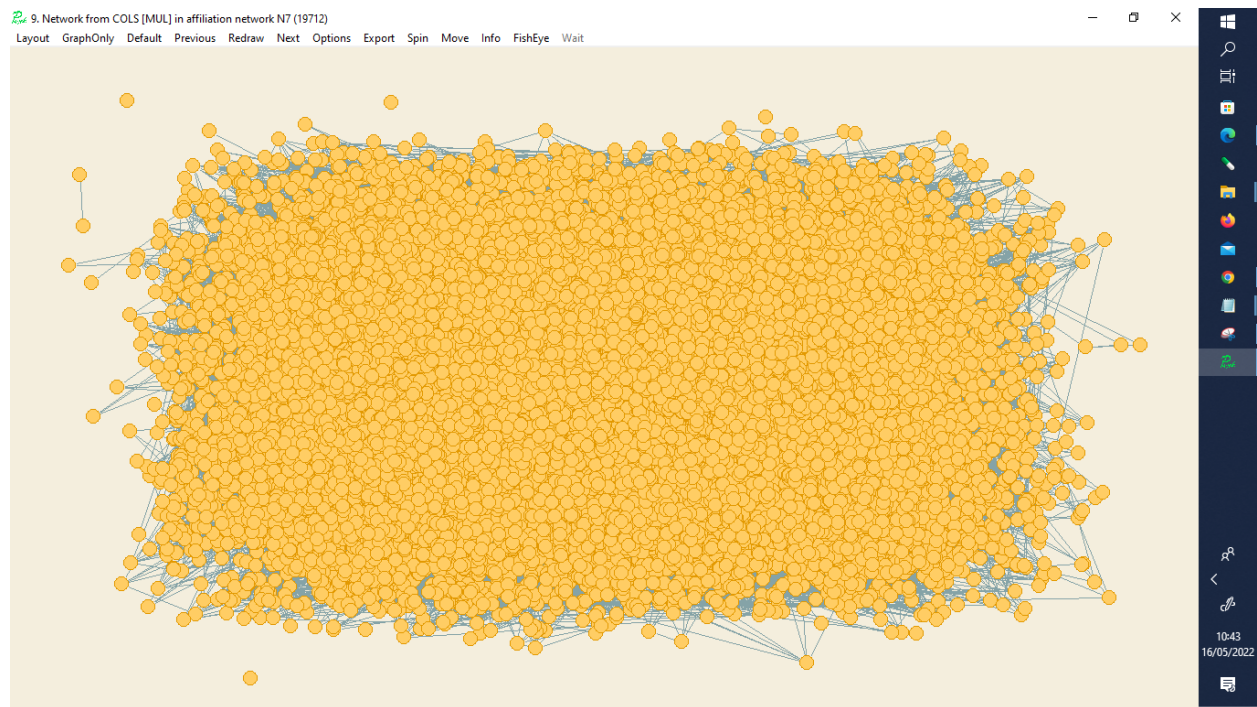
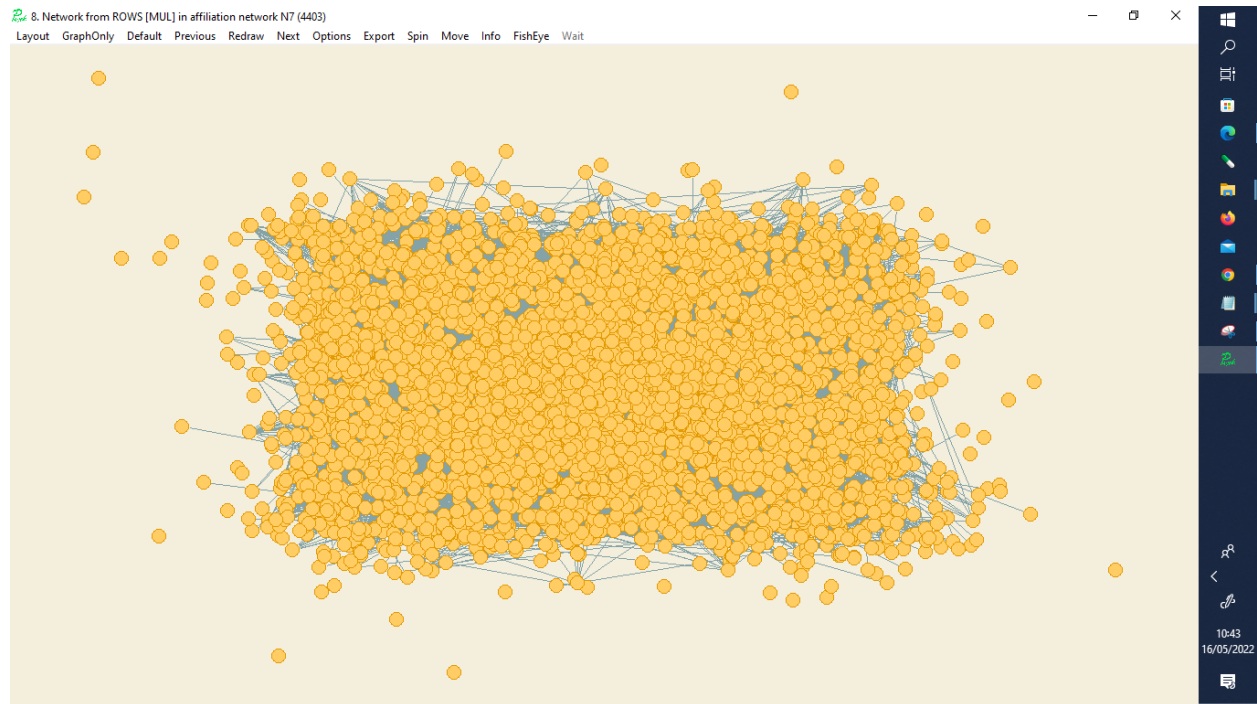
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NO. MEMEBERS	19711	42272	45128	36035	7766

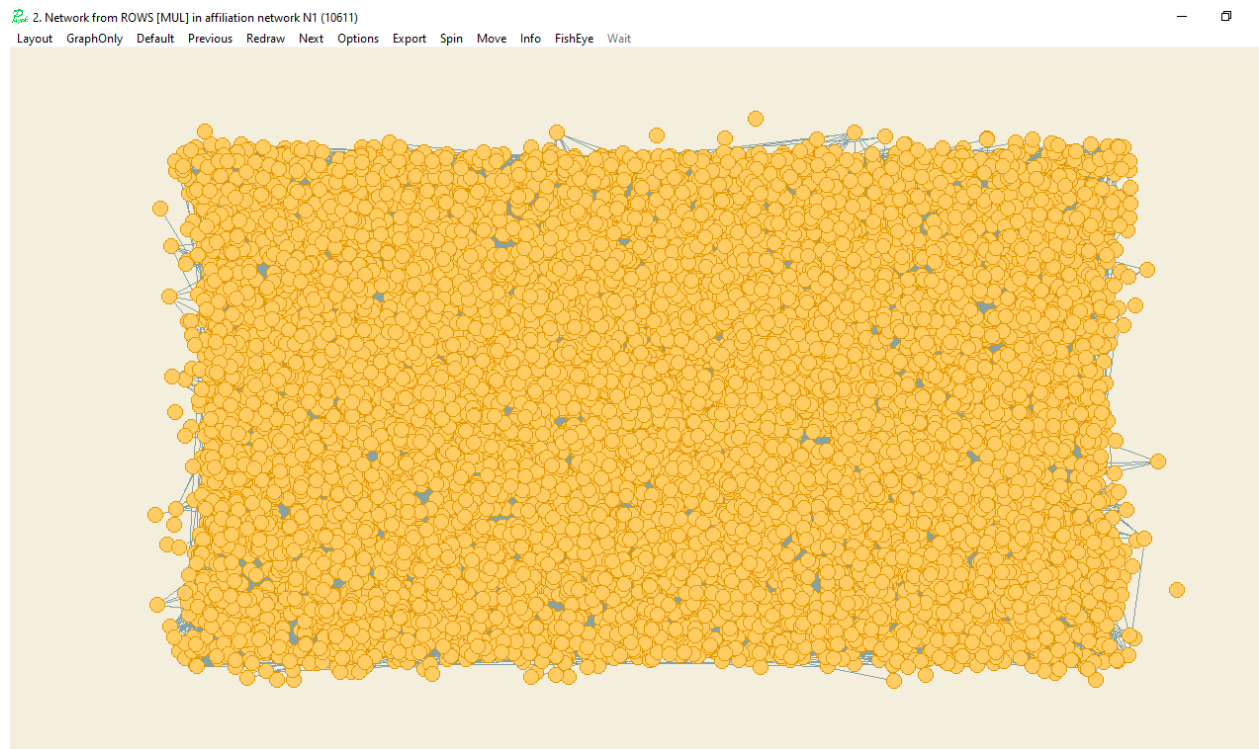
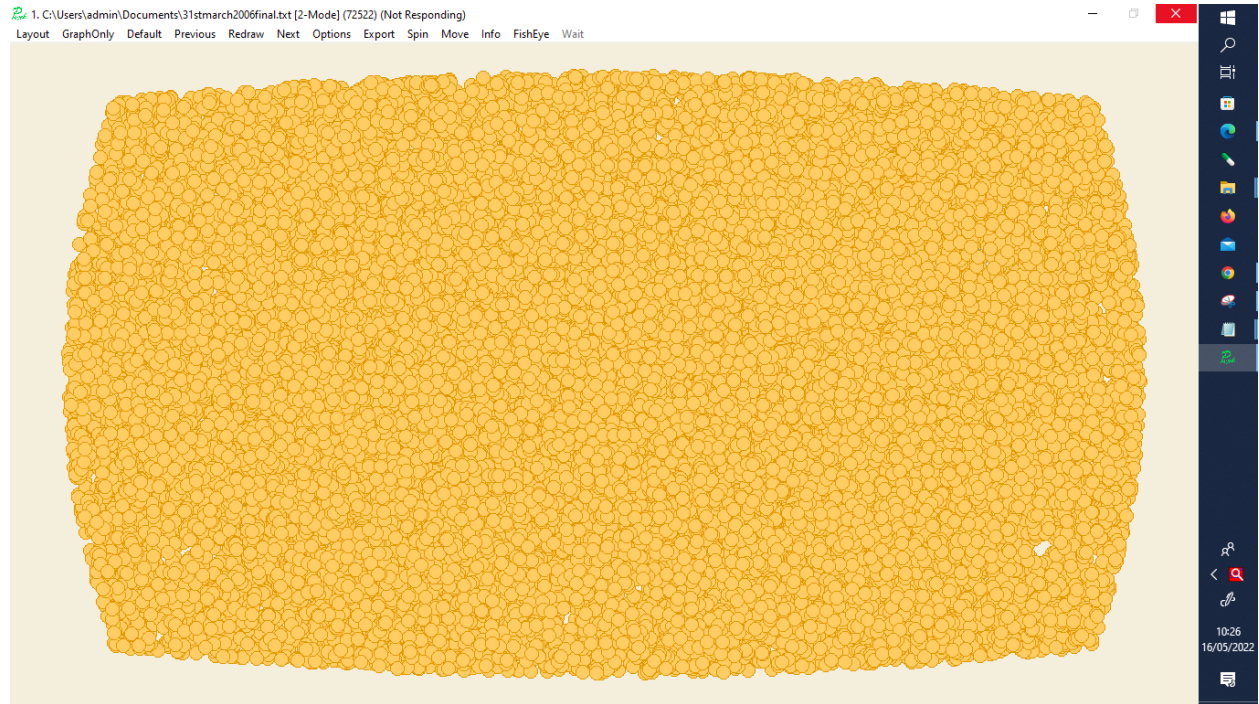
234 dates ranging from years 1988-2011

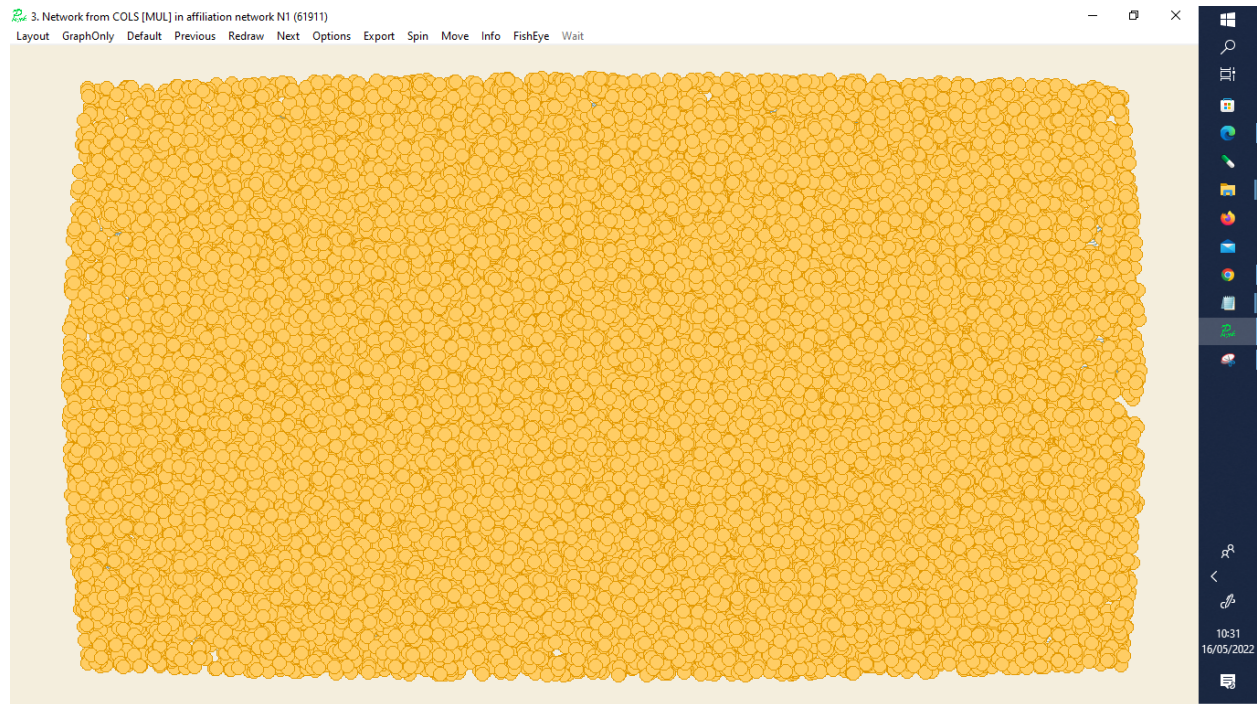
19828 companies in all

2002

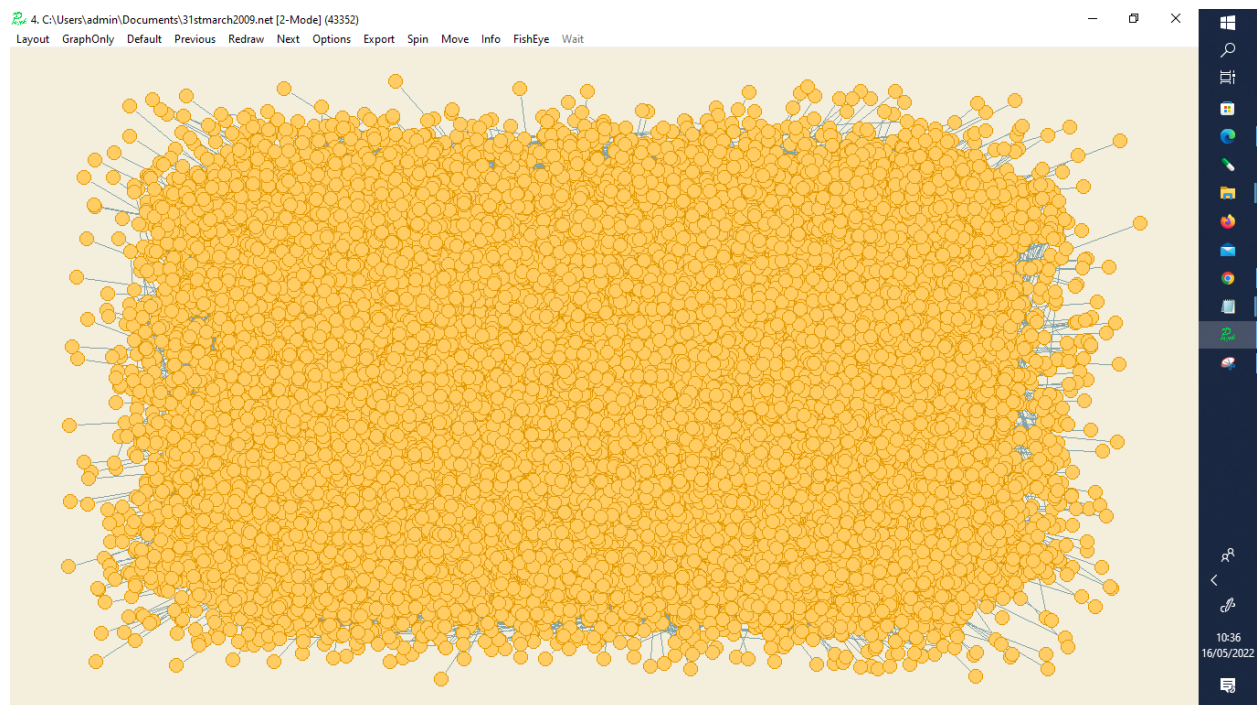






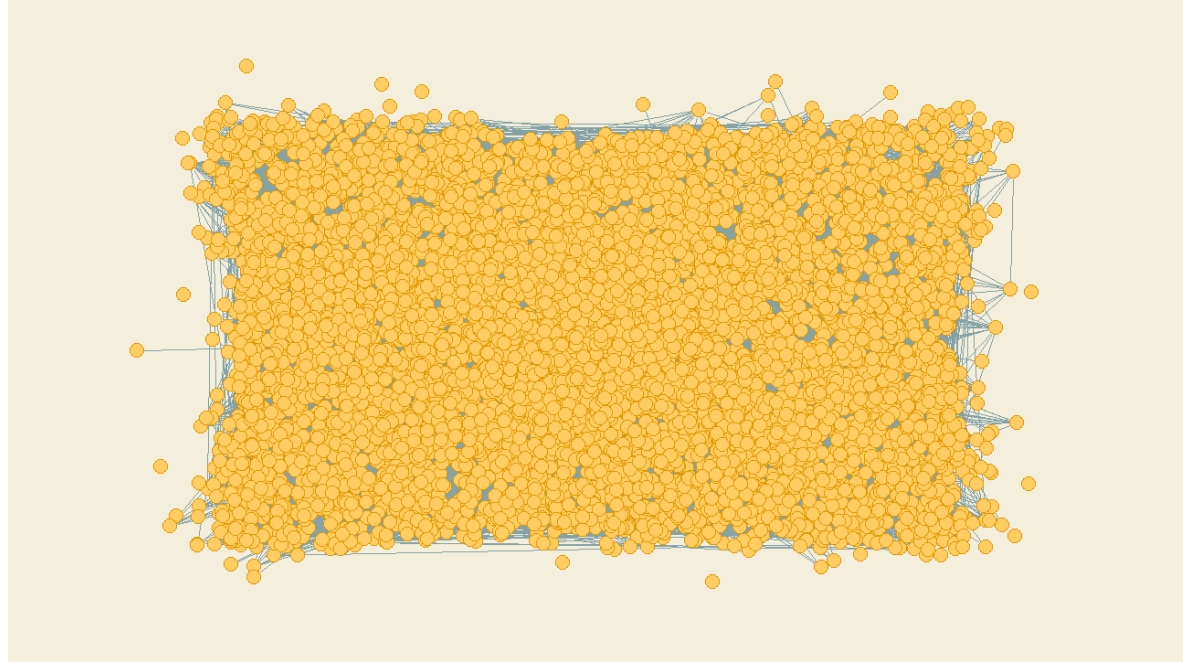


2009



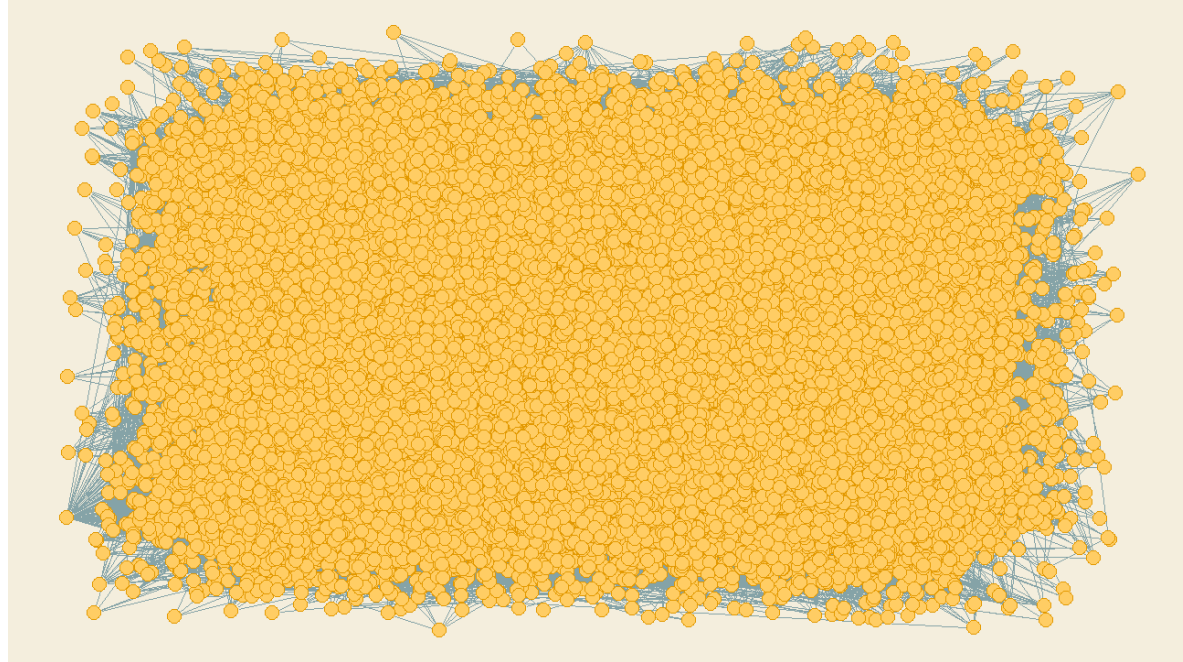
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6. Network from COLS [MUL] in affiliation network N4 (36036)

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Date = 2002-03-31 Total number of members in BoD = 19711
 Date = 2002-03-31 Maximum number of BoDs a person was part of = 17
 Date = 2002-03-31 Average number of BoDs a person was part of = 1.298361321089747

Date = 2006-03-31 Total number of members in BoD = 45128
 Date = 2006-03-31 Maximum number of BoDs a person was part of = 31
 Date = 2006-03-31 Average number of BoDs a person was part of = 1.3718755539797909

Date = 2009-03-31 Total number of members in BoD = 36035
 Date = 2009-03-31 Maximum number of BoDs a person was part of = 30
 Date = 2009-03-31 Average number of BoDs a person was part of = 1.3492992923546552

Date = 2002-03-31 Top 10 members in BoD and the companies they were a part of:

Member	Companies
Ravi Puri	'Vaibhav Software & Estate Ltd.', 'Unitech Residential Resorts Ltd.', 'Surakshit Constructions & Trading Ltd.', 'Sundram Builders Ltd.', 'Shashank Builders &

	Contracts Ltd.', 'Riverside Properties Ltd.', 'Ratika Constructions Ltd.', 'Pink Palace Invest & Contract Ltd.', 'Mumbai Builders Ltd.', 'Mahananda Builders Ltd.', 'Jhamman Builders & Contractors Ltd.', 'Iccha Shakti Builders Ltd.', 'Ichchha Shakti Constructions & Invest Ltd.', 'Daynasore Constructions & Invest. Ltd.', 'Cref Finance Ltd.', 'Classic Infrastructure & Devp. Ltd.', 'Achates Builders & Constructions Ltd.'
S K Jain	'Uniworth Ltd.', 'S P S International Ltd.', 'Rajdhani Nursuries Ltd.', 'Niryat-Sam Apparels (India) Ltd.', 'Narottam Investments & Trading Co. Ltd.', 'Maharashtra Seamless Ltd.', 'M V Cotspin Ltd.', 'Jaiprakash Industries Ltd. [Merged]', 'Jaipur Polyspin Ltd. [Merged]', 'Inox Air Products Ltd.', 'Inox India Ltd.', 'Inox Leasing & Finance Ltd.', 'Indo Vanillon Chemicals Ltd.', 'English Indian Clays Ltd.', 'Delhi Flour Mills Co. Ltd.', 'Beeyu Overseas Ltd.'
R K Agarwal	'Union Roadways Ltd.', 'T C I Industries Ltd.', 'Suryajyoti Spinning Mills Ltd.', 'Suryavanshi Textiles Ltd.', 'Rajasthan Rajya Vidyut Utpadan Nigam Ltd.', 'Prima Agro Ltd.', 'Prima Industries Ltd.', 'N E P C India Ltd.', 'Jodhpur Vidyut Vitran Nigam Ltd.', 'Jaipur Vidyut Vitran Nigam Ltd.', 'H T Interactive Media Properties Ltd.', 'Genus Power Infrastructures Ltd.', 'Emami Paper Mills Ltd.', 'Emami Paper Mills Ltd. [Merged]', 'Bihar Sponge Iron Ltd.', 'Aafloat Textiles (India) Ltd.'
N Srinivasan	'United Nilgiri Tea Estates Co. Ltd.', 'United Breweries (Holdings) Ltd.', 'Tractors & Farm Equipment Ltd.', 'Spencer & Co. Ltd.', 'Raasi Cement Ltd.', 'Madan Capital Market Ltd.', 'India Cements Ltd.', 'I C L International Ltd.', 'I C L Securities Ltd.', 'I C L Shipping Ltd.', 'I C L Sugars Ltd.', 'Herbertsons Ltd. [Merged]', 'Chemplast Sanmar Ltd.', 'Ceat Ltd.', 'Andhra Pradesh Paper Mills Ltd.', 'Ador Multiproducts Ltd.'
V Subramanian	'Wada Industrial Estate Ltd.', 'Sambhaw Holdings Ltd.', 'Rado Tyres Ltd.', 'Precot Meridian Ltd.', 'Jeya Bharath Benefit Fund Ltd.', 'Indian Airlines Ltd. [Merged]', 'India

	Tourism Devp. Corpn. Ltd.', 'Hotel Corpn. Of India Ltd.', 'Galada Power & Telecommunication Ltd.', 'Chettinad Cement Corpn. Ltd.', 'Binani Energy Pvt. Ltd.', 'B T Composites Ltd.', 'Alpha Garments Pvt. Ltd.', 'Air India Ltd. [Merged]', 'Airports Authority Of India'
A K Jain	'Usha International Ltd. [Merged]', 'Sona Koyo Steering Systems Ltd.', 'Rishabh Ispaat Ltd.', 'Olympic General Trading Ltd.', 'Ipca Laboratories Ltd.', 'Indian Seamless Metal Tubes (Kalyani Seamless Tubes) Ltd. [Merged]', 'Ind-Swift Laboratories Ltd.', 'Ind-Swift Ltd.', 'I S M T Ltd.', 'Dhanashree Electronics Ltd.', 'Delhi Flour Mills Co. Ltd.', 'Bulk Cement Corpn. (India) Ltd.', 'Bhilai Engineering Corpn. Ltd.', 'A C C Ltd.', 'A C C Mineral Resources Ltd.'
S K Gupta	'Vishvjyoti Trading Ltd.', 'Tata Communications Ltd.', 'Stewarts & Lloyds Of India Ltd.', 'Samtex Fashions Ltd.', 'Prima Industries Ltd.', 'Hanuman Agro Inds. Ltd.', 'Damodhar Cement & Slag Ltd. [Merged]', 'D L F Commercial Developers Ltd.', 'D L F Financial Services Ltd.', 'D L F Services Ltd. [Merged]', 'D L F Universal Ltd.', 'B T Tech Net Ltd.', 'B M F Beltings Ltd. [Merged]', 'Ahmadpur Katwa Railway Co. Ltd.'
Asjit Singh Shihn	'Vaibhav Software & Estate Ltd.', 'Surakshit Constructions & Trading Ltd.', 'Sundram Builders Ltd.', 'Shashank Builders & Contracts Ltd.', 'Riverside Properties Ltd.', 'Ratika Constructions Ltd.', 'Pink Palace Invest & Contract Ltd.', 'Mumbai Builders Ltd.', 'Mahananda Builders Ltd.', 'Jhamman Builders & Contractors Ltd.', 'Iccha Shakti Builders Ltd.', 'Ichchha Shakti Constructions & Invest Ltd.', 'Daynasore Constructions & Invst. Ltd.', 'Achates Builders & Constructions Ltd.'
Ashok Kumar	'Zubeda Hospitals Ltd.', 'Tata Metaliks Ltd.', 'Steel Strips Wheels Ltd.', 'Rites Ltd.', 'Oswal Overseas Ltd.', 'Indo Continental Hotels & Resorts Ltd.', 'H S C C (India) Ltd.', 'Globus Spirits Ltd.', 'Delhi State Indl. & Infrastruture Devop. Corpn. Ltd.', 'Bharat Wagon & Engg.

	Co. Ltd.', 'Ashirwad Steels & Inds. Ltd.', 'Alpine Environmental Engineers Ltd.', 'Allahabad Bank', 'Aditya Birla Chemicals (India) Ltd.'
N Ramachandran	'Rubber Products Ltd.', 'Raasi Cement Ltd.', 'Kerala State Cashew Devp. Corpn. Ltd.', 'Kashipur Holdings Ltd.', 'Jubilee Cements Ltd.', 'Industrial Chemicals & Monomers Ltd.', 'India Cements Capital Ltd.', 'India Cements Ltd.', 'I C L Financial Services Ltd.', 'I C L International Ltd.', 'I C L Securities Ltd.', 'I C L Shipping Ltd.', 'I C L Sugars Ltd.'

Date = 2006-03-31 Top 10 members in BoD and the companies they were a part of:

Member	Companies
R K Agarwal	['Zee Akaash News Pvt. Ltd.', 'Tinsukia Development Corpn. Ltd.', 'T C I Industries Ltd.', 'Suryajyoti Spinning Mills Ltd.', 'Spin Investment (India) Ltd.', 'Shri Radha Krishna Brokers & Holdings Ltd.', 'Rohilkhand Financiers Ltd.', 'Rajasthan State Ganganagar Sugar Mills Ltd.', 'Rajasthan Udyog & Tools Ltd.', 'Rajasthan Electronics & Instruments Ltd.', 'Rajasthan Rajya Vidyut Utpadan Nigam Ltd.', 'Pradeep Metals Ltd.', 'Passary Minerals Ltd.', 'Neptune Exports Ltd.', 'Madho Properties Ltd.', 'Jodhpur Vidyut Vitran Nigam Ltd.', 'Jaipur Vidyut Vitran Nigam Ltd.', 'Instrumentation Control Valves Ltd.', 'Indiabulls Securities Ltd.', 'Himgiri Foods Ltd.', 'Hanil Era Textiles Ltd.', 'Genus Power Infrastructures Ltd.', 'G E E Ltd.', 'Eurotex Industries & Exports Ltd.', 'Emami Paper Mills Ltd.', 'Dalmia Minerals & Properties Ltd.', 'Dalmia Power Ltd.', 'Dalmia Solar Power Ltd.', 'Assam Carbon Products Ltd.', 'Arjuna Brokers & Minerals Ltd.', 'Ankit Commerce Ltd.')
S K Jain	'Vision Comptech Integrators Ltd.', 'Vardhan

	<p>Ltd.', 'Shree Tulsi Online.Com Ltd.', 'S P M L India Ltd.', 'S P S International Ltd.', 'Rattan Vanaspati Ltd.', 'R S Software (India) Ltd.', 'Punjab & Sind Bank', 'Powerlink Oil Refinery Ltd.', 'Niryat-Sam Apparels (India) Ltd.', 'Niraj Jindal Ispat Udyog Ltd.', 'New Era Entertainment Network Ltd. [Merged]', 'National Plywood Inds. Ltd.', 'Mahananda Securities Ltd.', 'M V Cotspin Ltd.', 'Kisan Mouldings Ltd.', 'Jaiprakash Associates Ltd.', 'Jaiprakash Power Ventures Ltd.', 'J P T Securities Ltd.', 'International Diamond Services Ltd.', 'Inox Air Products Ltd.', 'Indraprastha Gas Ltd.', 'Indo Vanillon Chemicals Ltd.', 'Indo Borax & Chemicals Ltd.', 'Delhi Towers Ltd.', 'Bharat Heavy Electricals Ltd.', 'Beeyu Overseas Ltd.', 'Avon Mercantile Ltd.'</p>
Sanjay Gupta	<p>'Volex Finance & Inds. Ltd.', 'Venkateshwar Vanijya India Ltd.', 'Vardhman Acrylics Ltd.', 'Suvridhi Financial Services Ltd.', 'Supreme Tex Mart Ltd.', 'Southern Ispat & Energy Ltd.', 'Shivalik Agro Poly Products Ltd.', 'Shirpur Gold Refinery Ltd.', 'Right Address Ltd.', 'Rich Universe Network Ltd.', 'Rampur Engineering Co. Ltd.', 'Ram Krishan Kulwant Rai Enterprises Ltd.', 'Prima Agro Ltd.', 'Prima Industries Ltd.', 'Metro Tyres Ltd.', 'Mark Exhaust Systems Ltd.', 'Kajal (India) Ltd.', 'Jindal Cotex Ltd.', 'Jagran Prakashan Ltd.', 'J M D Alloys Ltd.', 'J J Finance Corpn. Ltd.', 'Interworld Digital Ltd.', 'Hind Comtel Ltd.', 'Era E-Zone (India) Ltd.', 'Clarity Financial Services Ltd.', 'Adani Energy Ltd.', 'A P L Apollo Tubes Ltd.'</p>
N Srinivasan	<p>'United Nilgiri Tea Estates Co. Ltd.', 'United Breweries (Holdings) Ltd.', 'Tractors & Farm Equipment Ltd.', 'Southern Energy Devp. Corpn. Ltd.', 'Southern Fuel Ltd.', 'Raasi Cement Ltd.', 'Peria Karamalai Tea & Produce Co. Ltd.', 'Murugappa Management Services Ltd.', 'Mcdowell Holdings Ltd.', 'M M Forgings Ltd.', 'India Cements Capital Ltd.', 'India Cements Ltd.', 'I C L International Ltd.', 'I C L Securities Ltd.', 'I C L Shipping Ltd.', 'I C L Sugars Ltd.', 'Essar Ports Ltd.', 'Emcee Telecom Ltd.', 'E W S Finance & Investments Pvt. Ltd.', 'Coromandel Sugars Ltd.',</p>

	'Bhuwalka Steel Inds. Ltd.', 'Anu'S Laboratories Ltd.', 'Andhra Pradesh Gas Power Corpn. Ltd.', 'Andhra Pradesh Paper Mills Ltd.', 'Amco Batteries Ltd.', 'Ador Fontech Ltd.', 'Ador Multiproducts Ltd.'
R Srinivasan	'Yuken India Ltd.', 'Wimco Ltd.', 'Tube Investments Of India Ltd.', 'T S L Techno Services Ltd.', 'T T K Healthcare Ltd.', 'T T K Prestige Ltd.', 'Sundram Fasteners Ltd.', 'Shriram Pistons & Rings Ltd.', 'Redington (India) Ltd.', 'Rane Investments Ltd.', 'Rajath Finance Ltd.', 'Pill Finance & Investments Ltd.', 'N T T F Industries Ltd.', 'Mcleod Russel India Ltd.', 'Lumiere Coolants Ltd.', 'Kirlokar Industries Ltd.', 'Hanover Securities & Invst. Mgmt. Ltd.', 'Espiem Plasticss Ltd.', 'Eltex Super Castings Ltd. [Merged]', 'East Coast Terminal Operations & Port Services Ltd.', 'D C M Hyundai Ltd.', 'Bhoruka Steel & Services Ltd.', 'A T C Ltd.', 'A B I-Showatech (India) Ltd.', 'A C E Designers Ltd.'
S K Gupta	'West Bengal State Electricity Board', 'Viom Networks Ltd.', 'Tata Teleservices Ltd.', 'Sunflag Iron & Steel Co. Ltd.', 'Samtex Fashions Ltd.', 'S S A International Ltd.', 'Ring Plus Aqua Ltd.', 'Rajasthan Udyog & Tools Ltd.', 'Prima Industries Ltd.', 'Mcleod & Co. Ltd.', 'Katakhal Lala Bazar Railway Co. Ltd.', 'Jindal South West Holdings Ltd.', 'J S W Steel Ltd.', 'Gadchiroli Metals & Minerals Ltd.', 'Deccan Mechanical & Chemical Inds. Ltd.', 'D T Cinemas Ltd.', 'Craig Jute Mills Ltd.', 'Cent Bank Home Finance Ltd.', 'Centbank Financial & Custodial Services Ltd.', 'Bormah Jan Tea Co. (1936) Ltd.', 'B T Tech Net Ltd.', 'Avon Mercantile Ltd.', 'Ahmedabad-Vadodara Expressway Co. Ltd.'
R K Gupta	'Vintron Informatics Ltd.', 'Vegepro Foods & Feeds Ltd.', 'V & K Softech Ltd.', 'Swastik Spintex Ltd.', 'Surya India Ltd.', 'Speciality Coatings & Laminations Ltd.', 'Shyam Indospin Ltd.', 'Seasons Furnishings Ltd.', 'Seasons Textiles Ltd.', 'Ravindra Tubes Ltd.', 'Rajasthan Rajya Vidyut Utpadan Nigam Ltd.', 'Plenty Valley Intra Ltd.', 'Pipavav Shipyard Ltd.', 'Pearl Polymers Ltd.', 'Pasupati Acrylon Ltd.', 'Pasupati Fabrics Ltd.', 'Kirlokar

	Electric Co. Ltd.', 'Hindustan Wires Ltd.', 'G K B Ophthalmics Ltd.', 'Chandrima Mercantiles Ltd.', 'Brahmaputra Valley Fertilizer Corpn. Ltd.', 'Bhushan Power & Steel Ltd.'
A K Jain	'Usha International Ltd. [Merged]', 'Usha (India) Ltd.', 'Tungabhadra Steel Products Ltd.', 'Shree Tulsi Online.Com Ltd.', 'S K G Consolidated Ltd.', 'Rajasthan Renewable Energy Corpn. Ltd.', 'Pioneer Finvest Ltd.', 'Oil India Ltd.', 'Jessop & Co. Ltd.', 'Ipca Laboratories Ltd.', 'International Diamond Services Ltd.', 'I S M T Ltd.', 'I B P Co. Ltd. [Merged]', 'Everest Industries Ltd.', 'Dabur India Ltd.', 'Bhilai Engineering Corpn. Ltd.', 'Bharat Pumps & Compressors Ltd.', 'Bharat Yantra Nigam Ltd.', 'Bharat Heavy Plate & Vessels Ltd.', 'Balmer Lawrie & Co. Ltd.', 'Balmer Lawrie Invsts. Ltd.'
V K Gupta	'Usha Housing Devp. Co. Ltd.', 'Sunita Gupta Share Brokers Ltd.', 'Sarthak Industries Ltd.', 'S P B L Ltd. [Merged]', 'R P G Paging Services Ltd.', 'Onida Saka Ltd.', 'Omax Autos Ltd.', 'Lord Krishna Bank Ltd. [Merged]', 'Jyoti Holdings Pvt. Ltd. (Kolkata)', 'Jubilee Investments & Industries Ltd.', 'Jindal Meadows Ltd.', 'Jindal Photo Ltd.', 'Eurotex Industries & Exports Ltd.', 'Delhi Safe Deposit Co. Ltd.', 'Delton Cables Ltd.', 'Crystal Cable Inds. Ltd.', 'Continental Petroleums Ltd.', 'Cenlub Industries Ltd.', 'C M S Computers Ltd.', 'A Infrastructure Ltd.'
K C Gupta	'Vittatum Ltd.', 'Vasundhara Rasayans Ltd.', 'Triton Corp Ltd.', 'Sonali Commercial Ltd.', 'Ricon Commerce Ltd.', 'Rajpur Farms Ltd.', 'Rajendra Seclease Ltd.', 'Ponderosa Holdings Ltd.', 'Pasari Spinning Mills Ltd.', 'Master Exchange & Finance Ltd.', 'Maritime Association Of Shipowners Shipmanagers & Agents', 'Lead Financial Services Ltd.', 'Intravest (India) Ltd.', 'Hargaon Investment & Trading Co. Ltd.', 'Hargaon Properties Ltd.', 'Crassula Ltd.', 'Condides Ltd.', 'Columnea Ltd.', 'Billbergea Ltd.', 'Arventea Ltd.'

Date = 2009-03-31 Top 10 members in BoD and the companies they were a part of:

Member	Companies
R Srinivasan	'Yuken India Ltd.', 'Tube Investments Of India Ltd.', 'T S L Techno Services Ltd.', 'T T K Healthcare Ltd.', 'T T K Prestige Ltd.', 'Sundram Fasteners Ltd.', 'Shriram Pistons & Rings Ltd.', 'Redington (India) Ltd.', 'Rane Investments Ltd.', 'Mcleod Russel India Ltd.', 'Lumiere Coolants Ltd.', 'Kirkoskar Industries Ltd.', 'J Kumar Infraprojects Ltd.', 'I T C Infotech India Ltd.', 'Hindustan Aeronautics Ltd.', 'Hanover Securities & Invst. Mgmt. Ltd.', 'Cholamandalam M S General Insurance Co. Ltd.', 'A T C Ltd.', 'A B I-Showatech (India) Ltd.'
R K Agarwal	'Tinsukia Development Corpn. Ltd.', 'T C I Industries Ltd.', 'Suryajyoti Spinning Mills Ltd.', 'Sophia Exports Ltd.', 'Shree Nirman Ltd.', 'Rajasthan Udyog & Tools Ltd.', 'Pradeep Metals Ltd.', 'Indiabulls Securities Ltd.', 'Hindusthan Engineering & Inds. Ltd.', 'Hanil Era Textiles Ltd.', 'Genus Power Infrastructures Ltd.', 'G E E Ltd.', 'Daverashola Estates Pvt. Ltd.', 'British India Corpn. Ltd.', 'Asutosh Enterprises Ltd.'
Sanjay Gupta	'Vardhman Acrylics Ltd.', 'Tirupati Services Ltd.', 'Supreme Tex Mart Ltd.', 'Shri Lakshmi Metal Udyog Ltd.', 'Shivalik Agro Poly Products Ltd.', 'Shirpur Gold Refinery Ltd.', 'Rampur Engineering Co. Ltd.', 'Prima Agro Ltd.', 'Prima Industries Ltd.', 'Mark Exhaust Systems Ltd.', 'K Sera Sera Ltd.', 'Jhagadia Copper Ltd.', 'Jagran Prakashan Ltd.', 'J J Finance Corpn. Ltd.', 'Interworld Digital Ltd.', 'Godfrey Phillips India Ltd.', 'Firstsource Solutions Ltd.', 'Cosmos Cements Ltd.', 'Clarity Financial Services Ltd.', 'Biecco Lawrie Ltd.', 'Bharti A X A Invst. Managers Pvt. Ltd.', 'Apollo Metalex Pvt. Ltd.', 'Anjney Investments & Trading Co. Ltd.'
S K Jain	'Vardhan Ltd.', 'Suraj Industries Ltd.', 'S P S International Ltd.', 'R S Software (India) Ltd.', 'Pasupati Fabrics Ltd.', 'Nuclear Power Corpn. Of India Ltd.', 'Niraj Jindal Ispat Udyog Ltd.', 'National Plywood Inds. Ltd.', 'Master

	Channel Community Network Pvt. Ltd.', 'Maharashtra Elektros melt Ltd. [Merged]', 'Kisan Mouldings Ltd.', 'Jaiprakash Associates Ltd.', 'Jaiprakash Power Ventures Ltd.', 'J P T Securities Ltd.', 'Inox Air Products Ltd.', 'Indraprastha Gas Ltd.', 'Indo Borax & Chemicals Ltd.', 'Hindustan Vacuum Glass Pvt. Ltd.', 'G C I L Finance Ltd.', 'Bhilai Engineering Corpn. Ltd.', 'Bharat Starch Products Ltd.', 'Beeyu Overseas Ltd.'
N Srinivasan	'W S Industries (India) Ltd.', 'United Nilgiri Tea Estates Co. Ltd.', 'United Breweries (Holdings) Ltd.', 'U B Engineering Ltd.', 'Tube Investments Of India Ltd.', 'Tractors & Farm Equipment Ltd.', 'T A F E Motors & Tractors Ltd.', 'Southern Fuel Ltd.', 'Redington (India) Ltd.', 'Raasi Cement Ltd.', 'Mcdowell Holdings Ltd.', 'M M Forgings Ltd.', 'Integra India Group Co. Ltd.', 'India Cements Capital Ltd.', 'India Cements Ltd.', 'I C L Financial Services Ltd.', 'I C L International Ltd.', 'I C L Securities Ltd.', 'I C L Shipping Ltd.', 'Essar Bulk Terminal (Salaya) Ltd.', 'Essar Ports Ltd.', 'Coromandel Sugars Ltd.', 'Cholamandalam Investment & Finance Co. Ltd.', 'Cholamandalam M S General Insurance Co. Ltd.', 'Bhuwalka Steel Inds. Ltd.', 'Best & Crompton Engg. Ltd.', 'Andhra Pradesh Gas Power Corpn. Ltd.', 'Andhra Pradesh Paper Mills Ltd.', 'Amco Batteries Ltd.', 'Ador Fontech Ltd.'
R Subramanian	'Viceroy Hotels Ltd.', 'V S T Tillers Tractors Ltd.', 'Sterling Holiday Resorts (India) Ltd.', 'Sezal Glass Ltd.', 'Sandur Manganese & Iron Ores Ltd.', 'Lotus Eye Care Hospital Ltd.', 'Kamala Sugar Mills Ltd.', 'Ircan International Ltd.', 'Blue Green Constructions & Investments Ltd.', 'Bartronics India Ltd.', 'Associated Auto Parts Pvt. Ltd.'
G Bhaskara Rao	'Lanco Budhil Hydro Power Pvt. Ltd.', 'Lanco Industries Ltd.', 'Lanco Infratech Ltd.', 'Clarion Power Corpn. Ltd.', 'Aban Power Co. Ltd.'
J N Godrej	'Godrej & Boyce Mfg. Co. Ltd.', 'Godrej Industries Ltd.', 'Godrej Investments Pvt. Ltd.', 'Geometric Ltd.', 'Bajaj Auto Ltd.'

If you analyze networks at the group level, what patterns emerge?

Tata group

degree centrality

Company with highest degree centrality from the Tata group is : Tata Coffee Ltd.

Person with highest degree centrality from the Tata group is : S Ramakrishnan

betweenness centrality

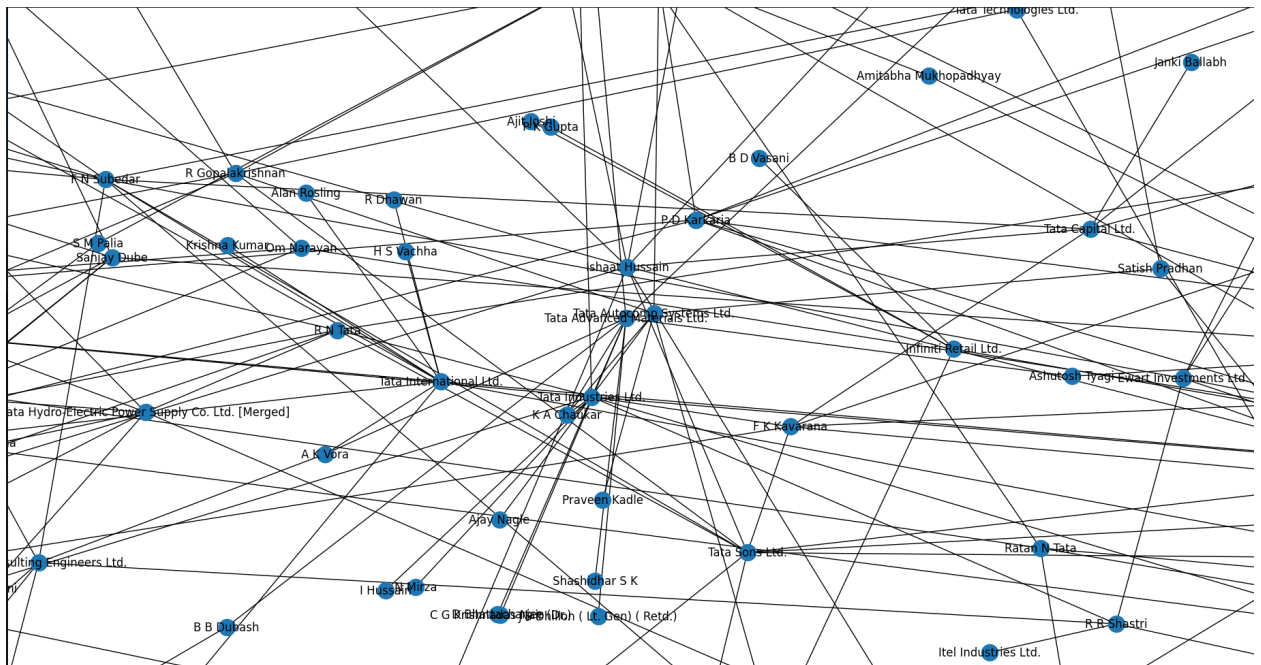
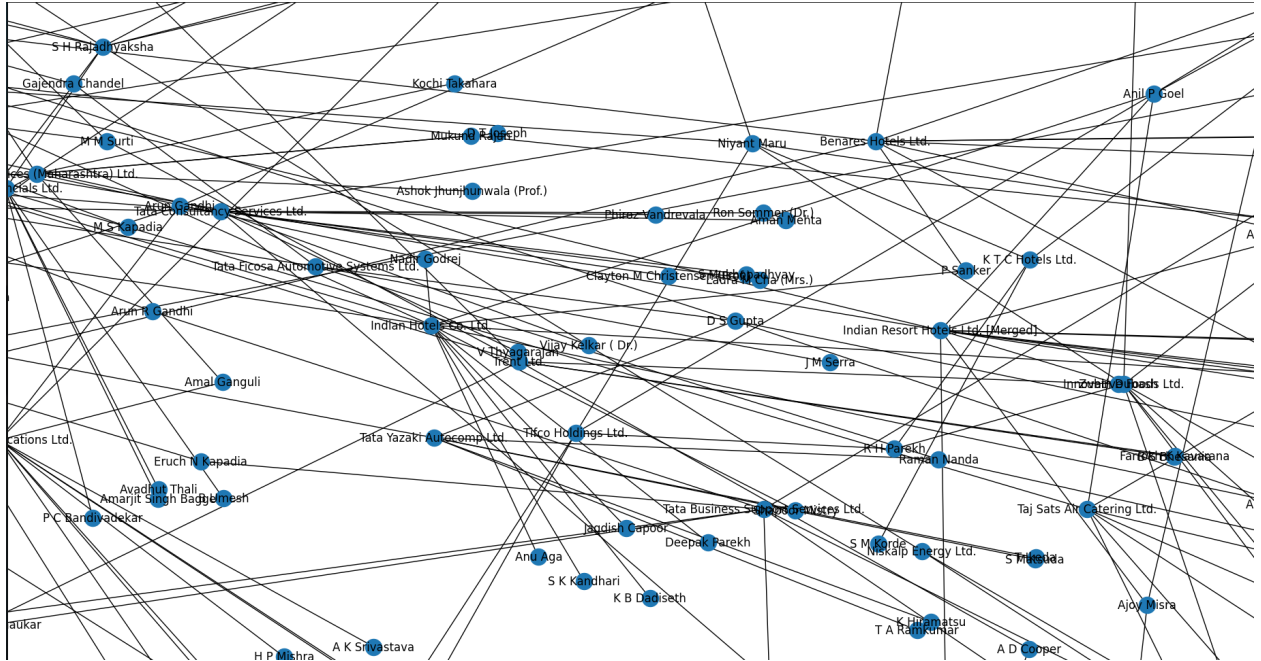
Company with highest betweenness centrality from the Tata group is : Tata Sons Ltd.

Person with highest betweenness centrality from the Tata group is : R K Krishna Kumar

closeness centrality

Company with highest closeness centrality from the Tata group is : Tata Sons Ltd.

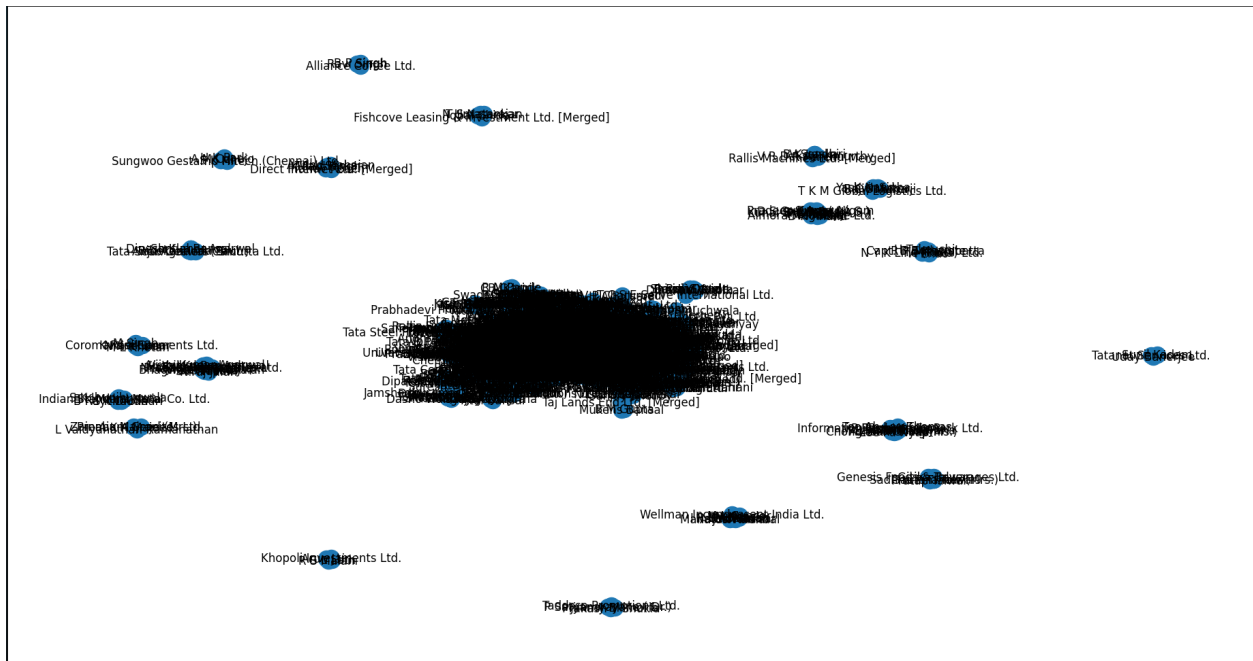
Person with highest closeness centrality from the Tata group is : R K Krishna Kumar



Rafiqul
Alliance Coffee Ltd.

N. U. Khan
Iqbal Chaudhary
Fishcove Leasing & Investment Ltd. [Merged]

Tatanet Services Ltd.
Uday Banerjee
Sunil Khadam



There is a large cluster of important companies and their directors in the Tata groups and many small clusters of smaller companies(like Tatanet Services Ltd, Alliance Coffee Ltd) and their directors. The directors of the smaller companies are not on the board of directors of larger companies. The board of directors of larger companies have multiple memberships in different companies. The most important company in the Tata Group is Tata Sons Ltd, and the most important person is R K Krishna Kumar.

Adani Group

degree centrality

Company with highest degree centrality from the Adani group is : Mundra Port & Special Economic Zone Ltd.

Person with highest degree centrality from the Adani group is : Rajesh S Adani

betweenness centrality

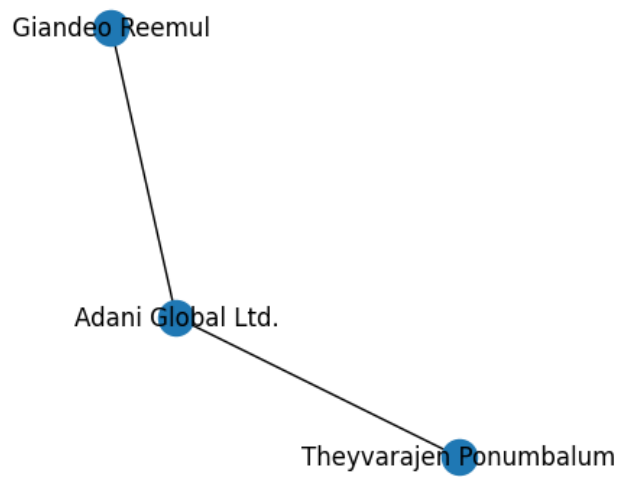
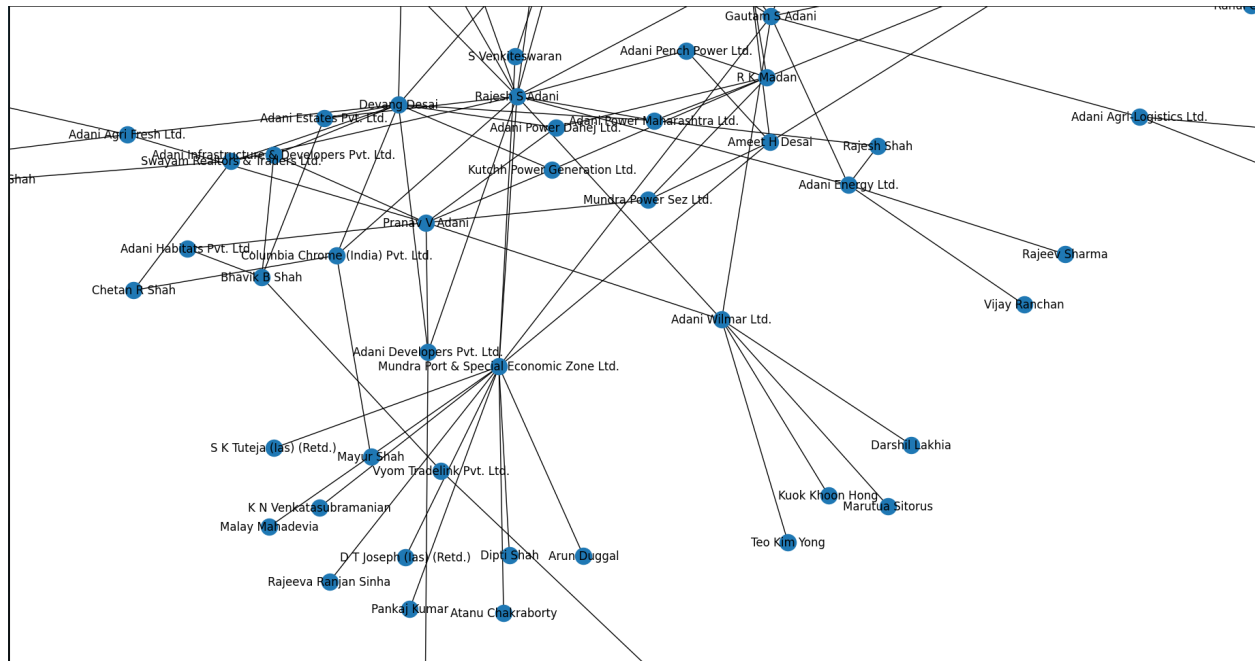
Company with highest betweenness centrality from the Adani group is : Mundra Port & Special Economic Zone Ltd.

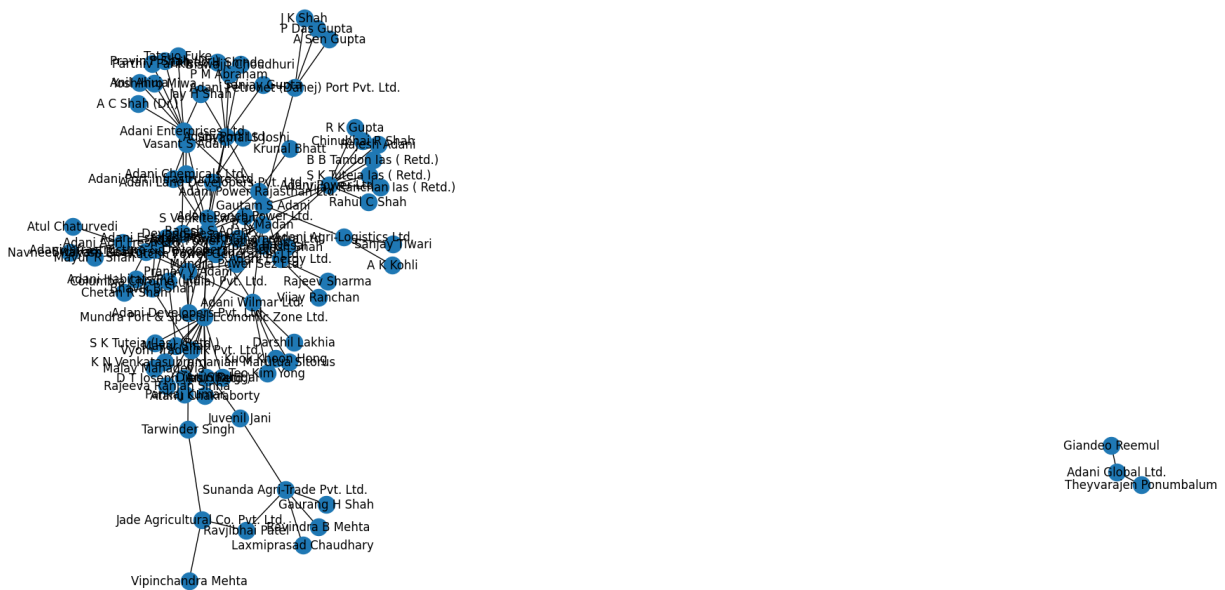
Person with highest betweenness centrality from the Adani group is : Rajesh S Adani

closeness centrality

Company with highest closeness centrality from the Adani group is : Adani Enterprises Ltd.

Person with highest closeness centrality from the Adani group is : Rajesh S Adani





Like the Tata Group, Adani Group has a big cluster of companies and their director. But, there is only one small cluster of Adani Global Ltd. The board of directors of larger companies have multiple memberships in different companies. The most important company in the Adani Group is Mundra Port & Special Economic Zone Ltd., and the most important person is Rajesh S Adani.

Analysing homophily in the 1-mode projections -

Homophily in the director and firm networks were analysed independently.

For the director network, we considered an edge between two directors to be homogeneous if they have the same last name. Homophily in this case would indicate preference of directors to have people related to them in the boards they serve in. We computed the fraction of these homogeneous edges in the graph, and the expected fraction of such edges if the associations were formed randomly. The fraction of these homogeneous edges is almost over 10 times the expected fraction in absence of homophily. This indicates that the director networks exhibit a significant amount of homophily. However, the homophily in the director network seems to be reducing with time as the fraction of homogeneous edges reduced from over 20 times its expected value in 2002 to slightly over 10 times in 2009.

For the firm network, we considered an edge between two firms to be homogeneous if they belong to the same group. This represents the preference of a company to have a director who is also a director in some other company within the group. We computed the fraction of these homogeneous edges in the graph, and the expected fraction of such edges if the associations

were formed randomly. The fraction of these homogeneous edges shows quite a lot of variation over time. There is small evidence of homophily in some years.

Year	Director network		Firm network	
	Actual	Expected	Actual	Expected
2002	7.90%	0.31%	39.07%	22.45%
2006	4.04%	0.41%	43.10%	43.48%
2009	4.07%	0.33%	44.07%	35.82%

From the bipartite graph you can do 1-mode projections

Eg: as in firmnetwork.xlsx

You can also do a director network

Try to see which firms are central

You also have information on companies in CompanyStatic_P4.txt

Includes age of incorporation etc

You can get an idea of which firms are 'big' by seeing if the nse / bse codes are in the bse100, bse 200, bse500 etc. or by looking at stock capitalisation

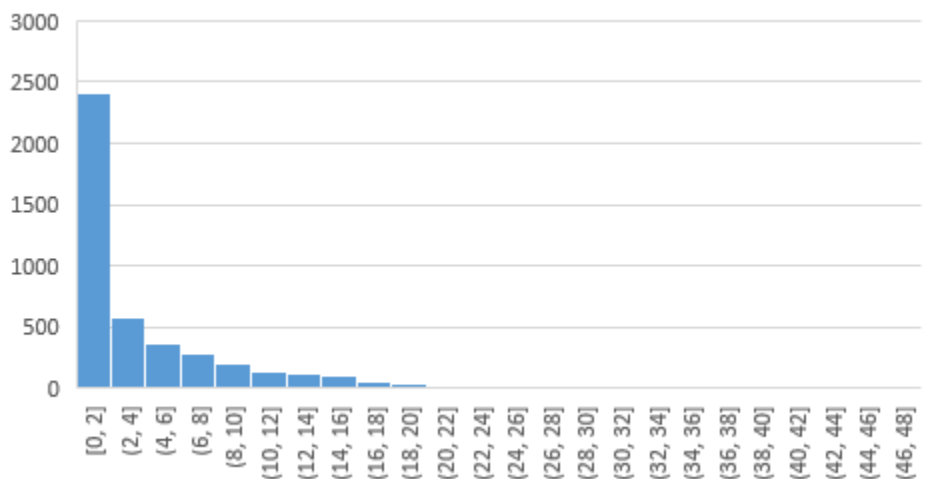
Top 15 companies as per degree centrality:-

2002

Tata Sons Ltd.	Unlisted on BSE	Unlisted on NSE
Tata Steel Ltd.	BSE group A	BSE 100, 200 and 500, Nifty 50
Ceat Ltd.	BSE 500 (group T)	Nifty 50
Larsen & Toubro Ltd.	BSE group A	Nifty 50
Prima Industries Ltd.	BSE group Z	Not included in BSE 100, 200, 500 or Nifty 50
Mahindra & Mahindra Ltd.	BSE group A	BSE100, BSE 200, Nifty 50 equal weight
Jaipur Polyspin Ltd. [Merged]	Unlisted on BSE	Unlisted on NSE
Texmaco Ltd.	BSE group B	Not on BSE 100, 200 or 500, or nifty 50
Bombay Dyeing & Mfg. Co. Ltd.	BSE group A	Not on BSE 100 and 200,
Stewarts & Lloyds Of India Ltd.	BSE group B	Not on BSE 100, 200 or 500, or nifty 50

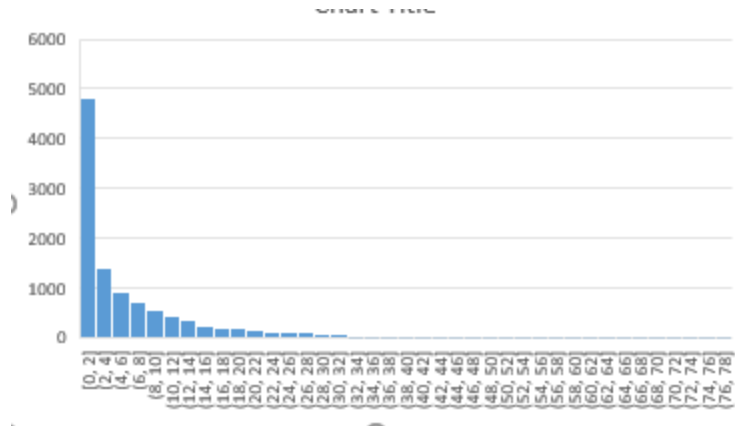
Tata Global Beverages Ltd.	BSE group A	BSE 100, 200 and 500, Nifty 50
Tata Housing Devp. Co. Ltd.	Listed on BSE	Not on BSE 100, 200 or 500, or nifty 50
Spencer & Co. Ltd.	Listed on BSE	Not on BSE 100, 200 or 500, or nifty 50
Tata Infotech Ltd. [Merged]	Unlisted on BSE	Unlisted on NSE
Bhilai Engineering Corpn. Ltd.	Unlisted on BSE	Unlisted on NSE

We see that it isn't necessary that the most central companies as per the one-mode projections are necessarily the "big ones" listed in the stock market. Some of these companies are even unlisted.



We can see that the distribution follows a power law approximately, few companies are connected to several others by the virtue of sharing common board members.

6432	Jaiprakash Associates Ltd.
10428	Aditya Birla Nuvo Ltd.
8277	Emami Paper Mills Ltd.
10566	A G R Investments Ltd.
3612	Piramal Healthcare Ltd.
7076	I A L Airport Services Ltd.
3192	Rajasthan Rajya Vidyut Utpadan Nigam Ltd.
3739	Pasupati Fabrics Ltd.
6776	Indo Continental Hotels & Resorts Ltd.
9481	Bharat Heavy Electricals Ltd.
7923	G E E Ltd.
3147	Rajasthan Udyog & Tools Ltd.
6348	Jessop & Co. Ltd.
6698	Inox Air Products Ltd.
8136	Eurotex Industries & Exports Ltd.



2009

Tube Investments Of India Ltd.
Bombay Dyeing & Mfg. Co. Ltd.
Essar Bulk Terminal (Salaya) Ltd.
Essar Ports Ltd.
Parsvnath Developers Ltd.
Godfrey Phillips India Ltd.
Cholamandalam M S General Insurance Co. Ltd.

Jhagadia Copper Ltd.

Sundram Fasteners Ltd.

Sundaram-Clayton Ltd.

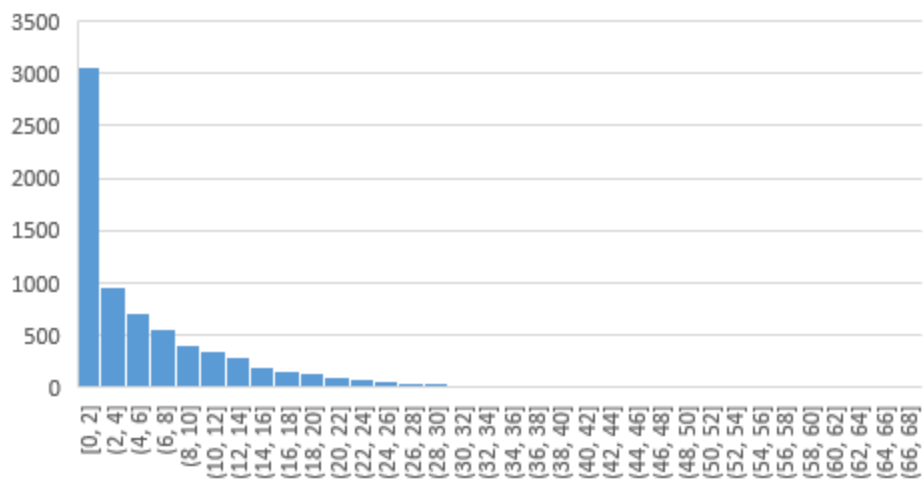
Jaiprakash Associates Ltd.

N T P C-S A I L Power Co. Pvt. Ltd.

Indo Continental Hotels & Resorts Ltd.

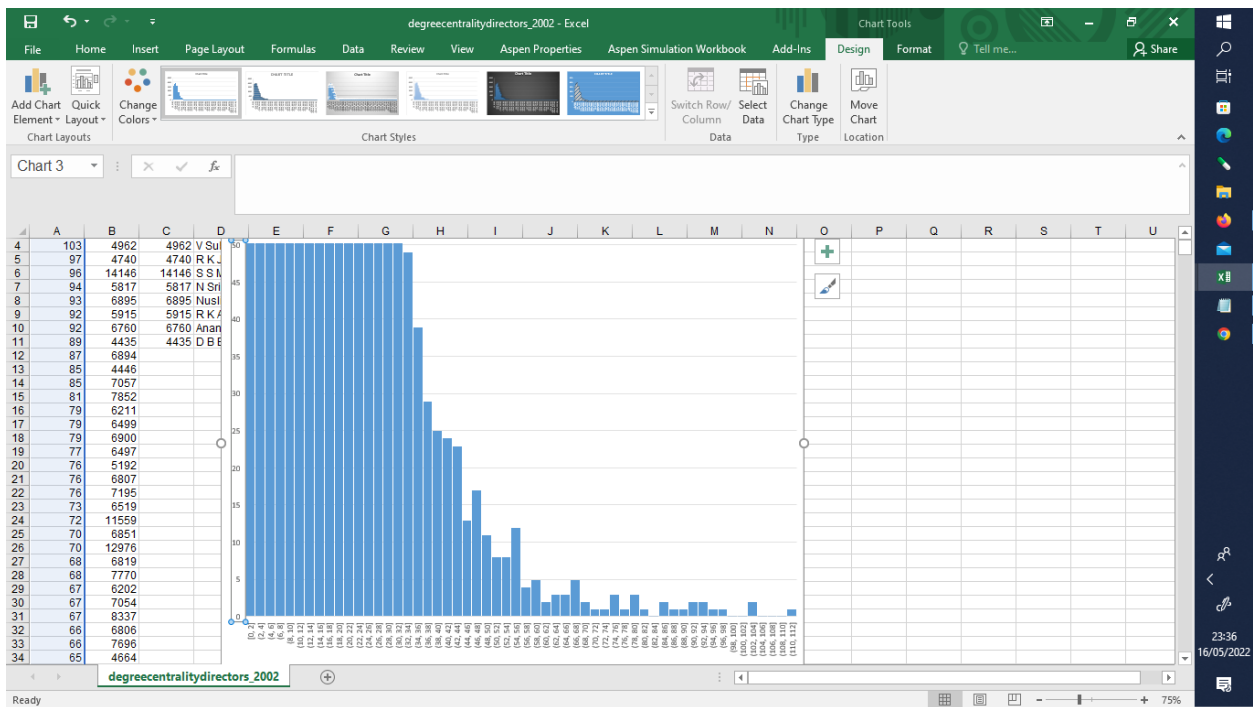
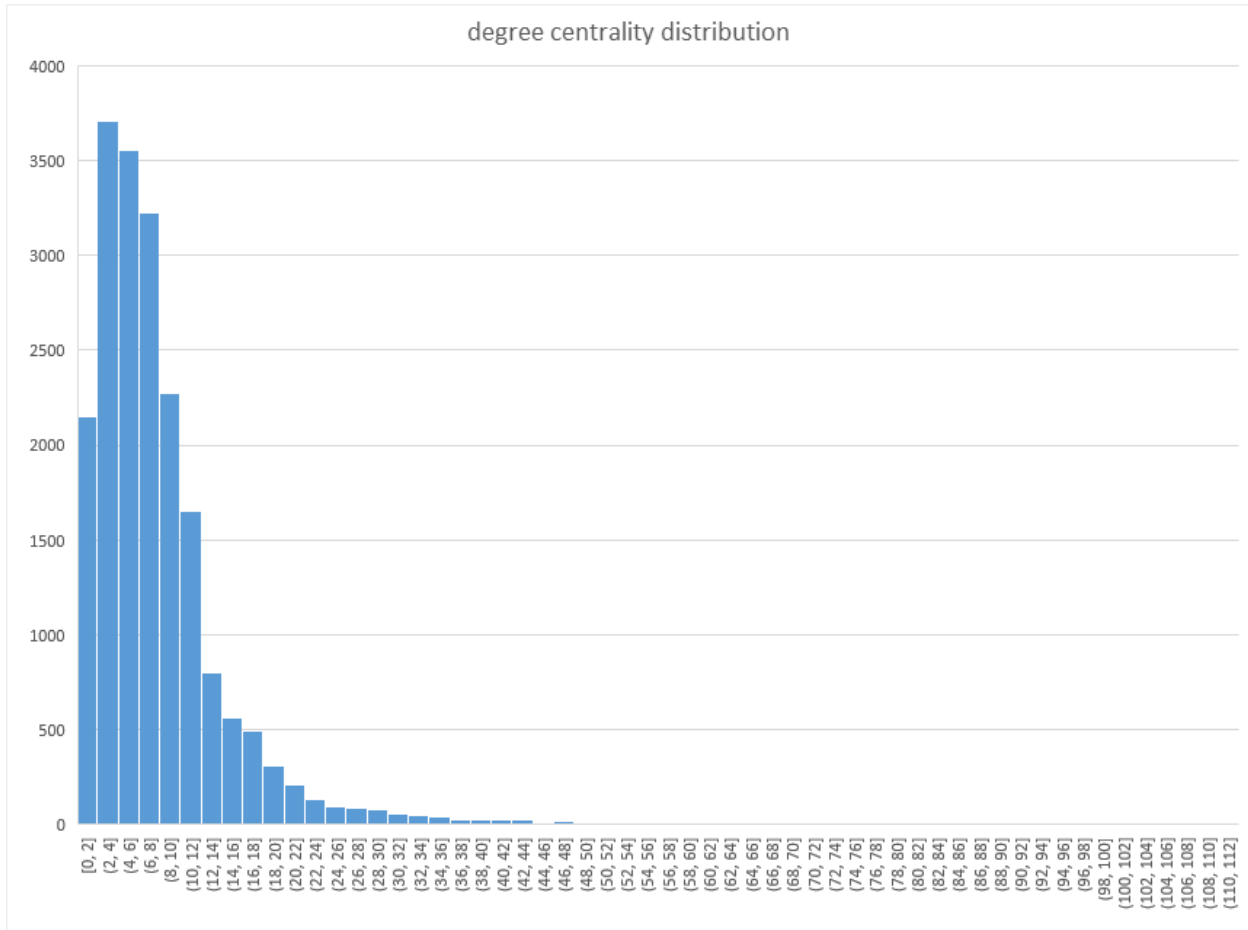
Madhav Marbles & Granites Ltd.

Best & Crompton Engg. Ltd.



2002 Central directors

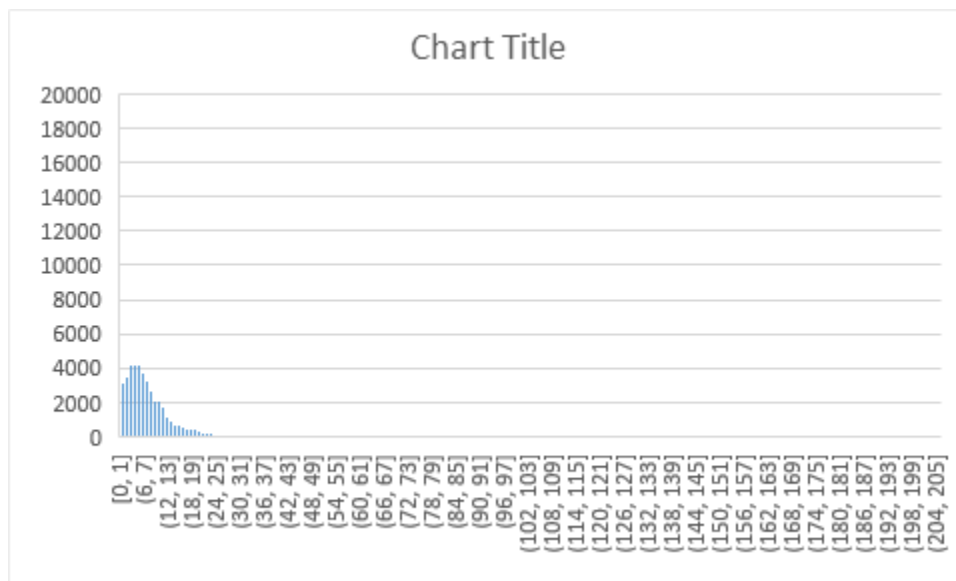
5787	S K Jain
5718	A K Jain
4962	V Subramanian
4740	R K Jain
14146	S S Marathe
5817	N Srinivasan
6895	Nusli N Wadia
5915	R K Agarwal
6760	Anand G Mahindra
4435	D B Engineer



(Zoomed in)

2006

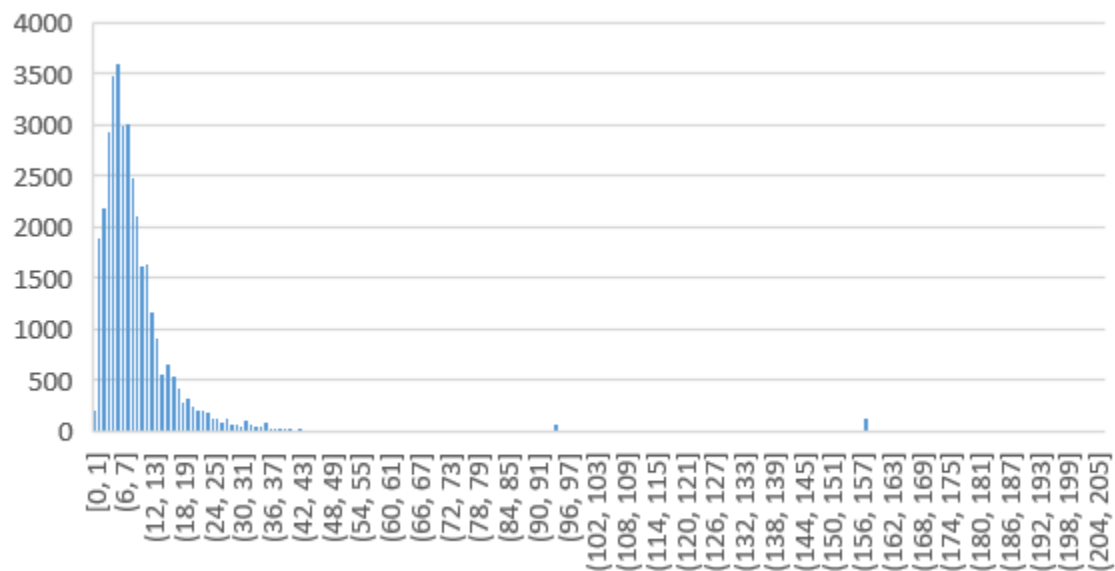
Richard T Raja
Ravindra Bhalwal
Santosh Gupta
Y P Trivedi
Mariamamma Babu
N Subba Reddy
P Augustine
D M Parikh
Md Osman Akthar
C N Ram



2009

7332	Y P Trivedi
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8246	N Srinivasan
9942	R P Singh
10557	Tushar Shah
20957	Prakash Parasher
8565	Sunil Saraf
15269	Mukesh Jain
12854	Virendra Jain
33903	Y Kamesh
17780	Jethabhai M Shah



Degree Distributions

Do firms that are central also have directors who are central ?

We analyze company & director centrality data obtained from 1 mode projections for 2002:

We see that: 0.56218 fractions of company nodes have degree centrality greater than 2

We see that:

0.522321

fractions of company nodes have degree centrality greater than 7

We define high centrality companies and high centrality directors as those that lie above respective thresholds. Rest are classified as low centrality nodes.

The fraction of edges that connect high centrality nodes to high centrality nodes or low centrality nodes to low centrality nodes are found to be 0.74906.

Fraction of edges that connect high centrality nodes to low centrality nodes or vice versa are 0.25094

However randomly this should have been $2 \times 0.522321 \times 0.56218 = 0.587$

However 0.25094 seems to be significantly lesser than this. Hence we can say that central firms usually have central directors.

How do directors choose which boards to serve on ?

What roles do they play ? (bridging / bonding ?)

How do directors choose which boards to serve on ?

What roles do they play ? (bridging / bonding ?)

2002

The average network clustering coefficient / transitivity (No of closed triangles/ total number of possible triangles)

In the 1 mode projection network on the director axis in 2002=0.591

In the 1 mode projection network on the director axis in 2006=0.653

In the 1 mode projection network on the director axis in 2009=0.728

We see that the clustering coefficient has increased over time which shows that people are more comfortable working with members whom they already know through a mutual connection.

The directors are working towards increasing their bridging capital.

We also look at network constraint:

Total network constraint in d

Now looking at the set of common nodes:-

Total constraint (As per Burt's metric of structural holes is) in 2002 is: 9830.46

Average constraint in 2002 is: 0.99735

Total constraint (As per Burt's metric of structural holes is) in 2006 is: 15352.59

Average Constraint in 2006 is 0.60985

Total constraint (As per Burt's metric of structural holes is) in 2009 is: 37756.41

Average Constraint in 2009 is 0.426035

Over the years we see that some people have found ways to maintain their relationships efficiently with less energy consumptions.

However We see that the average network constraint also decreases, which means structural holes have become stronger and bridging capital has increased on an average. This could be possible because the number of nodes in each network aren't constant and new actors have been introduced.

Hence we inspect the clustering coefficient and constraint changes in the common nodes:-

2002	1 "Company Name"	2006	1 Company Name	2009	1 Company Name				
	2 Zigma Software Ltd.		2 Zigma Software Ltd.		3 Zigma Software Ltd.				
	6 Zuari Industries Ltd.		11 Zuari Industries Ltd.		10 Zuari Industries Ltd.				
	7 Zuari Seeds Ltd.		12 Zuari Seeds Ltd.		15 Zuari Seeds Ltd.				
	9 Zyden Gentec Ltd.		14 Zyden Gentec Ltd.		16 Zyden Gentec Ltd.				
	13 Zylog Systems Ltd.		19 Zylog Systems Ltd.		19 Zylog Systems Ltd.				
	14 Zee Entertainment Enterprises		22 Zee Entertainment Enterprises		22 Zee Entertainment Enterprises Ltd.				
	17 Zen Infraventures India Ltd.		25 Zen Infraventures India Ltd.		25 Zen Infraventures India Ltd.				
	18 Zenith Computers Ltd.		29 Zenith Computers Ltd.		28 Zenith Computers Ltd.				
	19 Zenith Global Consultants Ltd.		33 Zenith Global Consultants Ltd.		33 Zenith Global Consultants Ltd.				
	20 Zenith Infotech Ltd.		35 Zenith Infotech Ltd.		35 Zenith Infotech Ltd.				
	26 Yuvraj International Ltd.		58 Yuvraj International Ltd.		52 Yuvraj International Ltd.				
	27 Z F Steering Gear (India) Ltd.		59 Z F Steering Gear (India) Ltd.		53 Z F Steering Gear (India) Ltd.				
	28 X O Infotech Ltd.		63 X O Infotech Ltd.		56 X O Infotech Ltd.				
	34 Yash Management & Satellite L		79 Yash Management & Satellite L		66 Yash Management & Satellite Ltd.				
	37 Wires & Fabriks (S.A.) Ltd.		85 Wires & Fabriks (S.A.) Ltd.		73 Wires & Fabriks (S.A.) Ltd.				
	39 Woodside Parks Ltd.		93 Woodside Parks Ltd.		75 Woodside Parks Ltd.				
	45 Window Glass Ltd.		109 Window Glass Ltd.		85 Window Glass Ltd.				
	47 Winsome Breweries Ltd.		111 Winsome Breweries Ltd.		88 Winsome Breweries Ltd.				
	49 Winsome Textile Inds. Ltd.		112 Winsome Textile Inds. Ltd.		89 Winsome Textile Inds. Ltd.				
	50 Winsome Yarns Ltd.		113 Winsome Yarns Ltd.		90 Winsome Yarns Ltd.				
	53 Wipro Ltd.		118 Wipro Ltd.		93 Wipro Ltd.				
	56 Western India Cottons Ltd.		120 Western India Cottons Ltd.		95 Western India Cottons Ltd.				
	57 Western India Plywoods Ltd.		121 Western India Plywoods Ltd.		96 Western India Plywoods Ltd.				
	58 Western India Shipyard Ltd.		123 Western India Shipyard Ltd.		97 Western India Shipyard Ltd.				
	62 Wheel & Precision Forgings Inc		132 Wheel & Precision Forgings Inc		101 Wheel & Precision Forgings India Ltd.				
	65 Williamson Financial Services L		140 Williamson Financial Services L		106 Williamson Financial Services Ltd.				
	66 Williamson Magor & Co. Ltd.		141 Williamson Magor & Co. Ltd.		107 Williamson Magor & Co. Ltd.				
	67 Welspun Syntex Ltd.		143 Welspun Syntex Ltd.		108 Welspun Syntex Ltd.				
	69 Welterman International Ltd.		145 Welterman International Ltd.		109 Welterman International Ltd.				
	76 West Coast Paper Mills Ltd.		159 West Coast Paper Mills Ltd.		112 West Coast Paper Mills Ltd.				
	81 Websity Infosys Ltd.		167 Websity Infosys Ltd.		121 Websity Infosys Ltd.				
	82 Weizmann Ltd.		170 Weizmann Ltd.		124 Weizmann Ltd.				

For common nodes we see that there is a tendency to improve their bridging capital by joining boards where they already know trusted members.

