

Entrepreneurial SMEs and Inter-Organizational Network Embeddedness

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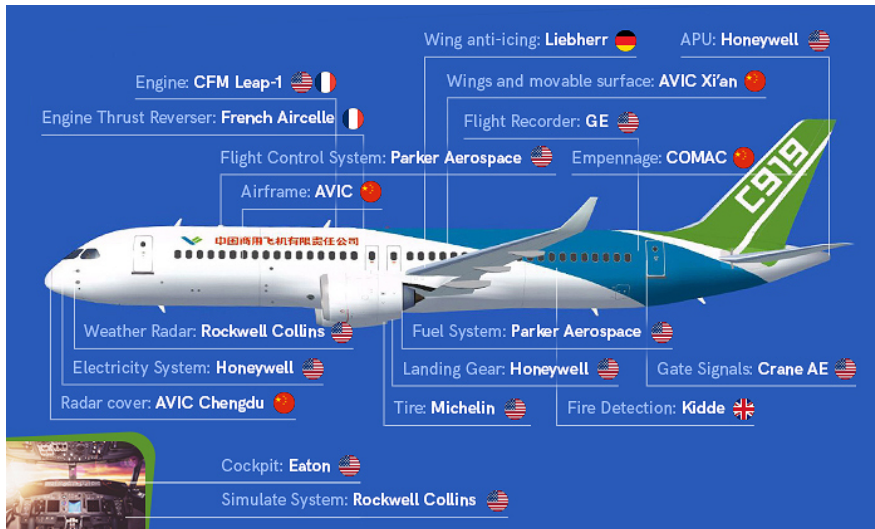
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COMAC C919 Made in China



- China's first large passenger jet COMAC C919 was rolled out off the assembly line in November 2015, and expects its first commercial flight in 2017
- Made in China? Composition of highly integrated systems and components manufactured across the globe.
 - Dispersion of production location
 - Dispersion of business sectoral specialization
 - Active engagement of various types of organizations
- Do domestic entrepreneurial SMEs also play an active part in the Chinese aerospace industry? What factors contribute to their competitiveness?



Entrepreneurship and Network Embeddedness

- **Network embeddedness**

- Effect of actor's **dyadic relations** and **hierarchical structure** on its action, performance and institution. (Granovetter, 1985; Hagedoorn, 2006; Cantwell et al. 2010)
- **Relational embeddedness** and **Structural embeddedness** (Gulati 1998)

- **Network-based entrepreneurship** (Hoang & Antoncic, 2003)

- **Content:** forms of relationship
- **Governance:** control and coordination of resources and information
- **Structure:** Hierarchical pattern of linkages

- **Inter-personal vs inter-organizational network in entrepreneurship** (Miller, 1983 & 2011)

- **Inter-personal network:** the personality, leadership, capacity of entrepreneurs
- **Inter-organizational network:** market strategies, organic structures, external environment

- **Global Value Chain and horizontal and vertical integration** (Gereffi et al. 2005)

- Hierarchy of value adding activities and competitiveness of firms

- **Entrepreneurial SMEs' competitiveness in inter-organizational network**
 - **Strategic resources acquisition** (Barney, 1991; Lavie, 2006)
 - **Absorptive capacity enhancement** (Cohen & Levinthal, 1990; Acs et al. 2001, 2007, 2009)
 - **Behavioral influence on partners:** status, legitimacy, reputation (Uzzi, 1997; Podolny, 2001; Hagedoorn, 2006)

- **Entrepreneurial SMEs – age and size**
 - **Age**
 - (+) Latecomer advantages – sunk cost avoidance, linkage-leverage-learning
 - (-) Liability of newness – inexperience, resistance to change, reliance on partners
 - **Size**
 - (+) Simplicity and efficiency
 - (-) Liability of smallness – constraints in resources and information

Egocentric Diversity of Entrepreneurial SMEs

- **Egocentric Diversity:**

- Diversity of dyadic partners and ties in an actor's first-order neighbourhood (Marsden, 2002)
- Diversity of dyadic partner composition (Goerzen & Beamish, 2005)
- Diversity of direct linkages (content and strength) (Granovetter, 1973; Shippilov, 2012)

- Egocentric diversity positively contribute to entrepreneurial SMEs' innovation capacity and market competitiveness (Pittaway, et al., 2004; Macpherson & Holt, 2007; Roper, et al., 2008)

- **Index of Qualitative Variation (IQV) (Blau et al. 1982)**

$$IQV_r = \frac{1 - \sum_{i=1}^n p_i^2}{1 - \frac{1}{n}}$$

p_i represents the proportion of each type of alter-partners' presence, and n represents the total number of categorized

Hypotheses

- **Negative impacts of age and size:**

- **Hypothesis 1.1** Younger entrepreneurial SMEs are less well-connected in inter-organizational network
- **Hypothesis 1.2** Smaller entrepreneurial SMEs are less well-connected in inter-organizational network

- **Positive impacts of age and size**

- **Hypothesis 2.1** Younger entrepreneurial SMEs are better connected in inter-organizational network
- **Hypothesis 2.2** Smaller entrepreneurial SMEs are better connected in inter-organizational network

- **Impact of egocentric diversity**

- **Hypothesis 3:** An entrepreneurial SME with high degree of dyadic partner diversity are better connected in inter-organizational network

- **Measures for tie diversity** (geographic location, governance structure, industrial specialization) are included as control variables

Data Collection

Step 1. Ego selection

140 commercial aviation business units with revenue above 20 million Yuan in 2013 (Civil Aviation Industrial Yearbook 2014).

Step 2. Alter selection

Business units (firms, universities, research institutes and governmental institutions) that have direct formal linkages with 140 ego business units

Step 3: Attributes collection

- Year of foundation/market entry, Registered capital, Industrial specialization, Location Governance structure etc.
- National Enterprise Credit Information Disclosure System (NECIDS), Official portal of business units, News and analytical reports

Step 4. Identification of types of ties

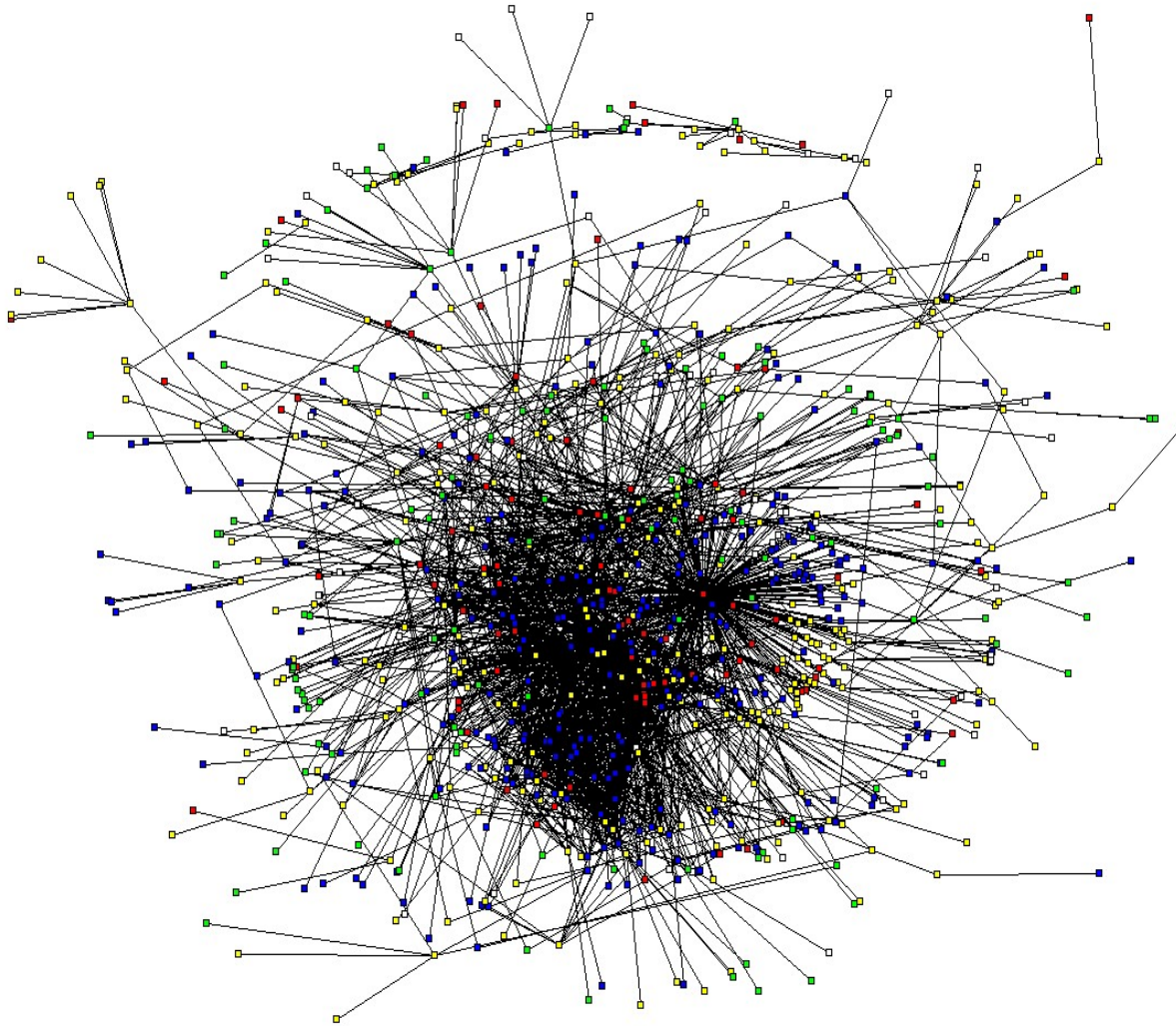
- Horizontal partnership linkages (Strategic alliance, Joint-Venture and R&D program, Intensive cooperation)
- Vertical supply chain linkages (Supplier-buyer relationships)

Step 5. Integration to multiplex networks

Proportion of Business Units by Region and Type

	Number	Percentage
By Region		
Domestic	543	59.02%
Foreign	377	40.98%
By Type		
Domestic Entrepreneurial SMEs	299	32.50%
Large Domestic Firms	97	10.54%
Foreign Firms	335	36.41%
Universities and Research Institutes	132	14.35%
Governmental Institutions	57	6.20%
Total	920	100.00%

Multiplex Network of Chinese Aerospace Industry



- Domestic entrepreneurial SMEs (yellow)
- Domestic large firms (red)
- Foreign firms (blue)
- Universities and research institutes (green)
- Governmental institutions (white)

**Index of Qualitative Variation
(Blau, et al., 1982)**

$$IQV_r = \frac{1 - \sum_{i=1}^n p_i^2}{1 - \frac{1}{n}}$$

p_i = proportion of each type of alter-partners' presence
 n = total number of categorized (in this study, equals 5)

Measuring Network Embeddedness

- **Network Centrality:**

Actor's prominent position to take control of resources and information flows and influence the behavior of other players. (Freeman, 1978; Wasserman & Faust., 1994).

- **Measurements of Network Centrality**

- **Degree Centrality**

- Number of direct ties
- Range of direct sources of resources and information flows

- **Betweenness Centrality**

- Frequency of appearance between other actors' geodesics
- Brokerage control and bargaining power

- **Closeness Centrality (“nearness”)**

- Inverse of sum of steps of all geodesics in the connected components
- Reachability and efficiency of communication

- **Eigenvector Centrality**

- Connection to other well-connected actors
- Proximity to centrality located well-connected market leaders

Empirical Analysis

- 299 domestic SMEs with registered capital less than 1000 million RMB Yuan (approximately 150 million US dollars)
- **Dependent Variables** – Multifaceted Network Centralities
 - **Degree centrality** – Range of neighbourhood
 - **Betweenness centrality** – Brokerage control and bargaining power
 - **Closeness centrality** – Reachability and efficiency
 - **Eigenvector centrality** – Connection to the market leaders
- **Independent variables**
 - **Age**: Year of foundation
 - **Size**: Registered capital – Limited liability of capital contributions from all shareholders on account
 - **Diadic Partner Diversity**: Index of Qualitative Variation (IQV, Blau, 1982)
(1) Domestic entrepreneurial SMEs ; (2) Domestic large firms ; (3) Foreign firms ; (4) University and research institutes (5) Governmental institutions
- **Control Variables**
 - Number of foreign connections
 - Number of connections to non-incorporated units
 - Number of connections to units specialized in non-manufacturing sectors
 - Number of horizontal linkages

Multiple Regression Models on Network Centrality

Dependent Variable	(1) ln (Degree centrality)		(2) Betweenness centrality		(3) Closeness centrality		(4) Eigenvector centrality	
Age	0.0012 (0.0016)		-1.4554 (5.5207)		-0.0002 (0.0002)		-0.0001 (0.0000)	***
Size	0.0180 (0.0120)		16.2281 (40.4329)		0.0017 (0.0013)		0.0010 (0.0003)	***
Dyadic Partner Diversity	1.5508 (0.1058)	***	831.3707 (356.9468)	*	0.0436 (0.0115)	***	0.0097 (0.0027)	***
Foreign Connections	0.0020 (0.0036)		0.1310 (12.2989)		-0.0008 (0.0004)	**	-0.0001 (0.0001)	
Non-incorporated Connections	0.0838 (0.0128)	***	86.4048 (43.0890)	*	0.0022 (0.0014)		0.0035 (0.0003)	***
Non-manufacturing Connections	0.1802 (0.0710)	**	-104.7804 (239.3556)		0.0056 (0.0077)		0.0029 (0.0018)	
Horizontal Linkages	0.1127 (0.0121)	***	457.4075 (40.8393)	***	0.0028 (0.0013)	**	0.0007 (0.0003)	**
N	299		299		299		299	
F	139.540	***	40.990	***	9.200	***	41.340	***
R-squared	0.771		0.497		0.181		0.499	
Root MSE	0.487		1644.100		0.053		0.013	

Note: Significance level: * <0.1 ; ** <0.05 ; *** <0.01

Conclusions

- **Liability of smallness** constraints entrepreneurial SMEs' proximity to market leaders (*Hypothesis 1.1* supported)
- **Latecomer advantage** (instead of liability of newness) contributes to entrepreneurial SMEs' connection to market leaders. (*Hypothesis 2.1* supported)
- **Diversify of dyadic partners** contribute to entrepreneurial SMEs'
 - (1) Range of direct sources of resources and information
 - (2) Brokerage control and bargaining power
 - (3) Communication reachability and efficiency
 - (4) Proximity to centrally located well-connected market leaders(*Hypothesis 3* supported)
- **Connection to foreign partners** may reduce SMEs' communication reachability and efficiency (redundancy of foreign ties)
- **Connections to government, universities and research institutes** significantly contribute to neighborhood range, brokerage and bargaining power, and proximity of market leaders
- **SMEs specialized in non-manufacturing sectors** have wider range of neighborhood, but their advantages in the whole network are not evident.
- **Number of horizontal ties** significantly contributes to all measures of network embeddedness

Future research direction

- **Network embeddedness and innovation**

How does an entrepreneurial SME's network position affects its innovation capacity?

- **Network embeddedness and regional agglomeration**

How do multiplex inter-organizational ties lead to regional agglomeration of entrepreneurial SMEs?

- **Inter-and Intra- regional network and competitiveness of industrial clusters**

How do inter-and intra-regional networks affect the entrepreneurial SMEs?

Thank you!

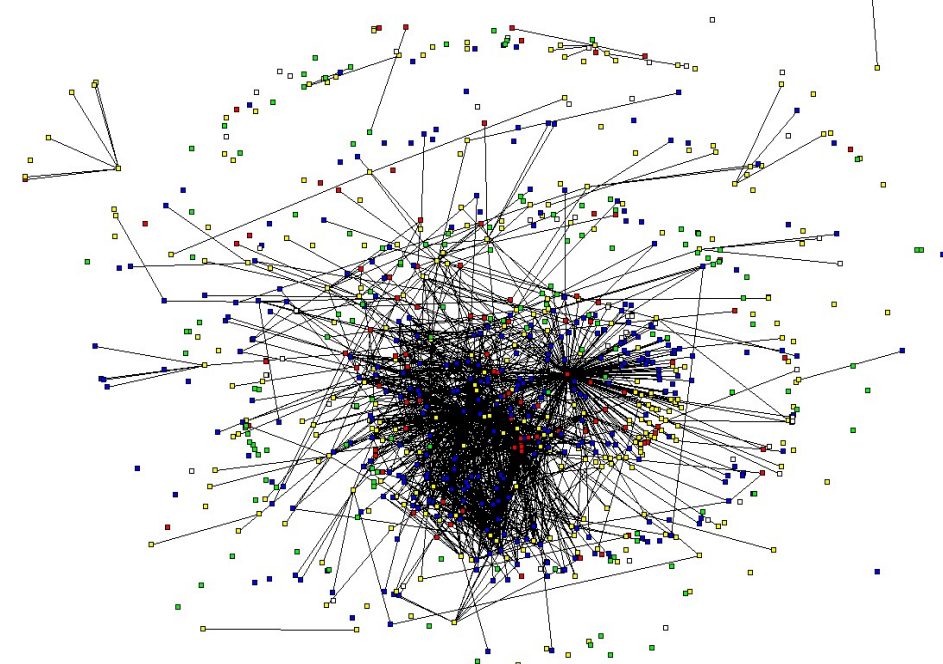
Correlations, means and standard deviations of independent variables

	Mean	S.D.	1	2	3	4	5				
1 Age	22.42	18.79									
2 Size	2.04	2.53	0.28	***							
3 Dyadic Partner Diversity	0.33	0.33	0.12	**	0.20	***					
4 Foreign Connections	2.85	7.83	0.05		0.13	**	0.02				
5 Non-incorporated Connections	0.89	2.51	0.05		0.01		0.38	***	0.02		
6 Non-manufacturing Connections	0.26	0.44	-0.18	***	0.02		0.20	***	-0.05	0.22	**
7 Horizontal Linkages	2.11	2.96	0.28	***	0.20	***	0.50	***	0.06	0.35	**

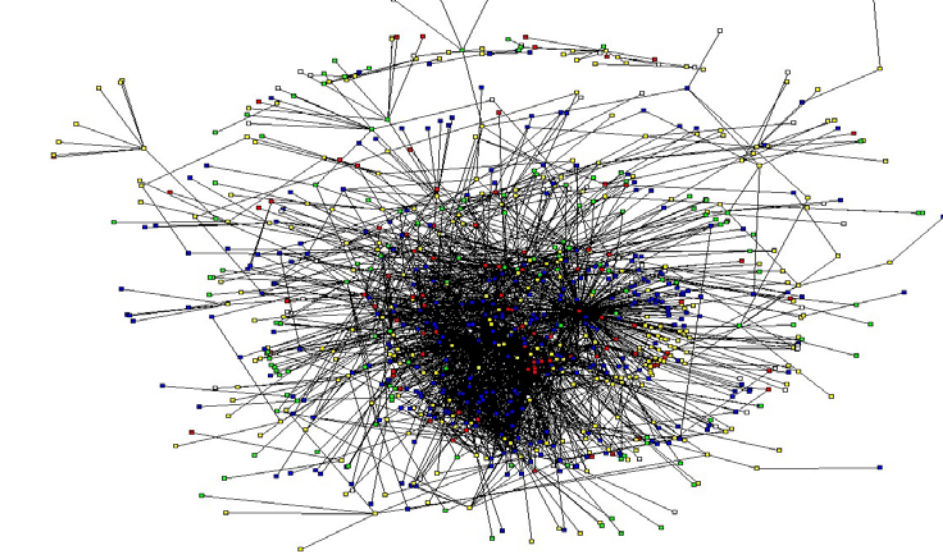
Horizontal network



Vertical network



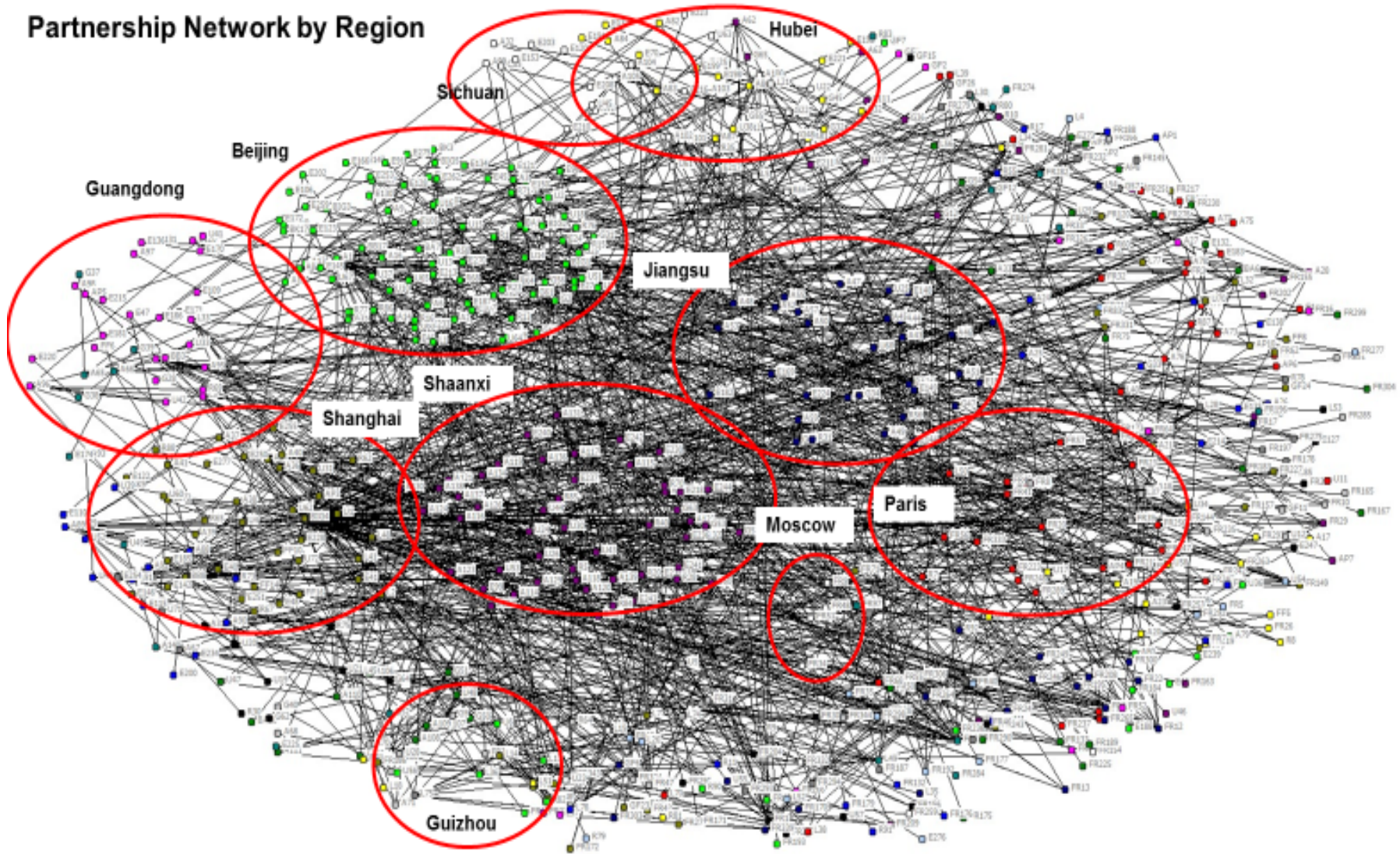
Multiplex network



Double-embedded network



Partnership Network by Region



Supply Chain Network by Region

