Global Embeddedness and Local Innovation in Industrial Clusters

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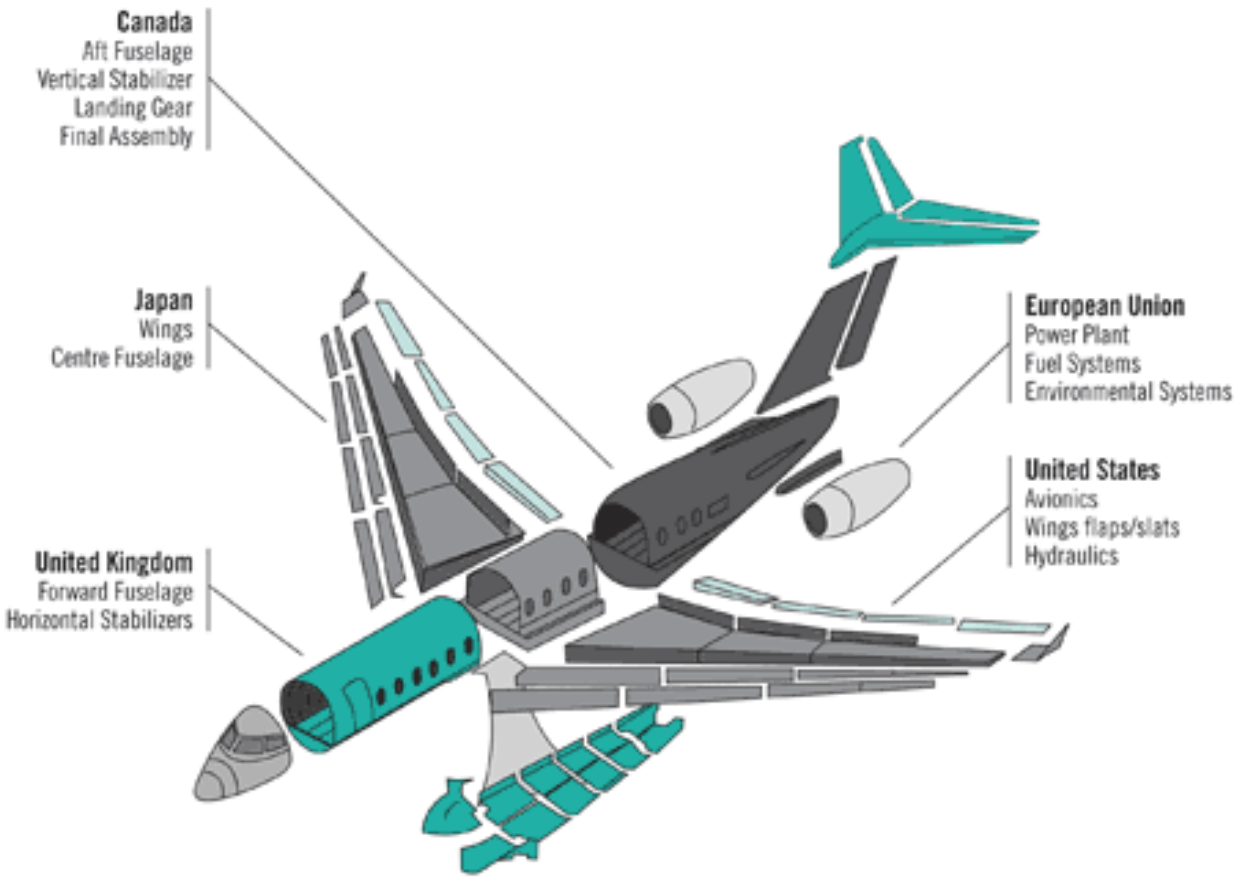
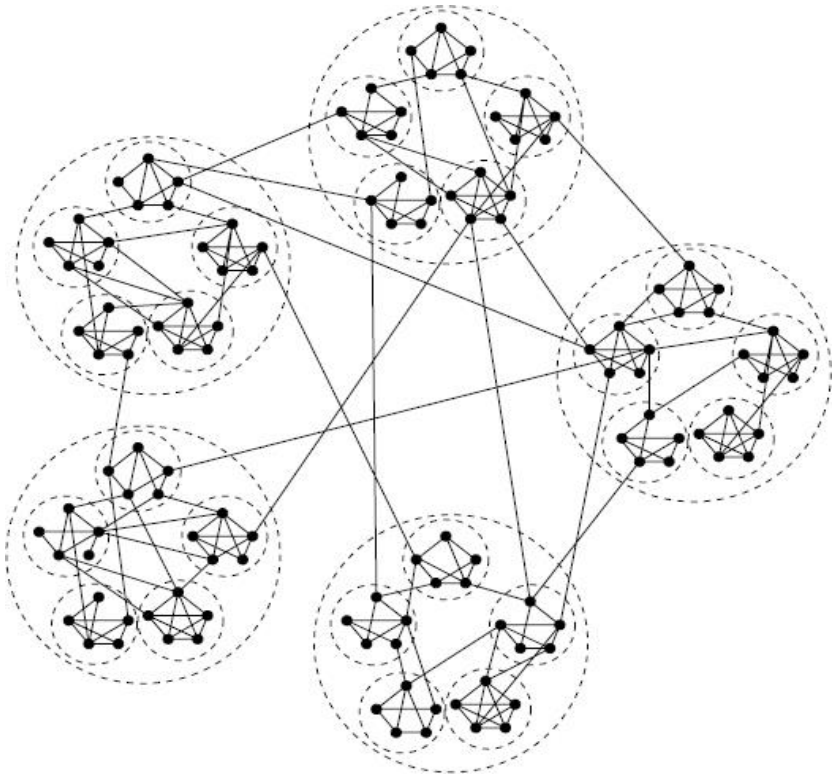
Global Value Chains



Location: A Neglected Factor?

- The implications of GVCs for location has been understudied (*Cano-Kollmann et al., JIBS, 2016*).
  - Do GVCs lead to the hollowing out of a regional economy (*Buciuni and Pisano 2015; Pisano and Shih 2009*)?
  - Do GVCs create a positive productivity boost to a local economy by improving the allocation of resources (*Grossman and Rossi-Hansberg 2008*)?
  - Do they allow regions to tap into foreign knowledge pockets, stimulating technological and knowledge spillovers from abroad (*Bathelt et al. 2004; Lorenzen and Mudambi 2013*).

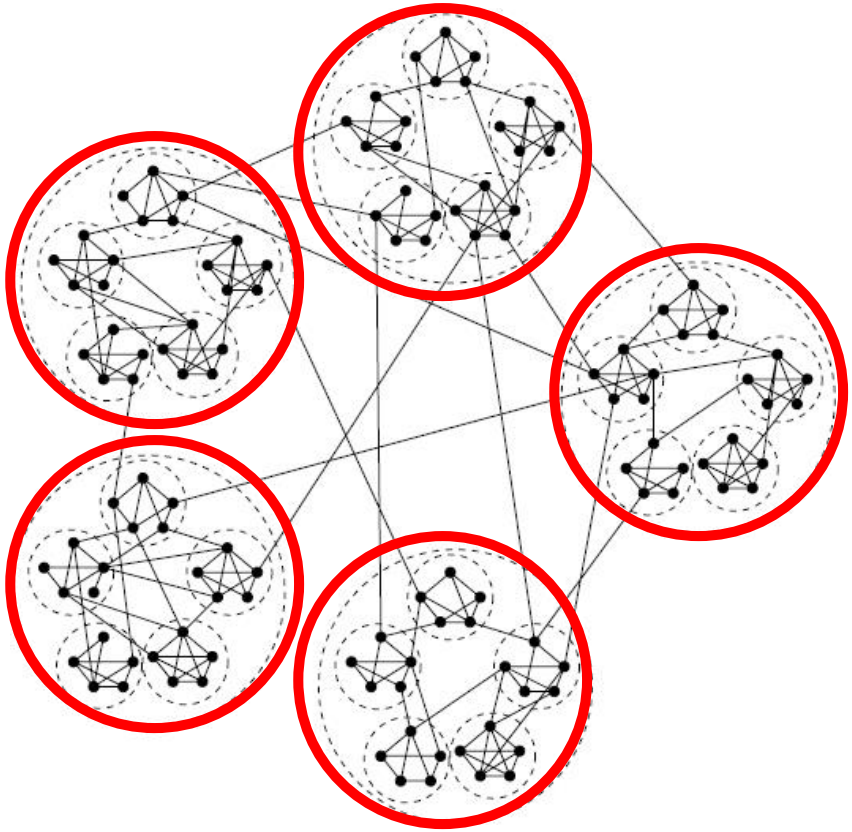
Network View of Industrial Clusters



- Tacit knowledge exchanges within a cluster depends on a firm's network position (*Giuliani and Bell 2005*)
- Cluster firms deliberately establish trans-local linkages to tap into complementary pockets of knowledge (*Bathelt et al. 2004; Lorenzen and Mudambi 2013*).

A cluster's structural embeddedness in the global cluster network affects the knowledge it can access through trans-local linkages

Mapping the global cluster network



1. Identify key industrial clusters in North America and Greater Europe in three industries:
   a. Aerospace (56)
   b. Biotech/Biopharma (51)
   c. IT/Telecom (47)
2. Identify firms (nodes) in each cluster during the periods 2002-2005, 2006-2010, 2011-2014.
3. Identify formal linkages (edges) between each dyad of firms.

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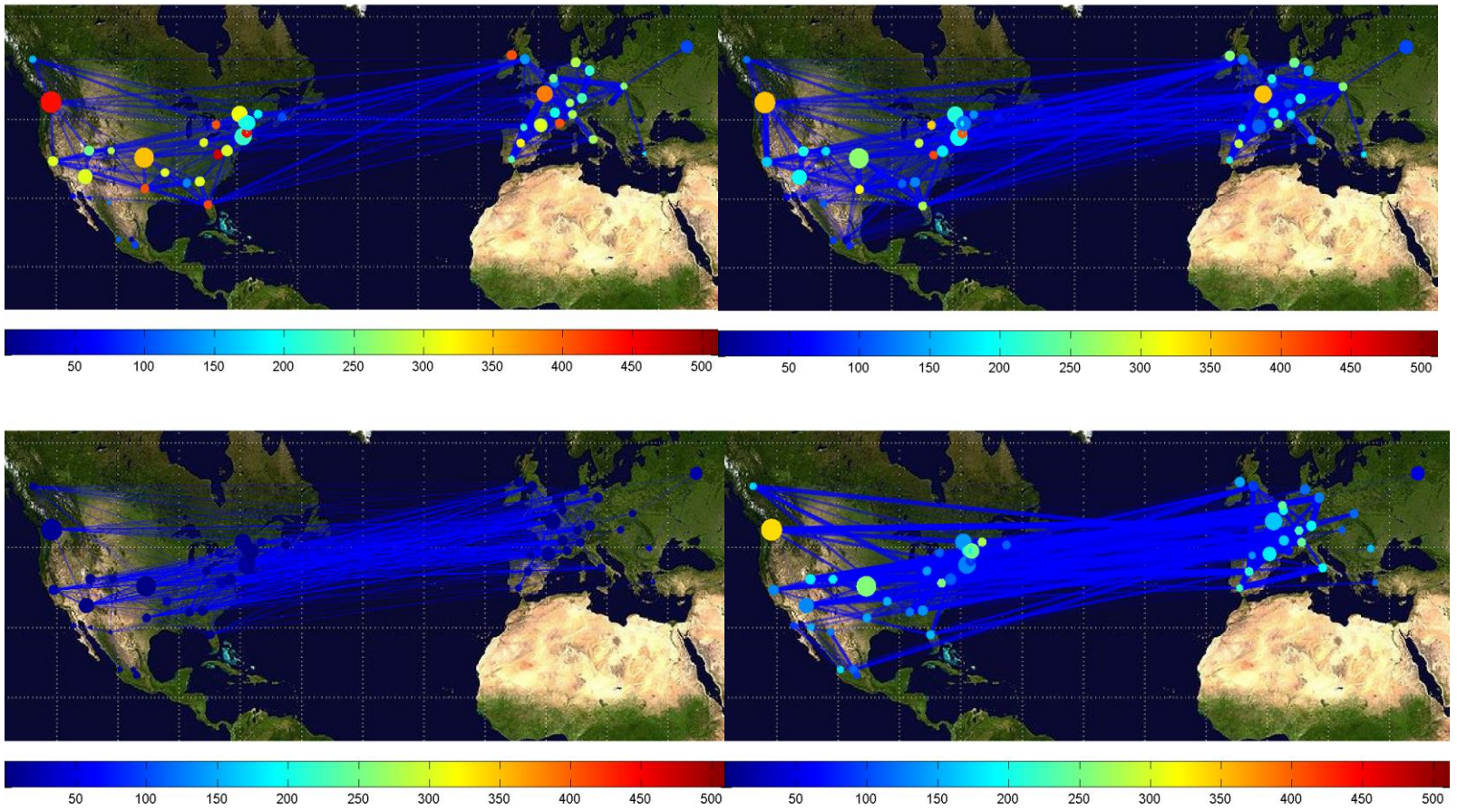
3x2 types of formal linkages

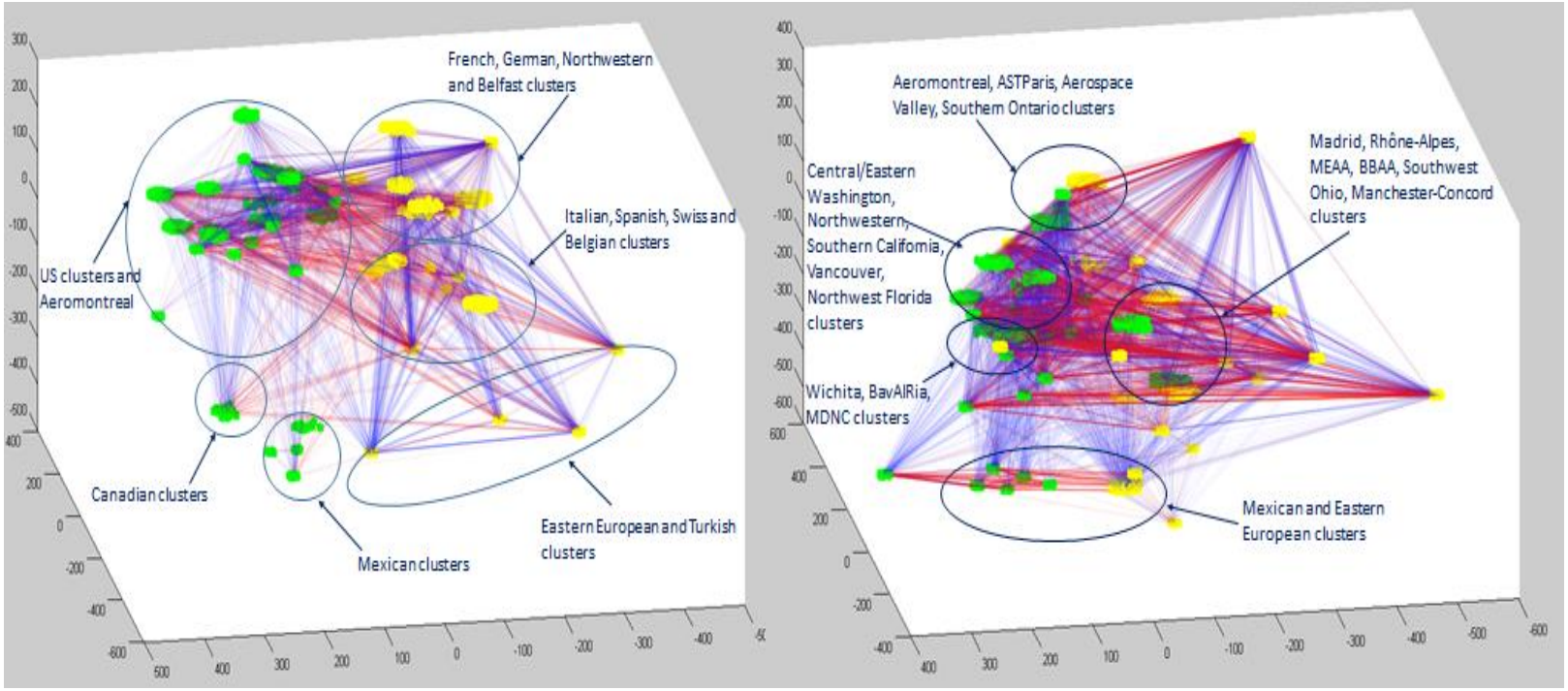
	Local	Trans-local
Vertical Buyer-supplier	Local buyer-supplier (12980)	Trans-local buyer-supplier (3340)
Horizontal Partnership	Local partnership (19968)	Trans-local partnership (2350)
Intra-firm	Local intra-firm (2233)	Trans-local intra-firm (3190)

The changing nature of industrial clustering



Hierarchicalization of clusters (*Turkina et al., JEG, 2016*)

2002-2005 **2010-2014**



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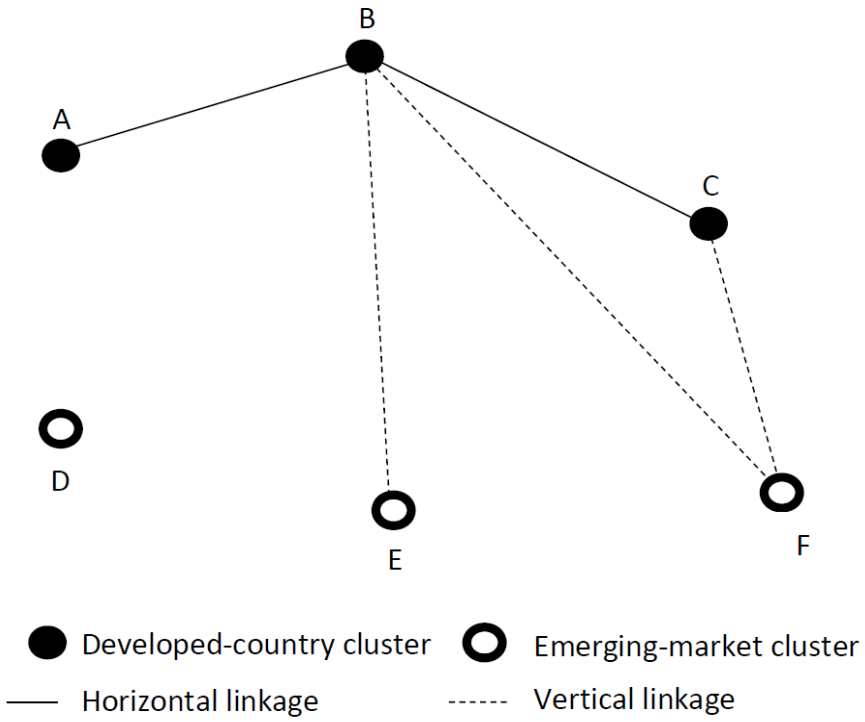
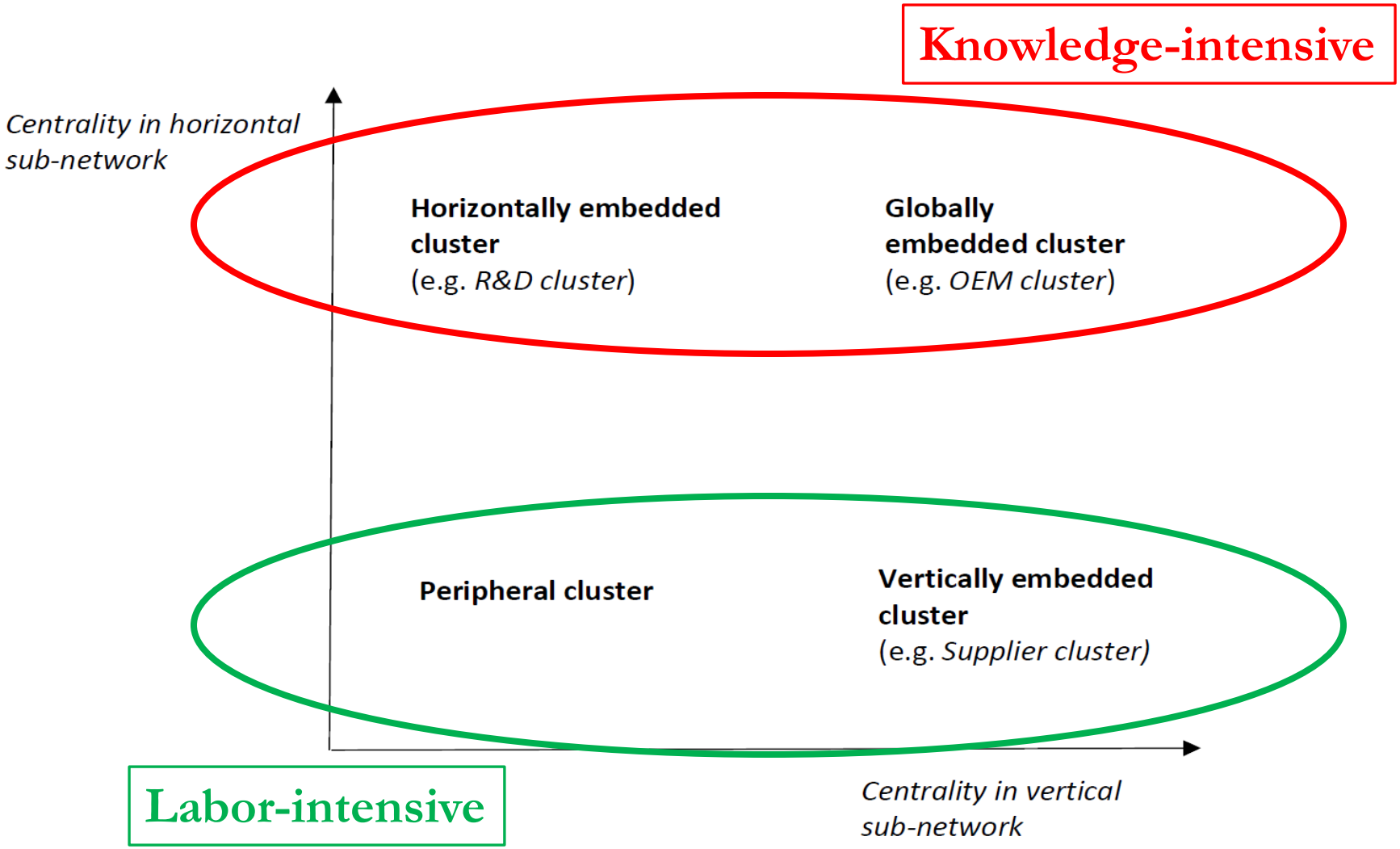
Red lines are partnership linkages; Blue lines are buyer-supplier linkages

Linkage heterogeneity

- **Horizontal linkages:** connections between similar firms in the same industry segment
- **Vertical linkages:** ties between complementary firms specializing in sequential activities in a supply chain



Cluster archetypes



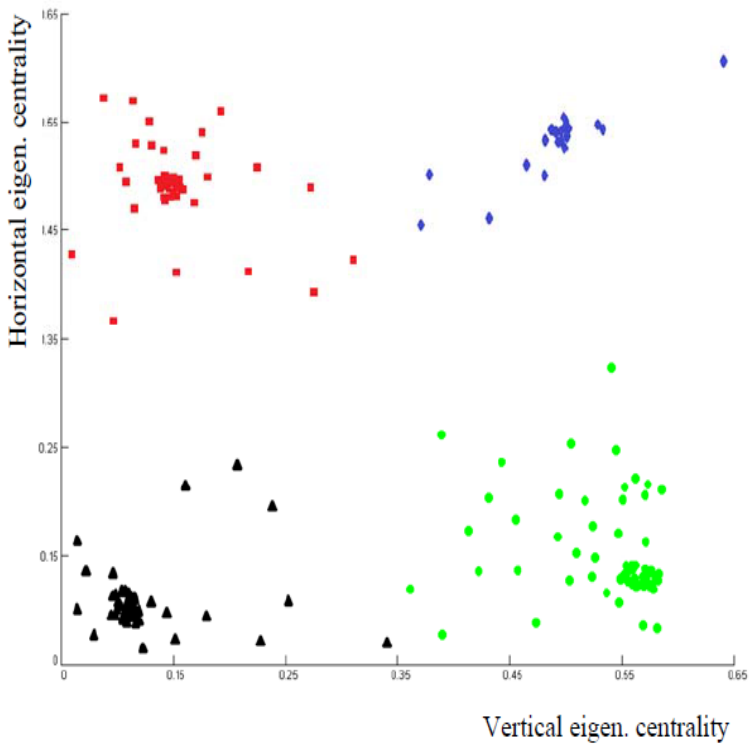
Hypotheses

- ***Hypothesis 1:*** An increase in a cluster's centrality in the horizontal sub-network leads to a larger improvement in innovation performance for globally and horizontally embedded clusters than for vertically embedded and peripheral clusters.

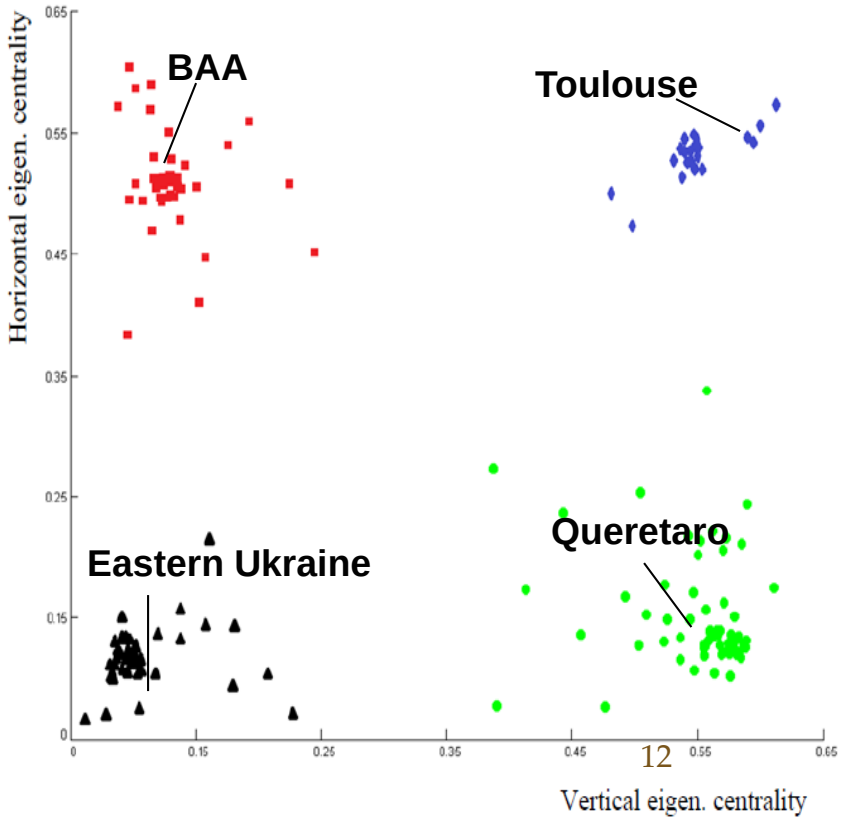
- ***Hypothesis 2:*** An increase in a cluster's centrality in the vertical sub-network leads to a larger increase in innovation for vertically embedded and peripheral clusters than for globally and horizontally embedded clusters.

Identification of Cluster archetypes

4 cluster archetypes – regional and international linkages



4 cluster archetypes - international linkages



Negative binomial regression analysis

$$P_{ikt} = \alpha + fe_i + fe_k + fe_t + \beta_1 HC_{ikt} + \beta_2 HC_{ikt} * T_{ikt} + \gamma_1 VC_{ikt} + \gamma_2 VC_{ikt} * T_{ikt} + \mathbf{L}_{ikt}\delta + u_{ikt},$$

(- on β_2, + on γ_2)

- *Pikt:* number of patents for location *i* in industry *k* in period *t*
- *HCikt:* eigenvector centrality of location *i* in industry *k* and period *t* in the horizontal sub-network
- *VCikt:* eigenvector centrality of location *i* in industry *k* and period *t* in the vertical sub-network
- *Tikt:* dummy variable that equals 1 if cluster archetype is peripheral or vertically embedded, and 0 otherwise.

Dependent variable: Number of Patents

- ***United States.*** Cluster-specific USPTO patent data extracted from the US Cluster Mapping Project.
- ***Canada.*** Institute for Prosperity and Competitiveness data extracted from Canadian Cluster Observatory.
- ***Mexico.*** SIGA data.
- ***Europe.*** EPO data.

Table 6: Negative binomial regression results, lagged independent variables

Dependent variable: number of patents in cluster *i* in industry *k* and period *t*		
	Peripheral/vertically embedded (*T=1*) vs. horizontally/globally embedded (*T=0*)	
	Regional and international	International
	(1)	(2)
Ln(vertical eigen. Centrality)	4.284* (4.197)	9.005* (7.178)
Ln(vertical eigen. Centrality) * T	81.612* (80.815)	84.701* (79.193)
Ln(horizontal eigen. Centrality)	99.003*** (8.235)	103.205*** (8.873)
Ln(horizontal eigen. Centrality) * T	-69.725* (69.720)	-64.684* (64.652)
Ln (Intra-firm centrality)	73.328* (65.147)	78.276** (33.926)
Ln(local buyer-supplier linkages)	12.682 (12.690)	12.028 (12.033)
Ln(local intra-firm linkages)	49.016** (19.547)	42.813** (18.752)
Ln(local partnership linkages)	64.347*** (4.012)	66.265*** (4.214)
Ln(cluster density)	76.069* (75.135)	77.043* (76.517)
Ln(wages)	18.557 (20.611)	21.418 (22.005)
Ln(location quotient)	113.519*** (16.206)	115.348*** (16.017)
Ln(R&D investments)	162.305*** (12.105)	171.782*** (14.008)
Labor force education	1.546*** (0.108)	1.781*** (0.113)
Industry fixed effects	Yes	Yes
N chi2 Log likelihood LR chi2	290 624.56* -1145.89 77.01	290 621.88* -1143.45 73.97

Notes: Coefficients are reported with errors that include eigenvector terms based on the weighted residuals to adjust for spatial autocorrelation. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively. Coefficients on constant and industry fixed effects are not reported.

Conclusion

- Among the first papers that empirically investigates how a cluster's structural embeddedness in a global network of clusters affects its local innovation performance.
- We developed a new typology of four cluster archetypes based on their multiplex embeddedness in the global cluster network.
- We developed hypotheses how the relation between a cluster's global embeddedness and its local innovation performance varies across cluster archetypes.
- Using a hand-collected longitudinal dataset of formal firm linkages between 154 clusters across three industries, we find empirical support for our predictions.