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# **A hybrid dynamic innovation network framework accounting for the importance of local supporting organisations**

The case of the Portuguese automotive industry

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# Outline

- Research Overview
- Holistic notion of industry: role of LSOs
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- Conclusion

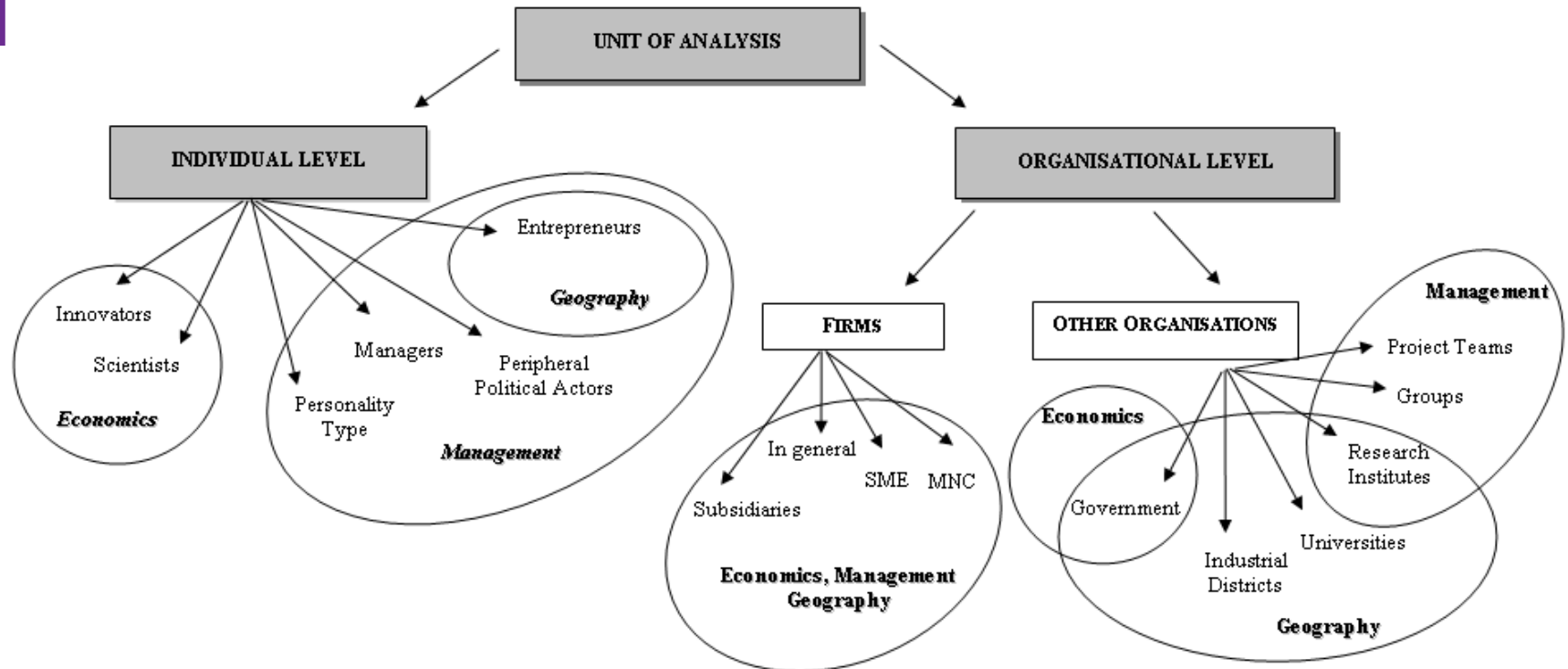
# Research overview

- Networks are an appealing concept to several academic disciplines (economics, management, geography, sociology,...)
- Different attributes and impacts
- Our view on networks:
  - Context of industry in general and innovation in particular;
  - Ability to exchange sources of information and expertise relevant for firms to innovate;
  - Form to coordinate the distributed nature of knowledge;
- Network framework: provide a systematic account
  - Dynamic perspective: focus on the network process
  - Holistic notion of industry: heterogeneity of players (firms and supporting orgs)
  - Content: emphasis on the nature of links

# Holistic notion of industry

- Related to the **boundaries** of networks and the definition of its participants
- Accounts for the **heterogeneity** of organisations (scope of activities and resources)
- Argument of **embeddedness**: how economic activity depends on actions or institutions that are non-economic in content, goal or processes (Granovetter, 1985)
- **Goal**: to bring the role of supporting organisations to the analysis of the dynamics of industrial networks

# Holistic notion of industry: network studies



# Holistic notion of industry

## Contributions from the literature

- Units of analysis: relevance of firms
- Network organisations
  - Generic acceptance of a variety of network players;
  - Innovation studies: recognition of supporting organisations; IS as “network of institutions in the public and private sectors whose activities and interactions initiate, import and diffuse new technologies” (Freeman, 1987:1)
  - Boundaries of enquiry – study of inter-firm networking
- Supporting organisations: intermediary & localised nature
  - Seeking, managing, transmitting information; bridging communication between firms; advising.

# Methodology

- Combination of quantitative and qualitative techniques
- **Social Network Analysis:**
  - Map the links between various organisations
  - Capture the importance of organisations over time
- **Qualitative data:** background of organisations
  - Interviews
  - Secondary data
- Importance of follow up the maps with the context of the industry and players

# Case Study: Automotive Industry

- **Participation of a broad set of organisations**
- **Knowledge is particularly distributed and hence innovation is particularly reliant on several players:**
  - Vast array of technological fields: mechanical engineering, ICT, electronics, nanotechnology, ergonomics, plastics...
  - Multiple drivers of change: role of consumer preferences and national/regional frameworks
- **Responses:**
  - Horizontal networks: between OEMs (collaborations, co-development, common platforms); between suppliers (modularity)
  - Vertical networks: assembly industry (supply chain); transfer of developmental capabilities from OEMs to suppliers (value chain)

# Portuguese Automotive Industry

- Why Portugal?
  - Small, peripheral and newcomer economy, with recent automotive industry (1980s) that was able to improve its capabilities, attract FDI and reinforce its market;
  - The evolution of the local industry reveals a great deal of change in terms of the emergence of players.
- Importance of investments by Renault (1980s) and VW/Ford (1990s)
  - Attracting further investment by major multinational suppliers
  - Inducing contacts from local suppliers with global standards
  - Development of engineering capabilities
- Dynamic of local industry influenced by suppliers:
  - No national OEM
  - Variety of suppliers (plastics, metal mechanics,...)

# Survey Design: Typology of Organisations

Type	Organisation
<b>Firms</b>	<i>Automotive Suppliers</i>
	<i>OEMs</i>
<b>Local Supporting Organisations (LSO)</b>	<b><i>Research and Technology Organisations (RTO) :</i></b> - Technological centres - Technological interfaces - University and Polytechnic departments - Public laboratories
	<b><i>Production-Based Suppliers (PBS) :</i></b> - Raw material suppliers - Equipment suppliers - Logistics
	<b><i>Strategic Factor Provider s (SFP) :</i></b> - Consultancy and IT - Training organisations - Certification organisations
	<b><i>Facilitators :</i></b> - Industrial/Commercial Associations - Governmental Agencies

Source: Almodovar, 2008.

**Dynamics**  
**1995:** Year in which the joint-venture formed by VW and Ford - AutoEuropa - started operating in Portugal.  
**Before/After:** To compare the pattern of interaction in two points in time, in terms of structure and content

**Network Structure**  
 Type of Organisations:  
 OEMs, Suppliers, LSOs

	VW AutoEuropa		Simoldes		AFIA	
	Before 1995	After 1995	Before 1995	After 1995	Before 1995	After 1995
<b>With whom does the organisation interact in order to:</b>						
Train human resources						✦
Undergo a certification process						
Create design or product development						
Buy equipment (machine, software)						
Produce component						
Secure logistics						

**Network Content**

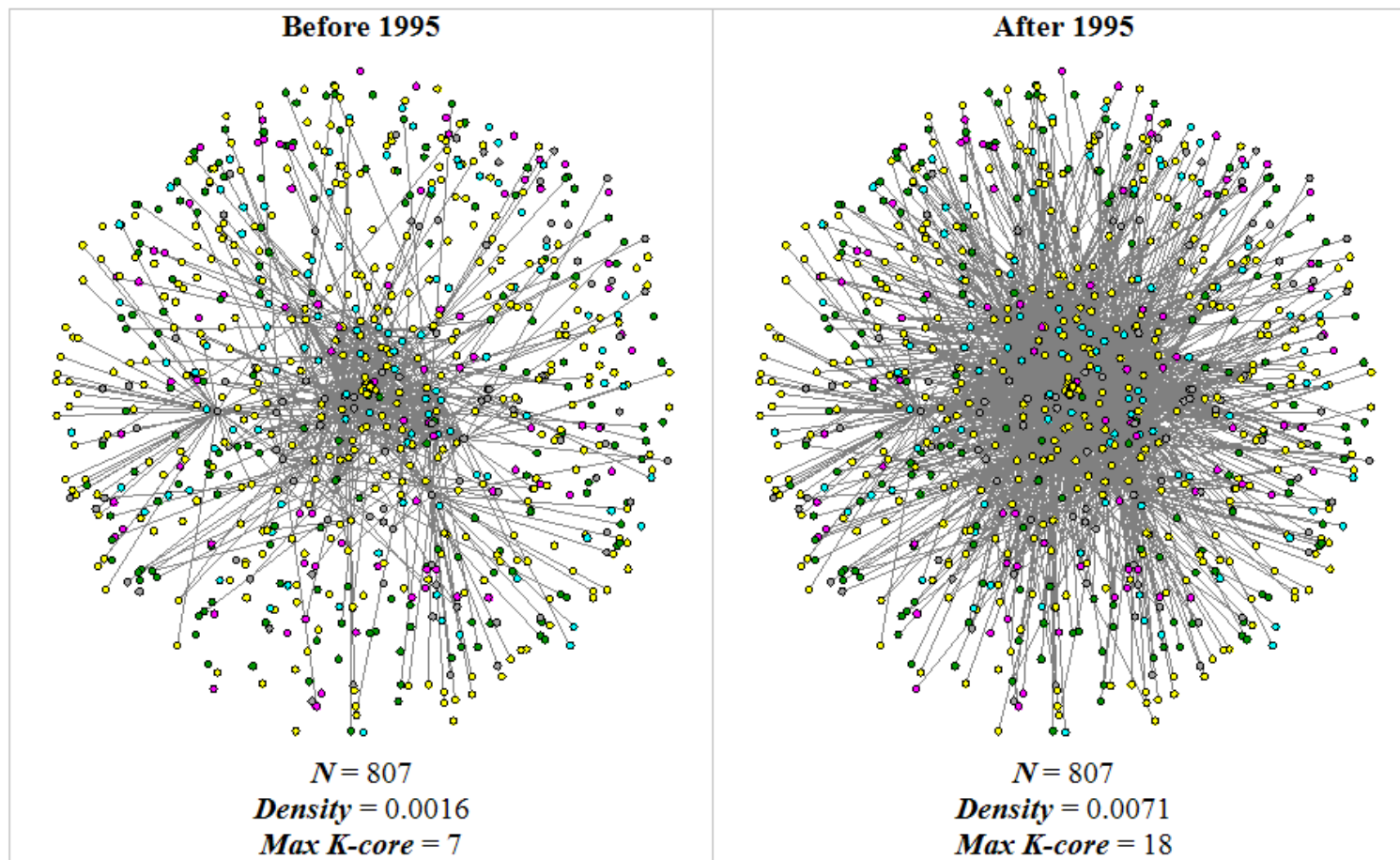
**Example**  
 After 1995, the surveyed organisation interacts with AFIA, in terms of *human resources*

# Target & Sample

Type of organisation	Target population	Sample
	<i>No.</i>	<i>No.</i>
<b>Auto Suppliers</b>	43 <sup>(*)</sup>	28
<b>OEMs</b>	4	3
<b>LSOs including:</b>	38	26
- <i>Research and technology organisations</i>	16	11
- <i>Production-based suppliers</i>	3	2
- <i>Strategic factor providers</i>	7	5
- <i>Facilitators</i>	12	8
<b>Total</b>	<b>85</b>	<b>57</b>

**Source:** Author. (\*) Beyond the 41 suppliers which are members of AFIA we interviewed another 2 suppliers – Ipetex and Sunviauto.

- Free recall & free choice: 57 interviewees generated a network composed of 867 automotive organisations



**Figure 6:** Dynamics of Networking: Automotive s suppliers and LSOs

**Source:** Author. **Legend:** *Yellow nodes* – Suppliers; *Blue nodes* – Research and technology organisations; *Green nodes* – Production-based suppliers; *Pink nodes* – Strategic factor providers; *Grey nodes* – Facilitators.

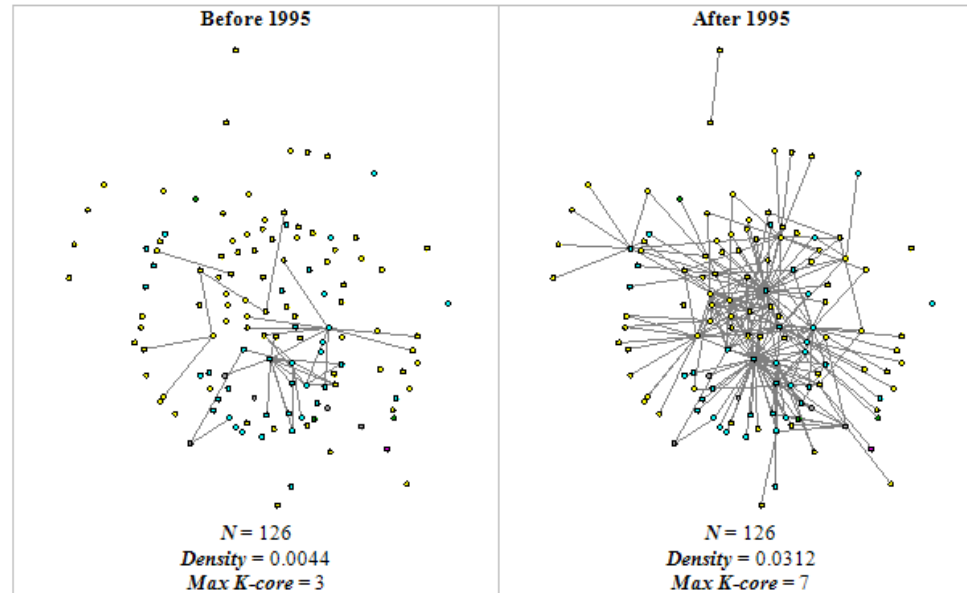
# Degree centrality: Top 15 Organisations

Before 1995				After 1995			
Organisation	Type		Degree	Organisation	Type		Degree
AFIA	LSO	Fac	45	AFIA	LSO	Fac	126
ANEMM		Fac	43	Inapal Plasticos	Supplier		96
AIMMAP		Fac	34	MCGraca			88
APIP		Fac	31	Inapal Metal			86
IAPMEI		Fac	31	INETI	LSO	RTO	85
APF		Fac	29	IAPMEI		Fac	78
Faurecia	Supplier		25	INEGI		RTO	73
ANIMEE	LSO	Fac	25	Simoldes Plasticos	Supplier		71
Couro Azul	Supplier		22	INTELI	LSO	SFP	71
Inapal Metal			21	Sunviauto	Supplier		71
UP-FEUP-DEMEGI	LSO	RTO	19	Epedal			
INEGI		RTO	19	CENTIMFE	LSO	RTO	67
Kupper & Schmidt	Supplier		18	Kupper & Schmidt	Supplier		65
KROSCHU			16	Fabrilcar			65
CATIM	LSO	RTO	16	Edaetech			

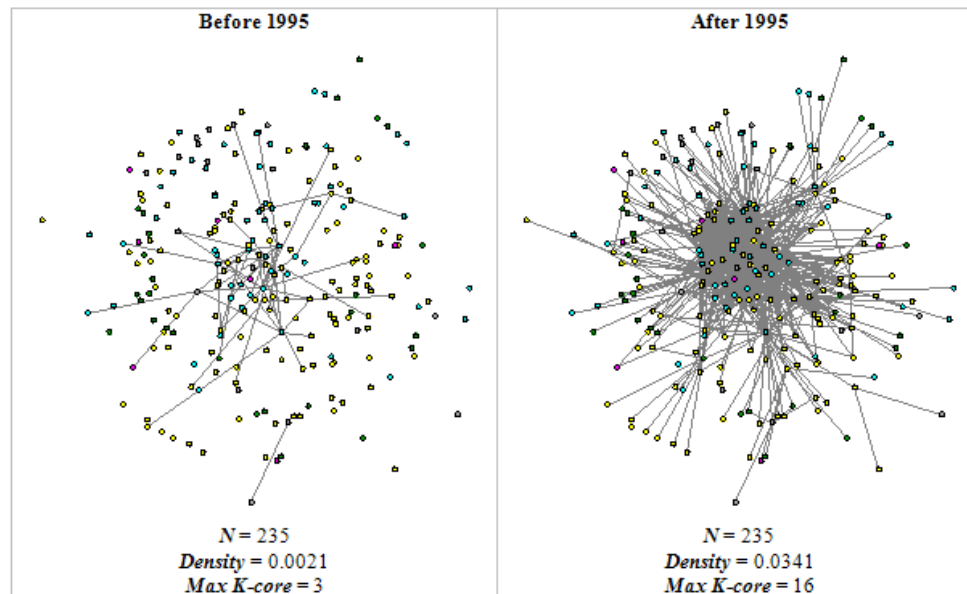
**Source:** Author's calculations. (\*) By decreasing order of importance. **Legend:** RTO – Research and technology organisations; PBS – Production based suppliers; SFP – Strategic factor providers; Fac – Facilitators.

# Network of suppliers and LSOs

- **Overall pattern of interaction:**
  - Increased connectivity & cohesiveness
  - Isolates decrease from 517 to 60
  - Links increase from 524 to 2327
- **Individual organisations: degree**
  - Popularity of LSOs in various domains
  - Before 95: role of facilitators (intermediaries)
  - After 95: popular suppliers report key links with LSOs; role of research and technology orgs



Dynamics of Product Innovation Networking: suppliers and LSOs



Dynamics of Process Innovation Networking: suppliers and LSOs

# Degree centrality: Top 6 Organisations

Content	Before 1995			After 1995				
	Organisation	Type	Degree	Organisation	Type	Degree		
All	AFIA	LSO	Fac	45	AFIA	LSO	Fac	126
	ANEMM			43	Inapal Plasticos	Supplier	96	
	AIMMAP			34	MCGraca		88	
	APIP			31	Inapal Metal		86	
	IAPMEI			31	INETI	LSO	Fac	85
	APF			29	IAPMEI	78		
Product	INEGI	LSO	RTO	10	INEGI	LSO	RTO	44
	UM-Eng-Polymers			8	CEIIA	42		
	UP-FEUP-DEMEGI			6	Sunviauto	Supplier	17	
	Sunviauto	Supplier	3	INTELI	LSO	SFP	16	
	Simoldes Plásticos		2	Simoldes Plásticos	Supplier	15		
	Kupper & Schmidt		2	UM-ENG-Polymers	LSO	RTO	15	
Process	CATIM	LSO	RTO	11	Inapal Plasticos	Supplier	70	
	ISQ			8	Inapal Metal		69	
	UM-ENG-Polymers			8	MCGraca		67	
	UP-FEUP-DEMEGI			7	CENTIMFE	LSO	RTO	64
	INEGI			6	Simoldes Plásticos	Supplier	51	
	INESC Porto			5	INEGI	LSO	RTO	48

Source: Author calculations.

Legend: RTO – Research and technology organisations; PBS – Production-based suppliers; SFP – Strategic factor providers; Fac – Facilitators.

# Innovation networks of suppliers & LSOs

- **Overall pattern of interaction:**
  - Increased connectivity & cohesiveness
  - ‘product innovation’ network more hierarchical than ‘process innovation’ network
- **Individual organisations:** Selection of contents refines analysis of LSOs
  - Confirms the relevance of LSO (intermediates)
  - Stresses the role of RTO on innovation-related contents
  - Shows different organisations depending on the content

# Conclusion

- Contribution of holistic view of industry:
  - Systematic account of networks: heterogeneity of participants;
  - Need to extend the view of distributed capabilities beyond the space of inter-firm interaction
  - Supporting organisations as firms' partners for innovation activities
  - Intermediary nature of supporting organisations
- LSOs participate in the dynamics of the Portuguese automotive networks:
  - Role of facilitators and Research/Technology Organisations
  - Increased connectivity and cohesiveness between suppliers and LSOs over time

# Thank you!

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