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**KNOWLEDGE AND INFORMATION:**

**THE DIFFUSION OF ICT IN THE ARGENTINEAN  
MANUFACTURING INDUSTRY**

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# OBJECTIVES OF THE PAPER

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- To highlight the differences between information and knowledge in a new techno-organizational paradigm.
- To study the connections between endogenous capabilities and *ICT* diffusion in a sample of 256 Argentinean manufacturing firms.



# Main research questions (1)

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In the context of globalization and the emergence of new techno-organizational paradigms, the central research questions were:

- What are the connections between *ICT* and firms' endogenous competences?
- Do *ICTs* enable the closing of the technological gap between developing and developed countries?

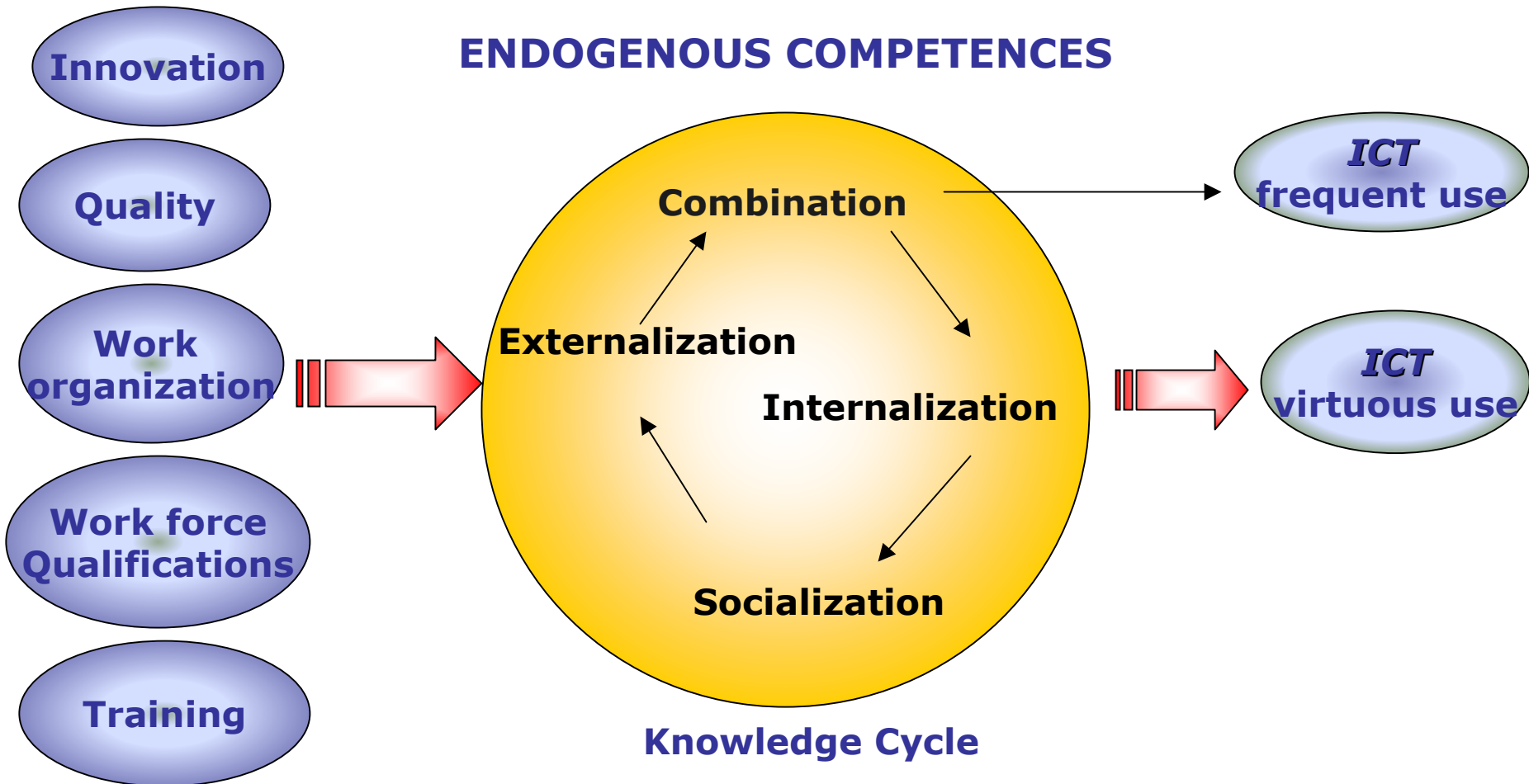
# Main research questions (2)

- Is it necessary to have a minimum threshold of previous codified and tacit knowledge in order to make an efficient use of *ICT*?
- Is it possible to generalize the use of *ICT* without previous organizational changes and without the development of learning processes inside firms and institutions?
- How do these issues work in the Argentinean manufacturing industry?

# Knowledge generation and circulation.

## *ICT* and endogenous competences

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# Technological characteristics of Argentina

- Reduced level of technological competences and innovation capabilities.
- Weak production networks from the point of view of generation of knowledge.
- Specialization pattern intensive in natural resources and commodities.
- Limited institutional development and weakness in the relationship between private-private and private-public agencies.
- Strong presence of FDI.
- Absence of systemic policies.

# METHODOLOGY (1)

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- Sample of 256 manufacturing firms.
- ICT diffusion and endogenous competences indicators defined.
- Multiple correspondence Factor Analysis.  
Cluster analysis
  - ICT diffusion
  - Endogenous competences
- Linkages between ICT diffusion and endogenous competences.

# METHODOLOGY (2)

## Systemic indicators related to *ICT* diffusion

### ■ Degree of complexity of *IT* in management

- Database drivers servers
- Management software
- Information area

### ■ Degree of complexity of *IT* in production

- Soft-hard in production
- Planning and control software
- Design software

### ■ Communications tools used by firms

- Intranet
- Internet
- E-mail

### ■ E-commerce importance





# METHODOLOGY (3)

## Endogenous competences indicators

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- **Innovative capability**

- Formal and informal efforts in R&D
  - Weight of new products in sales

- **Quality assurance**

- Certified norms

- **Work organization**

- Job proportion in cells
  - Cells autonomy

- **Human resources competences**

- Weight of human resources training
  - Weight of technical personnel



# Main panel characteristics

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- Size of firms
  - 87% SMEs
  - 13% Large firms
- Sectors
  - 43% Traditionals
  - 22% Knowledge intensive
  - 16% Automotive complex
  - 12% Commodities
  - 4% Durable goods

***ICT* diffusion appears as a vehicle oriented to promote the circulation of information rather than as a channel for knowledge generation and the improvement of firms' competences**

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### **Hardware**

**Servers 78%**

**Data base driven servers 41%**

### **Communication tools**

**Internet access 96%**

**Lack of complexity**

**Reduced interconnection**

**Prevalence of management areas**

**Strong heterogeneity**

### **Software**

**Sophisticated management 22%**

**Planning and control 30%**

# ICT diffusion

## Main characteristics of clusters

Structural endogenous characteristics	<i>ICT</i> diffusion		
	High	Medium	Low
Firms (%)	28%	36%	36%
Size	Medium-Large	Medium	Small
FDI	Yes	Partial	No
Export-sales ratio	Medium o High	Interm.	Low or null
Quality assurance	72%	43%	25%
R&D team full time	39%	28%	12%
% in cells and programming	56%	45%	36%

# RESULTS

## *ICT* Diffusion vs endogenous competences

Degree of <i>ICT</i> diffusion	Endogenous competences			Total
	Low	Medium	High	
Low	<b>59%</b>	18%	<b>23%</b>	100%
Medium	42%	24%	34%	100%
High	<b>21%</b>	17%	<b>62 %</b>	100%
Total	42%	20%	38%	100%



# Diffusion and competences.

## Joint analysis (1)

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### **1. High ICT diffusion and competences (17% of the panel)**

#### **High Diffusion**

Sophisticated Soft both in management and production

Relevance to Staff ICT training

Planning and design soft integrated

- **High endogenous competences**

Quality system all implemented

Important efforts in training

R&D staff full time

Cells and high level of personnel qualifications

- **Structural characteristics**

More than 100 employees, sales more than u\$ 20 millions

FDI

Higher Export–Sales ratio related to sample



# Diffusion and competences.

## Joint analysis (2)

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### **2. Low endogenous capabilities and limited ICT diffusion (21%)**

- **Limited diffusion**

  - No servers or data base driven servers

  - Basic office software

  - No software in production, design and planning and control

  - Limited relevance of Internet, Intranet and email

- **Negative endogenous characteristics**

  - No training

  - Low importance of cells and low level of personnel qualifications

  - Limited presence of quality systems

- **Structural characteristics**

  - Less than 50 employees and sales less than us\$ 3 millions.

  - Very low export ratio

  - FDI (5% of firms)



# Diffusion and competencies.

## Joint analysis (3)

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### 3. Endogenous competences higher than ICT diffusion (28%)

- **Low diffusion**

- Only administrative software and basic equipment
  - Limited use and complexity of production software
  - Low software integration between production and administrative area

- Limited relevance of internet, intranet and email

- **Positives endogenous characteristics**

- Quality assurance implemented (below Group 1)
  - Important efforts in training (somehow below Group 1)
  - R&D staff full time
  - Cells and high level of personnel qualifications

- **Structural characteristics**

- Less than 50 employees and sales less or equal u\$ 3 millions (similar to Group 2)





# Diffusion and competencies.

## Joint analysis (4)

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### 4. **Less endogenous competences (26%)**

- **High Diffusion**

  - Data base driven servers

  - Networks interconnected

  - Training in informatics

  - High relevance of Internet, Intranet and email

  - Complex and integrated software in administrative area and production

- **Limited endogenous characteristics**

  - Intermediate between groups 1 and 2

  - Knowledge generation not relevant

- **Structural characteristics**

  - Medium and big firms

  - Important FDI

  - No sectoral specialization



## CONCLUSIONS (1)

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- Diffusion is greater in administrative areas than in production
- Limited sophistication and limited scope and integration (who and what for)
- Inside the firms *ICT* incorporation is incomplete and uneven. Heterogeneity in diffusion: clusters
- *ICT* Diffusion related to previous endogenous competences. 50% of the firms are placed in the extreme groups of both classification



## CONCLUSIONS (2)

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- Size of firms is also relevant to explain ICT diffusion
- In intermediate groups ICT diffusion lags or leads with respect to endogenous competences
- Incorporation of these technologies is unbalanced and uneven inside firms, among firms and among sectors
- Identification of four groups thorough cluster analysis highlights the existence of different types of ICT diffusion. These “types” could inform public policies