

Italy's External Competitiveness
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**The economic impact of technological and organizational innovations on
firms' performances:**

Is there a difference between manufacturing and service industries?

Rinaldo Evangelista
University of Camerino

Antonio Vezzani
University of Rome "Tor Vergata"

Challenges in empirical research

- It is widely acknowledged that technological change and innovation are the major drivers of economic growth and are at the very heart of the competitive process
- Most of the literature has been characterized by a sort of technology and manufacturing focus/bias (focus on product and process innovation and their effects on performances)
- Although more is known about the relevance of innovation in services, its economic impact has been investigated to a very limited extent, particularly at the firm level

Empirical issues addressed in the paper

1. How do product, process and organizational innovations relate to each other (level and type of complementarity)?
2. What are the (direct and indirect) effects of product, process and organizational innovations on economic performances?
3. Are there systematic differences between manufacturing and services industries?

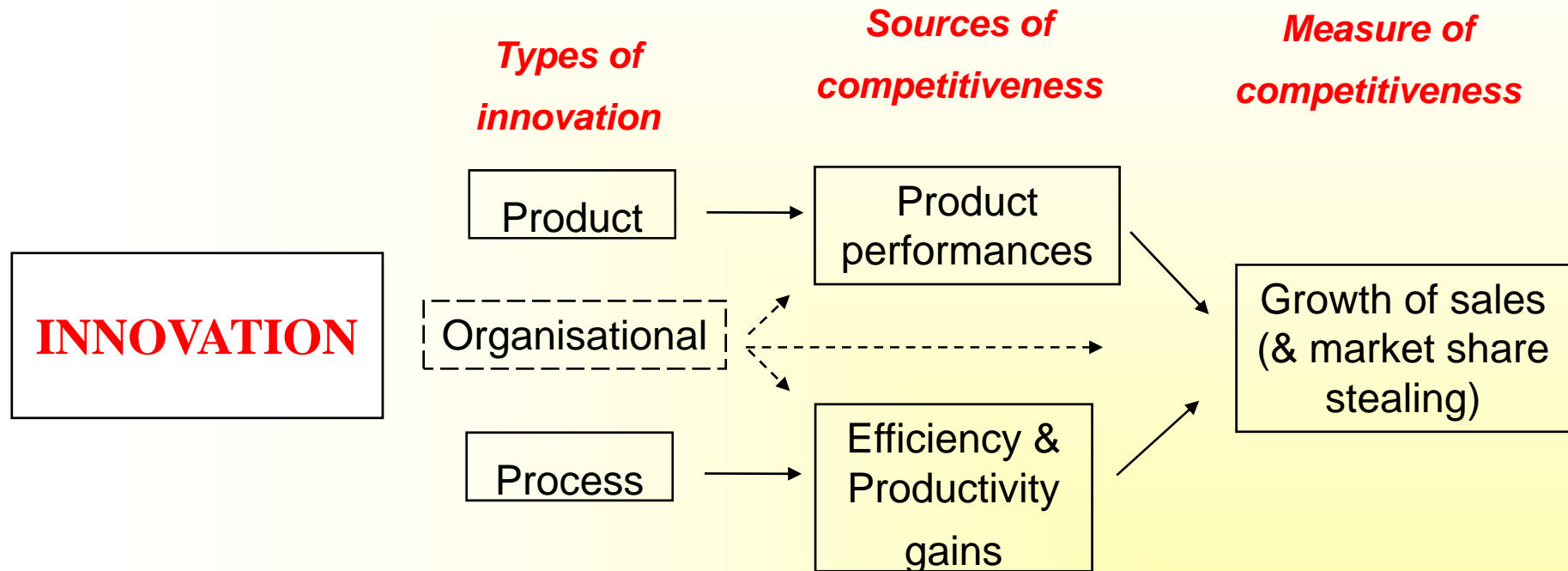
Relevance of (& complementarity between) technological and non-technological innovations

ONLY PROD.	ONLY PROC.	PROD & PROC.
ONLY TECH. M: 25.3% S:16.6%		

ONLY ORG.	ONLY NON-TECH M: 31.7% S: 44.9%
ONLY MKT	
ORG. & MKT	

BOTH: M: 43.0% S: 38.5%	
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Innovation as a source of firms' competitiveness



Methodology

- Data: Italian CIS4 (2002-2004) for both Manufacturing & Services
- Firm level analysis (comparative analysis)
- CIS variables used:
 - Type of innovation (product/process/organizational/marketing)
 - > Innovation modes
 - Sales growth (2002-2004)
 - > performance/competitiveness

Strengths and Weaknesses

Main caveats of CIS (and of this study)

- Very basic information of non-technological and organizational innovation
- Cross sectional nature of data

Major strengths

- Data representative of all manufacturing and service sectors
- Possibility of combining data on technological innovations with data on non-technological with (no other dataset available, especially with the same coverage)

Types of non-technological innovation (CIS4)

Organisational innovations

A major change to the **organisation of work** within your enterprise, such as changes in the management structure or integrating different departments or activities

New or significant changes in your **relations with other firms** or public institutions, such as through alliances, partnerships, outsourcing or sub-contracting

New or significantly improved **knowledge management** systems to better use or exchange information, knowledge and skills within your enterprise

Marketing innovations

Significant changes to the **design or packaging** of a good or service (Exclude routine/seasonal changes such as clothing fashions)

New or significantly **changed sales or distribution methods**, such as internet sales, franchising, direct sales or distribution licenses

Innovation modes: results from a cluster analysis

	Type of tech. innov.			Type of non-tech. innov.		
	Only Proc.	Only Prod.	Prod. & Proc.	Only Mkt	Only Org.	Org & Mkt
Clusters						
Prod. Oriented		63.60%		43.90%		20.30%
Proc. Oriented	65.00%			5.40%		51.80%
Org. Oriented	23.60%	8.50%			100.00%	
Complex			100.00%	6.40%	31.90%	41.30%
All sample	25.70%	11.30%	25.00%	8.80%	43.20%	26.80%

Sectoral characterization of innovation modes

	<i>Process oriented</i>	<i>Product oriented</i>	<i>Organisational</i>	<i>Complex</i>
<i>Manufacture</i>	32.44%	15.84%	27.56%	24.17%
<i>Services</i>	30.35%	11.77%	<u>38.86%</u>	19.02%
<i>Taxonomies</i>				
Science based	16.02%	26.73%	15.60%	<u>41.66%</u>
Scale intensive	<u>36.43%</u>	8.21%	<u>34.13%</u>	21.24%
Specialized supplier	14.67%	24.69%	27.52%	<u>33.12%</u>
Supply dominated	<u>41.65%</u>	17.37%	22.43%	18.56%
Trade & Leisure	<u>38.88%</u>	13.74%	29.91%	17.47%
Transport	21.07%	9.23%	<u>51.86%</u>	17.83%
Finance & Banking	18.66%	4.88%	<u>43.76%</u>	<u>32.71%</u>
Business services	17.70%	10.67%	<u>49.05%</u>	22.57%

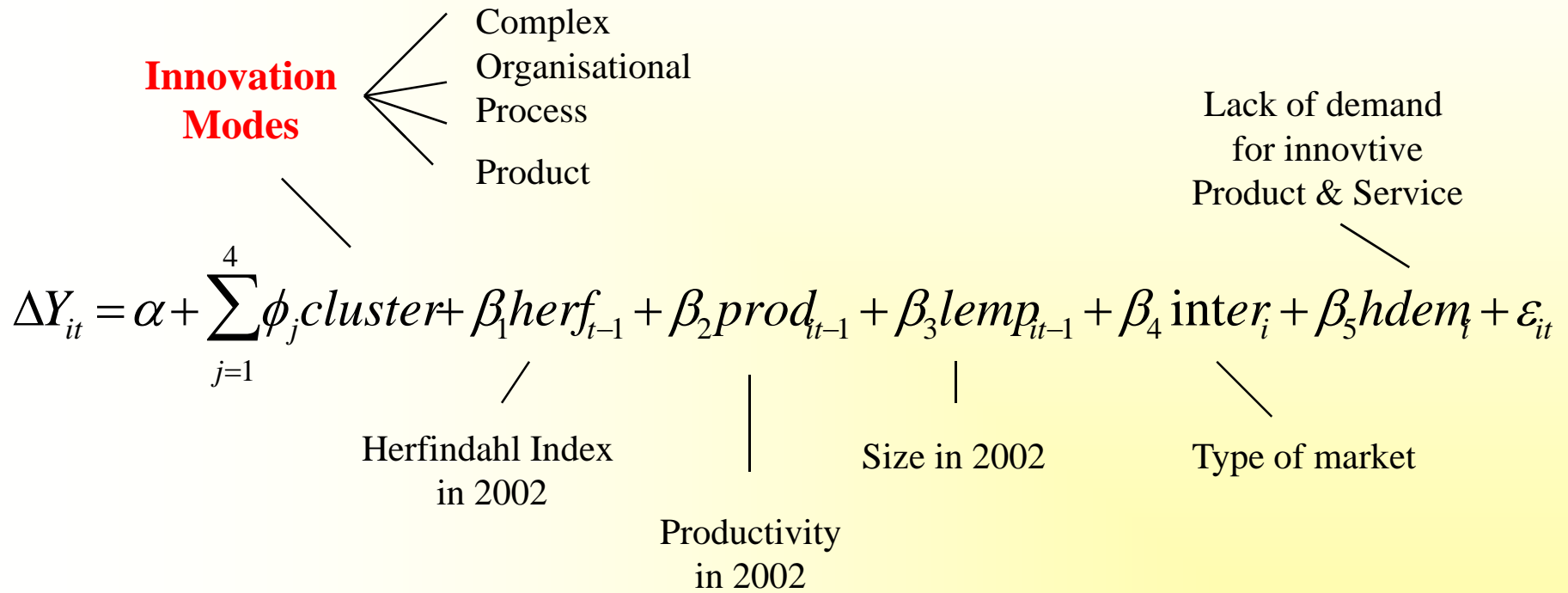
Innovation profile of clusters (probit estimates) – Manuf. & Services

	Product	Process	Organisational	Complex
Effects of tec. innovation				
Product related	0.033**	-0.088**		0.065**
Process related	-0.103**	0.064**		0.090**
Effects of non-tec. innovation				
Product related		-0.077**	0.116**	0.0508**
Process related		-0.017	0.012	0.012
Job satisfaction		-0.041**	0.050**	-0.012
Innovation exp. & output				
% turn. from innov. sales	0.127**			0.665**
% mac expenditure	-0.111**	0.193**		-0.065**
Inn. Exp per employee (log)	-0.007*	-0.015**		0.028**
Firms size classes (employees)				
_19	0.032**	0.049**	-0.015	-0.072**
_20_49	0.030*	0.024	0.040*	-0.075**
_250_more	-0.003	-0.049*	-0.087**	0.114**
Group	0.015	0.00546	-0.048**	-0.030
Sectoral dummies				
S&T Based services	-0.014	0.010	0.246**	-0.006
Scale intensive services	-0.014	0.089*	0.215**	0.127**
Supplier dominated services	-0.005	0.138**	0.293**	0.010
Sc. Based	0.066**			0.054
Scale intensive		0.185**	0.185**	0.005
Specialized supplier	0.046**	-0.040	0.143**	0.029
Supplier dominated	-0.002	0.254**	0.092**	
Observations	5170	5170	8213	5170
Succ. classified	86.87%	78.94%	72.76%	74.97%

* significant at 5%; ** significant at 1% - Marginal effects are reported in table

The model

Growth of sales estimation (rate of change):



Industry dummies are included in the general specification

The impact of innovation on sales growth: OLS estimation results

	All sample	Services	Manufacture
Complex	5.445 (0.677) **	4.997 (1.03) **	5.936 (0.906) **
Organisational	4.253 (0.581) **	3.234 (0.777) **	5.322 (0.873) **
Process	2.77 (0.626) **	1.52 (0.927)	3.669 (0.851) **
Product	1.761 (0.845) *	1.421 (1.362)	2.108 (1.047) *
herf	12.092 (2.326) **	18.665 (3.465) **	6.814 (3.148) *
prod02	-0.004 (0.001) **	-0.005 (0.001) **	-0.002 (0.002)
lemp02	-0.864 (0.175) **	-0.397 (0.24)	-1.295 (0.258) **
inter	0.703 (0.372)	1.581 (0.498) **	-0.225 (0.561)
hdem	-1.081 (0.188) **	-0.669 (0.265) *	-1.432 (0.266) **
Ind. dummies	0.000 **	0.000 **	0.000 **
Constant	6.495 (0.982) **	6.009 (1.147) **	9.783 (1.312) **
Observations	13870	6816	7054
Prob > F	0.000	0.000	0.000
R-squared	0.05	0.06	0.05

* significant at 5%; ** significant at 1% - Standard errors in parenthesis

Industry dummies coefficients refer to the p-value of a test of the joint significance of industry fixed effects.

Results broken-down by Manufacturing and Services sectors

	Science based	Scale intensive	Specialized supplier	Supply dominated
Complex	4.018 (2.484)	5.891 (1.46) **	8.391 (2.338) **	6.203 (1.65) **
Organisational	-0.174 (3.161)	5.662 (1.277) **	8.791 (2.394) **	4.493 (1.529) **
Process	5.424 (3.303)	2.44 (1.222) *	5.15 (3.109)	4.358 (1.288) **
Product	4.93 (2.839)	4.432 (2.011) *	-0.921 (2.798)	1.333 (1.765)
Observations	704	2649	1012	2689
Prob > F	0.000	0.000	0.000	0.000
R-squared	0.04	0.03	0.04	0.11
% on total Manuf. Ind.	0.1	0.38	0.14	0.38
	Trade & Leisure	Transport	Bank & Finance	Business Services
Complex	4.953 (1.614) **	8.129 (2.941) **	2.593 (2.256)	5.907 (2.187) **
Organisational	3.495 (1.111) **	2.301 (1.849)	0.687 (1.97)	3.752 (1.789) *
Process	1.527 (1.128)	-1.734 (2.544)	1.87 (2.455)	2.324 (2.605)
Product	0.308 (1.689)	12.846 (3.874) **	0.066 (3.906)	-1.721 (3.352)
Observations	3205	1215	840	1556
Prob > F	0.000	0.000	0.023	0.000
R-squared	0.05	0.04	0.05	0.04
% on total Serv ind.	0.47	0.18	0.12	0.23

* significant at 5%; ** significant at 1% - Standard errors in parenthesis

Industry dummies coefficients refer to the p-value of a test of the joint significance of industry fixed effects.

Main results of this empirical exercise

Enhancing the role played by Competition in the adoption of technological innovations provides a much richer and complex picture of firm's innovation strategies and performances.

A strict technological strategy exerts a positive and significant impact on firm's organizational performance. Only 1/3 of innovating firms are following a strict technological strategy.

Competitive models in the tertiary sector seem to be more binding requiring the adoption of innovation systems. A period is identified depending on the ways which firms combine (or not) technological and non-technological innovations.

Effects of technological innovations (CIS4)

- Increased range of good or services
- Entered new markets/increased market share

→ *Product related effects*

- Improved flexibility of production/service provision
- Reduced labour costs per unit output
- Reduced materials and energy per unit output

→ *Process related effects*

Effects of non-technological innovations (CIS4)

- Improved quality of your goods or services
- Reduced time to respond to customer/supplier needs

→ *Product related effects*

- Reduced costs per unit output

→ *Process related effects*

- Improved employee satisfaction/reduced employee turnover