SDA Bocconi

XI Seminario de Gestiòn Tecnòlogica

ALTEC

25-28 October 2005

Industrial Districts and Competition

Key Issues and Performances in Innovation and Operations Processes

Prof. Alberto Grando
SDA-Bocconi School of Management
Bocconi University, Milan (Italy)

Presentation Objectives and Structure

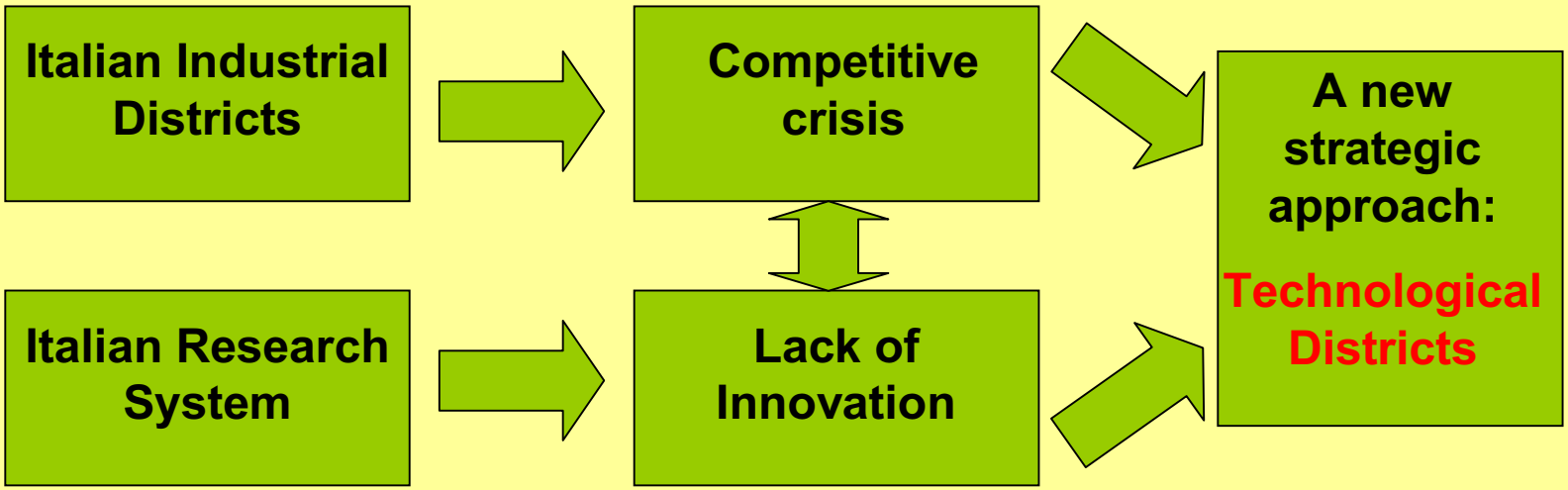
Describe the role played by innovation processes in the networks of SMEs

- Focus on:
  - the Italian experience of Industrial Districts
  - the transition from Industrial Districts to Technological Districts
  - the implications in terms of government policies and governance

Presentation Objectives and Structure

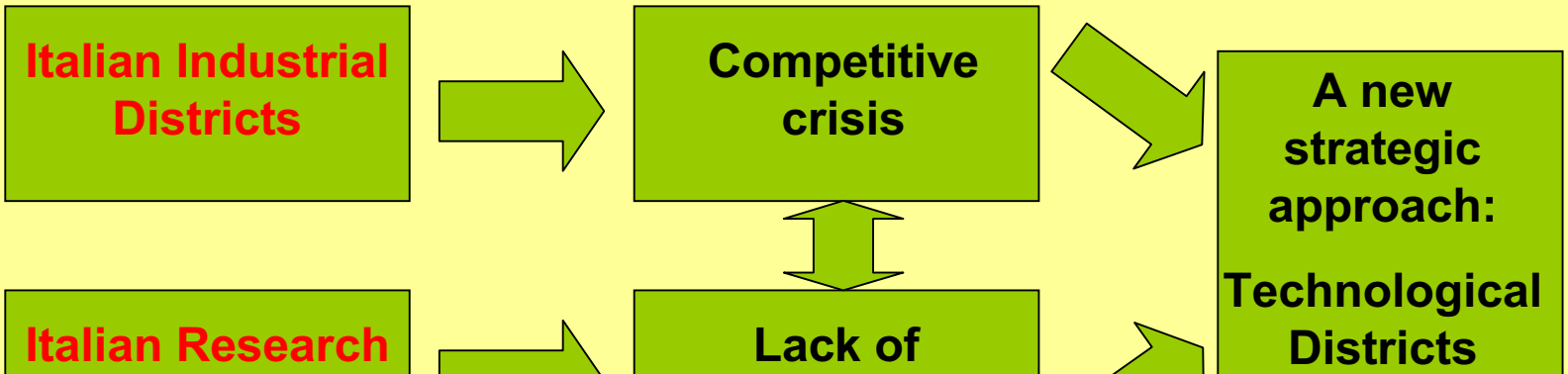
The presentation is organized in four parts:

1. Size and profile of the phenomenon
   ID performances and innovation in Italy
2. The crisis of the Italian Industrial Districts
   recent crisis but old problems
3. Towards a new strategic approach
   from Industrial Districts to Technological Districts
4. Conclusions



1) Size and profile of the phenomenon

Industrial district performances and innovation in Italy



Industrial Districts in Italy

- Industrial District (Law 317/91): “is a territorial area characterized by high concentrations of small companies, industry specialized, with a specific relationship between proximity of firms and local population”
- 97.7% of companies are Small (< 49 employees) and 95% < 10 employees
- 199 industrial districts, 2.2 million employees, 27% of GDP, 38% of manufacturing GDP and 46% of manufacturing exports
- 75% are specialized in Textile and clothing, Mechanical, Furniture, leather and shoes

District's performances: a first comparison

- A Survey, based on IBFA data base, was conducted at the end of 2004
  - The survey aimed to investigate the main plant performances of SMEs and to highlight the performance differences between those which operate in an industrial district and those which do not belong to such a network
    - Three samples in the Mechanical industry (16,1% national total employees, 19.7% national value added*)
      - Independent SMEs (50 plants, < 250 employees**)
      - District companies (31 plants, <250)
      - Large Plants (36 plants, > 250)
    - 36 indicators, grouped into six different performance categories (efficiency, employee profile, lead times, flexibility, inventory management and production schedule adherence, quality, innovation)

* ISTAT 2003
** EU direttive 96/C – 213/03

A Comparison in the Mechanical Industry

Category	Code	Variables	Mechanical SMEs ◆	Mechanical District ■	Mechanical Large ▲	p value	
Plant profile	P1	Items in use at product level (number)	1,287	979	6,239	0.0630	*
	P2	Items in use at manufactured componenents, bulk intermediate or sub-assembly level (number)	2,217	942	1,711	0.8461	
	P3	Items in use at bought out component or sub-assembly level (number)	6,455	834	15,704	<0.0001	***
	P4	Manufac. comp., purchased items or purchased assemb. present in the product with the largest output (number)	320	68	1,796	<0.0001	***
	P5	Total production related employees (number)	82	23	438	<0.0001	***
	P6	Total employees (number)	107	30	601	<0.0001	***
	P7	Proportion of the plant's total output supplied to customers off the shelf (%)	23	39	26	0.1054	
	P8	Prop. of the plant's total output supp. to cust. on a quoted lead time shorter than the actual manuf. lead time (%)	29	22	26	0.9352	
	P9	Prop. of the plant's total output supp. to cust. on a quoted lead time equal/ longer than actual man. lead time (%)	48	39	49	0.5803	
Efficiency	E1	Overall Equipment Effectiveness (%)	80.2	NA	86.6	0.2279	
	E2	Average rate of absenteeism (%)	5.8	3.8	5.8	<0.0001	***
Employee profile	EP1	Average length of service (years)	10	14	13	0.0437	**
	EP2	Average rate of absenteeism (%)	5.8	3.8	5.8	<0.0001	***
	EP3	On-job training for new starters (days per year)	18	85	22	<0.0001	***
	EP4	On-job training for existing employees (days per year)	5	29	7	<0.0001	***
	EP5	Production employees able to carry out more than 50% of the production tasks in their area (%)	68.2	51.2	65.1	0.1241	
Lead times	LT1	Planned procurement lead time for the main bought out item (days)	57	35	108	0.0002	***
	LT2	Average manufacturing lead time for components (days)	23	15	25	0.9130	
	LT3	Average assembly lead time (days)	14	7	27	0.5592	
	LT4	Shortest customer lead time quoted (days)	24	9	39	0.0518	*
	LT5	Average customer lead time quoted (days)	50	24	73	0.1223	
	LT6	Longest customer lead time quoted (days)	93	56	155	0.0466	**
	LT7	Due-date reliability (%)	85.9	86.4	89.0	0.3059	
Flexibility, inventory management, production schedule adherence	FIP1	Average set-up time in component-intermediate manufacture (minutes)	73	127	91	0.2366	
	FIP2	Longest set-up time in component-intermediate manufacture (minutes)	227	371	418	0.1775	
	FIP3	Average set-up time in assembly (minutes)	48	85	80	0.9518	
	FIP4	Longest set-up time in assembly (minutes)	93	114	250	0.5193	
	FIP5	Time spent on setting/changeover (%)	11	26	7	0.0010	***
	FIP6	Days of usage of finished goods ready for sale (days)	24	42	19	0.5537	
	FIP7	Production schedule adherence (%)	87.1	78.4	91.9	0.0026	***
Quality	Q1	Scrap or yield loss rate (%)	4.1	5.6	4.4	0.6137	
	Q2	Time spent on rework/reprocessing (%)	3.2	3.7	2.4	0.6999	
	Q3	Customer returns (or complaints) for quality reason (%)	3.4	1.2	0.5	0.0060	***
	Q4	First Time Pass Rate at final test (%)	86.2	89.7	94.1	0.3093	
Innovation	I1	Time to market (month)	14.7	18.0	20.2	<0.0001	***
	I2	Actual innovation rate (%)	1.5	6.7	4.3	0.6236	
	I3	Future innovation rate (%)	1.5	3.1	1.4	0.1452	

•p-value<0,1; ** p-value<0,05; *** p-value<0,01

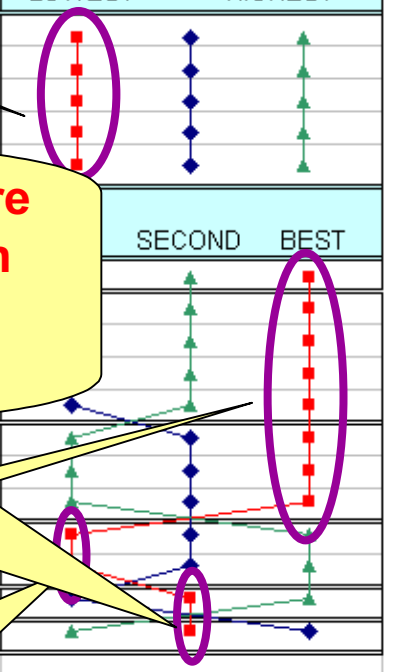
Source: Grando, Belvedere, 2005

A Comparison in the Mechanical Industry

- Lowest level of complexity (production phase focalization)

Category	Variables	Mechanical SMEs ◆	Mechanical [illegible] ■	Mechanical Large ▲	p value
Plant profile	Items in use at product level (number)	1.287	979	6.239	*
	Items in use at bought out component or sub-assembly level (number)	6.455	834	15.704	***
	Total number of items present in the product with the largest output (number)	320	68	1.796	**
	Total production related employees (number)	82	23	438	***
Perfor					
Efficie					
Emplo profile					
Lead time	Planned procurement lead time for the main bought out item (days)				***
	Shortest customer lead time quoted (days)	24			*
	Longest customer lead time quoted (days)	93	56		
Flexibility	Time spent on setting/chageover (%)	11	26	7	
	Production schedule adherence (%)	87,1	[illegible],40	91,90	***
Quality	Customer returns (or complaints) for quality reason (%)	[illegible]	1,20	0,50	***
Innovation	Time to market (month)	14,7	18,0	20,2	

* p-value≤0.1; ** p-value≤0.05; *** p-value≤0.01



- Great risk from the innovation standpoint: future innovation rate (3.1) is half the actual innovation rate (6.4)

- Highest level of workforce loyalty and training (social network)

- Greatest attention to lead times and responsiveness (physical proximity)

- Lower level of flexibility

Research & Development in Italy

- 3 networks in the Italian scientific system:
  - Universities (30% of R&D expenses)
    - 77 universities, 52,000 employees, 14,000 Phd, 1,600,000 students
  - Public Research Centres (16,2% of R&D expenses)
    - 7 Large National Centres, 14 minor centres monitored by MIUR, 32 research institutions monitored by MHC, 23 Experimental Institutes for agriculture, several centres monitored by other ministers, 30,000 employees
  - Industrial Research (53,5% of R&D expenses), of which:
    - 13% transferred by the Government
    - 3% transferred by the private companies to the public ones
- Total investments: 15.6 billion $, 57% Public and 43% Private

Source: Miur, 2005

Research & Development in Italy

- Lisbon objectives: R&D investments / GDP
  - Average EU = 1.9% in 2004 ⟹ 3% in 2010

Country	$ billion	% tot OCSE	% GDP 1991	%GDP 2001
U.S.A.	277.1	43.4	2.72	2.67
Japan	103.8	16.3	2.93	3.06
Germany	55.1	8.6	2.53	2.51
France	36.1	5.7	2.37	2.20
United Kingdom	29.4	4.6	2.07	1.89
Korea	22.0	3.4	1.92	2.92
Canada	17.3	2.7	1.60	1.82
Italy	**15.6**	**2.4**	**1.23**	**1.07**
Sweden	9.9	1.5	2.70	4.27
Holland	8.8	1.4	1.97	1.89
Spain	8.2	1.3	0.84	0.96
Australia	7.8	1.2	-	1.55
Belgium	6.2	1.0	1.62	2.17
Others	41.1	6.4	-	-
Total OCSE	638.4	100	2.23	2.29

Source: Fortis and Carminati, 2004, data OECD 2001 - 2002

Research & Development in Italy

- Weaknesses
  - Reduction in R&D investments
  - Few Large companies in High-tech industries
  - Little private investment (43%)
  - Insufficient number of graduates and PhD students in high-tech
  - Low level of diffusion of research outcomes
  - Weak interaction among the 3 research networks

- Strengths
  - Some excellence in the public scientific system
  - Strong presence of private companies in some specific sector (Advanced mechanical, robotics, microelectronic, optoelectronic, etc.)
  - High flexibility in the industrial structure, based on SMEs
  - High number of Industrial Districts focused on (incremental) innovation

R&D investments in Italian companies

- Number of companies that invest more than 100 million Euros in R&D and total Investments

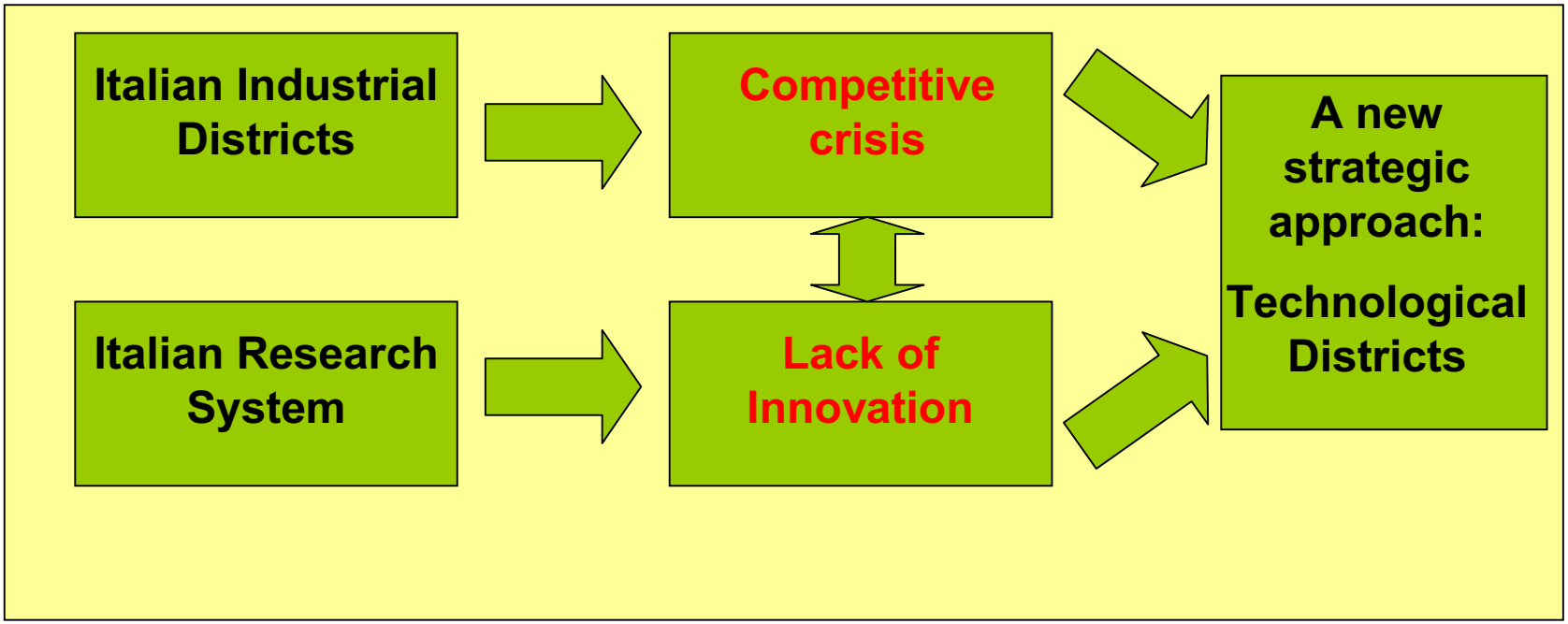
Country	Companies (N.)	R&D Investments (billion €)
Italy	5	3,6
Germany	37	35,3
France	28	18,3
United Kingdom	22	13,5

- 5,5 billion € in R&D was invested by Siemens in 2004, more than the first 100 Italian companies!

Source: EU, 2003, Fortis, 2005

2) The crisis of Italian Industrial Districts

Recent crisis but old problems



163 Industrial Districts of Made in Italy

Categories	Structure	N. of ID
Large Company dominated ID	Dominated by Large companies	13
Robust ID with structured Medium-sized companies	>50% of employees are in Large and Medium-sized Companies (>50% Medium-sized Companies with > 100 employees)	19
Robust ID without structured Medium-sized companies	>50% of employees are in Large and Medium-sized Companies (<50% Medium-sized Companies with > 100 employees)	31
Atomized ID with structured Medium-sized companies	<50% of employees are in Large and Medium-sized Companies (>50% Medium-sized Companies with > 100 employees)	14
Atomized ID without structured Medium-sized companies	<50% of employees are in Large and Medium-sized Companies (<50% Medium-sized Companies with > 100 employees)	86

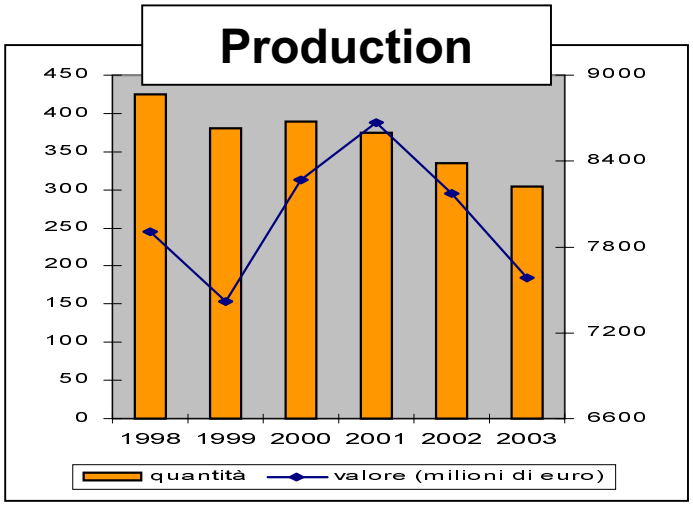
Source: Edison Fundation, 2005

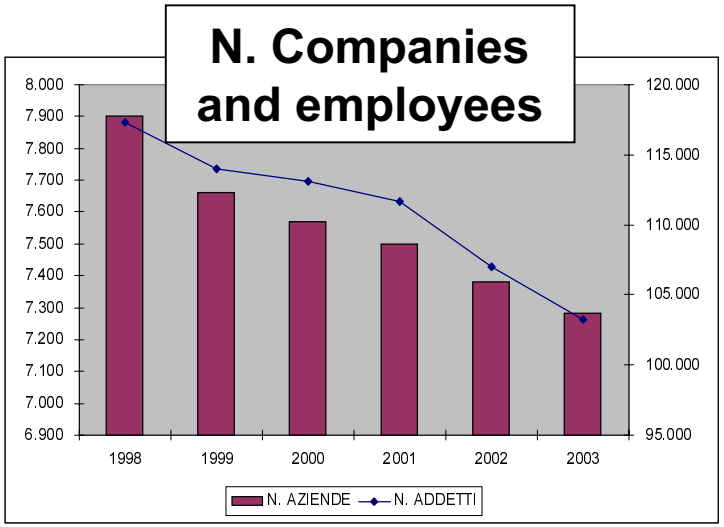
Competition in the Made in Italy

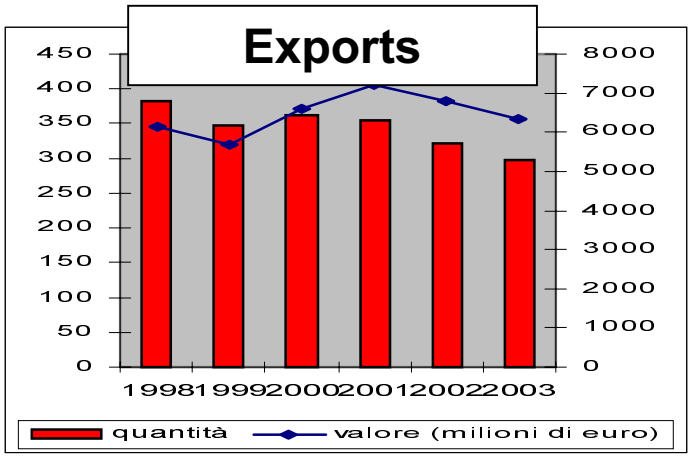
Imports to EU-15	1996 € million	2003 € million	Var. %
Clothing & Fashion: first 7 product categories			
- Imports from Italy	10,941	11,062	**1**
- Imports from China	7,554	16,096	**113**
Furniture & Households: first 9 product categories			
- Imports from Italy	6,402	7,835	**2**
- Imports from China	1,466	6,187	**322**

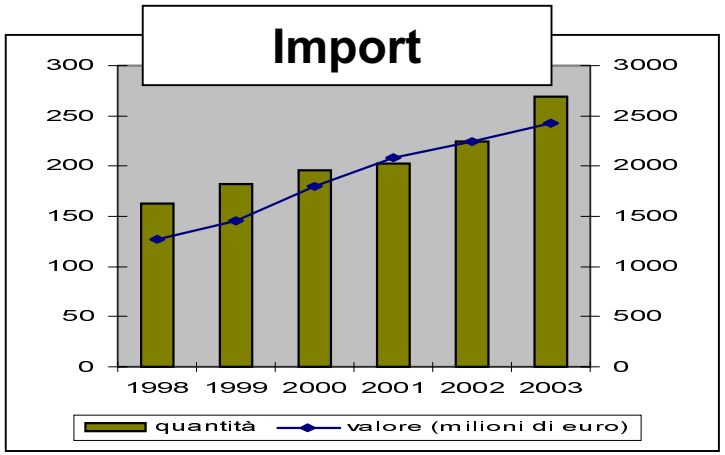
Source: Edison Foundation, 2005 data Eurostat

The shoe Industry in Italy









The shoe District of Lucca (1998-2004) has lost - 14.2% of companies and -26.4% of employees

The crisis of Traditional Districts

Textile and Clothing Industry

- In the first quarter of 2005, Europe has imported from China:
  - 150 million shirts
  - 65 million pullovers
  - 105 million pairs of trousers
  - 44 million bras
  - 886 tons linen yarns
- Impact in Italy on:
  - 68,000 SMEs
  - 570,000 employees
  - 43 million euros turnover

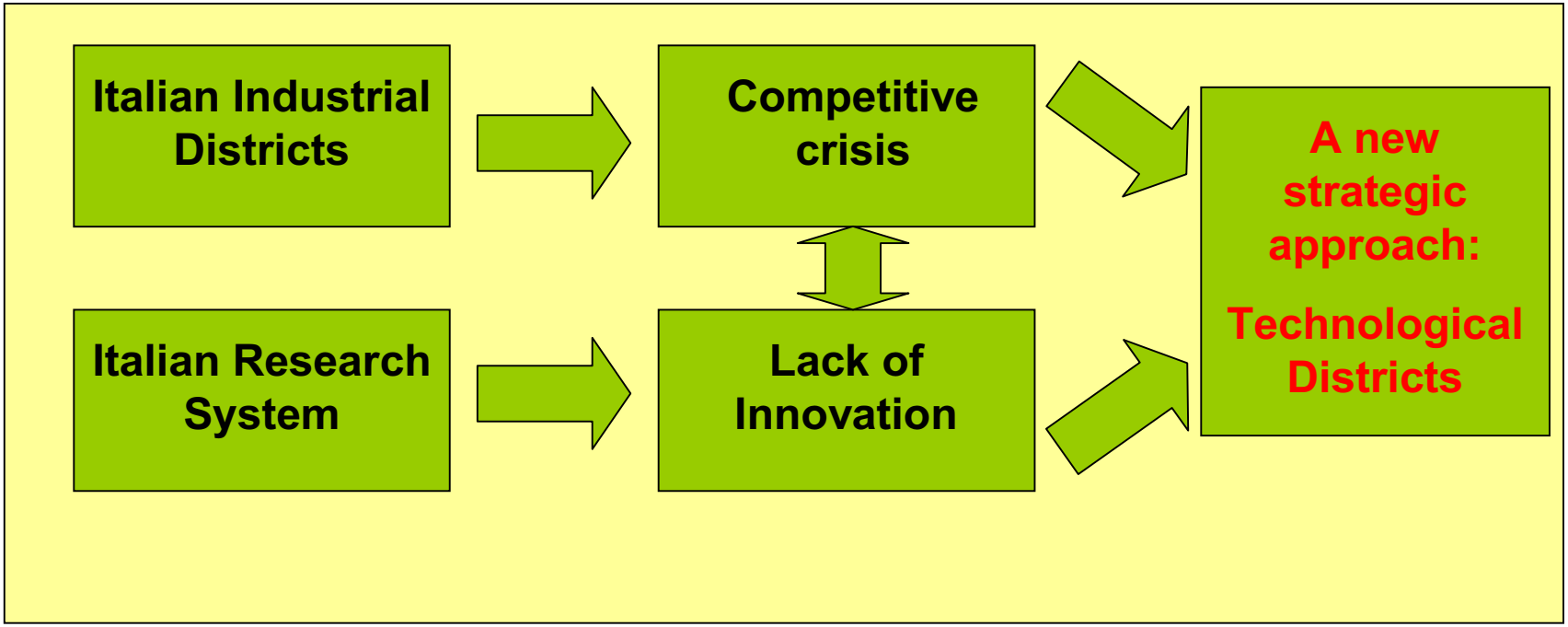
Source: IPI, 2005

The crisis of Industrial districts

- External variables
  - Monetary stability thanks to the introduction of Euro: end of competition of SMEs based on devaluation (focus on real competitiveness: efficiency, differentiation and innovation)
  - Globalization of markets and delocalization of some phases of the value chain

- Industrial districts are primarily made by SMEs:
  - Focused on incremental innovation
  - Too small to compete at global level
  - Mainly based on traditional industries
  - And labour intensive processes

3) Towards a new strategic approach
from Industrial Districts to Technological Districts



From Industrial to Technological Districts

- Migration from a “factory centred” district rooted on the territory and linked to traditional industries, to a new pattern of “network governance” in strategic high-tech sectors and along their value chains: “TD as hub of innovation”
  - Strengthen the cooperation among the knowledge and innovation producers (Universities and public Research Centres), the users (private companies) and the Local Government presence
  - Facilitate the access of these subjects (Universities and Firms) to the financial system (private equity and venture capital)
  - Focus the public support to R&D in strategic industries

The role played by the Government

• Local government (Regions) were delegated to define policies for ID:

- PROS
  - Proximity to the local needs
  - Knowledge of local networks
  - Flexibility in defining the ID

- CONS
  - Lack in defining a common model of Governance
  - Lack in coordinating common strategies

• Initial results:

• Focus on single SMEs and less attention to the intra-district collaborations and to the networking among district companies, Research institutions, Universities, Financial Institutions;

• Focus on infrastructure and traditional local services

•Service Centres (ICT, Quality Certification, promotion abroad, e tc.)

•Training and education

•R&D Laboratories (new materials, new technologies, etc.)

The new strategic approach: policies

Guide-lines and priorities for Research 2003-06, realised by Miur in April 2003

Research National Plan 2005-07, realised in March 2005

1. **International scientific and technological Trends**
2. **Priorities of EU**
3. **Specific impact on domestic system:**
   Economic impact, Social impact, Impact on Public investments, Competitive positioning in the export/import balance, Return of Research investments in term of products, processes and services with high tech intensity

Priority areas: Production systems, ICT, energy, environment, transportation, agri-food, healthcare, tourism and culture

Priority areas and expected impact

Expected Impact / Priority Areas	Economic/ employment	Social/enviro nmental	Competitive positioning	Fallout in NP&PD
Production systems	++	+	+++	+++
Information/Telecommunication	+++	++	++	+++
Energy	+	++	+	++
Environment	++	+++	+	+
Transportation	+	++	++	++
Agri-food industry	++	++	++	++
Healthcare	+	+++	+	++
Tourism/culture	++	++	(tourism)	+

+ = good, ++ = high, +++ = excellent

The new strategic approach: policies

Guide-lines and priorities for Research 2003-06, realised by Miur in April 2003

1. **International scientific and technological Trends**
2. **Priorities of UE**
3. **Specific impact on domestic system:** Economic impact, Social impact, Impact on Public investments, Competitive positioning in the export/import balance, Return of Research investments in term of products, processes and services with high tech intensity

Priority areas: Production systems, ICT, energy, environment, transportation, agri-food, healthcare, tourism and culture

Research National Plan 2005-07, realised in March 2005

4 axis of action:

1. **Basic research**
2. **Mission oriented research**
3. **Industrial (applied) research**
4. **Innovation for SMEs in high-tech industries**

Enabling technologies: biotech & post-genomic, nanotech & new materials, ICT, aerospace

Enabling technologies and priority areas

Areas / Technologies	Production systems	ICT	Energy	Environmental	Transportation	Agri-food	Health care	Tourism culture
Biotech				+		+++	+++	+
Advanced inform.	+	+++			+		+++	+++
Microelectronic	+++	+++		+	+	+	+	+
Optoelectronic	++	+++		+	+		+	++
Biomedical	++						+++	
Micro / nano-technology	+++	+++	+	+	++		++	
New materials	+++		++		+++	+	++	+++
Chemical			+++	++		+	+	
Fluid dynamic			+++	+++	+++			
Control systems	++	+	++	+	+++		+	
Robotics	+++	+	+	+	++	+	+	

+ = good, ++ = high, +++ = excellent

Launch of Technological Districts

- 11 high-tech new districts were defined
  - Wireless ICT (Piemonte)
  - Nanotechnologies (Veneto)
  - Biotechnologies (Lombardy)
  - ICT (Lombardy)
  - New materials (Lombardy)
  - Intelligent Integrated Systems (Liguria)
  - Advanced mechanics (Emilia Romagna)
  - Molecular biomedicines (Friuli Venezia-Giulia)
  - Aerospace and Defence (Lazio)
  - Composite and Polymeric materials (Campania)
  - Micro and nano-systems (Sicily)
- Another 11 districts are going to be defined

First experiences: Governance, objectives and target results

Turin Wireless in Piemonte region

- 2002 start of Torino Wireless Foundation:
  - Piemonte Region accounts:
    - 15% of Researchers (2.000 in Turin) specialized in the industry
    - 23% of total investments in research made by private companies
- Partners and their investments (million €):
  - Ministry of Education, University and Research (26)
  - Local Government (region, province, Turin council) (10, 8, 6)
  - Local Universities (Polytechnic, State University)
  - Industrial Association and Chamber of Commerce (2.9)
  - Firms (Alenia Aeronautics, FIAT, Motorola, STMicroelectronics, Telecom Italia) (7)
  - Financial Institutions (S.Paolo IMI; UniCredit) (1.2)
- Official kick-off: May 2003

First experiences: Governance, objectives and target results

Turin Wireless in Piemonte region

- Financial target
  - 130 million € investments in 5 years
    - 35 million € in R&D projects
    - 25 million € in technology transfer processes
    - 70 million € new Venture Capital Fund for start ups
- Mid-range objectives (2010)
  - Triple the number of specialized researchers (6.000)
  - Create 50 new companies in ICT
  - Attract Italian and foreign companies to Piemonte
  - Increase the presence of ICT in the local economy from 5% to 8-10%
  - Reach sustainability

First experiences: High-mec district in Emilia Romagna region

In a three years period (2002-2004), with a local contribution of 30 million € and a total investment of 77 million €:

- **188 projects have been launched**
- **600 new projects are under evaluation**
- **10 new companies and 16 start-ups were launched in high-tech sectors, with an investment of 1 million €**
- **234 agreements of collaboration with - Universities and Research Centres and 155 agreements of collaboration with MIUR-certified laboratories will be signed next year**

Source: Cotec, 2005

4) Conclusions

Conclusions

It is the beginning of a long way, but there is a new commitment to strengthen research and innovation

Initial results

- New initiatives on the Industrial and scientific research (universities) side (some examples):
  - Pirelli Lab (May 2001), 135 million €, focused on new materials, fuel cells, nano-tech, etc.
  - Telecom Tilab (2003), 148 million €, 1.000 researchers, focused on ICT, 68 new patents (14 co-signed with Pirelli Lab)
  - Molecular Oncology Firc Institute (April 2003)
  - ……
- A renewed focus on innovation from the Government side:
  - The document of financial planning that is under discussion in these days in the Italian Parliament introduces:
    - A new fund of 100 million € for Research projects
    - 0.5 % of annual the private taxes flow devoted to fund innovatio n
    - A series of specific investments in R&D tax-free

Conclusions

Technological Innovation is the key issue to revamp the competitiveness of Italian industrial networks

To support these networks in developing and utilizing innovation and research as a new assets and sources of competitive advantage

- Develop a stronger collaboration among local government, research system and private companies
- Establish an effective system of governance, based on central coordination and local execution
- Focus the investment through a proper selection of priority areas of presence and enabling technologies
- Leverage the existing centres of specialized competencies

References

- Baden-Fuller C., Lorenzoni G. (1995), Creating a strategic centre to manage a web of partners, *The California Management Revew*, vol.37, n. 3, pp. 146-163
- Becattini G. (1987), Mercato e forze locali: il distretto industriale, Il Mulino, Bologna
- Becattini G. (1990), *The Marhallian Industrial District as a Socio-Economic Notion*, in Pike F., Becattini G., Sengerberger W. (edit.) *Industrial Districts and Inter-firm Cooperation in Italy*, International Institute of labour Studies, Genova
- Bianchi G. (1994), *Tre e più Italie: i sistemi territoriali di piccola impresa e transazione post-industriale*, in Bortolotti F. (edit.), *Il mosaico e il progetto: lavoro, imprese, regolazione nei distretti industriali della Toscana*, F. Angeli, Milano.
- Brunetti G., Micelli S., Minoya M. (2002), *La sfida delle tecnologie di rete: distretti veneti e lombardi a confronto*, F. Angeli, Milano
- Bossi G., Scellato G. (edit.) (2005), Politiche distrettuali per l'innovazione delle Regioni italiane, Fondazione COTEC
- Etzkowitz H., Leydesdorff L. (1995), The Triple Helix of University-Industry-Government Relations: A Laboratory for Knowledge Based Economic Development, *EASST Review* , vol14, n. 1, pp. 11-19.
- Etzkowitz H., Leydersdorff L. (2000), The dynamics of Innovation:from nat ional systems and Mode 2 to a Triple Helix of "University-Industry-Government relations, *Research policy*, vol.29, n. 2, pp. 109-123 .

References

- Fortis M. (2005), *Le due sfide del Made in Italy: globalizzazione e innovazione*, Il Mulino, Bologna
- Fortis M, Carminati M. (2004), Le azioni a sostegno della ricerca e dell'innovazione science based, *Economia Italiana*, n. 1, pp. 117-147
- Grando A., Belvedere V. (2005), District's Manufacturing Perfomance: a comparison among large, small-to-medium-sized and district enterprises, *International Journal of Production Economics*, Forthcoming
- Lazerson M.H., Lorienzoni G. (1999), The firms that feed industrial districts: a return to the Italian source*, Industrial and Corporate Change*, vol.8, n.2
- Leydersdorff L., Etzkowitx H. (1998), The Triple Helix as a model for innovation studies, *Science and Public Policy*, vol. 25, n.3, pp. 195-203
- Malipiero A., Munari F., Sobrero M. (2005), *Focal firms as technological gatekeepers within industrial districts: knowledge creation and dissemination in the italian packaging machinery industry*, DRUID working paper, Dansih Research Unit for Industrial Dynamics, n.5.
- Morrison A. (2004), *Gatekeepers of knowuledge within industrial districts: who they are, how they interact*, Working Paper Series Cespri, Un. Bocconi, n. 163, November