

**Is Italy equipped to face the coming age of robots?  
A comparison with Korea and Singapore  
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XLI Conferenza Scientifica Annuale  
Web Conference, 2-5 settembre 2020

*«Regioni tra sfide e opportunità inattese»*

# What is “Artificial intelligence” (AI)?

The artificial intelligence is what is commonly called “robot”. After industrial revolution, automation has basically consisted in making hardware components and software programs capable of functioning automatically.

On the contrary, artificial intelligence might perform the cognitive capacities of human beings.

# Salient point of my reasoning:

- 1) The employment of AI is increasing (especially in productive activities), it is no more science fiction;
- 2) The diffusion is more evident in Asia (e.g. Singapore, Korea) but also in Europe (Germany, Italy);
- 3) The literature on the impact of AI (but in general of technological progress) on employment is not unanimous;
- 4) Probably every country reacts to technological progress according to its institutional and economic context.

TO INVESTIGATE POINT 4) WE COMPARE SINGAPORE, SOUTH KOREA AND ITALY IN ORDER TO ANALYSE THEIR ECONOMIC AND INSTITUTIONAL CONTEXT AND THE WAY THEY REACT TO INNOVATION (method: Grounded Theory).

The current diffusion of robots, a special look to Italy, Singapore and South Korea

**Tab. 2 - Manufacturing industry-related robot density in selected countries - 2018**  
(in units per 10,000 employees)

Singapore	831
South Korea	774
Italy	200
Global average	99

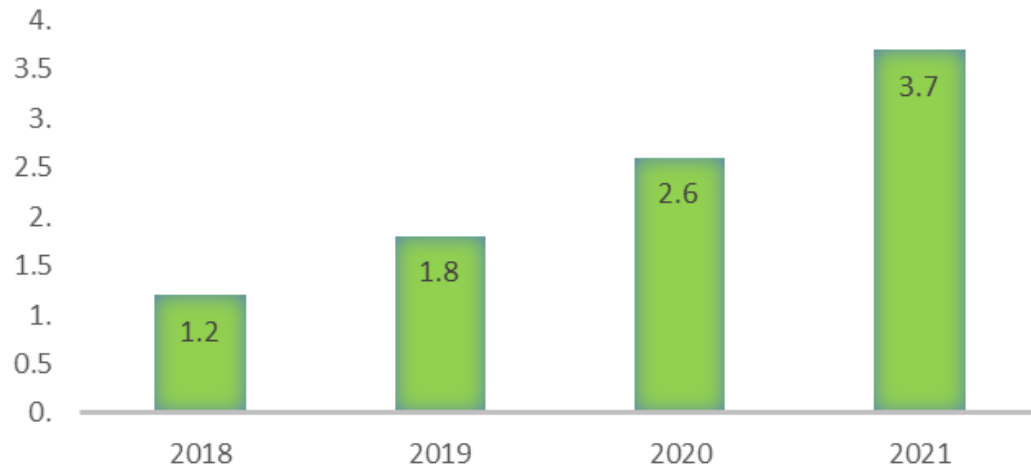
**Unit shipments of industrial robots worldwide in 2018, by country (in 1,000s)**

South Korea	37.8
Italy	9.8
Singapore	4.3

*Source: IFR World Robotics Presentation 2019, page 7*

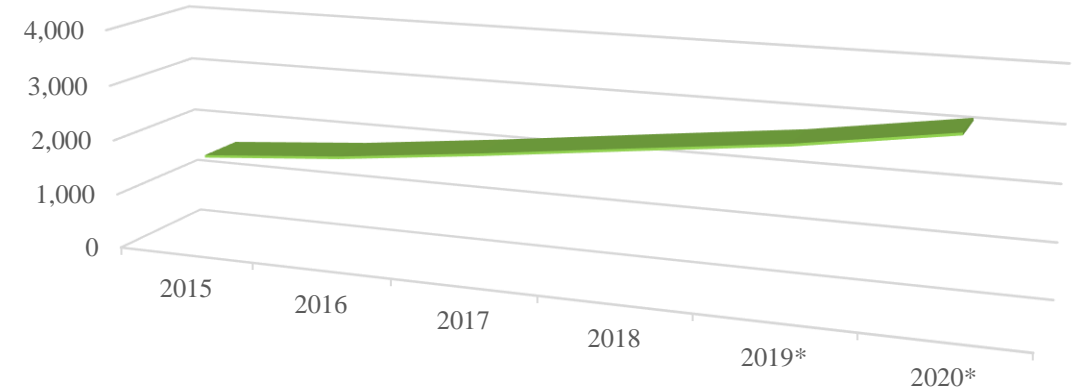
# The diffusion of robots in productive activities is forecasted to follow a positive trend

**Fig. 2 - Projected demand for advanced robotics in manufacturing worldwide between 2018 and 2021 (in billion U.S. dollars)**



Source: IFR, *Advanced Robotics in the Factory of the Future*, exhibit 1

**Fig. 3 - Operational stock of multipurpose industrial robots worldwide 2015-2020 (in 1,000 units)**





# The impact of robotization on the production systems

The literature on the impact of robotisation on economic system is **not unanimous**.

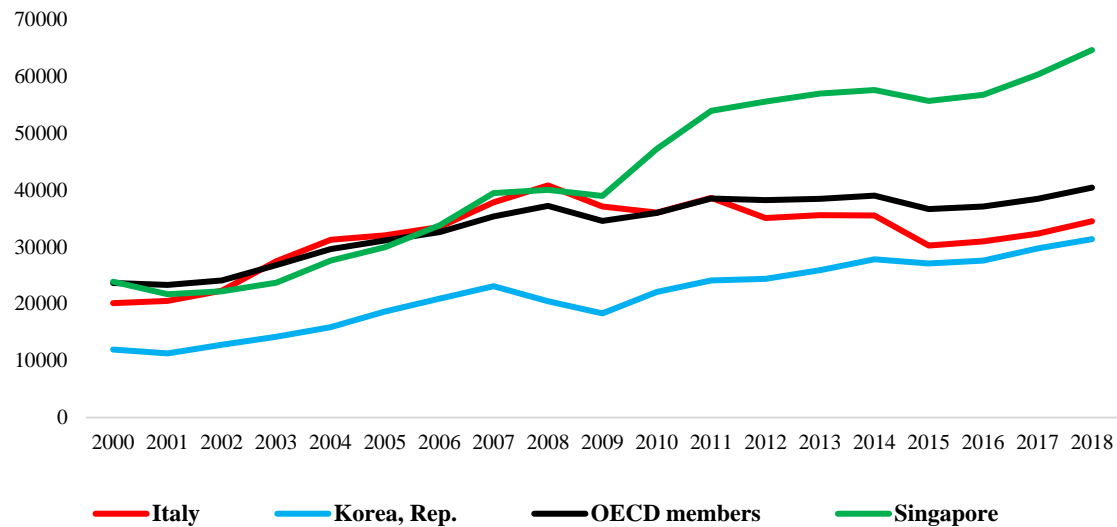
To analyse the impact of robotization on the production systems, the first step may be to study which kind of transformations it is expected to produce.

According to the economic literature, AI may have the following effects:

- ✓ Workers' displacement;
- ✓ Productivity increment and economic growth;
- ✓ Skill bias;
- ✓ Distributional bias.

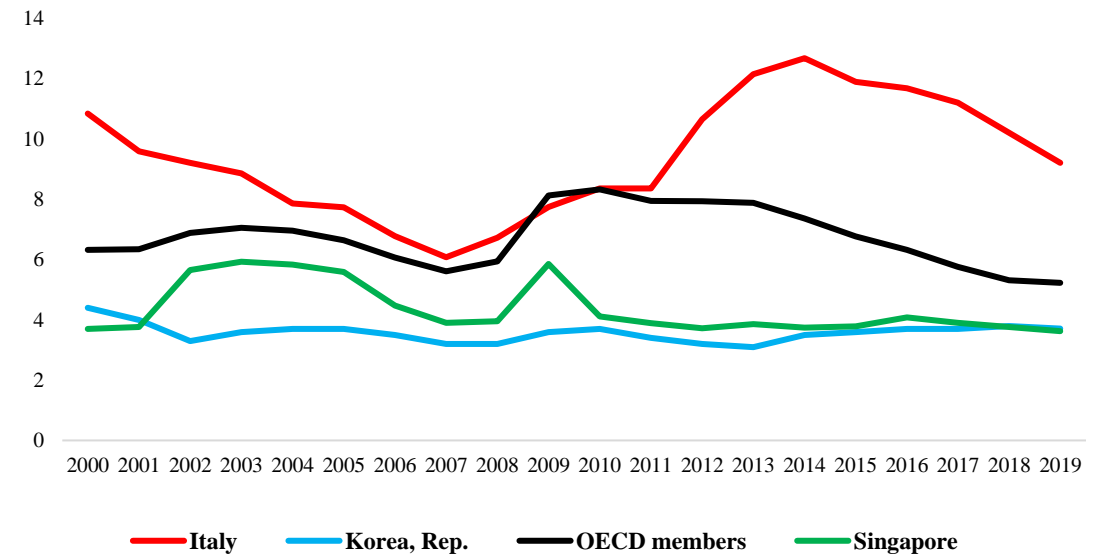
# The institutional capabilities to face the coming age of robots: economic factors

Fig. 5 - Per capita GDP 2000-2018 (current U.S. dollars)



Source: World Bank data

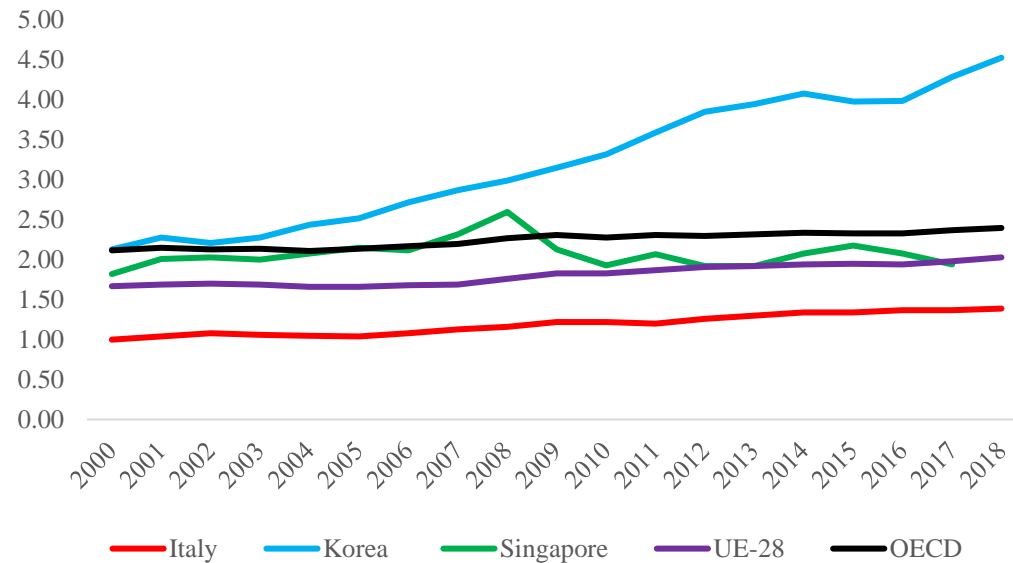
Fig. 6 - Unemployment rate (% of total labor force)



Source: World Bank data

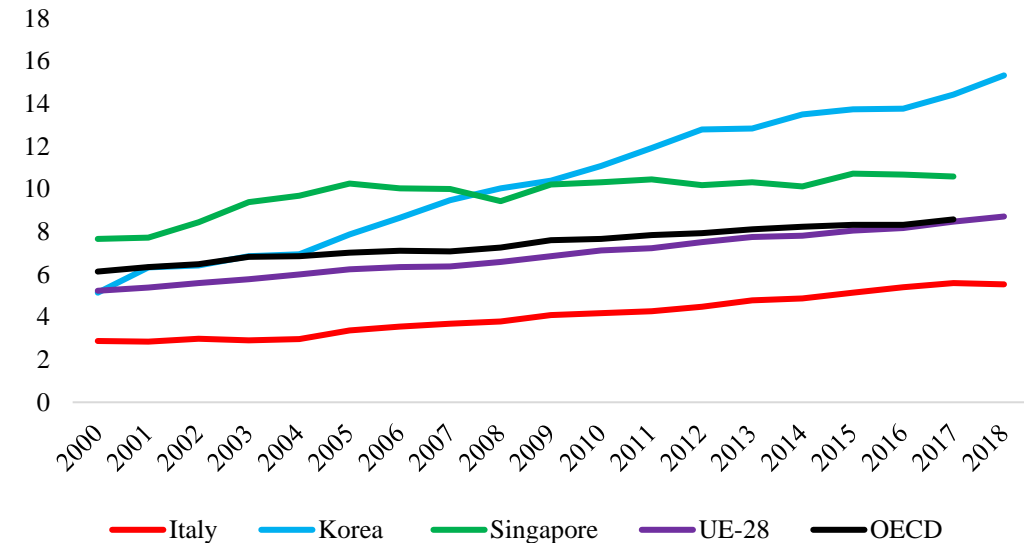
# The institutional capabilities to face the coming age of robots: knowledge-based economies

Fig. 7 - Gross domestic spending on R&D (% GDP)



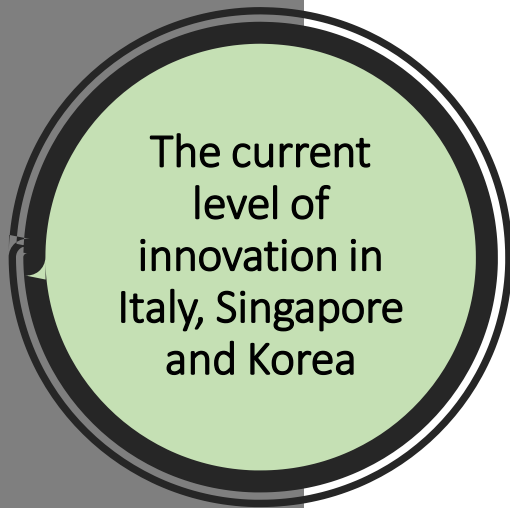
Source: OECD

Fig. 8 - Researcher (1000 employed) 2000-2018



Source: World Bank data





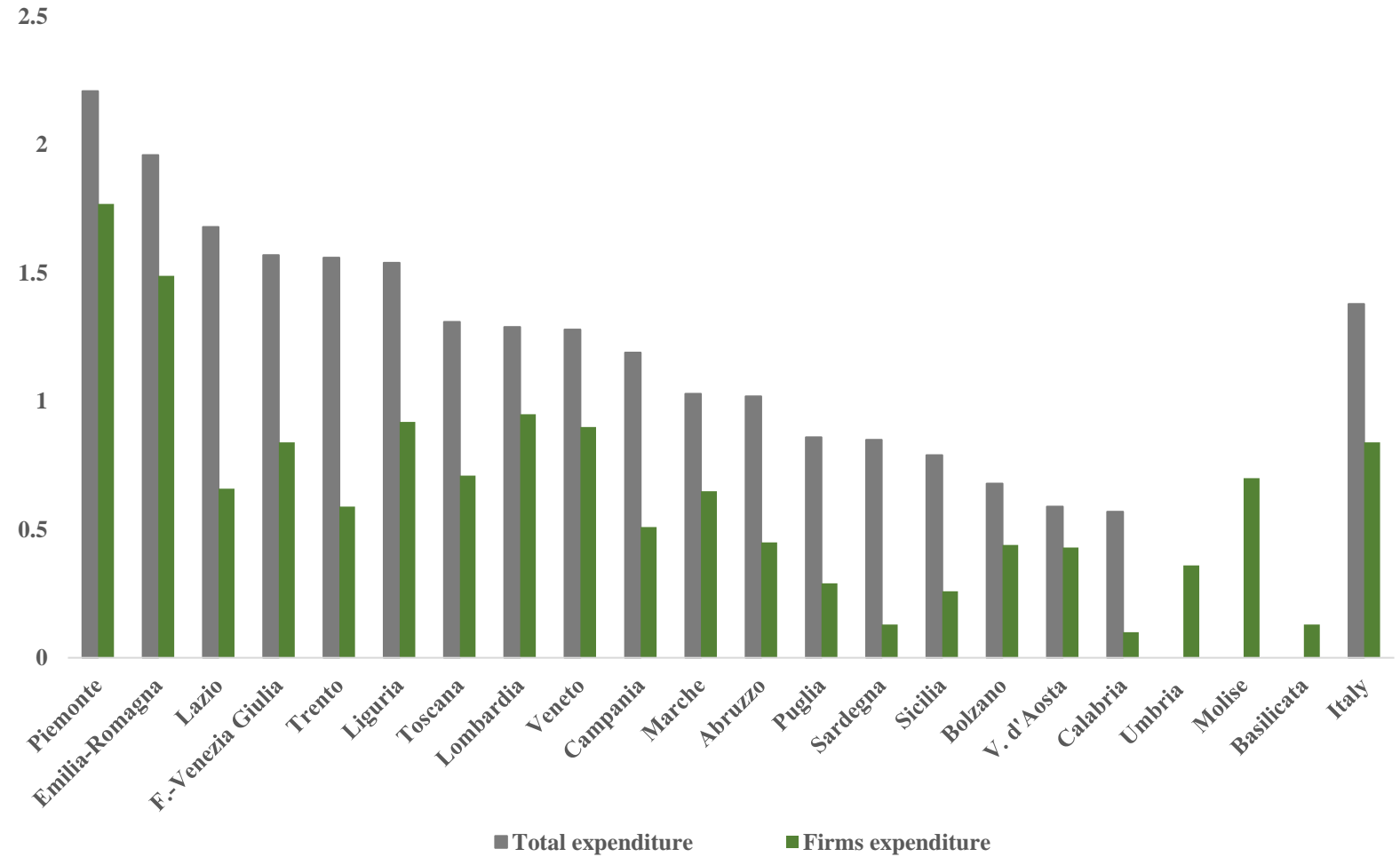
Tab. 3 - Global Innovation Index (Italy, Korea, Singapore)

Global Innovation Index 2019	Italy		Korea		Singapore	
Input and outputs	Score/value	Rank	Score/value	Rank	Score/value	Rank
	Input pillars					
Institutions	75.3	34.0	79.7	26.0	94.9	1.0
Human capital and Research	45.4	31.0	66.5	1.0	63.0	5.0
Infrastructure	59.4	22.0	61.6	15.0	65.4	7.0
Market sophistication	51.4	50.0	64.3	11.0	73.6	5.0
Business sophistication	42.2	29.0	57.6	10.0	63.9	4.0
	Output pillars					
Knowledge and technology outputs	38.9	22.0	50.2	13.0	50.9	11.0
Creative outputs	36.8	37.0	44.1	17.0	38.3	34.0

The key innovation drivers for Korea and Singapore are respectively Human capital and research and Institutions. The weakness of Italian institutional context depends upon Political and operational stability, Government effectiveness and Rule of law (Cornell University, INSEAD, and WIPO, 2019).

A look to the  
Italian  
Regions'  
innovation  
propensity

Fig. 9 - Gross domestic spending on R&D by regions (% GDP) - 2016

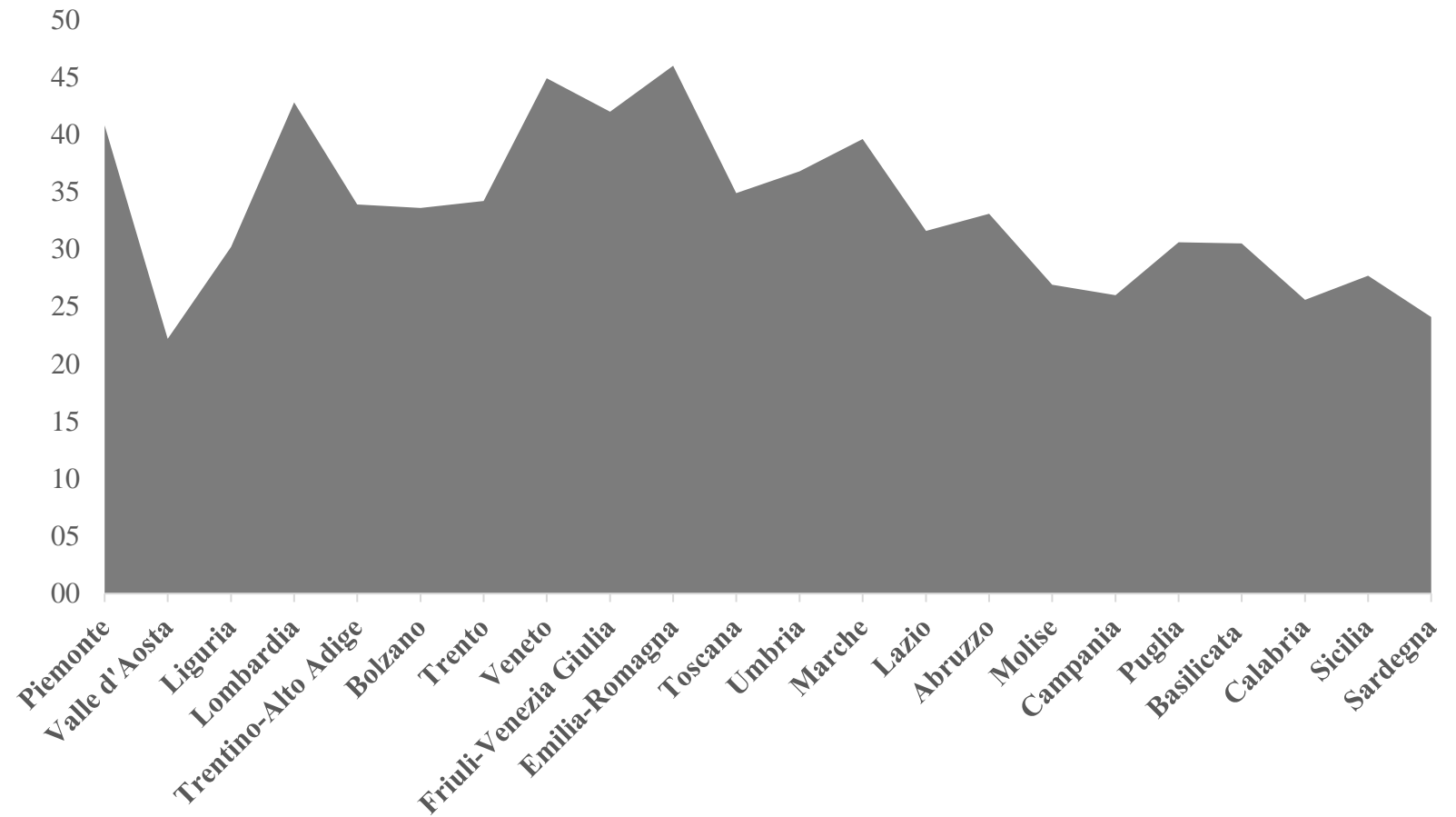


Source: Istat, ASI 2018

Intramural R&D  
– 2016  
(thousand euro)  
by financing  
institutions

ANNI REGIONI	Aggregate values				
	Public Institutions	Universities	Private non-profit institutions	Business enterprise	Total
2012	3,040,406	5,747,760	607,114	11,107,205	20,502,485
2013	2,937,418	5,938,235	627,059	11,480,390	20,983,102
2014	2,959,783	5,815,921	661,798	12,343,773	21,781,275
2015	2,910,618	5,653,047	706,890	12,886,403	22,156,958
By regions - 2016					
Piemonte	99,629	388,860	79,427	2,296,561	2,864,477
Valle d'Aosta	1,207	3,718	2,218	19,167	26,310
Liguria	153,648	139,540	8,602	447,198	748,988
Lombardia	236,309	765,145	255,260	3,500,769	4,757,483
Trentino-Alto Adige	80,122	127,805	29,251	208,369	445,547
Bolzano	1,620	29,953	22,228	97,175	150,976
Trento	78,502	97,852	7,023	111,194	294,571
Veneto	93,754	482,887	15,695	1,396,844	1,989,180
Friuli-Venezia Giulia	100,717	162,250	6,009	312,462	581,438
Emilia-Romagna	192,942	527,802	13,732	2,288,376	3,022,852
Toscana	152,732	506,982	24,435	794,489	1,478,638
Umbria	15,920	130,575	*	76,071	*
Marche	15,238	139,773	219	263,711	418,941
Lazio	1,232,801	588,450	67,850	1,238,158	3,127,259
Abruzzo	39,726	136,403	1,529	143,775	321,433
Molise	1,925	18,745	*	42,855	*
Campania	180,882	514,507	32,332	544,382	1,272,103
Puglia	82,726	297,645	22,903	202,895	606,169
Basilicata	28,755	24,193	*	14,911	*
Calabria	17,162	137,815	419	31,520	186,916
Sicilia	117,376	332,765	12,892	224,026	687,059
Sardegna	67,756	171,052	1,053	41,657	281,518
North-West	490,793	1,297,263	345,507	6,263,695	8,397,258
North-East	467,535	1,300,744	64,687	4,206,051	6,039,017
Centre	1,416,691	1,365,780	*	2,372,429	*
South	351,176	1,129,308	*	980,338	*
Isles	185,132	503,817	13,945	265,683	968,577
ITALY	2,911,327	5,596,912	575,177	14,088,196	23,171,612

Innovative\*  
firms by  
regions (%  
total firms) -  
2016



Source: Istat, NoiItalia 2018

\*Firms introducing innovative products or processes

# A study on the impact of AI on Italian firms by the American Chamber of Commerce in Italy (2019)

The findings of this survey are quite interesting and are as follows:

- The potential of artificial intelligence may change significantly by industrial sectors.
- Industries which invest in artificial intelligence might grow up to 2.8% more than non-investing companies and their value-added is expected to grow up to 5.3% more than non-investing companies.
- Artificial intelligence may be profitable only if companies show the following characteristics: strategic vision, talent readiness, project governance, project maturity (ability of companies to approach AI projects as immediately operational), cybersecurity/data privacy (compliance with the most advanced standards related to this area), capital adequacy, and ecosystem role.

# A study on the impact of AI upon Italian firms by the American Chamber of Commerce in Italy (2019)

Companies carrying on artificial intelligence projects pointed out its benefits and risks:

## **BENEFITS**

- ✓ a more efficient relation with customers;
- ✓ significative upskilling of workers through “learning by doing”.

## **RISKS**

- ✓ maintenance costs (namely *process alignment, IT integration and training*);
- ✓ Initial impact on employees.

## Some final insight

Companies, involved in AI projects, perceive a lower risk (by almost 50 percent) than the remaining ones. Therefore, a negative attitude towards innovation (without experimenting its possible potential) may play a key role in determining the impact of any technological advancement upon employment and economic growth. In other words, the institutional context (economic and social fabric, innovation propensity, habit, customs, culture, history, level of education, rule of law, government effectiveness) may have a key role in determining the impact of technological advancements on the economic system of a country.