



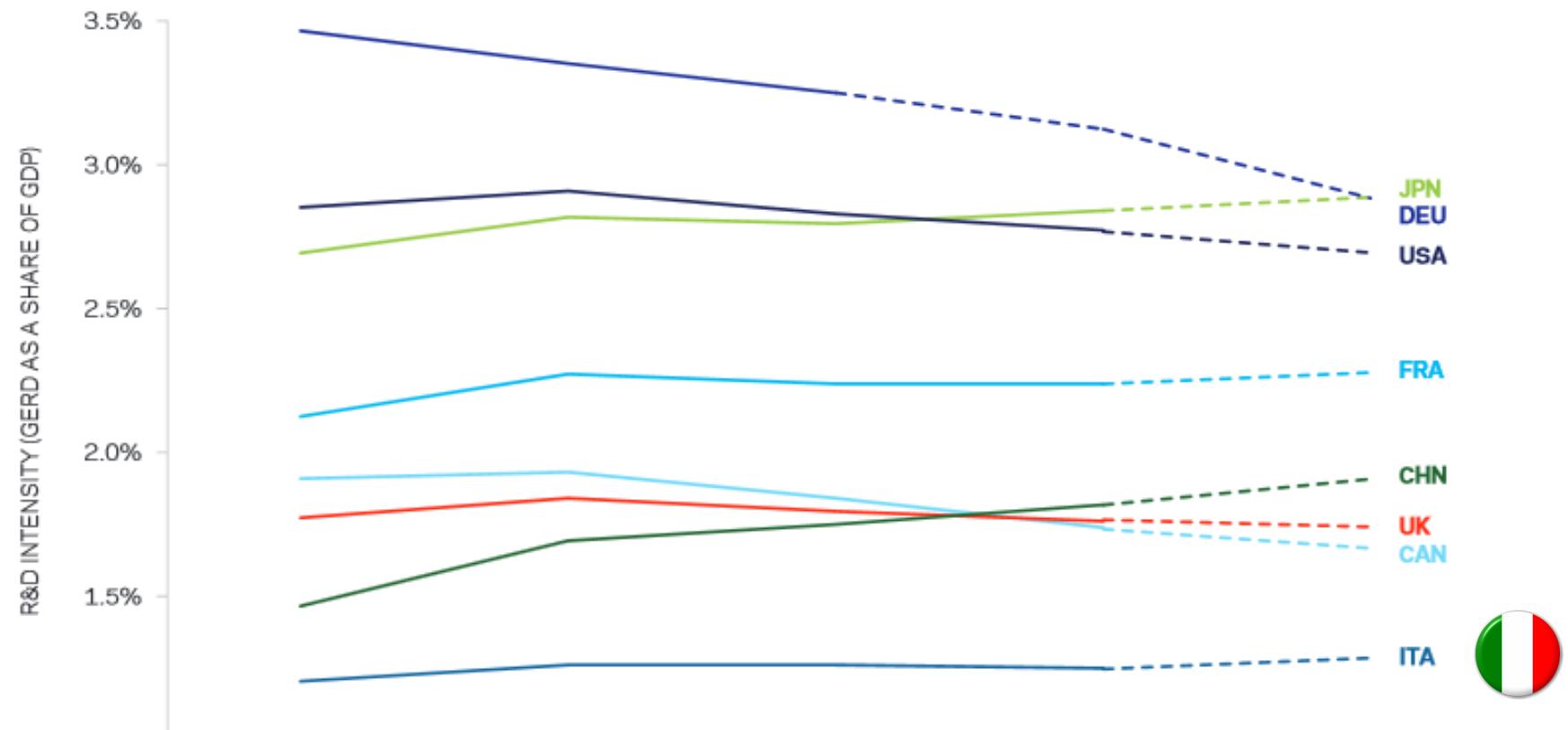
Sant'Anna
Scuola Universitaria Superiore Pisa

The Italian Paradox: myths and facts about science and innovation in Italy

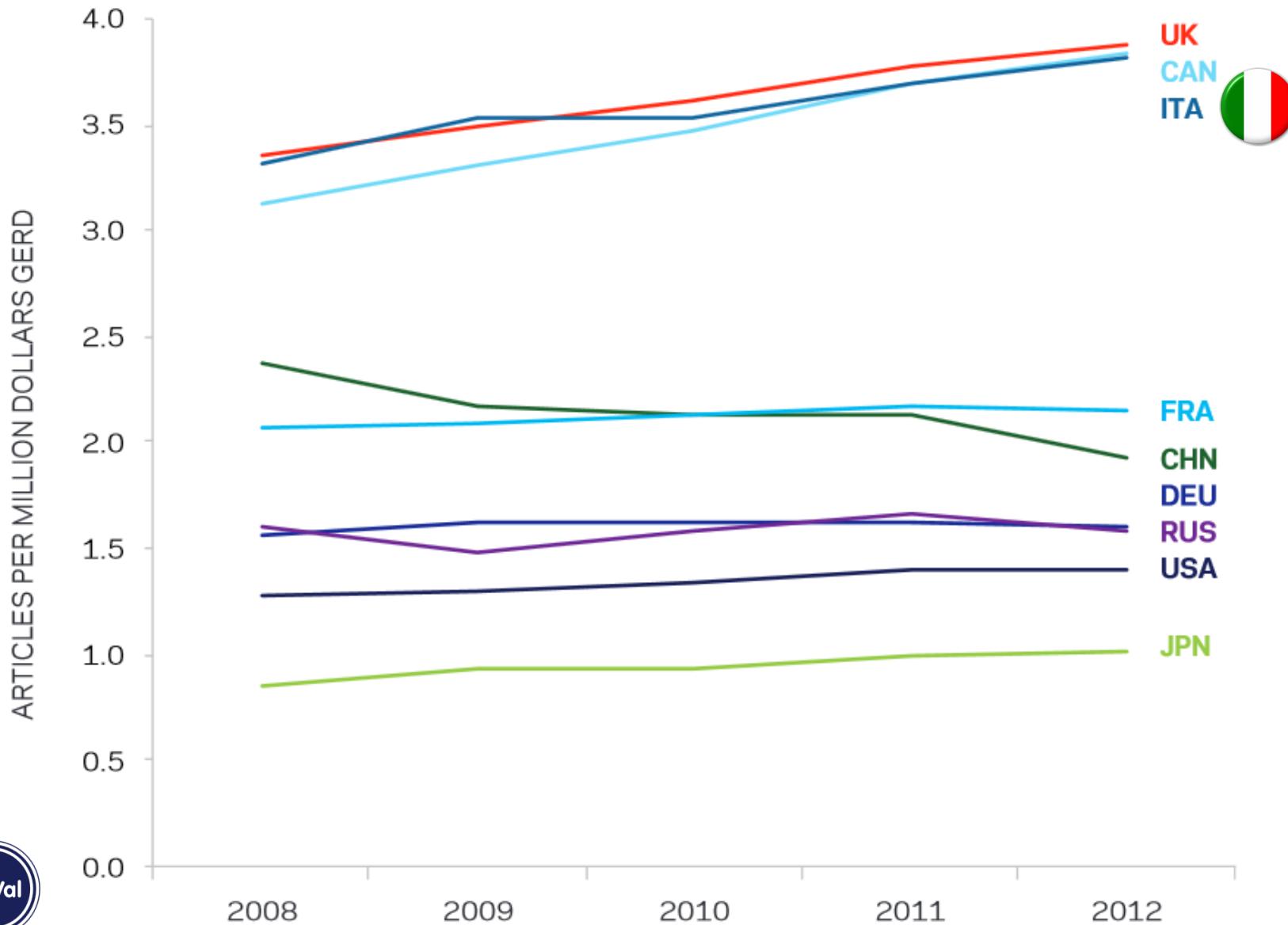
Pierdomenico Perata



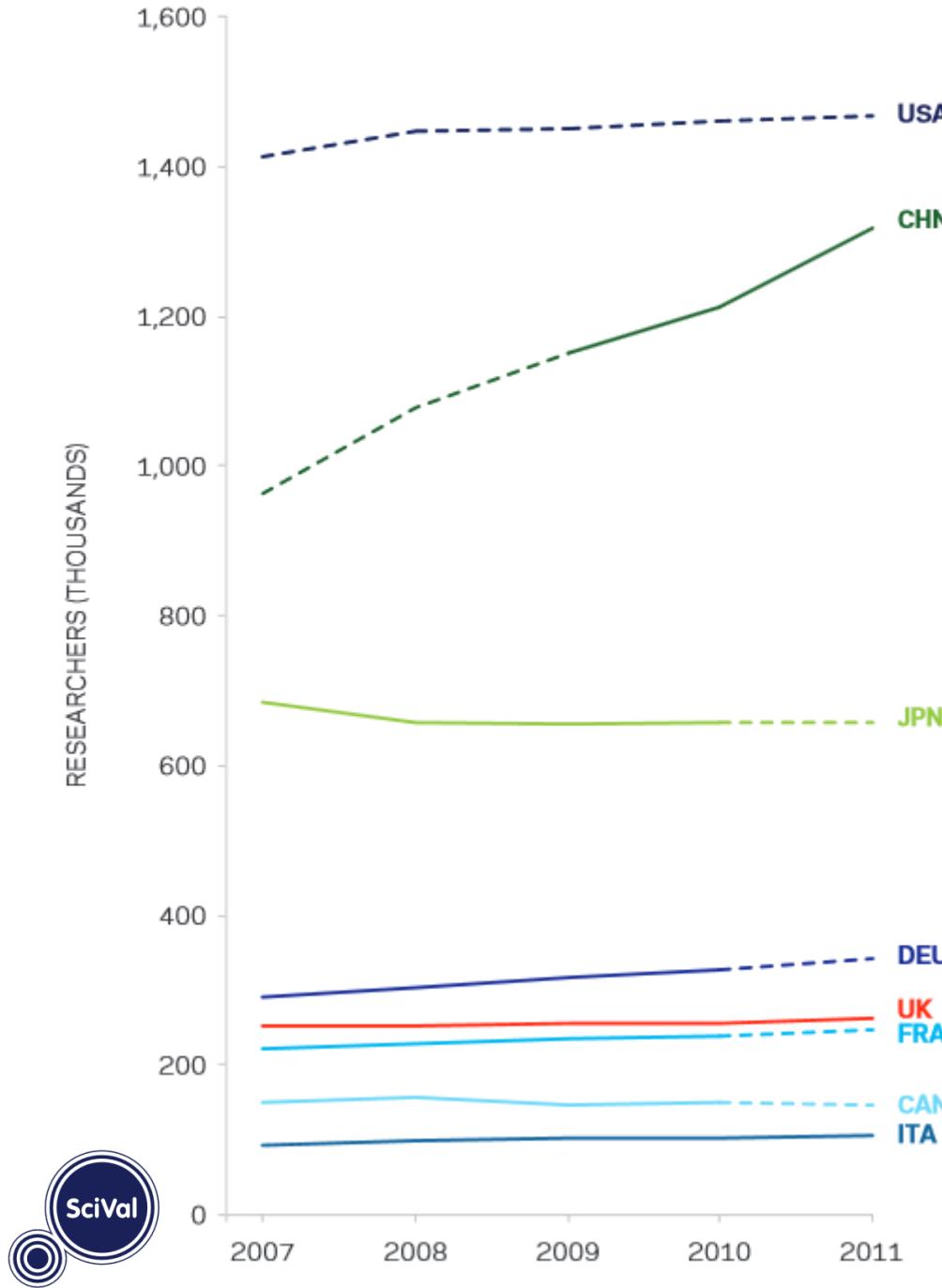
Gross domestic expenditure on R&D (GERD) as % of GDP



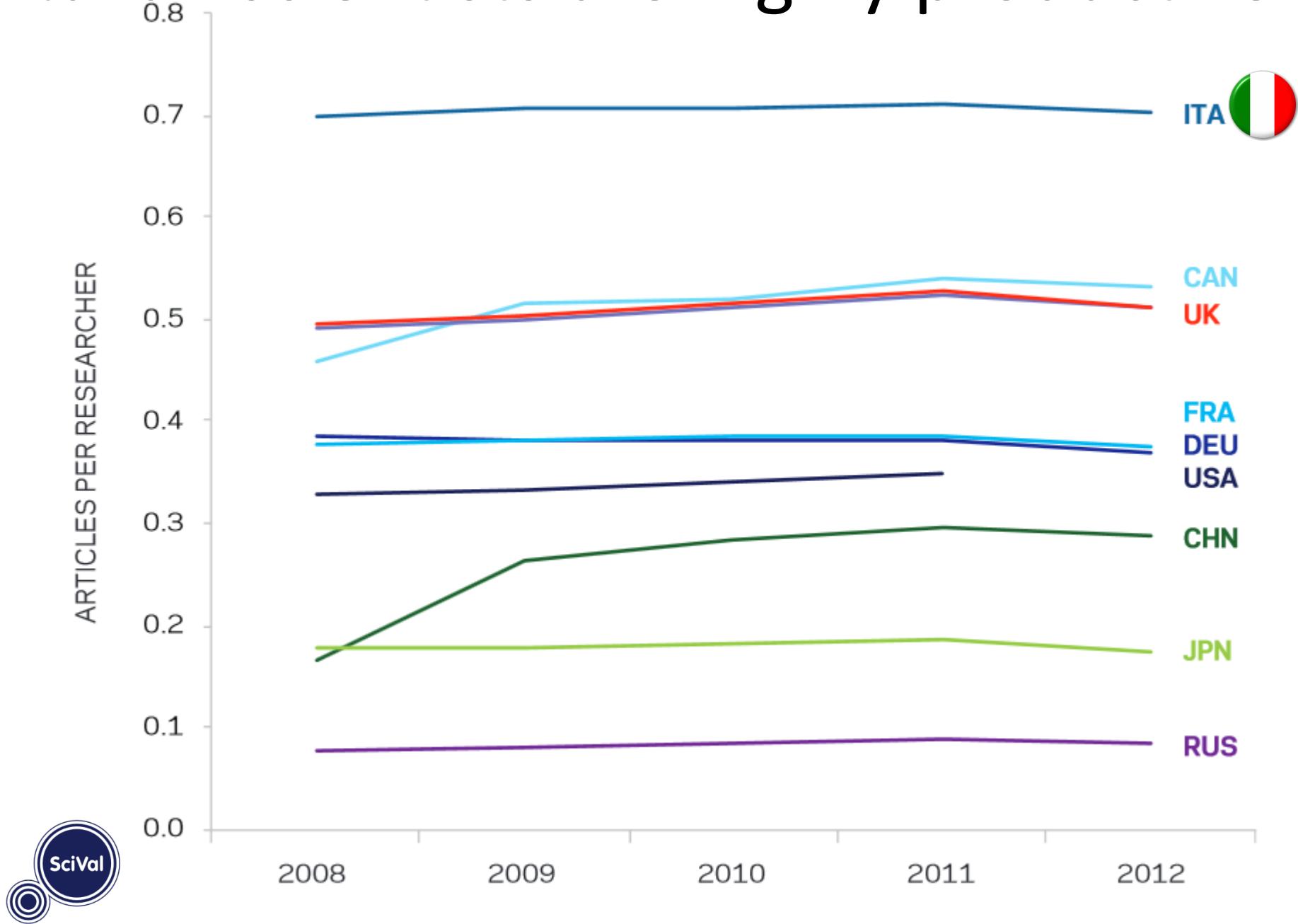
Articles/million \$ GERD



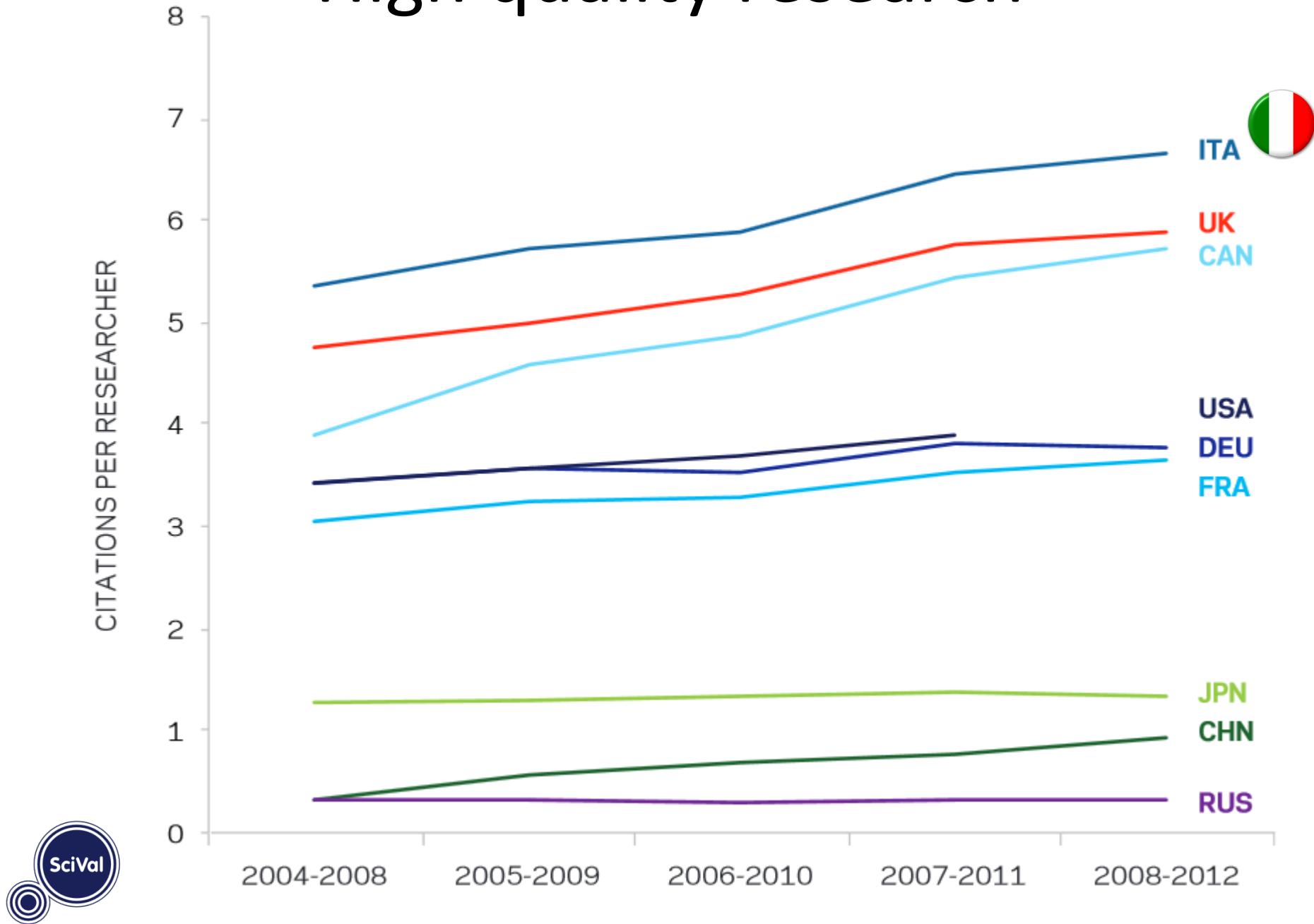
Researchers



Italian scientists are highly productive



High quality research





Italy's Science is alive!

Brain drain



Brain drain?



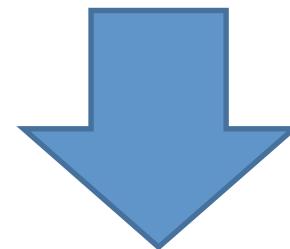
<u>Comparator</u>	<u>Sedentary</u>	<u>Total Transitory</u>	<u>Total Outflow</u>	<u>Total Inflow</u>	<u>Net Total Outflow</u> (Total Outflow less Total Inflow)
UK	28.4%	49.5%	12.7%	9.4%	3.3%
France	36.7%	46.8%	8.6%	7.9%	0.7%
Italy	51.9%	36.7%	5.9%	5.5%	0.4%
Germany	36.3%	44.8%	10.7%	8.2%	2.6%
Japan	60.0%	29.4%	5.5%	5.1%	0.4%
US	46.8%	35.6%	9.7%	7.9%	1.8%
Canada	27.0%	50.0%	12.5%	10.5%	2.0%
China	71.1%	17.8%	4.1%	7.0%	-2.9%





Italy's brain drain is much
lower than Germany's one

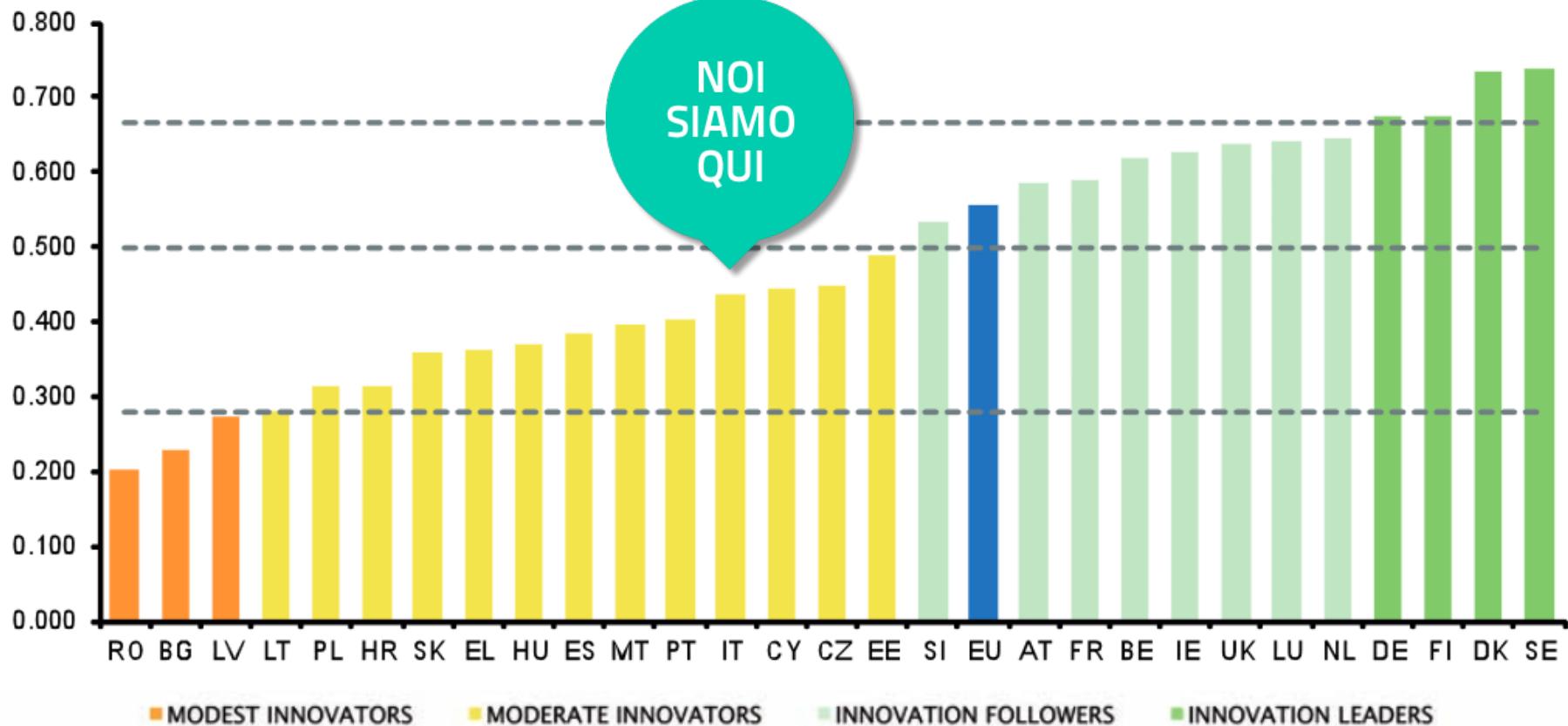
Knowledge



Innovation



Where we are

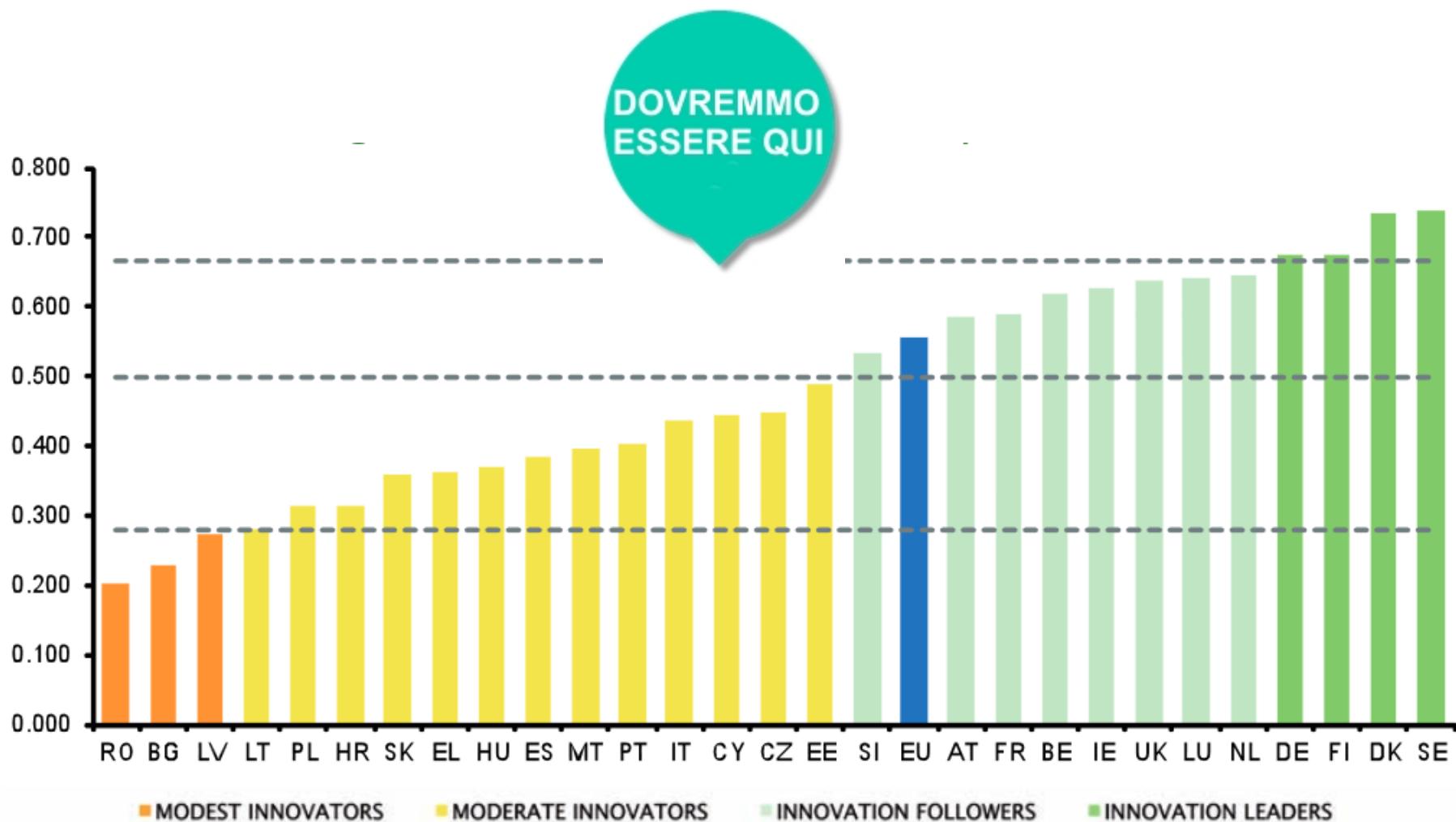


Innovation **Union**
Scoreboard 2015

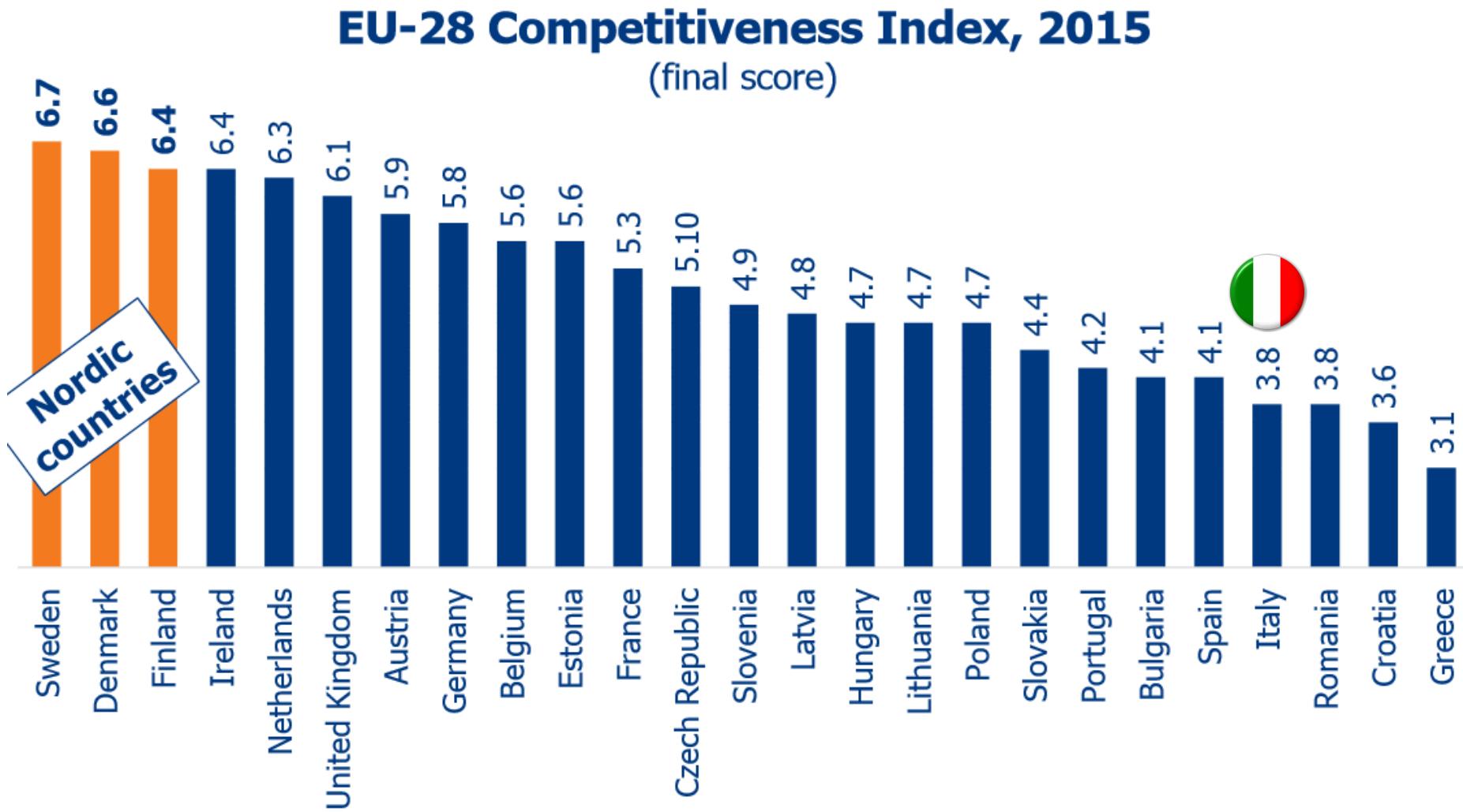


Italy is a moderate innovator
country

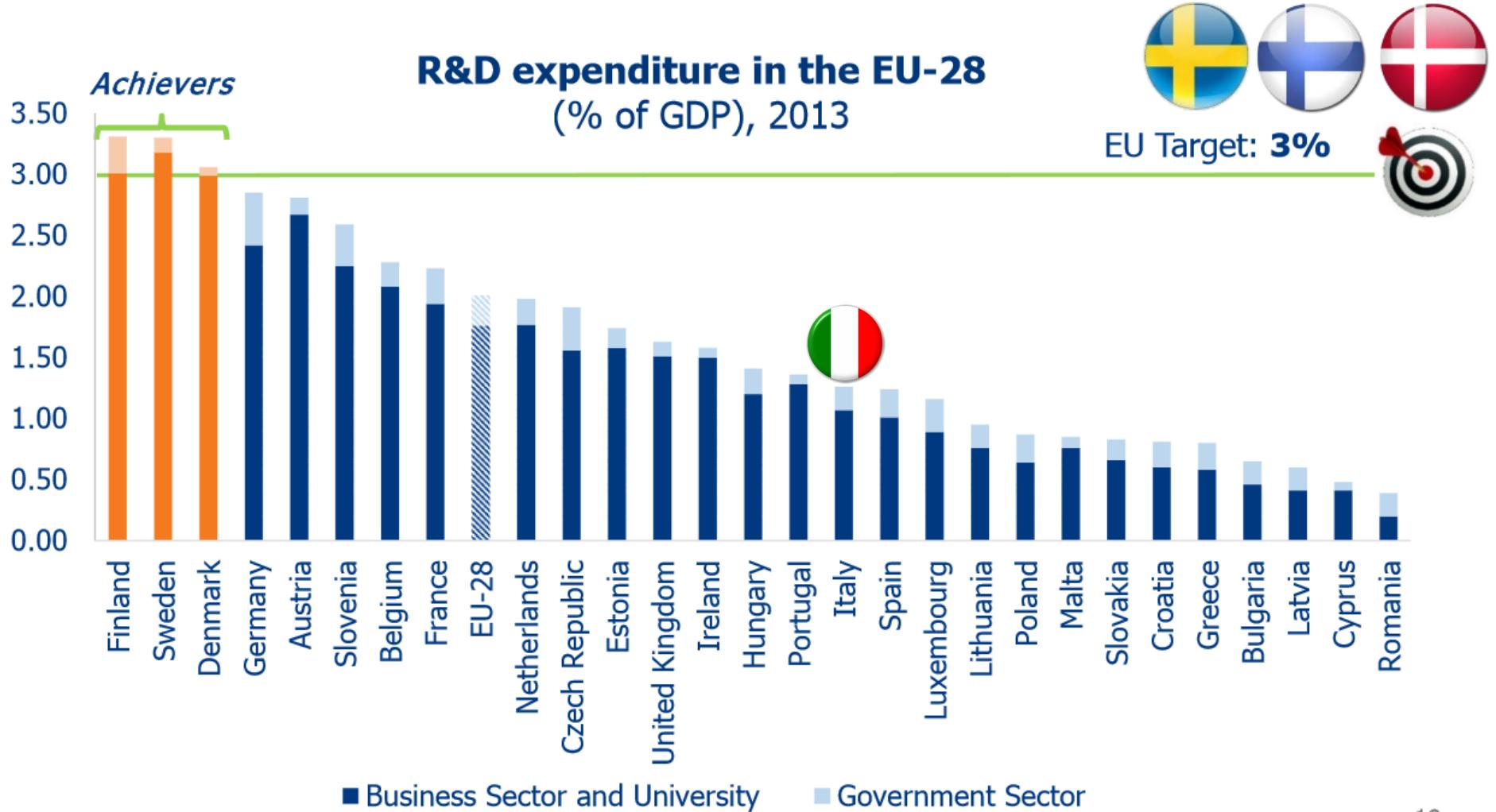
Where we should be



The success of Nordic Countries



High vs. low R&D expenditure

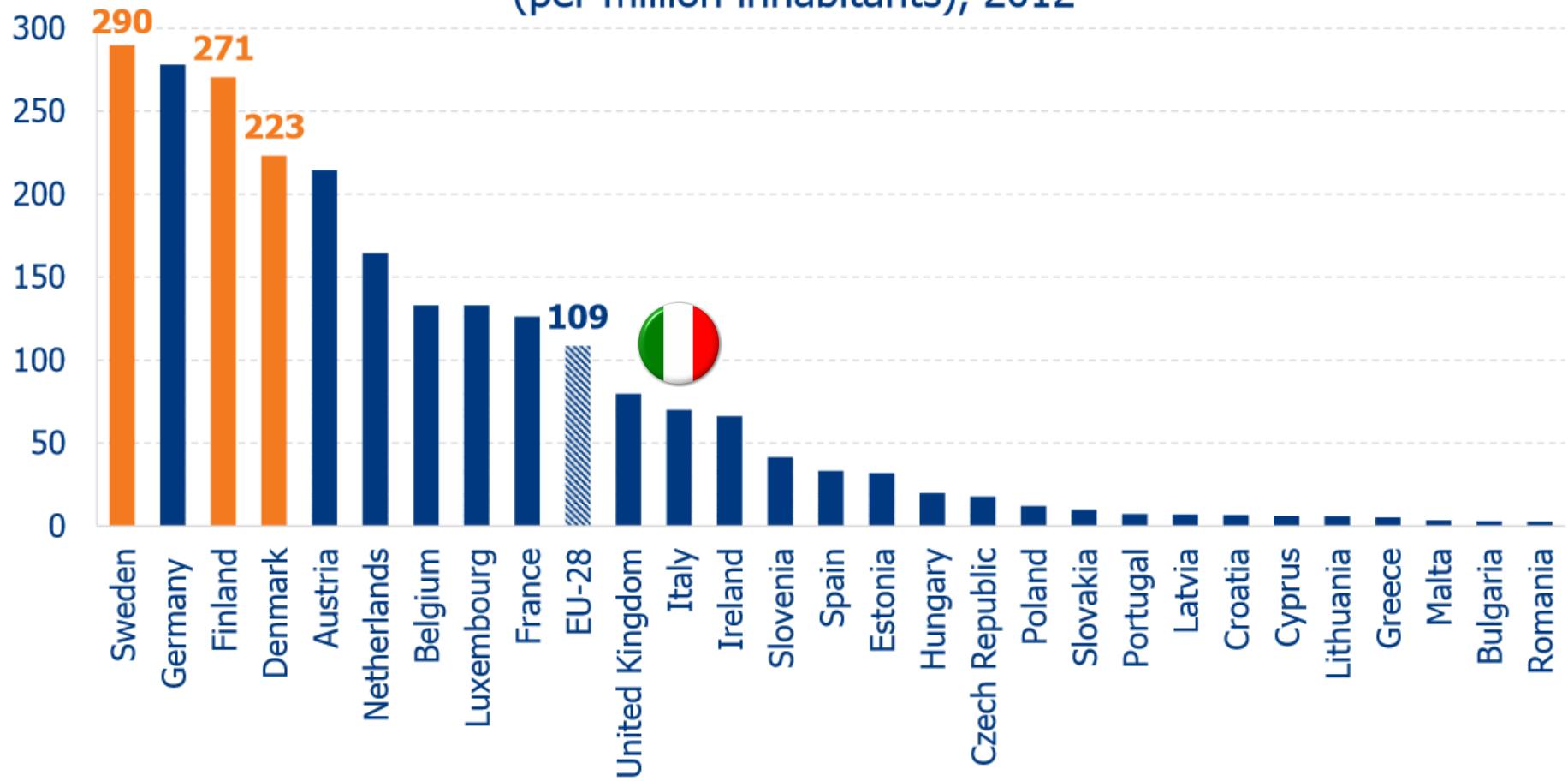


14

Patents!



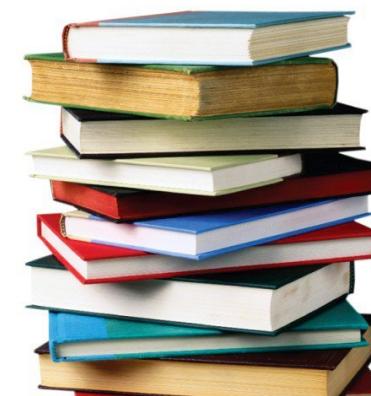
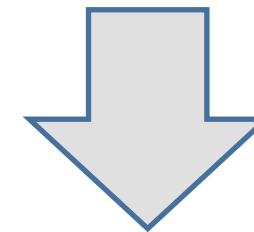
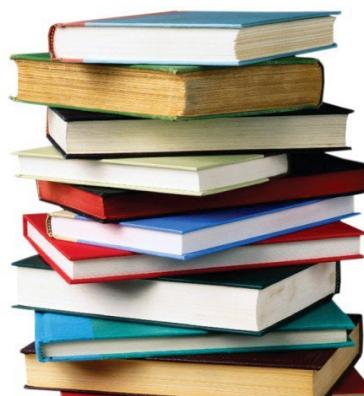
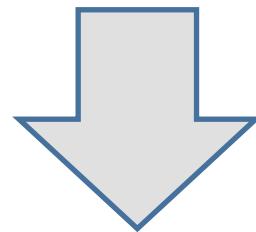
Patent applications to the European Patent Office
(per million inhabitants), 2012





Italy is unable to translate
Science into Innovation

The Italian Paradox



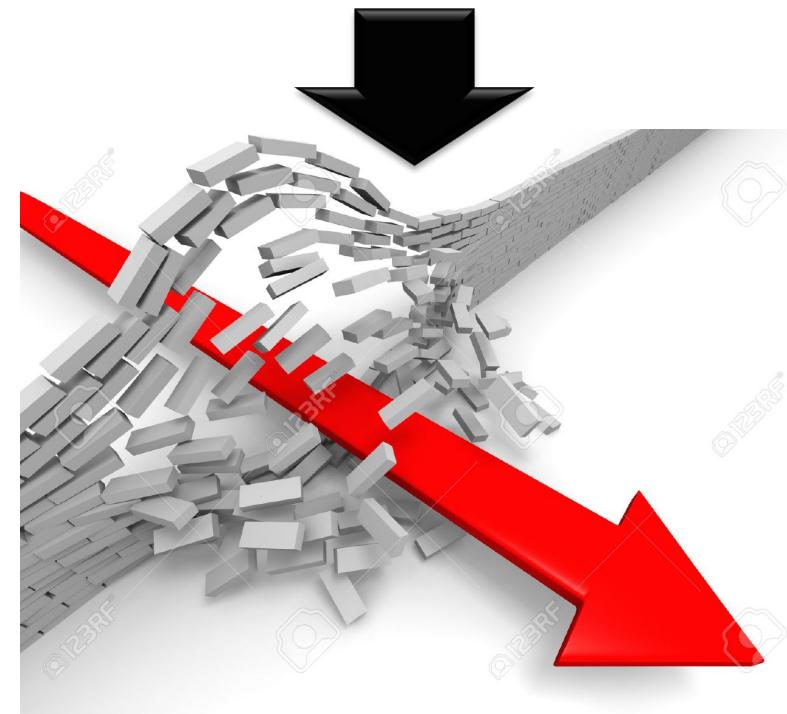
High R&D Expenditure



High Risk Science



**Breakthrough
Discovery**



Low R&D Expenditure



Low Risk Science



**Confirmatory
Science**



High risk, High gain

Science | Life Sciences | Biotechnology | Agriculture | Research | News

Gates Foundation backs high-risk science for big wins

Hakusha Elkori

Agricultural researchers are experiencing a renaissance. The Gates Foundation is leading the charge in the hopes of solving food security in the developing world.

The Bill and Melinda Gates Foundation has invested over \$1 billion in agricultural research projects over 20 years. The foundation's chief priorities are making healthy, nutritious diets one of the most complete and bioavailable proteins in plant foods, including how to increase plant yields out of photosynthesis – the ultimate primary productivity – in efficient, climate-resilient and robust rice, corn, and cassava.

The process of photosynthesis helps the human body obtain energy for living, "photosynthesis [from plants] is what links the planet's plant system at the cellular level," according to David Tilman, who is leading a team of 100 researchers from the University of Minnesota to develop a new understanding of the relationship between solar energy and the chemical energy produced by plants. "There are probably hundreds of thousands of people working on this issue," says Tilman. "There are also foundations all over the world that work really hard on helping understand photosynthesis. It facilitates economic development and a difference in life for everyone."

The foundation's goal could depend heavily on a major breakthrough in agricultural science, which requires billions of dollars invested with the potential for impacts that will prove beneficial and valuable, could have on the health and economic well-being of people in the developing world. "We have to do more high-risk projects because they can't be done in a regularistic way. We can't do the same old incremental 'tinkering' and generate the kind of knowledge base on which the foundation can build its biggest projects depend."

David Tilman participates on three of the foundation's agricultural science projects that the Gates Foundation has funded:

Expanding photosynthesis

Agroforestry has achieved great gains in crop resilience and yield stability through intercropping studies using different techniques and learning from others' and their own efforts. But these approaches have the "biomass trade-off" in mind as they work, since there being a plant selected at the expense of others. That way, these approaches can help farmers help the world grow more productively.

Increasing the efficiency of photosynthesis is one strategy that increasing soil photosynthesis could improve crop stability of yields. In 2012, the long-term team was used to calculate how the team's calculated increase in soil photosynthetic efficiency could improve yields in cereal crops. The team found that the increase in soil photosynthetic efficiency could increase yields in cereal crops by 10%.

The increasing photosynthetic efficiency project has an aim of improving soil photosynthetic rates across the soil. The key strategy involves adding biochar to the soil, namely Biomass Biochar 1.0 (a phosphate-rich biochar produced by 100% hydrolyzed plant 1.0 biochar), "The project is also looking to scale up resistance to pests and diseases that can affect the crop by introducing biopesticides and biofertilizers that help protect the soil against pests and diseases."

The third project the foundation has invested in is a biopesticide breeding program for soybean aphid. The foundation has invested in the project along with the USDA-ARS, Texas A&M, and Michigan State University. A plant selected at the foundation's Biopesticide Agricultural

center near the Netherlands, which includes the team.

Biopesticides reduce costs and increase plant biomass production and reducing insecticides. But biopesticides tend to have a longer residual reducing the efficiency of the plant. This year, the team will explore how these biopesticides can prevent insect damage after a year or two (around 10 months of residue per year).

Part of the research will involve a better analysis of biopesticides in the soil before it disappears completely ... this creates knowledge which the team hopes to improve for agriculturalists. They are also exploring some soil microorganisms that, when applied to the soil, break down the biopesticides that contributes to the enhanced outcome.

So far the team has invested the development of Biopesticide and soil associated biopesticides with efficiency below 10%.

The biopesticide research started for better biopesticide development (biopesticides) and biopesticides under the name of "biopesticides" who has a part about a higher success rate than the current biopesticides. The team has made significant improvements in the development of biopesticides, which is a reduction in the cost of production and application. They have developed biopesticides that are effective against pests and diseases. The project is being funded by the foundation and the government of Michigan.

In early 2013, the team has published a paper describing their findings from the project that are described in detail. They plan to scale through another 100 species or more of target crops in

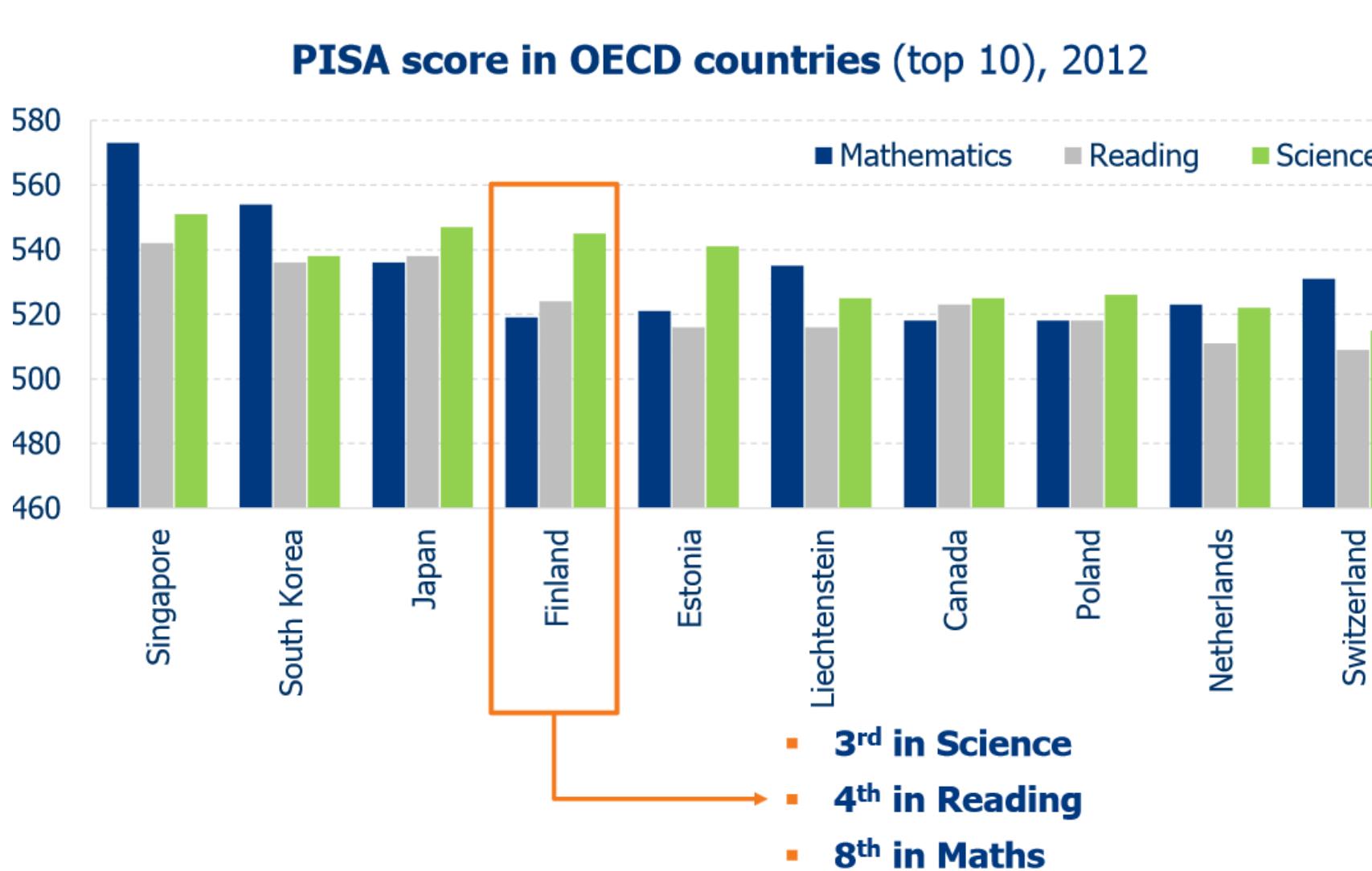
Source: Bill & Melinda Gates Foundation

Image: Bill & Melinda Gates Foundation



**Italy low investment in R&D
results in low risk science**

Education



Source: The European House - Ambrosetti on OECD data, 2015

Mathematics performance among PISA 2012 participants



Finland is among the world leaders in education

- Finland built its **outstanding, efficient, and equitable educational system** in a few decades from scratch.
- Only 11% of **applicants to the teaching profession** are accepted, which means that the only **most motivated are selected**.



**I nuovi docenti:
"Ho detto sì, ma
mi sento
deportata".
"Troppe
incertezze, io ho
rinunciato"**

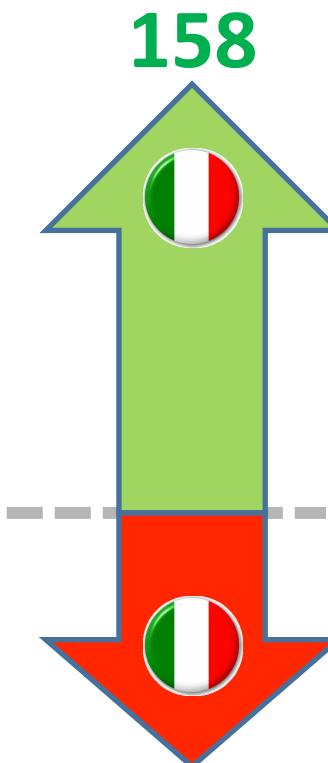
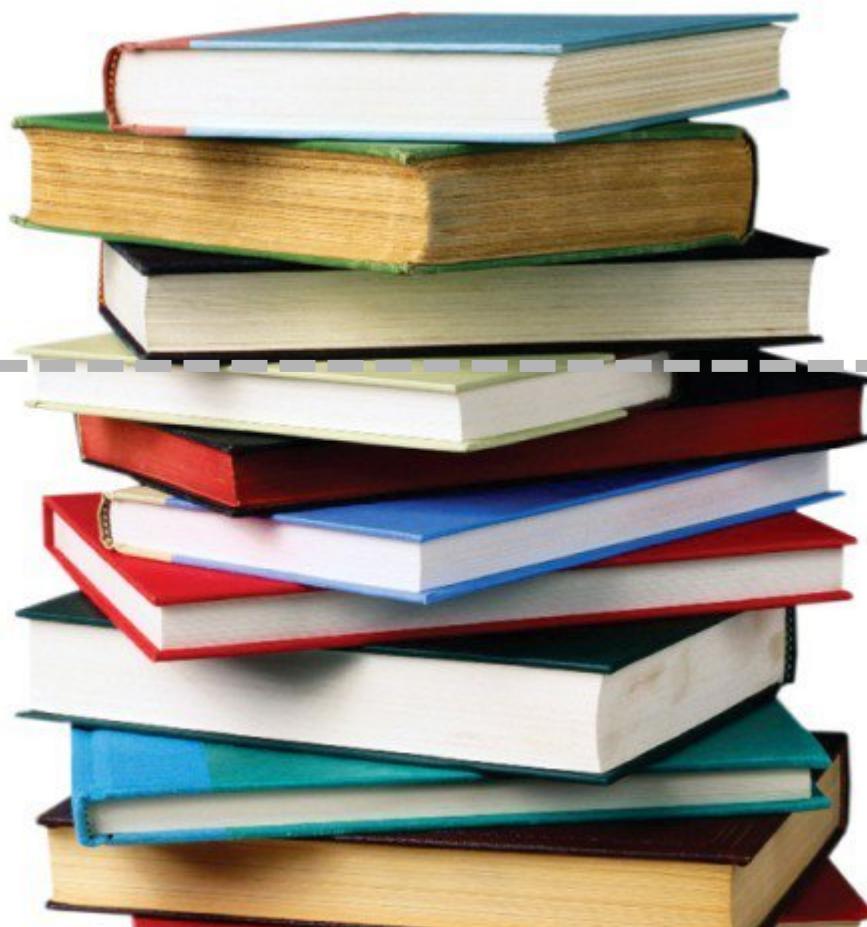




Italy's School system is
unable to meet the
innovation challenge

The university- industry connection

International
Scientific
co-publications



Publis-Private
co-publications

59

100



Academia and industry: Companies on campus



Academia and industry: Companies on campus



Fundamentally, a university must view companies as partners in its research and education mission, not simply as an alternative revenue source

Academia and industry: Companies on campus





University-Industry in Italy
needs more reciprocal trust

Recipe for: INNOVATION

- School= better STEM education
- + public & private R&D Investments
- High Risk, High Gain Research!
- More PhDs in Industry
- Academia-Industry partnerships

thank
you!



@theplantlab