



CLAIU-EU Conference

The Engineering Doctorate

Madrid – 9th & 10th February 2012



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European Society for Engineers and Industrialists – **SEII**

What career in industry for engineers with a PhD ?

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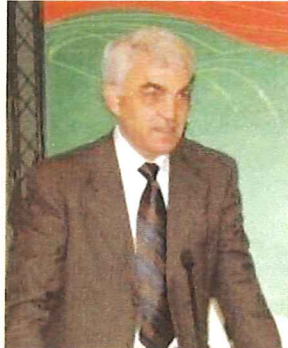
SEII : who are we ?

- A 8 years old non-profit-making association.
- Providing European Engineers & Industrialists with leading-edge information and reflections.
- Mainly by organizing lectures and conferences.
- Also involved in EC programmes :
 - Partner of EUGENE (European and Global Engineering Education).
 - Participant to the European University-Business Forum.

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A warm “thank you” to :



Sergio POLESE,
President of
CLAIU-EU



Denis McGRATH,
Past President
of CLAIU-EU



Summary of the presentation

- 1. Preliminaries**
- 2. The pros and cons of doctoral studies in science and engineering**
- 3. The policy of industrial companies about PhD graduates**
- 4. Throwing various lights on the problem**
- 5. Conclusions**



1. Preliminaries

- A. Back to the roots : a historical perspective**
- B. The situation of PhD graduations in the world**



1.A. Back to the roots : a historical perspective

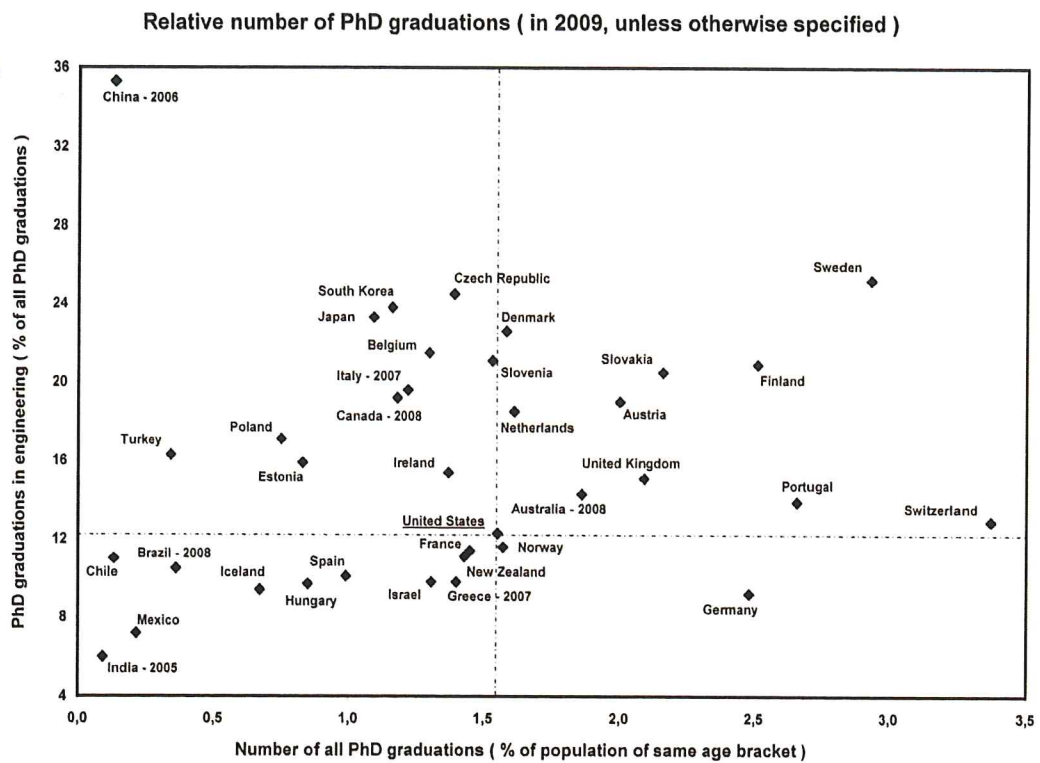
- Latin *doctum / docere* (to teach)
- First : Doctors of Divinity (Theology)
- Middle-Ages : Doctor of Laws and Doctor of Medicine (professional doctorates)
- In Germany (19th century) : Doctor of Philosophy (research-based doctorate)
- Imported to the US (triple structure : bachelor / master / doctor degrees)
- Now in science and engineering : mostly research-based doctorates



Aquatint of a Doctor of Divinity at the University of Oxford, from Rudolph Ackermann's *History of Oxford*, 1814



1.b. The situation of PhD graduations in the world



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2. The pros and cons of doctoral studies in science and engineering

- Opinions that are not in favour of them
- Opinions that are in favour of them
- Could those opinions be reconciled ?



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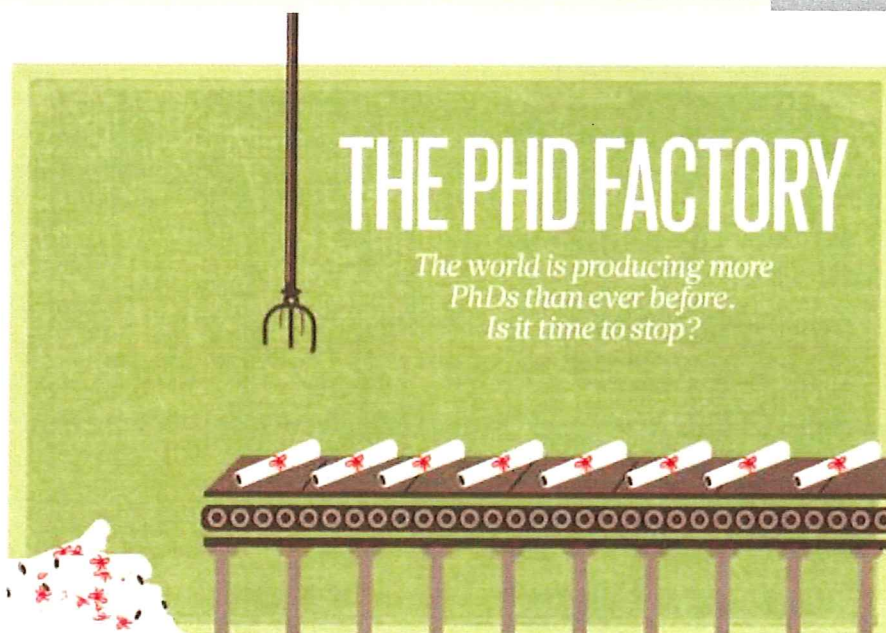
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2.A. Opinions that are not in favour of them

1. From “Nature” : *Education : the PhD factory*
2. Individual opinions
3. From “The Economist” : *The disposable academic : why doing a PhD is often a waste of time*



2.A.1. From “Nature” : *Education : the PhD factory*



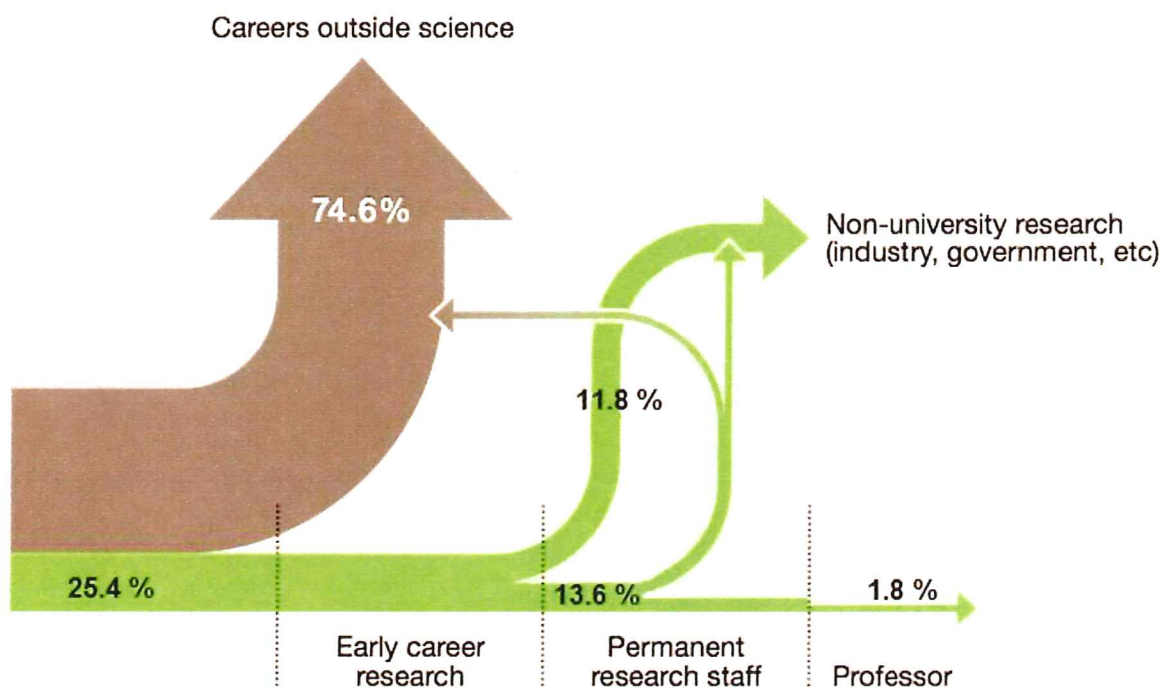
2.A.2. Individual opinions

- a. Paula STEPHAN, Economist at Georgia State University in Atlanta
- b. Laudeline AURIOL, Analyst for OECD
- c. Andrzej KRAŚNIEWSKI, Secretary General of the Polish Rectors Conference

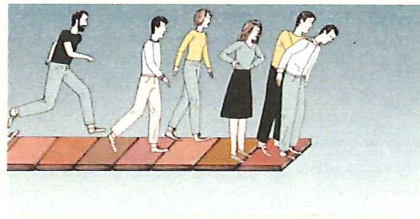
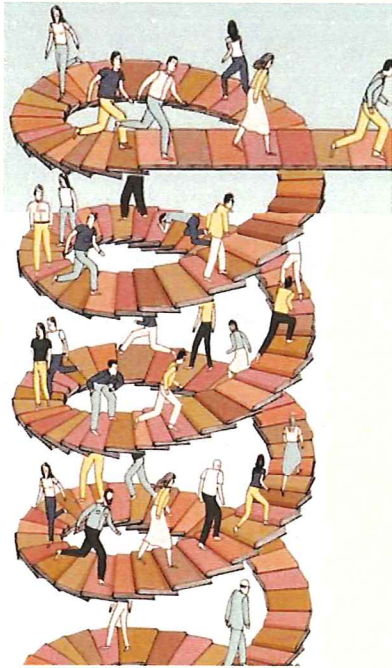


Career pathways for New Zealand science PhD students

Sources: Statistics New Zealand, *Research and Development in New Zealand 2006*, *Census 2006*, Ministry of Education, *Profile & Trends: New Zealand's Tertiary Education Sector (2006)*.



2.A.3. From “The Economist”



The disposable academic : why doing a PhD is often a waste of time



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2.B. Opinions that are in favour of them

- Georg WINCKLER, Rector of the University of Vienna (Austria).
- Martine PRETCEILLE, Professeur des Universités and General Manager of Intelli'agence (France).



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2.C. Could those opinions be reconciled ?

YES : they do not relate to the same thing !



3. The policy of industrial companies about PhD graduates

- A.** In large companies, PhD's recruitment is linked to R&D volume, and :
- A PhD will not always do research work
 - Enterprises are built and operated by groups
 - Importance of soft skills
 - Danger if the PhD is overqualified
- B.** More or less the same in SMEs
- C.** A three-body problem



4. Throwing various lights on the problem



A. The red light : motivation of PhD students

B. The green light : transferable skills



C. The blue light : curricula for PhDs in engineering

D. The amber flashing light : R&D in Europe



4.A. Motivation of PhD students

Motivation for doing a PhD

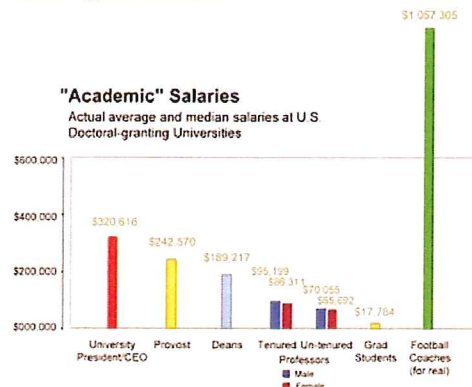


GraphJam.com

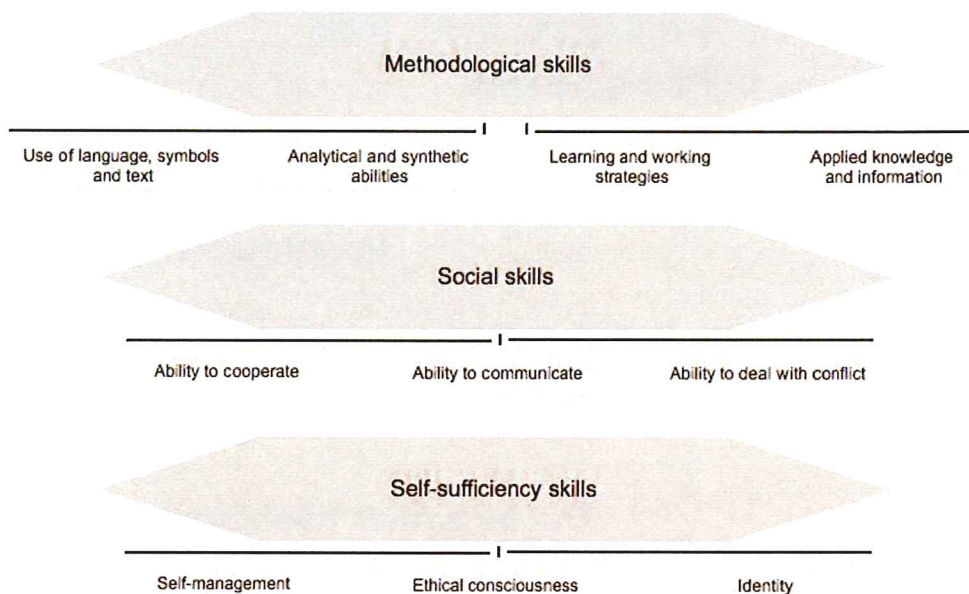
About 1/3 of them don't know why, 1/3 have a wrong motivation and the others know more or less what they want, but not always what is expecting them !



"Academic" Salaries
Actual average and median salaries at US Doctoral-granting Universities



4.B. Transferable skills (1)



4.B. Transferable skills (2)

Leadership : *Integrity* *Judgment*
 Empathy *Courage*
 Vision *Passion*
 Emotional intelligence

Innovation = imagination (vision)
+ judgment
+ empathy
+ courage

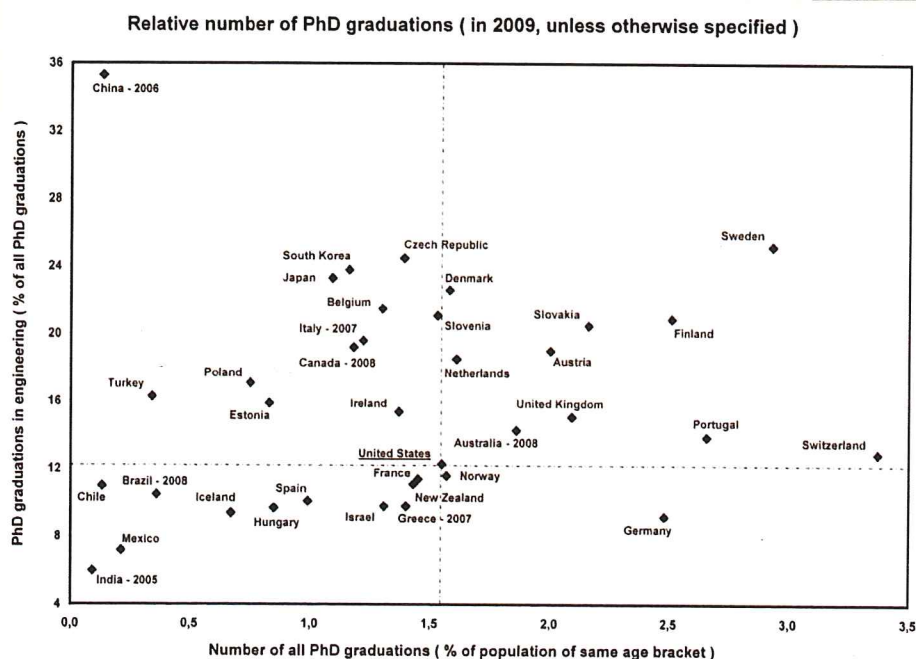


4.C. Curricula for PhDs in engineering

- Doctorate \neq professional experience (industry)
- Interesting for universities to have as many PhD students as possible : false academic culture
- Perverse effect : graduates tend to sell their degree, not their skills and personality traits
- New professional doctorates in engineering (Australia, UK, USA) and collaborative doctoral programmes (UEA)

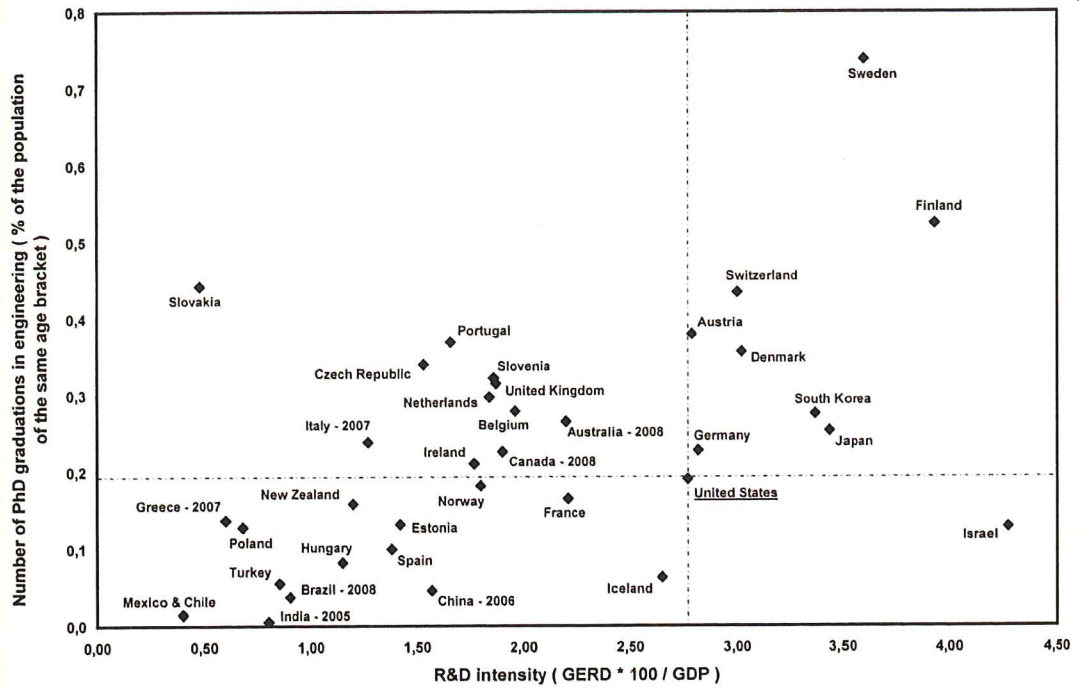


4.D. R&D in Europe (1)



4.D. R&D in Europe (2)

Relative number of PhD graduations in engineering as a function of the R&D intensity



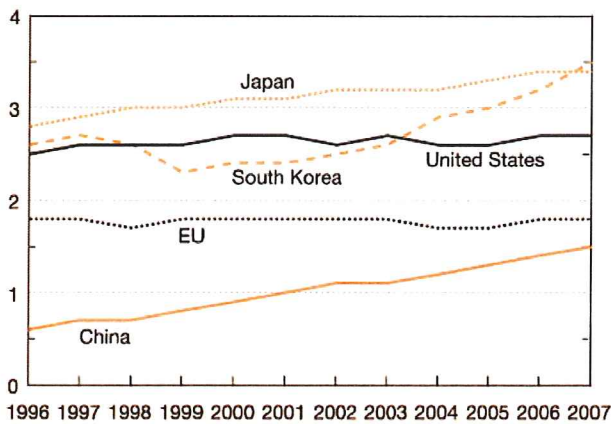
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4.D. R&D in Europe (3)

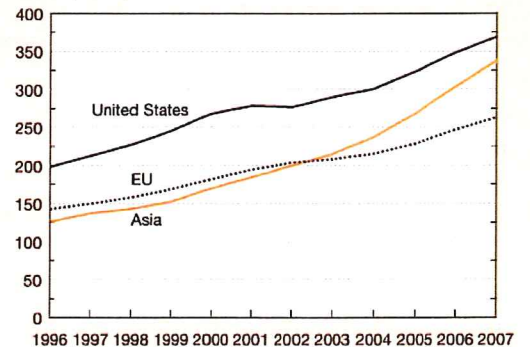
R&D expenditures as share of economic output of selected countries: 1996-2007

Percent of GDP



R&D expenditures for United States, EU, and Asia: 1996-2007

Dollars (billions)

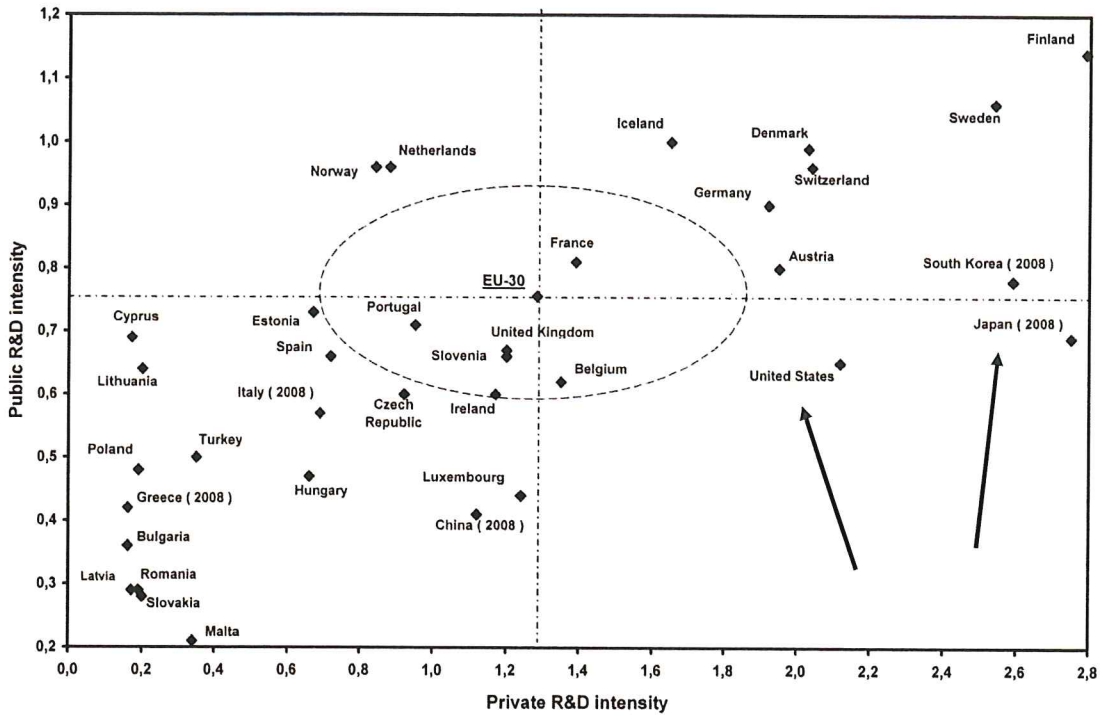


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4.D. R&D in Europe (4)

R&D intensity per country (2009 unless otherwise specified)

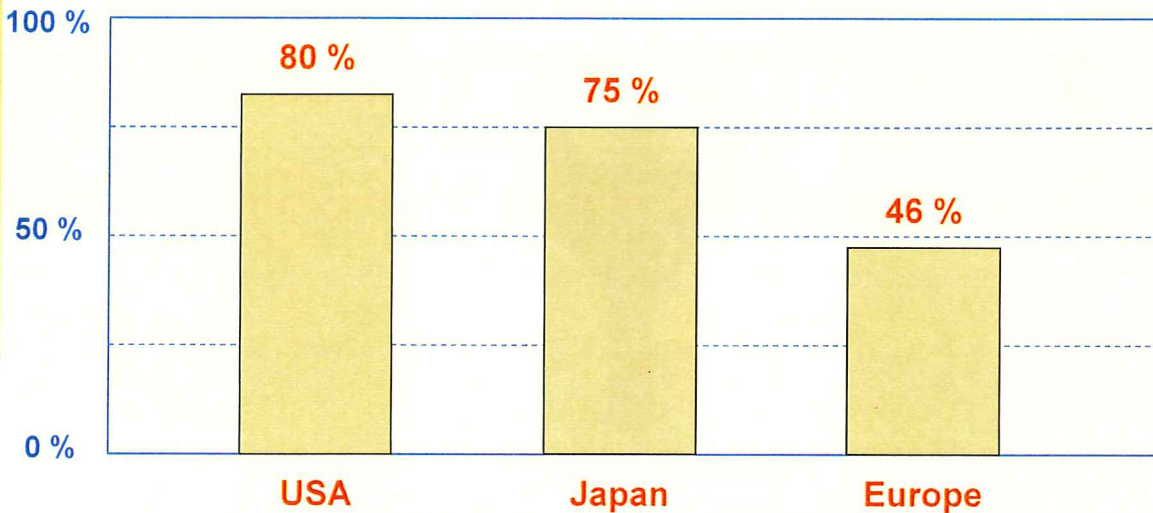


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4.D. R&D in Europe (5)

Relative number of researchers working in the private sector :



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4.D. R&D in Europe (6)

Number and R&D intensity of industrial companies, depending on their age :

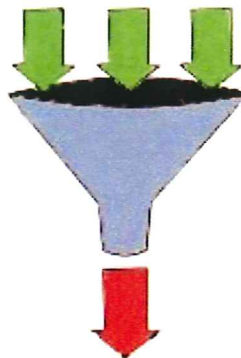
	Old (created before 1975)		Young (created since 1975)	
	<i>Number</i>	<i>R&D intensity</i>	<i>Number</i>	<i>R&D intensity</i>
Europe	82.2 %	2.8 %	17.8 %	4.4 %
USA	45.6 %	3.6 %	54.4 %	11.8 %



4.D. R&D in Europe (7)

The “ funnel ” effect

New PhDs in engineering



R&D expenditures



4.D. R&D in Europe (8)

Where does that come from ?

- Usually advanced explanations
- The overwhelming power of financiers

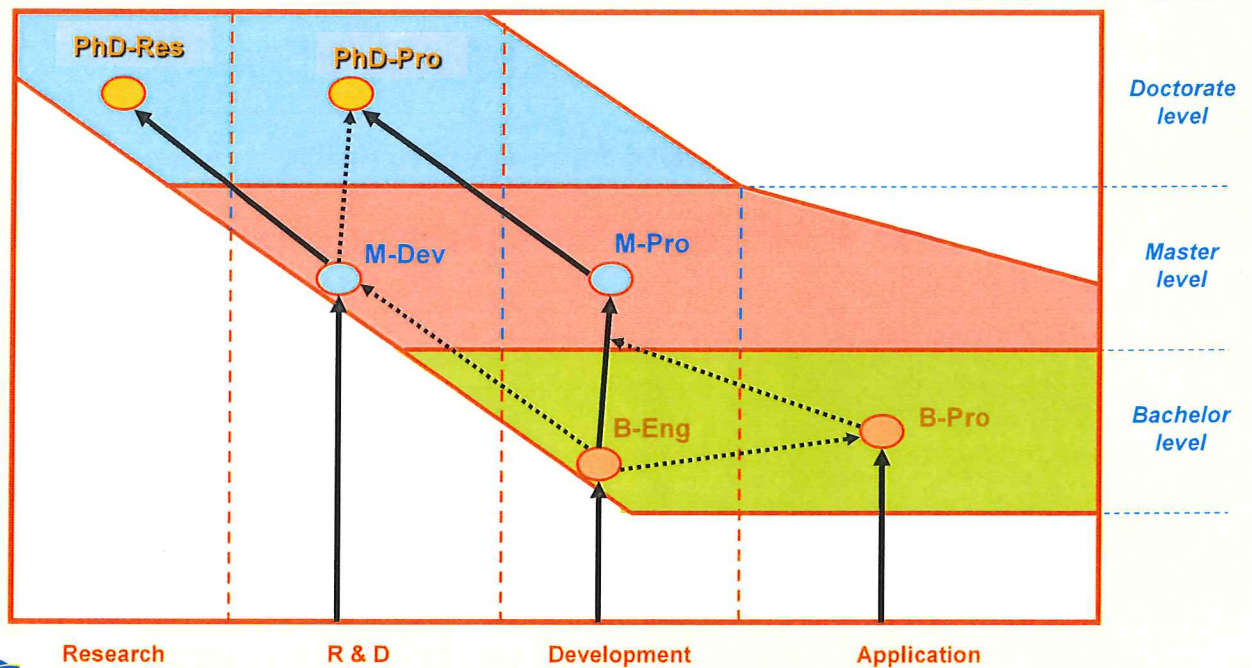


5. Conclusions (1)

- Supply of PhDs in engineering is overcoming the demand !
- Before all, Europe needs more R&D in industry !
- Too many managers are economists and financiers : short term return of investments !
- Better improve the quality of graduates : leadership and entrepreneurship skills
- Other longer term solutions
- Engineers must take their future into their hands !



5. Conclusions (2)



5. Conclusions (3)

*Wanderer, nothing but your tracks
Are laying out your way
Wanderer, there is no road,
The road is made by walking.
By walking, you make the road
And, when glancing back,
You see the track which
You will never tread again.
Wanderer, there is no road,
Only wakes upon the sea.*

Antonio MACHADO





Thank you for your attention



Any questions ?

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