THE ATTRACTIVENESS OF BEING AN ENGINEER

WP 5

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Darmstadt, 23rd and 24th of September 2010

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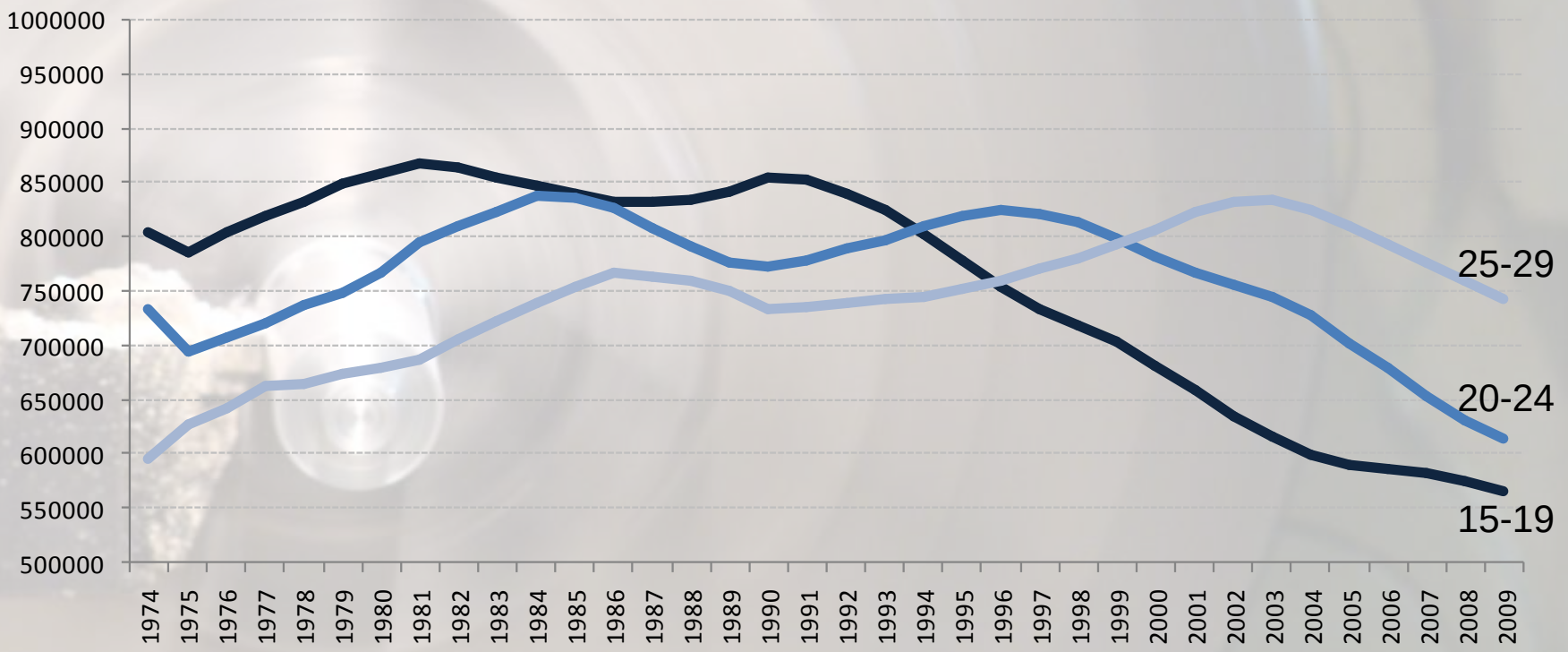
0.National Overview

Demographics
Higher Education
State of the Art

Demographic trend: decreasing young population

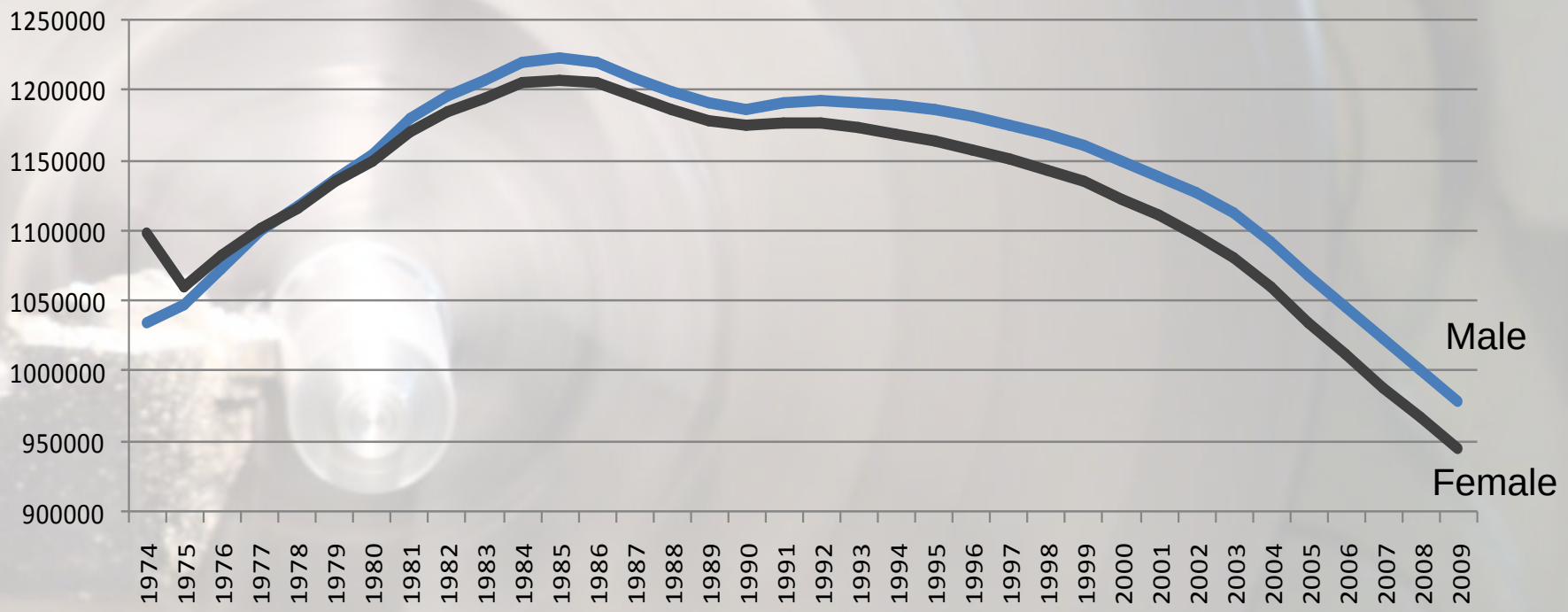
Resident Population in Portugal – 1974 to 2009, by age groups
15-19; 20-24 and 25-29



Source: INE, 2009

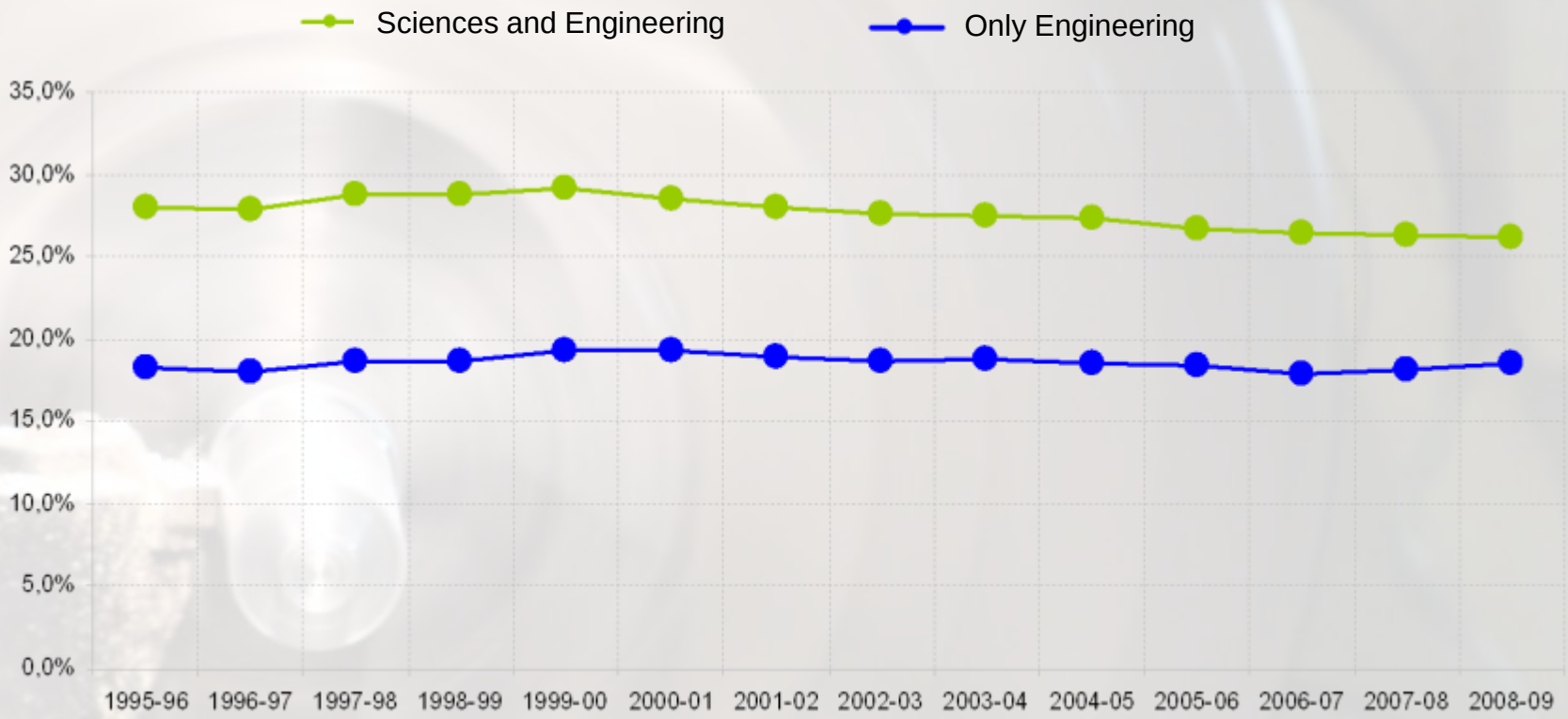
Demographic trend: decreasing young population
By gender

Resident Population in Portugal (Age Group 15-29) – 1974 to 2009, by gender



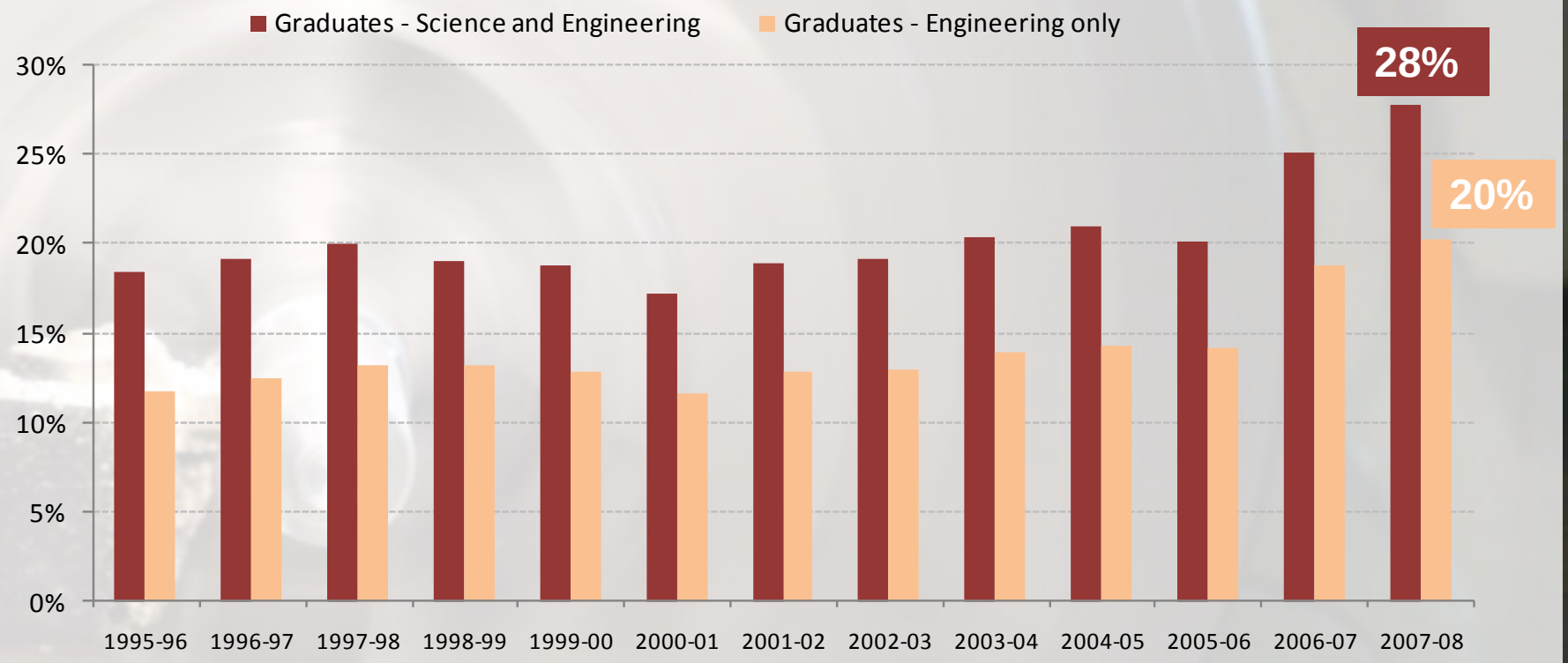
Source: INE, 2009

HE Admission in the S&T area – Total Education: Share of Science and Engineering – vacancies (%)



Source: GPEARI/MCTES, 2009

Trends in Graduation: S&T area – Total Education



Source: GPEARI/MCTES, 2009

State of the Art – Literature review

Research	Subject	Date (year)
The engineers in Portugal Mª Lurdes Rodrigues	The situation of engineers in Portugal between 1972-1991 focus: engineers survey	1999
Enginnering and Technology in service of the development of Portugal L.ValadaresTavares	The prospective and strategy of the sector in Portugal 2000-2020 focus: sector analysis	2000
Sexual segregation in the ICT sector Sara Falcão Casaca	The analysis of the gender relations in the work context focus: gender analysis	2006
IST Graduates Survey	General Survey focus: Academic & professional status/evolution	2009
Perceptions about the Engineer	General Survey Focus: engineer social representations	2010 (i.d.)

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1.Defining an Engineer

Formal concept of engineer

Enginering Formal Education: how hard?

How do we look at engineers?

Formal concept of Engineer

- The profession of engineer is governed by the Portuguese Professional Association of Engineers
- Graduates need to register in this Association to use the title of Engineer
- Only the graduates with a Master in engineering (2nd cycle) can apply

ENGINEERING PRACTICE IS:

Using the knowledge of laws of nature, to design, to analyse, to promote, to manage or to control an achievement of something:

…economically profitable

...technically predictable

…of social interest

Definition by Portuguese Order of Engineers

Formal concept of Engineer

ENGINEERING TRAINING

- Theory
- Testing
- Design
- Technical visits
- Seminars

BEGINNING OF PRACTICE

- Communication
- Technical activities
- Management
- Leadership
- Research & development

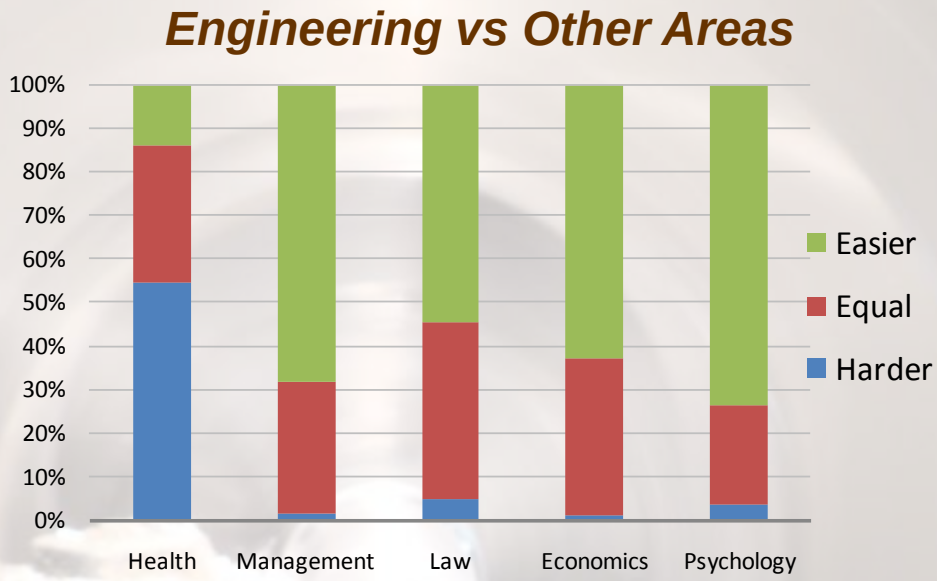
PROFESSIONAL PRACTICE

- Leadership
- Management
- Communication
- Technical activities
- Research & development

FOR THE DEVELOPMENT OF THE POTENCIAL OF ENGINEERING PROFESSIONAL IS ESSENCIAL THE ACQUISITION OF NON TECHNICAL EXPERTISES.

Structured by Portuguese Order of Engineers

Enginering Formal Education: how hard?



ENGINEERING HIGHER EDUCATION PERCEPTIONS

Most mentioned aspects:

- Quality (+)
- Demanding (+)
- Excessive Theory (+-)
- Differs according to HEI (+-)

Other interesting aspects:

- Entrepreneurship skills (+-)
- Decreasing quality (-)
- Solving problems (+)

Source: Engineering Perceptions Inquiry 2010, IST ; Websurvey: 233 Answers

How do we look at engineers?

Engineers

1st **Dynamic**
2nd **Creative**
3rd **Affirmative**
4th **Entrepreneur**
5th **Assertive**
6th **Curious**
7th **Efficient**
8th **Uncomplicated**

Other Professions

1st **Affirmative**
2nd **Dynamic**
3rd **Active**
4th **Arrogant**
5th **Confident**

Source: Engineering Perceptions Inquiry 2010, IST

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2.Engineer and Society

Contribution to delevopment

Engineering profession - how hard?

Contributes to Portugal Development

Engineer Contribution:

VERY IMPORTANT	170	74,2%
IMPORTANT	58	25,3%
LESS IMPORTANT	1	0,4%
NOT IMPORTANT	0	0,0%

"Scientific and Technological development of the country"

"Public Works": sciences in action

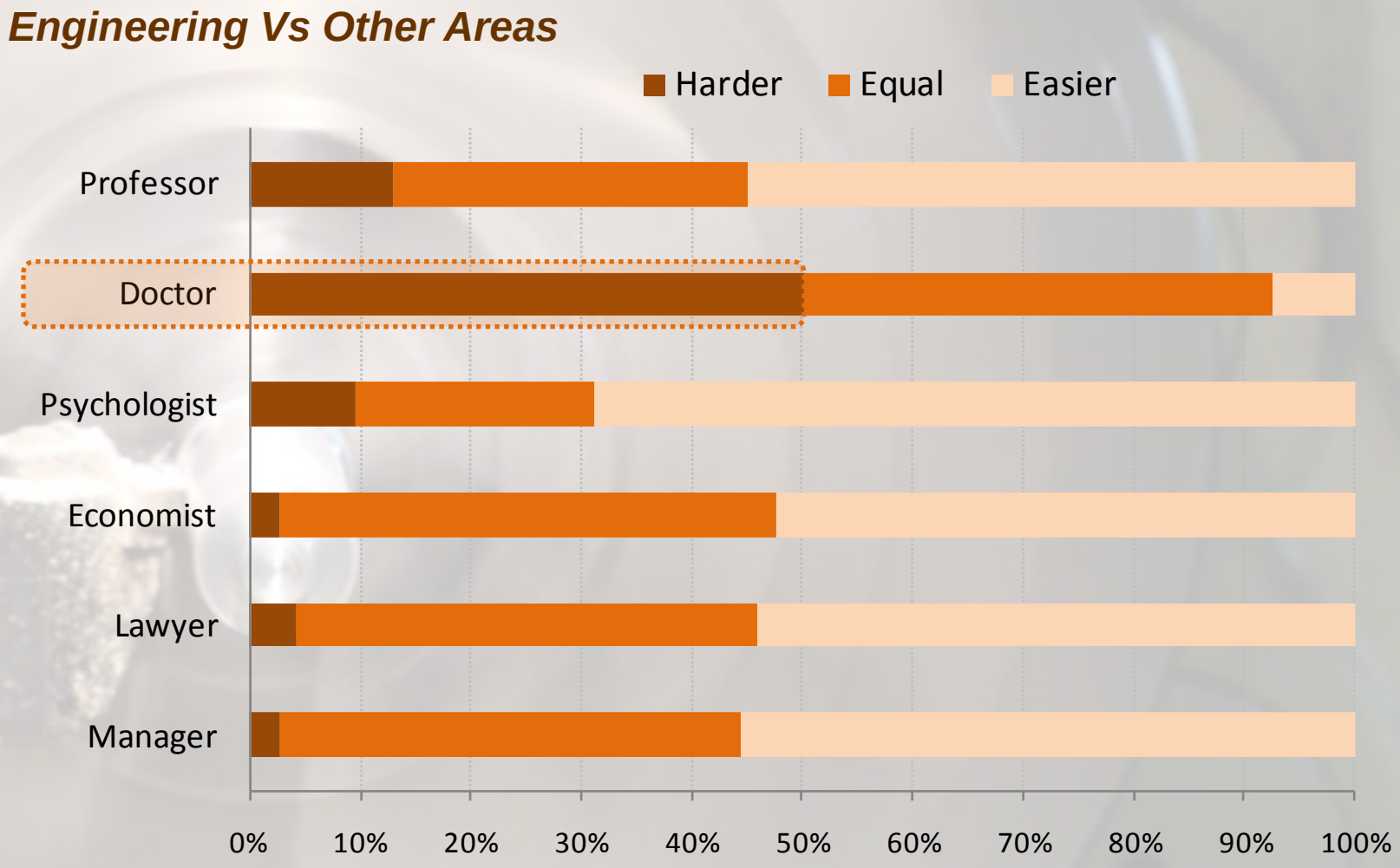
"Process and Market Innovation"

"Life quality improvement"

"Economic growth and development"

Source: Engineering Perceptions Inquiry 2010, IST

Enginering Profession: how hard?



Source: Engineering Perceptions Inquiry 2010, IST

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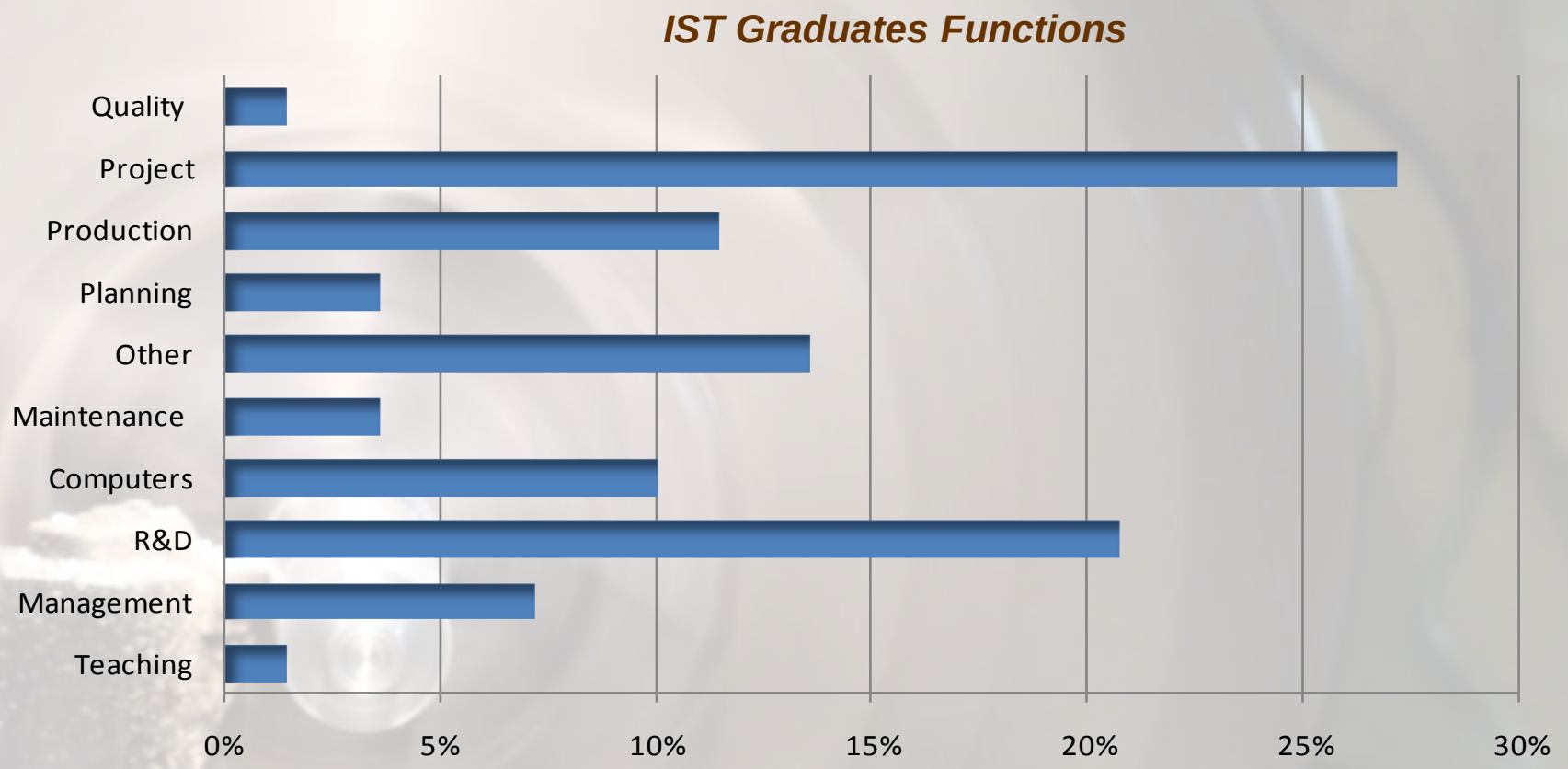
3. Job Market & Reputation

What do IST Engineers do in Portugal?
What perceptions do we have about what engineers do ...
What reputation do engineers have in Portugal?
How is engineering linked to society domains?
Perceptions about income (engineering vs others)
Engineer importance to employers (engineering vs others)
Labour market access: unemployment statistics
Labour market access: perceptions

What do engineers do in Portugal: "The IST overview"



Main Activity Areas:

- **Consulting, Scientific & Technical activities (35%)**
- **Information & Communication (15%)**
- **Construction (11%)**
- **Education (11%)**

Source: IST Graduates Survey 2009; (IST Engineers; N=802, Response Rate: 34%);

What do engineers do: Perceptions on skills

Main skills associated with engineers:

1º Versatility/Flexibility (26%)
2º Analytical Capacity
3º Accuracy
4º Entrepreneurship
5º Project Management (7%)
6º Leadership
7º Computer Skills
8º Focus
9º Team Management
10º Negotiation/Line of Argument (1%)

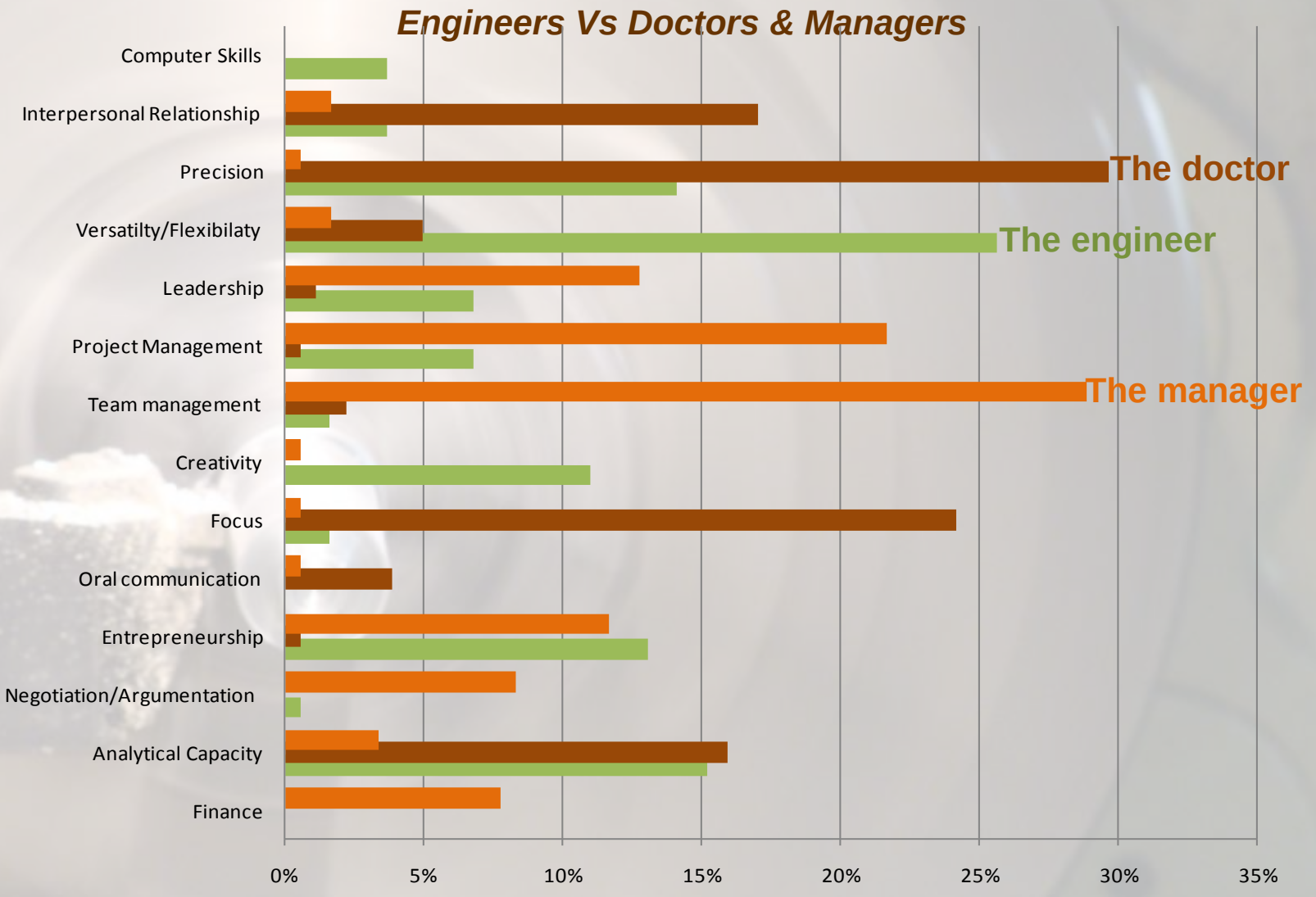
+

−

Skills not associated with engineers: **Finance & Oral communication**

Source: Engineering Perceptions Inquiry 2010, IST

What do engineers do:
Perception on skills (a comparative view)



Source: Science Perceptions Inquiry 2010, IST

Perceptions on Reputation & Prestige

The most prestigious professions in Portugal:

1st Doctor
2nd Engineer
3rd Manager
4th Lawyer
5th Teacher
6th Magistrate
7th Politician
8th Architect
9th Researcher

Source: Engineering Perceptions Inquiry 2010, IST

How is engineering linked to society domains?

Engineering primary association to society domains:

- **Public Works & Transports (98%)**
- **Industry & Technology (96%)**
- **Environment & Territory (96%)**
- **Agriculture & Fishing (83%)**

Engineering was also associated with:

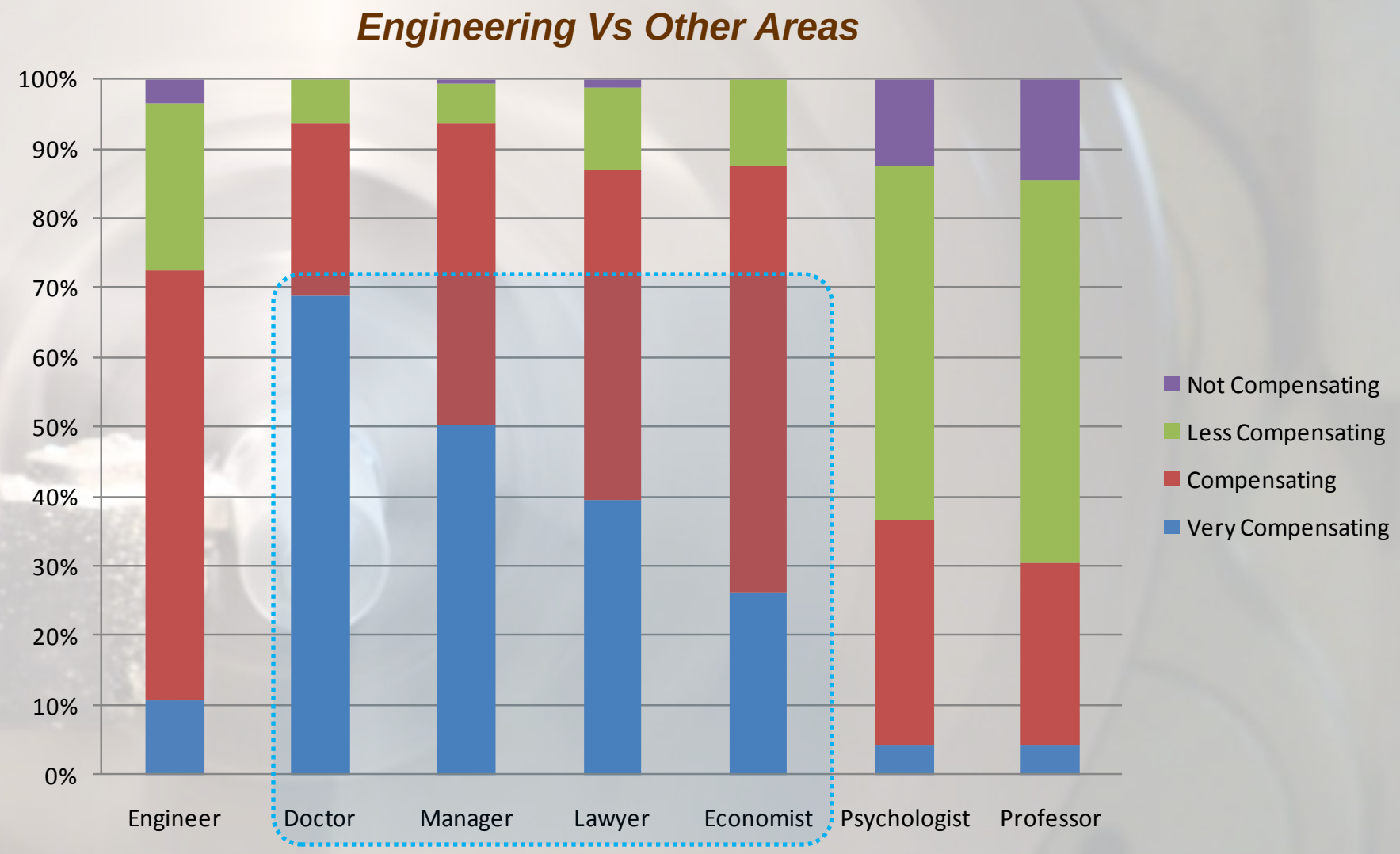
- **Defense & Military (30%)**
- **Politics (13%)**
- **Sports (8%)**
- **Education (1%)**
- **Finances (0.5%)**
- **Health (0.5%)**
- **Economy (0.5%)**

Engineering wasn't associated with:

- **Justice**

Source: Engineering Perceptions Inquiry 2010, IST

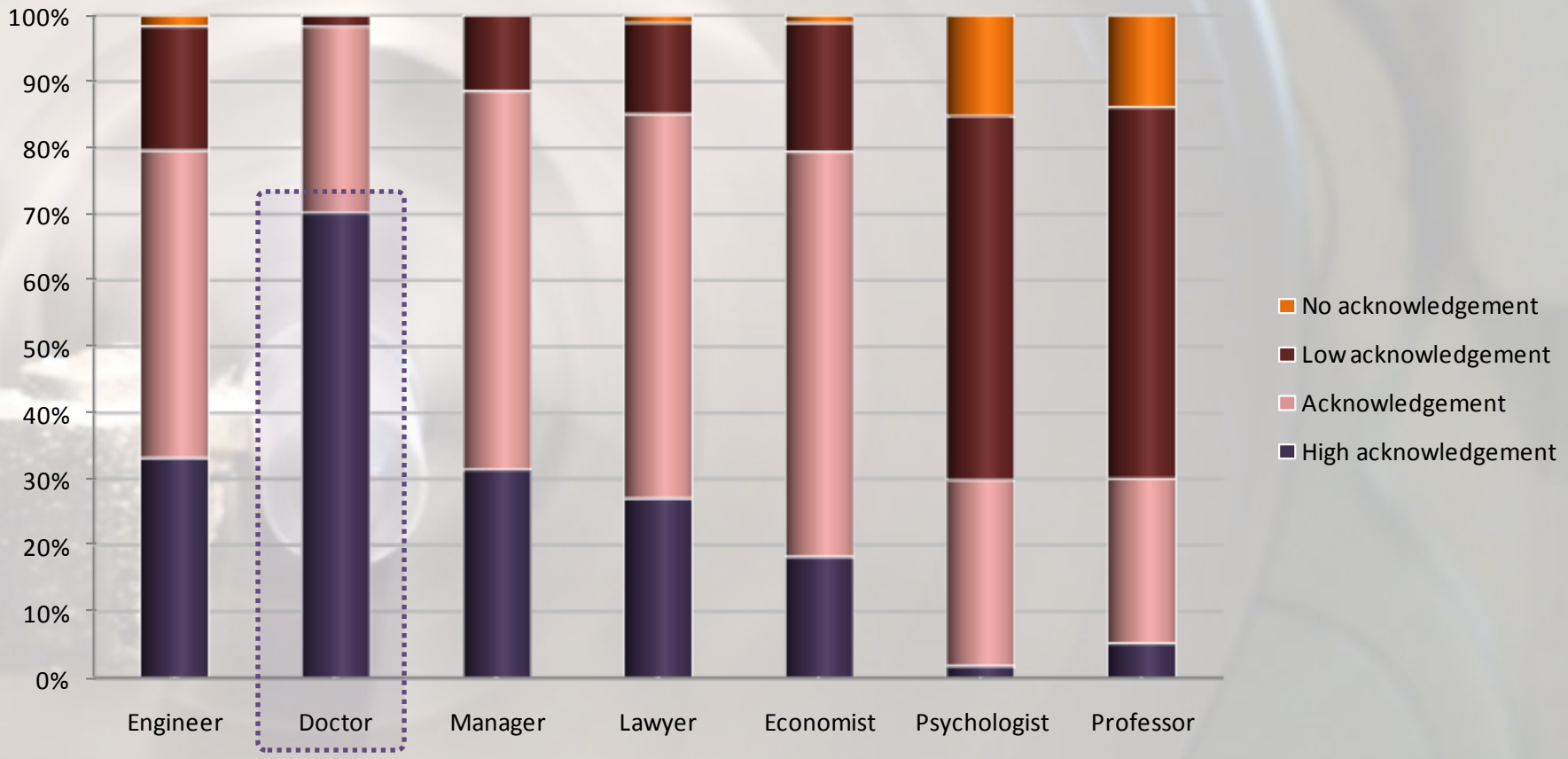
Perceptions about income: a comparative view



Source: Engineering Perceptions Inquiry 2010, IST

Engineer importance to employers: a comparative view

Engineering Vs Other Areas



Source: Engineering Perceptions Inquiry 2010, IST

Low Engineering Unemployement Rates

Weight of unemployees registered in the Job Centers in the last 10 years / Graduates in the last 10 years

3 most represented study areas (in number of entries), by descending order

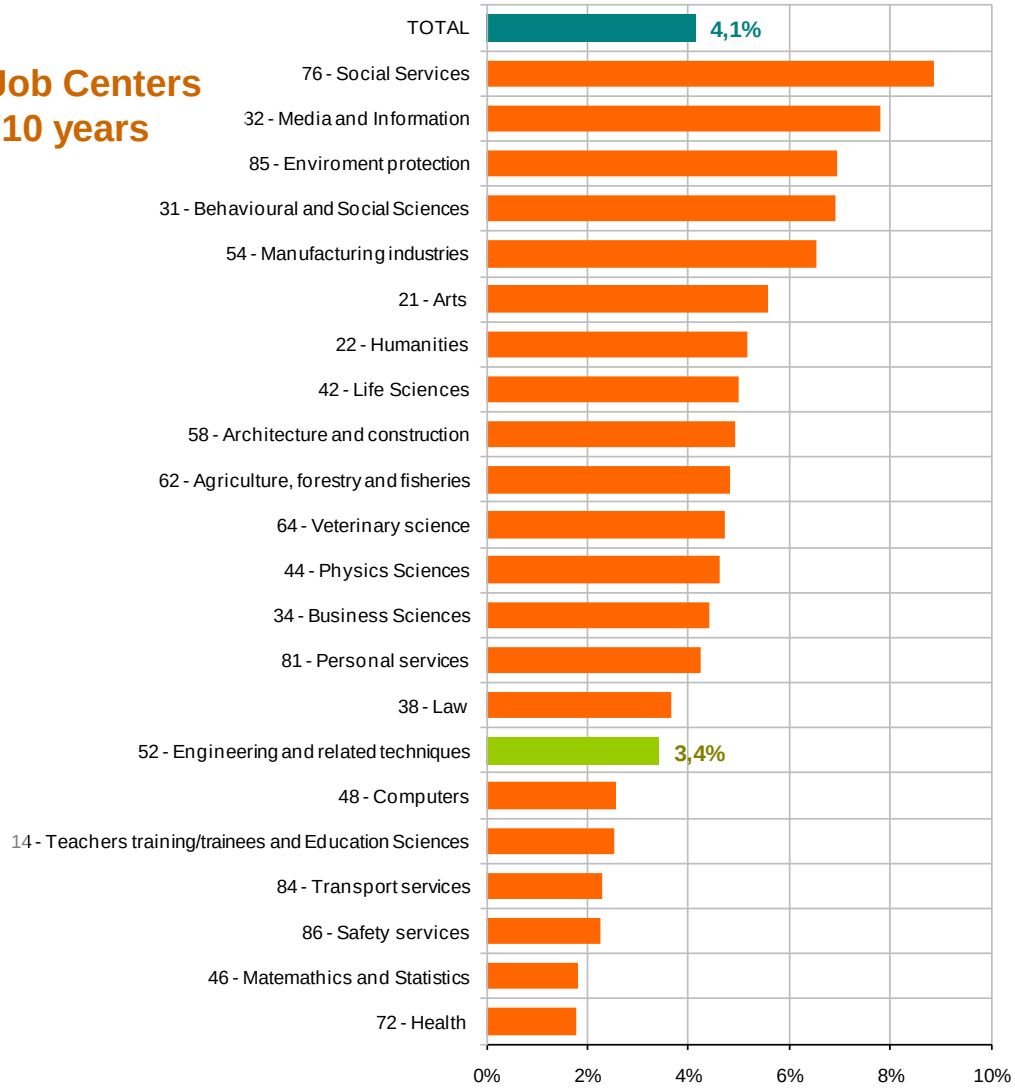
“Management Sciences” (7 306 entries).Management, in some educational establishments should be pointed out.

“Social and Behavior sciences”” (5 162 entries).Psychology, Economics and Sociology, in some educational establishments should be pointed out.

“Engineering and related areas”” (3 437 entries). Mechanical Engineering and Chemical Engineering, in some educational establishments should be pointed out.

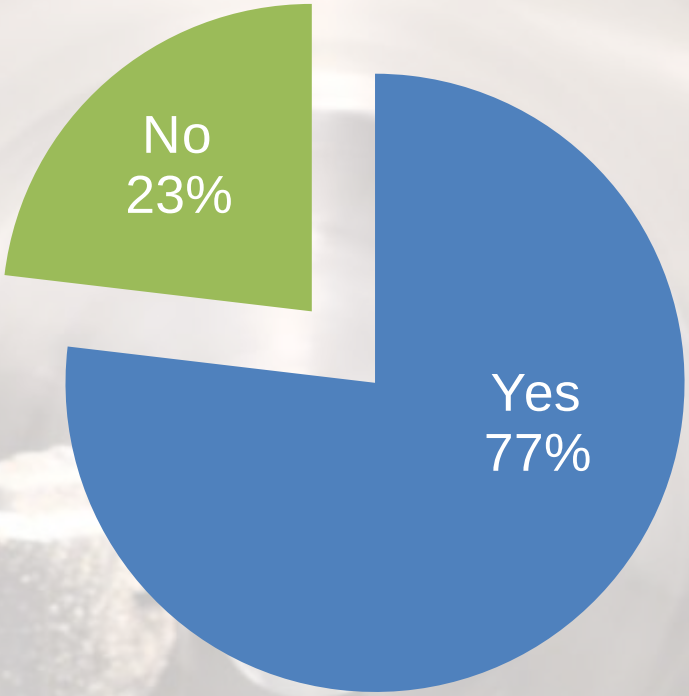
Source: GPEARI/MCTES,

Job Search for the Higher Education graduates, 2009



Job market access: perceptions

"Do engineers have easy Job market access ?"



Main reasons: "Yes"

- Versatility of the engineer
- Need for engineers
- Large amount of job ads
- Most engineer acquaintances are employed

Main reasons: "No"

- Saturated job market
- Current global crisis

Interesting mixed perception: *"Engineering has high job rates because engineers accept low financial income"*

Source: Engineering Perceptions Inquiry 2010, IST

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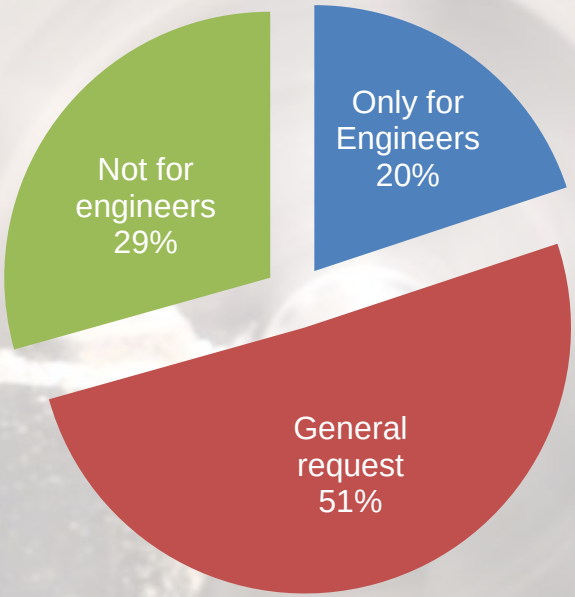
4.Media Coverage

Media coverage: job offers profile in engineering

Shadow engineers: ideas? Help us!!!!

Job offers profile in engineering

Job offers posted between 7th and 14th of september:



What skills and traits do employers ask for?

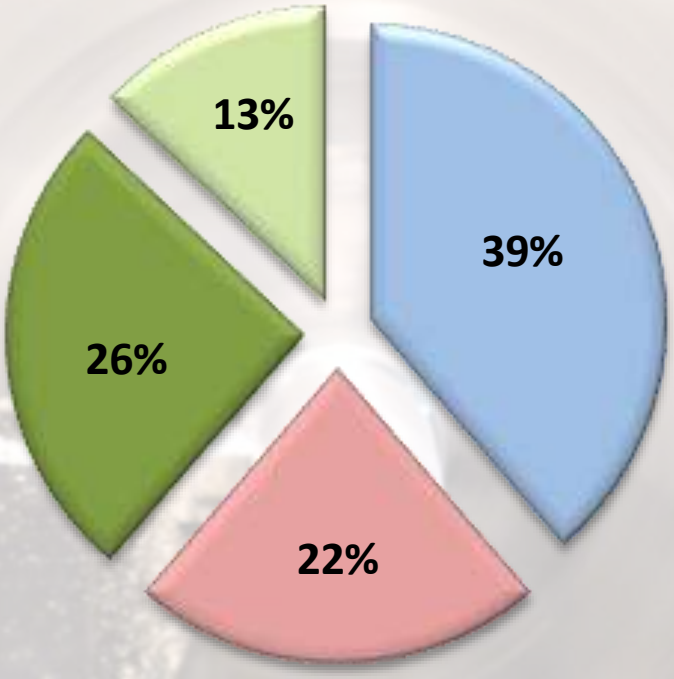
- **Specific technical skills**
- **Planning and organizing**
- **Leadership**
- **English speaking**
- **Goal-oriented**
- **Computer skills**
- **Responsibility**
- **Team work skills**

65% of the engineering ads asked previous professional experience from candidates

Source: http://aeiou.expressoemprego.pt/

Job offers profile in engineering

Requested Scientific Areas



Source: http://aeiou.expressoemprego.pt/

Job offers profile in engineering: differences among other areas

WHAT SKILLS AND TRAITS DO EMPLOYERS ASK FOR?

ONLY FOR ENGINEERS

- Specific technical skills
- Planning and organizing
- Leadership
- English speaking
- Goal-oriented
- Computer skills
- Responsibility
- Team work skills

NOT FOR ENGINEERS

- English speaking
- Computer skills
- Planning and organizing
- Specific technical skills
- Other foreign language
- Communication skills
- Team work skills
- Dynamism

54% of the NON engineering ads asked previous professional experience from candidates

Source: http://aeiou.expressoemprego.pt/

Job offers profile in engineering:
IST most requested areas (2009)

Most requested engineering and scientific IST areas:

- Electric and computer engineering
- Information systems and computer engineering
- Mechanical Engineering
- Mathematics
- Communication networks engineering
- Industrial engineering and management
- Environmental engineering

Source: Job Banking IST, 2009

Shadow engineers: ideas? Help us!!!!

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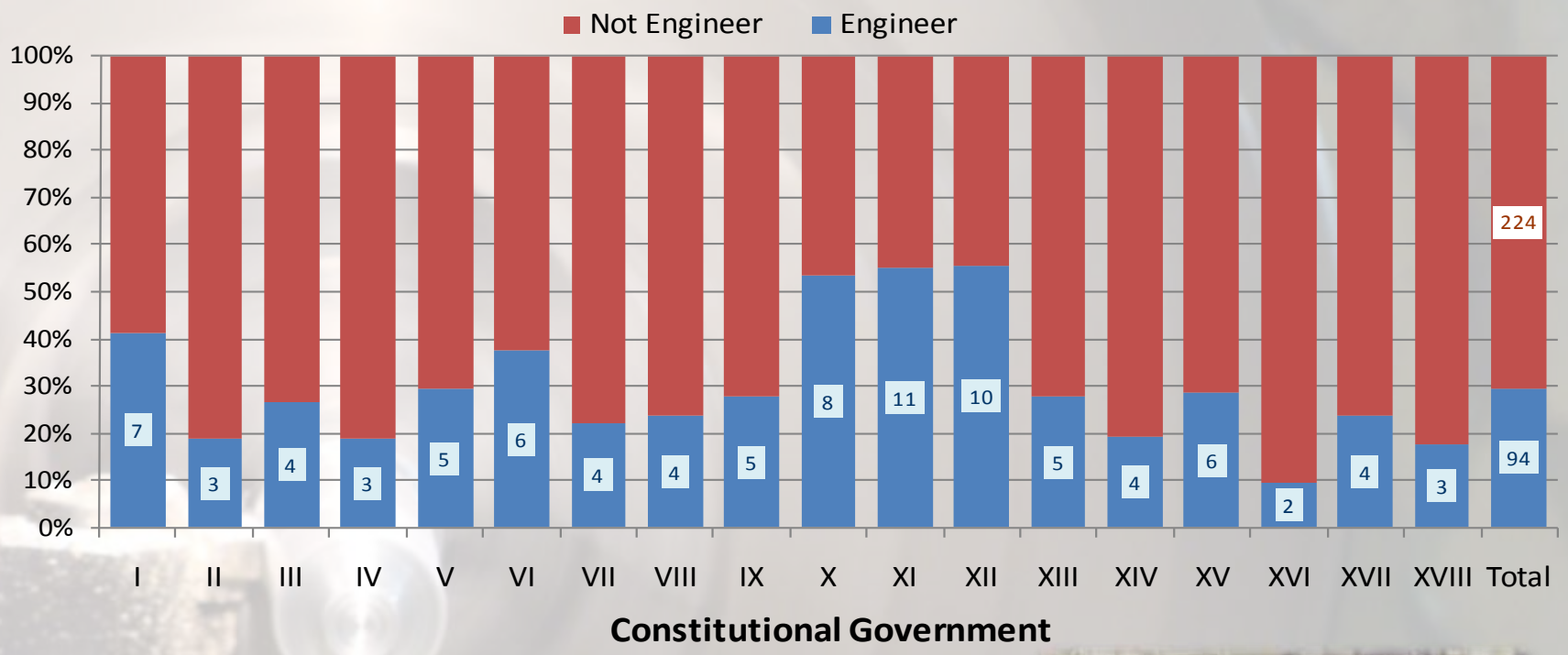
5.Engineers Outside Engineering

Engineer profession attractiveness

Engineer profession attractiveness in other sectors



35% of the prime ministers were engineers
30% of the overall ministers were engineers

Engineer profession attractiveness in other sectors

MINISTERS SCIENTIFIC AREAS

25 - Chemical Engineering
24 - Civil Engineering
22 - Engineering (unspecified)
15 - Mechanical Engineering
9- Electrical Engineering

MINISTERIAL PORTFOLIO

7 - Education
5 - Industry and Technology
5 - Public Works, Transports and Communications
4 - Industry and Energy
4 - Housing and Public Works
4 - Trade and Tourism
4 - Internal Administration
4- Transports and Communications

Engineer profession attractiveness in other sectors

Top Portuguese companies CEO's academic background:

	PSI 20 (20 Main Portuguese Companies listed on the Stock Market)	Exame Magazine (20 Best companies)
Engineering	4	5
Law	3	1
Economics	8	6
Management	2	1
Without Higher Education	3	0
Undetermined	0	7

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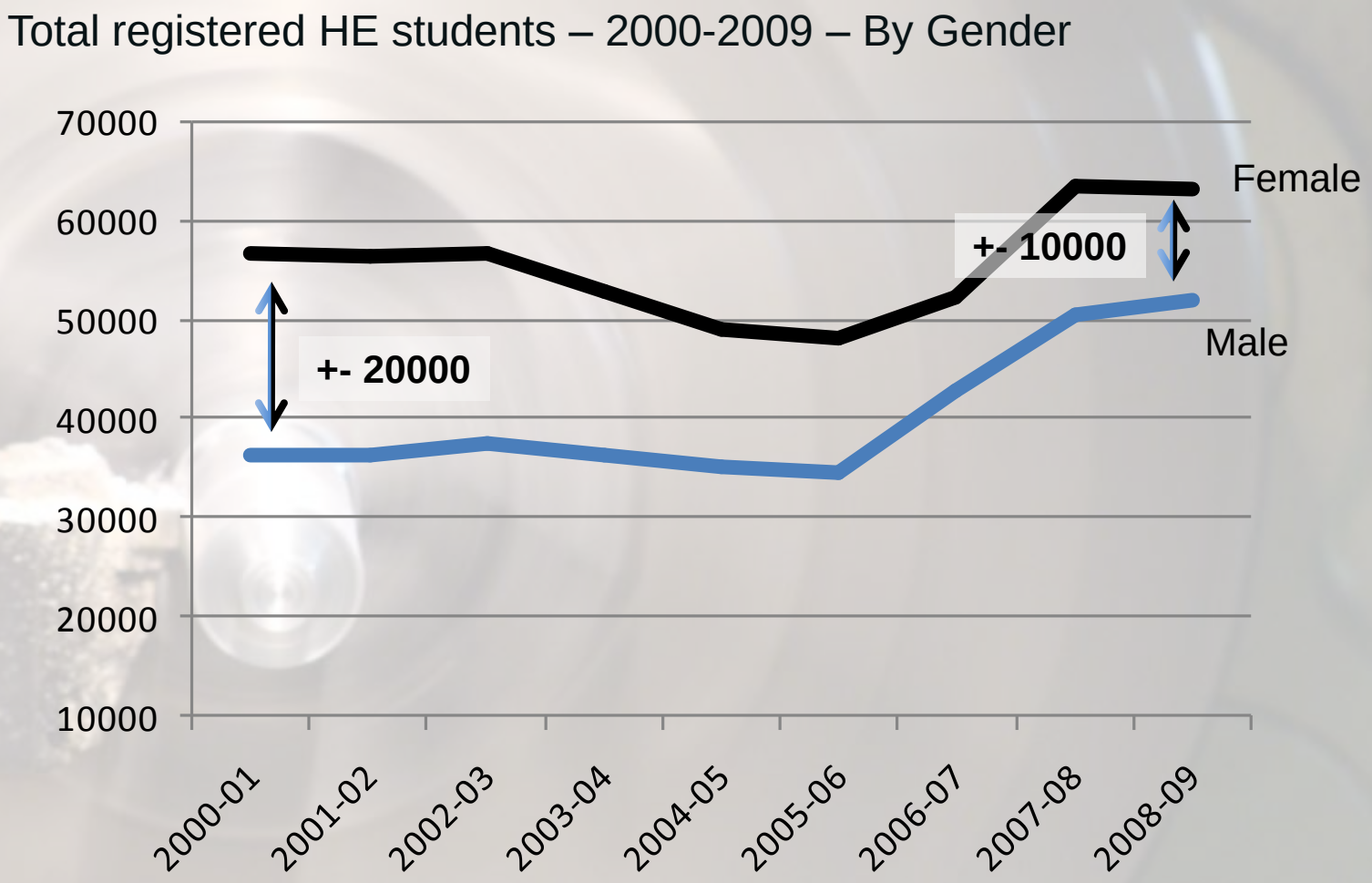
Gender Differences

Context (HEI).1

Results of the 1st Inquiry on Social Perceptions.2

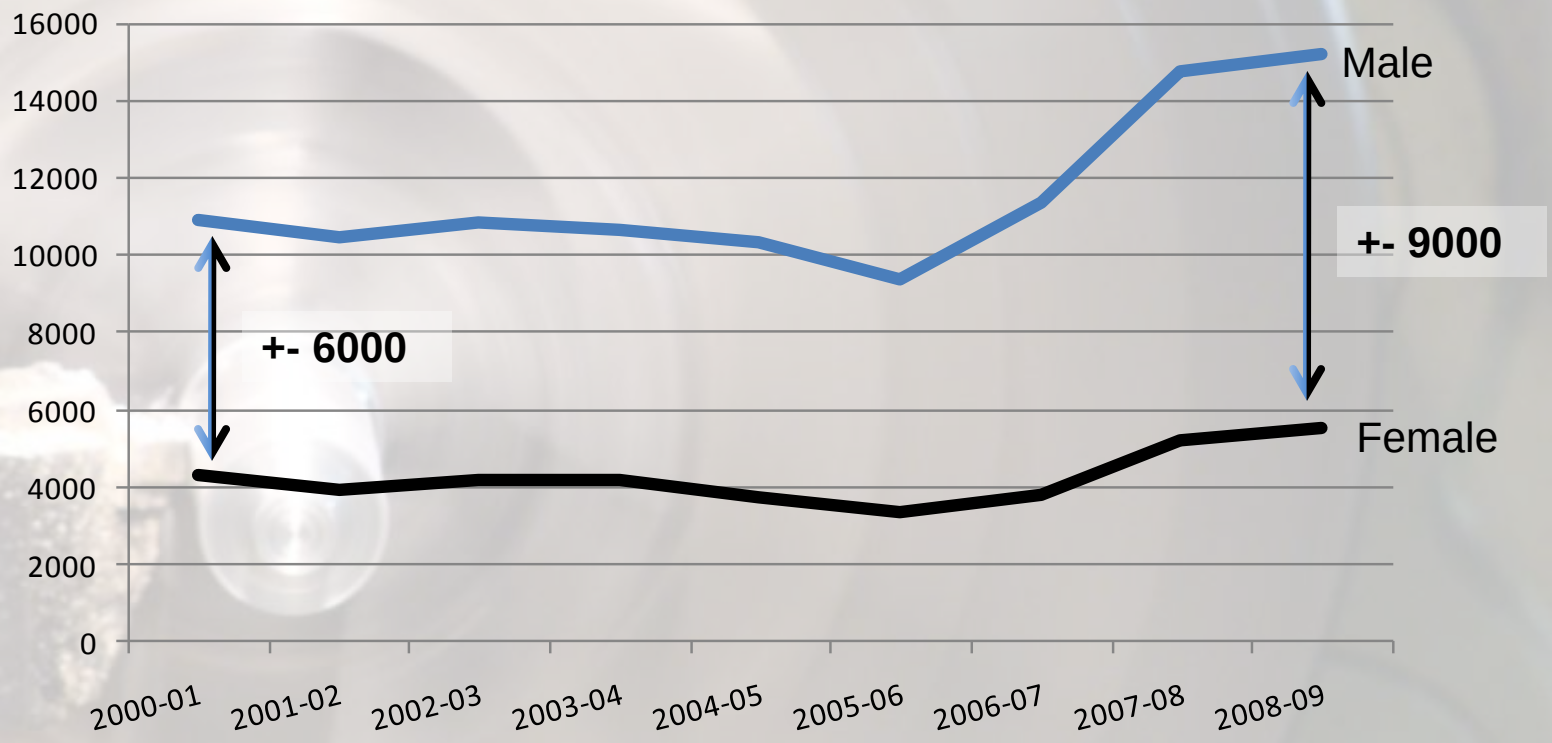
Gender Differences
Higher Education evolution



Source: GPEARI/MCTES, 2009

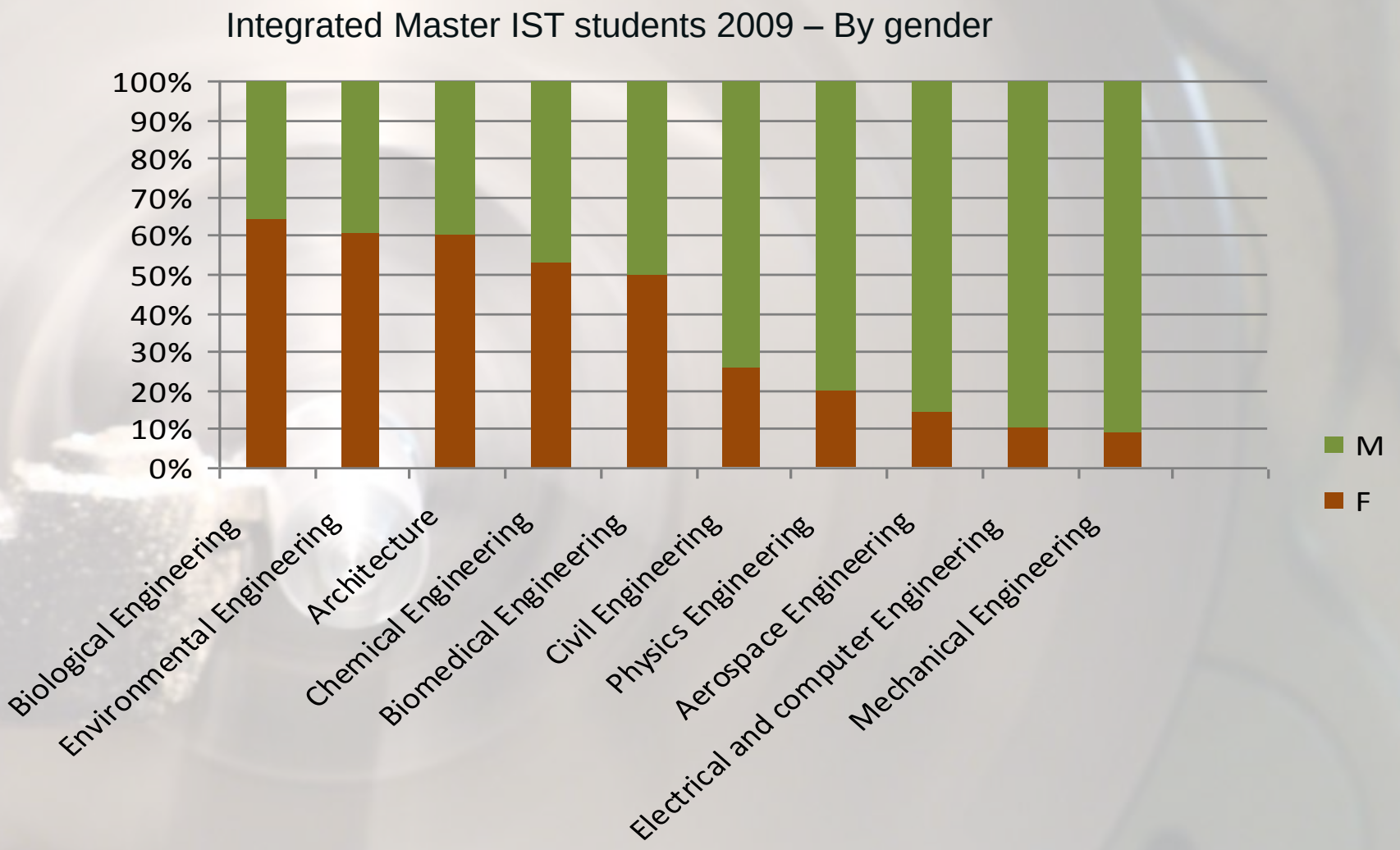
Gender Differences:
Engineering, Transforming Industry and Construction

Registered Engineering, Transforming Industry and Construction HE students – 2000-2009 – By Gender



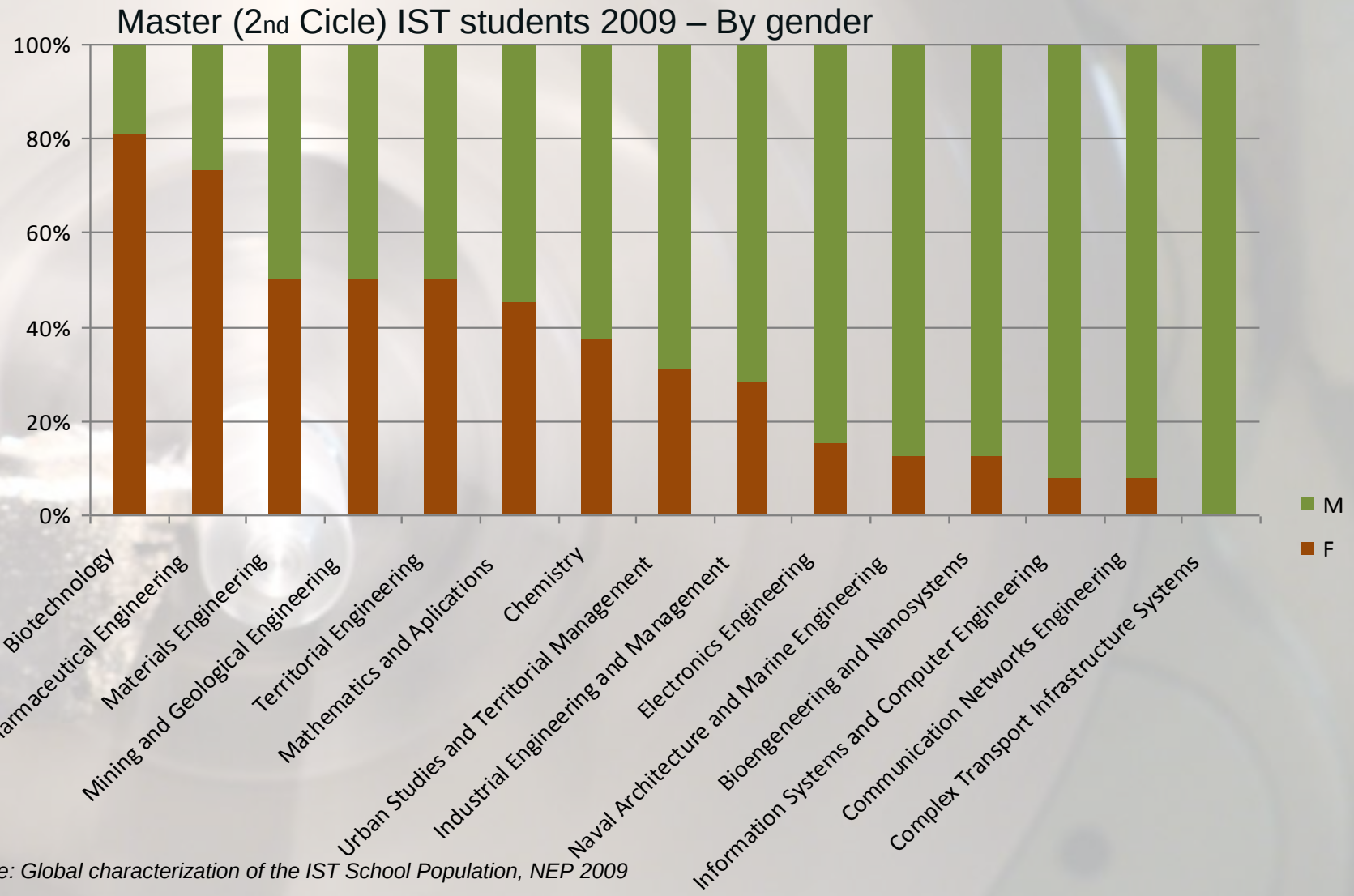
Source: GPEARI/MCTES, 2009

Gender Differences:
IST Registered Sudents – 2009, By Course and Gender



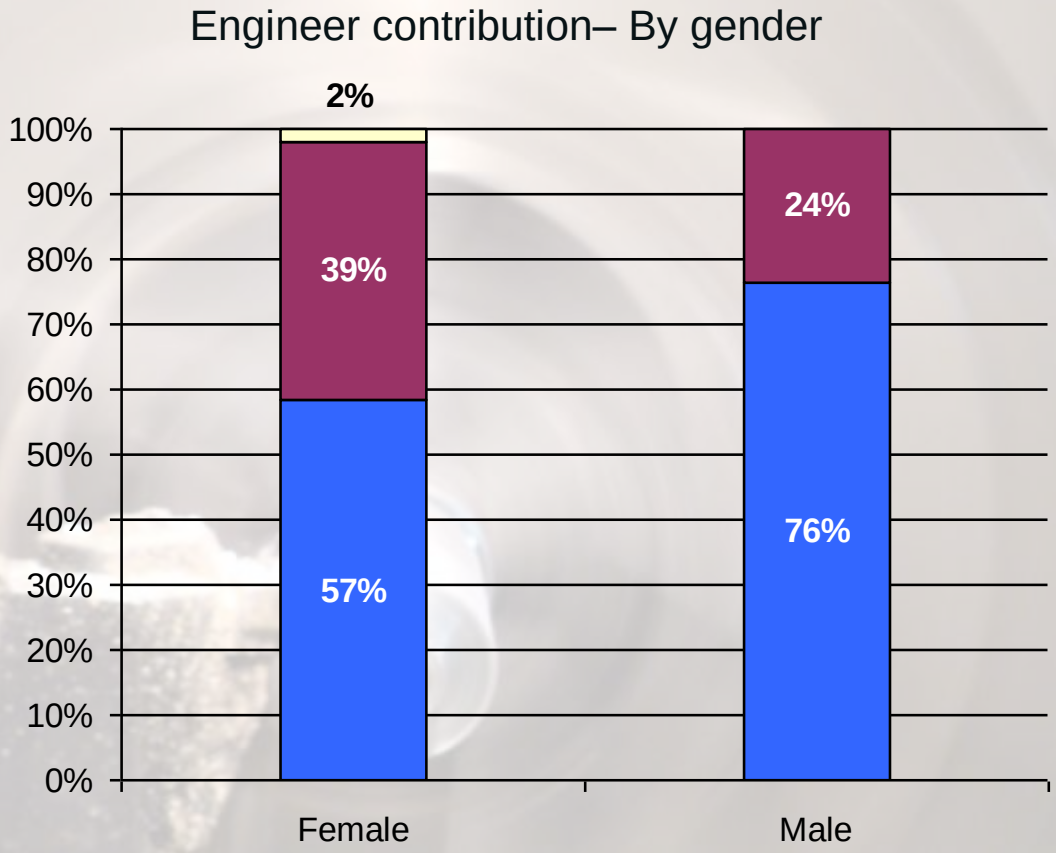
Source: Global characterization of the IST School Population, NEP 2009

Gender Differences:
IST Registered Sudents – 2009, By Course and Gender



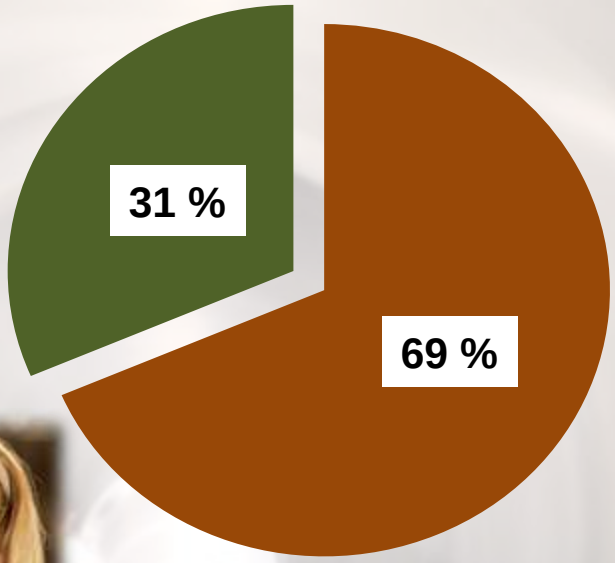
Source: Global characterization of the IST School Population, NEP 2009

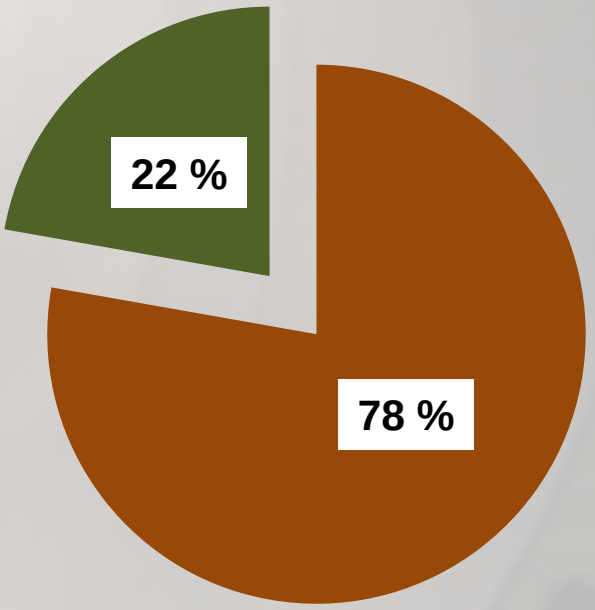
Gender Differences:
Engineer contribution to Portugal's delevopement



Source: Engineering Perceptions Inquiry 2010, IST

Gender Differences:
Easy Engineer access to job market?





Source: Engineering Perceptions Inquiry 2010, IST

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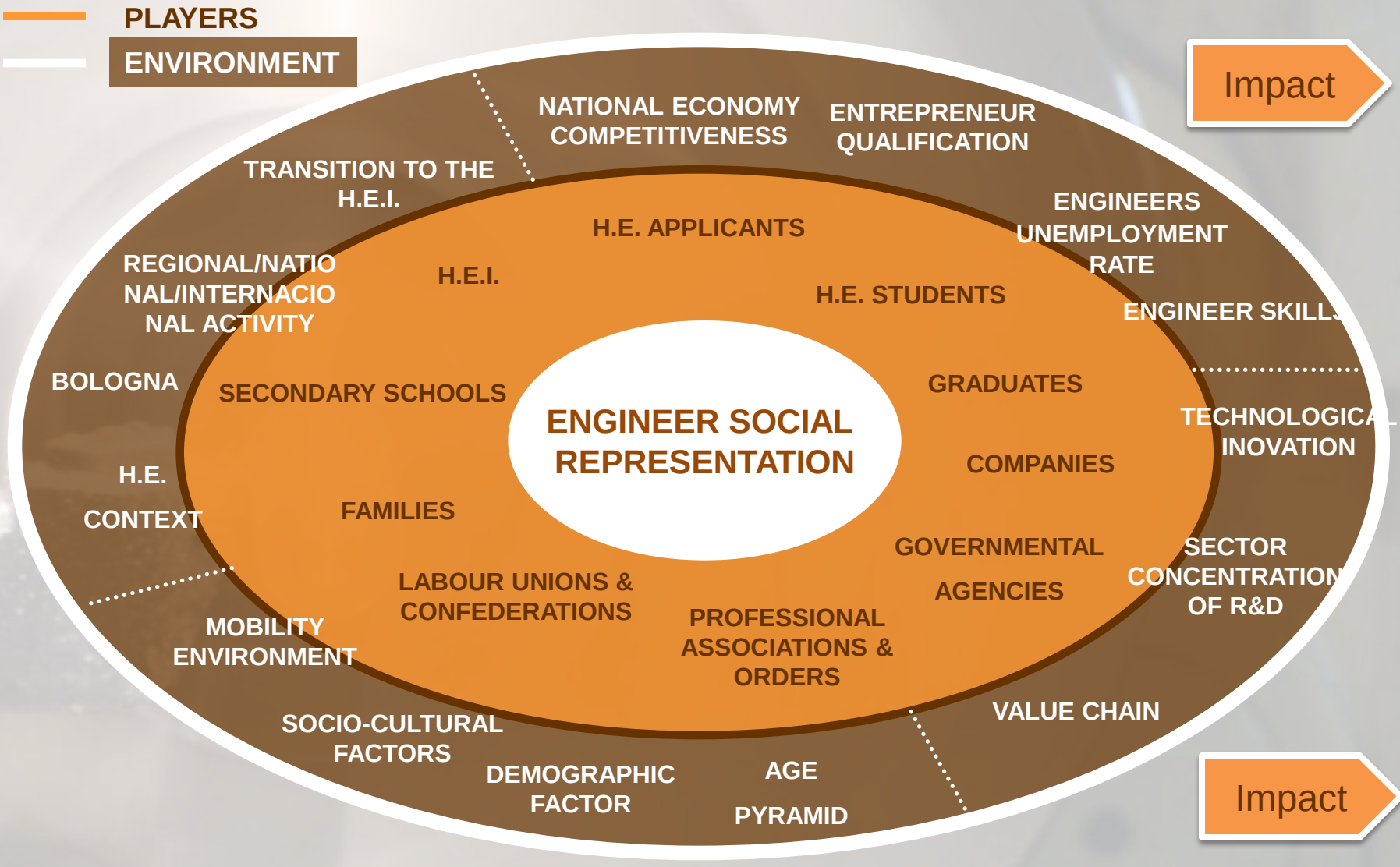
Final comments

Perceptions

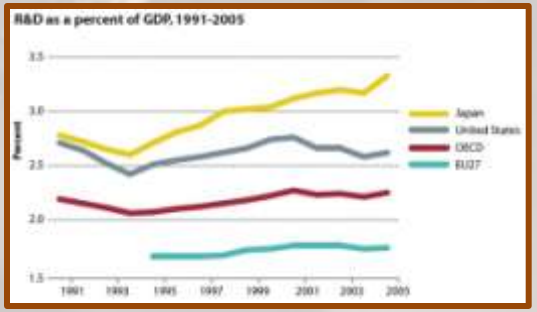
Factors that influence perceptions

Analysis Model (potential influence factors)



Main Factors that influence the attractiveness of engineering in Portuguese context

- **Positively:**
  - **High media projection/coverage**
  - **Important social role of the engineer: relevant political and economic positions**
  - **Family background/context: parents graduates in S&T motivated children to pursue their studies and careers in the same area**
  - **HEI's and Government S&T initiatives (like Mathematic Routes – UTL)**
  - **% GDP related to Science, R&D and H.E.(high increase in the last decade)**
  - **Increase in researchers and scientific publications in Portugal as compared to the EU average**
  - **Relative increase in the number of graduates in S&T**



Main Factors that influence the attractiveness of engineering in Portuguese context

- **Negatively:**
  - **Mathematics; Physics: linked "negatively" with the prospective sudents (weak results in the PISA scores)**
  - **High rates of academic failure/drop-out in secondary and higher education**
  - **Weak linkage to the study object (eg: civil enginnering, along the course has small contact with the real work) and low synergies between industry and university (projects during academic course and integrated seminaires)**
  - **Pre-bologna period did not enphasize the soft skills; the learning outcomes aren't centered on students**
  - **Demographic trend;**