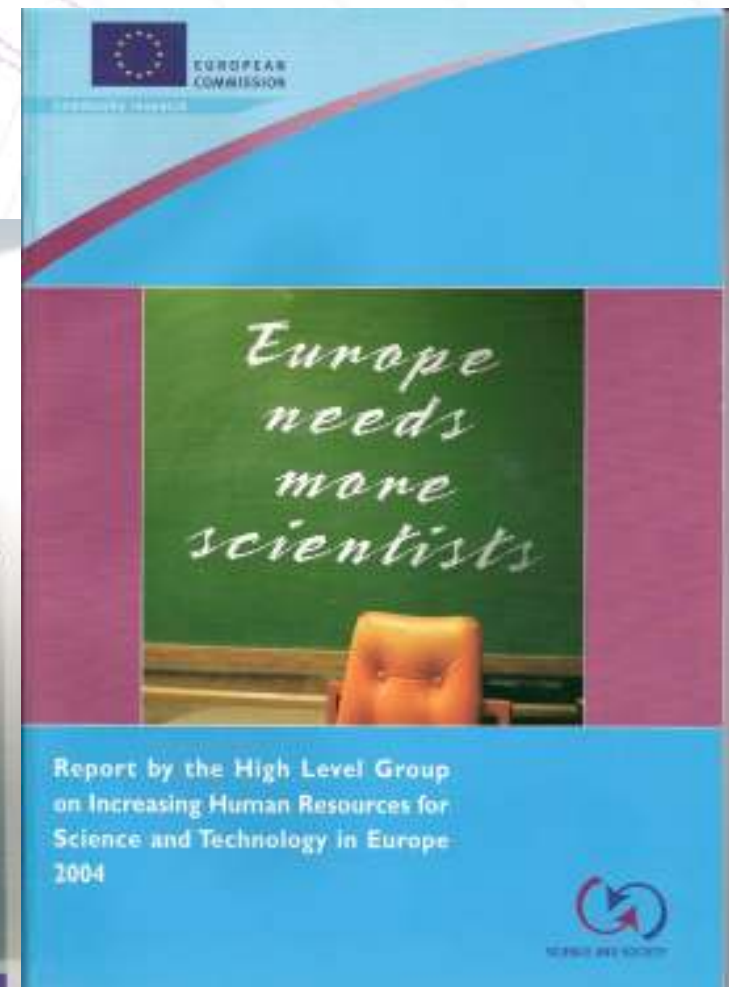
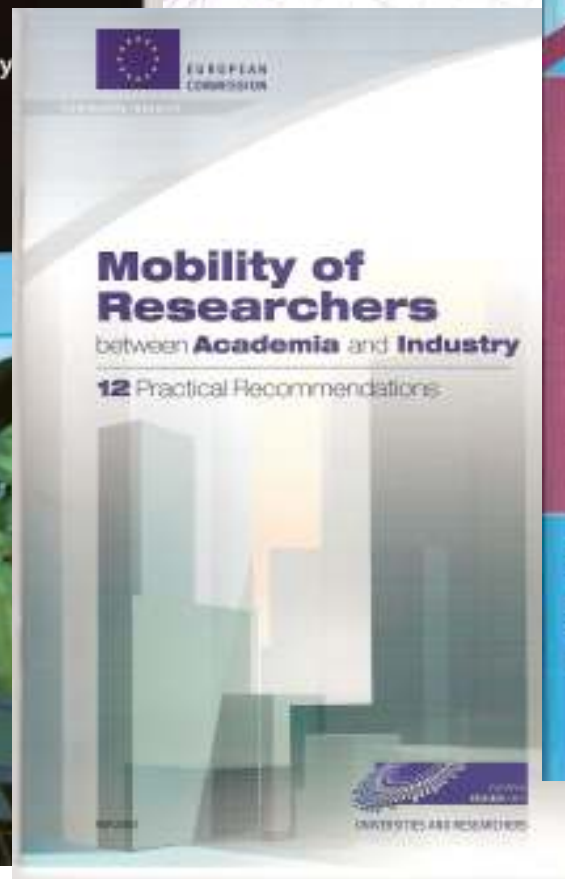
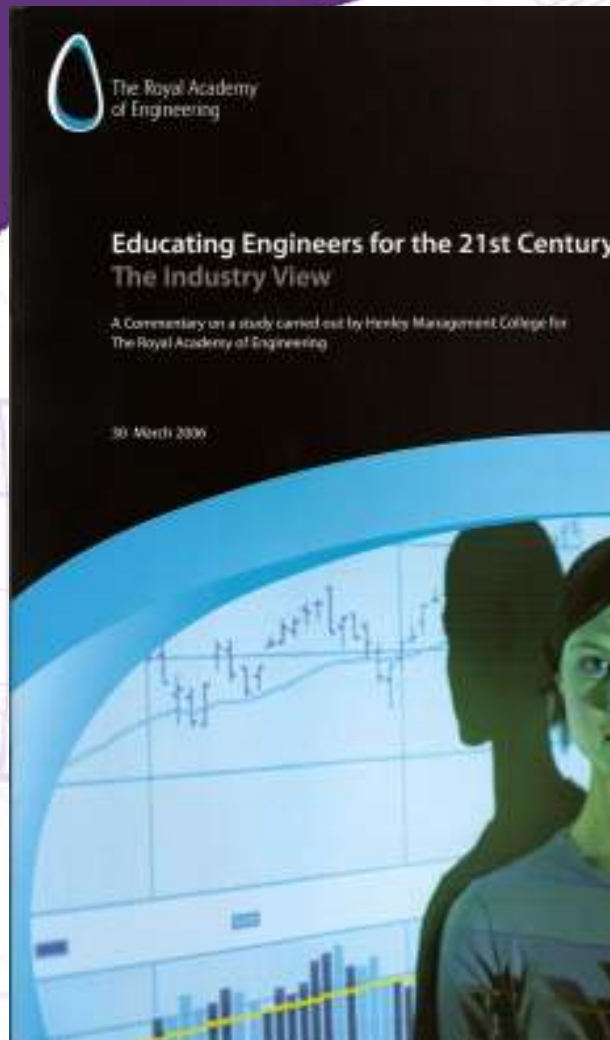


SET Human Resource implications for Europe

Graham Davies

The University of Birmingham

Science and Technology Human Resources Reports



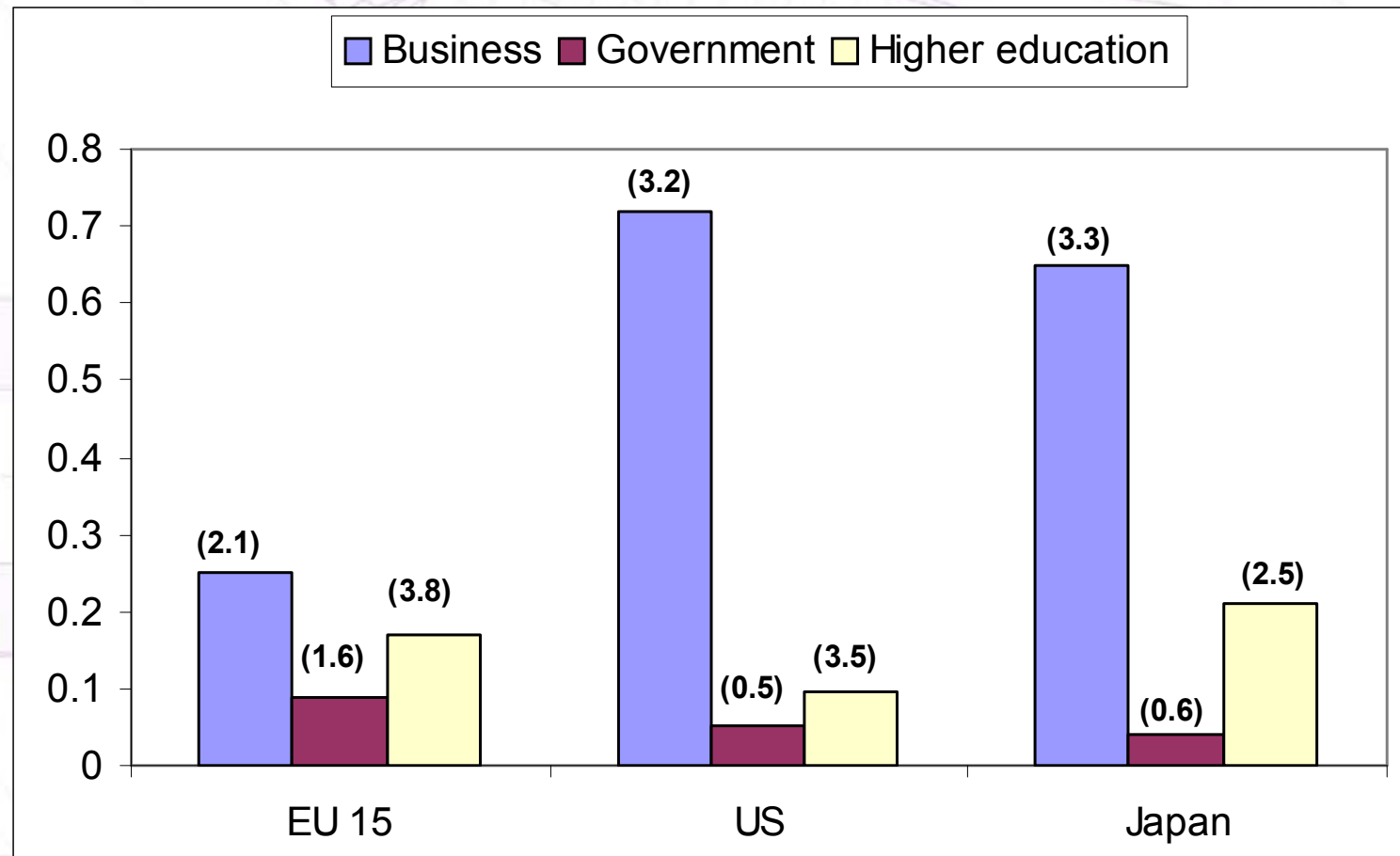
Motivation: changing world, changing engineering

- Increasing dependence on technology - global engineering challenges
- Energy, climate change, clean water, care of the elderly...
- Growing requirement for scientists & engineers
- 3% EU GDP on R&D by 2015
- Changing nature of engineering jobs
- Products to integrated systems/customer solutions
- Growing technological and system complexity
- Increasing management complexity
- Globalisation, offshoring and international teaming
- 700,000 extra SET workers by 2015
- EU scientists & engineers pa: static
- Financial pressures on universities and students
- Shortage of good maths and physics teachers
- Student motivation

' a key knowledge hub in the global economy...with a reputation ...as a world leader in turning knowledge into new products and services'

Science and
Innovation
Investment
Framework
2004 – 2014

SET Researchers as a Percentage of the Total Labour Force



The Dynamics

- At present rates of recruitment, this target cannot be met
- At present rates of importing SET workers this target cannot be met
 - Do not stay
 - An unreliable source which can be easily diverted elsewhere
- The EU also has an outflow of nationals to the US
- The proportion of women in SET careers is unacceptably low

Where is the Demand?

- No reliable statistics
- Industry is not demanding more – except in a few niche areas
- If SET was in short supply then one would expect a premium to be paid – no evidence
- We must conclude

Supply = Demand

At least for the present. However, industry is notoriously poor at predicting the future HR requirements, especially 10 years ahead.

The Royal Academy of Engineering Study

– Industry:

- ▶ 21 in-depth interviews with major companies
- ▶ 13 interviews with SMEs - including 7 high-tech spin-outs
- ▶ 3 focus groups with recent graduates
- ▶ 444 questionnaire responses, 53% SMEs
 - industry changes, skills requirements
 - quality of graduates, changes needed in engineering education

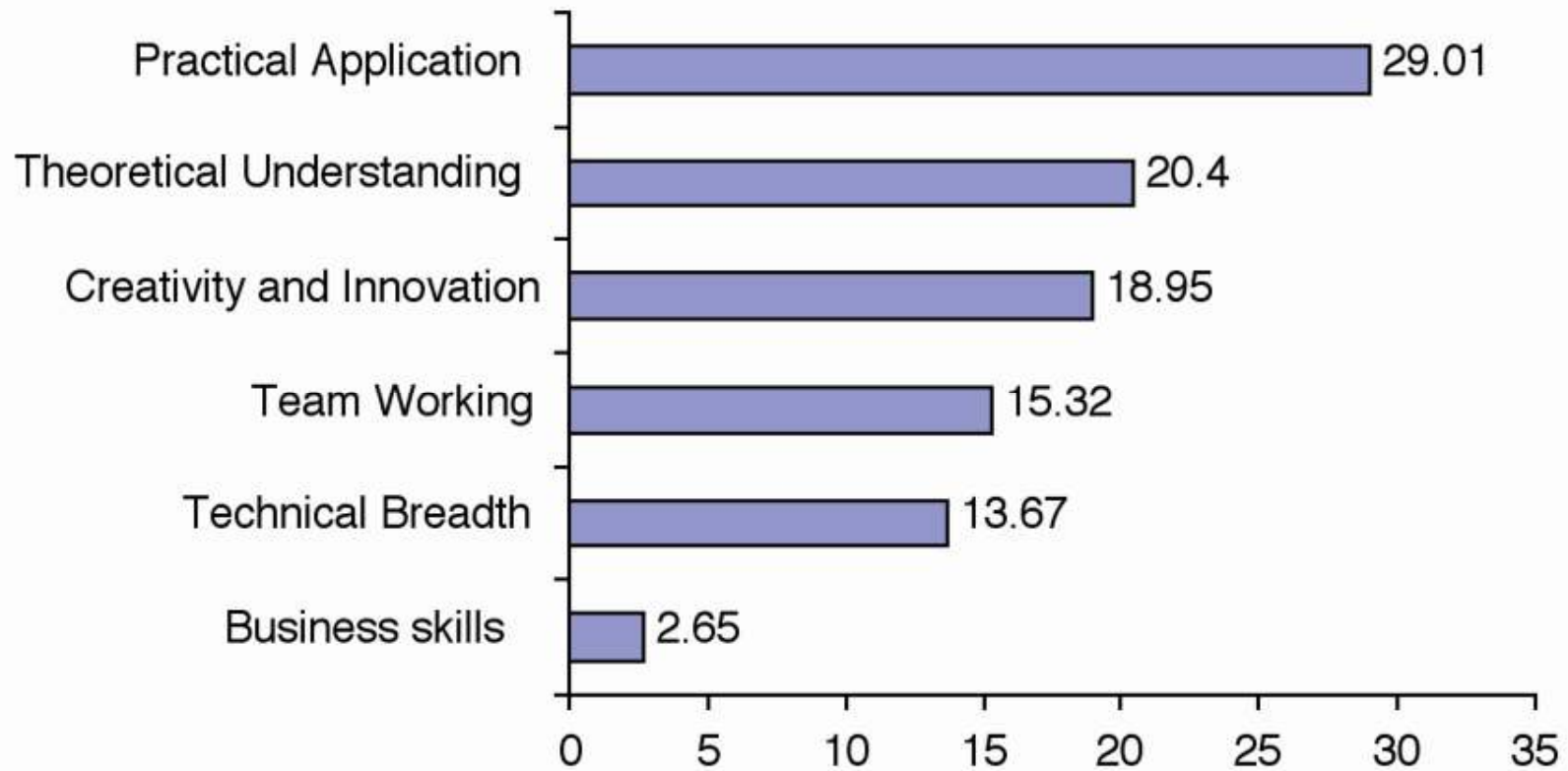
– Academia:

- ▶ questionnaire to all university engineering departments
 - responses to industry conclusions
 - examples of issues and of best practice
- ▶ 80 replies

Industry study conclusions

- Business predicts a worsening shortage of high calibre UK engineering graduates
- Civil Engineering, Electrical & Electronic Engineering, Systems Integration, Communications Technology and Materials.
- Shortages and skill gaps are costing money
 - ▶ impacting productivity, creativity and business growth
- Graduates need more experience of applying theory to real problems
- Industrial experience during the degree is a strong indicator of early success in industry
- The best graduates are competitive with their peers Internationally
- Engineering degree courses need attention
 - ▶ to recognise the changing requirements of industry
 - ▶ to attract and maintain motivation of students
 - ▶ to ensure degrees remain world class

Industry priorities for engineering graduates



Academic Survey Conclusions

- **Strong agreement with industry conclusions and concerns**
 - multi-disciplinary teaching
 - more design/make, project and practical activities
- **88% want more industrial involvement**
 - concern that industry doesn't think long term about engagement with university education
 - but - resistant to universities 'doing industry's training'
- **Enthusiastic for change**
 - 72% support introduction of new engineering courses: Bioengineering, Nanotechnology...
 - 59% promoting CDIO-type approaches to learning and teaching
 - keen to introduce 'systems thinking' - but only 30% think Systems Engineering should be a stand-alone course
 - Many examples of good practice quoted; Formula Student; Constructionarium.
- **There are some Major Inhibitors**
 - Research Assessment Exercise – highly detrimental to teaching: 75%
 - Decline in funding per student for teaching
 - Current quality assessment and accreditation approaches: 60%

Recommendations

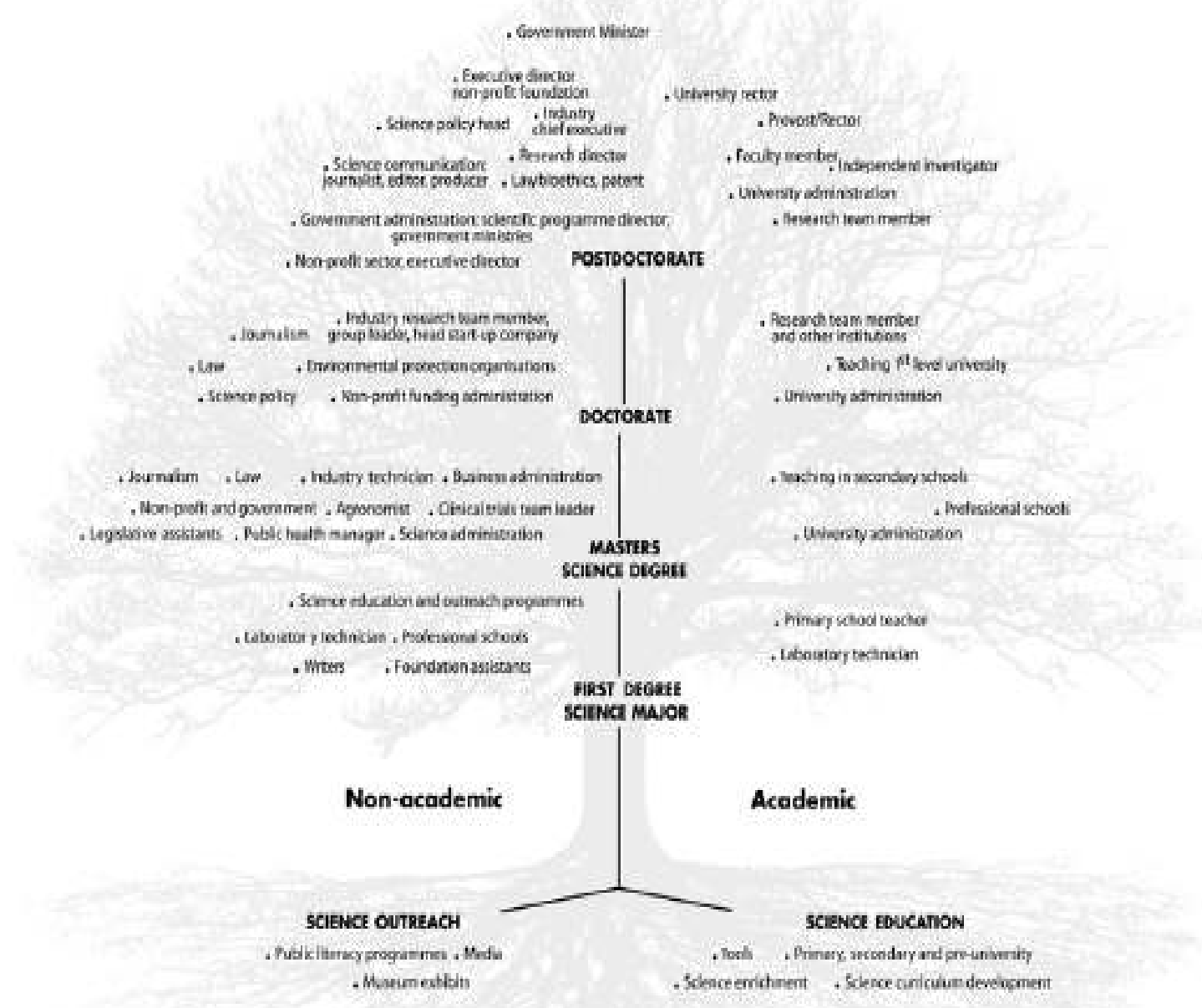
- Data on Human resources is deficient
- *Economic strategy to create new businesses*
- Better conditions for developing R&D in business
- *Skills gap is an important advertisement for new entrants into SET careers*
- *Perception regarding careers in SET needs correcting – remuneration and mobility*
- *The importance, opportunities of SET need to be more visible in schools – to fill the “pipeline”*

Recommendations

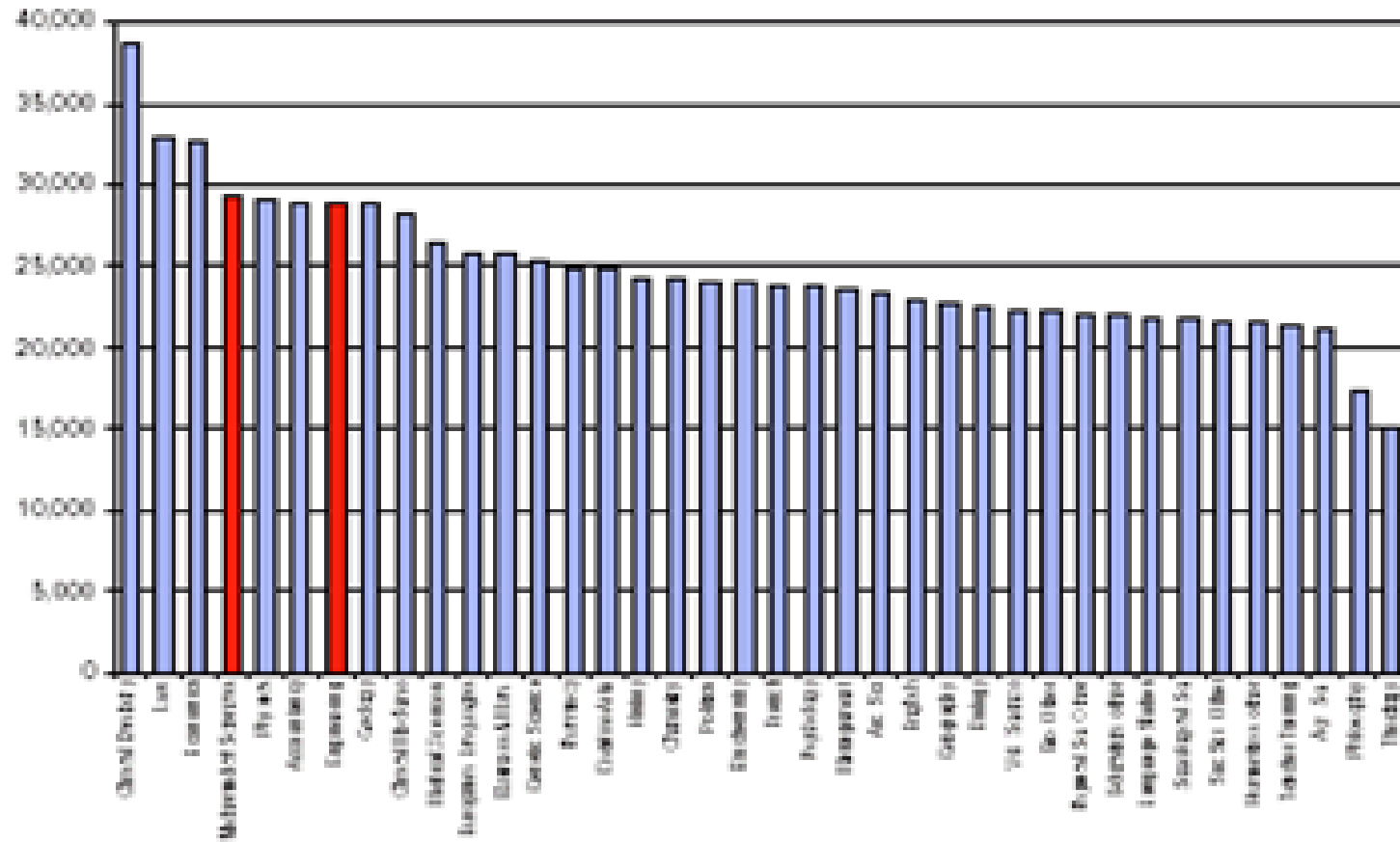
- *Reliance on importing SET workers is not a viable long term strategy, unless there are visa changes*
- Bologna needs to concentrate on outputs not time serving
- Careers in Public Service are poor in terms of remuneration and structure. Public funding/researcher needs correcting (x2 vs US)
- *A new role for universities*
- *Quality of SET training in universities is declining. More funding for infrastructure.*
- *Universities need to cater for and celebrate the whole range of R&D employment opportunities*

SET Career Mobility

- Some popular misconceptions
 - Poor remuneration and lack of career structure
- Must compare industry with academia and government
- It is not all bad news!



1996 salaries of 1985 graduates by degree subject (£)



Recommendations to Government

- To increase university funding to cover the true cost of providing world-class teaching in engineering
- To place teaching excellence alongside research excellence in the assessment of the funding requirements for universities
- To enable overseas engineering students to work in the UK for a period of 5 years after graduation
- To support replacement of the European Credit Transfer System by output competences in the new European Qualifications Framework
- To increase the funding for initiatives which strengthen industry links such as Visiting Professor and Lecturer schemes
- To support industrial placements in small companies either through funding or tax incentives
- To continue to provide support for the training of more maths and physics teachers

Recommendations to Universities

- To recognise excellence and innovation in course design and delivery through promotion criteria, bonus payments and salary
- To strengthen links with industry to enhance course design and delivery and to better understand the engineering skills and competences needed by business
- To ensure that courses produce motivated graduates with a high level of relevant technical competence backed up by the ability to apply it appropriately, for example through the CDIO approach
- To develop new world-class engineering degree courses with strong technical content in areas which appeal to students and deliver industry's needs
- To engage actively in science and engineering initiatives in schools

New Role for Universities

- Death of the Corporate Laboratories
- Industry's "Outer Radar"
- A true partnership with industry
- A supply of people and research
- Clustering of industry, sme's and universities
- Standardisation

New Role for Industrial R&D

BTeXact

Adastral Park - fastest growing technology park in Europe

- Bringing down the fence :

CORNING



IDL



- Establishing a 5 star University on site
- Strengthening academic partnerships
- Developing the Park infrastructure

Berkeley
UNIVERSITY OF CALIFORNIA



MIT
Media
Laboratory

- Adastral Park is a key component of the development of the East of England region



Recommendations to Industry

- To commit to active, long term relationships with university engineering departments focused on engineering education and recruitment
 - » Advisory Boards
 - » Visiting Professors, Lecturers and Industrial Tutors
 - » student placements
 - » visits
 - » project and design/make challenges
 - » mentoring of young academics
 - » two-way staff exchanges
 - » feedback on the quality of graduates and the relevance of their education
- To promote science and engineering in schools
- To engage with the Institutions in the accreditation of professional engineering - with active members of company staff serving on Accreditation Boards and Panels

SUMMARY

- Industry does recognise the future shortage of SET.
- Industry must play a larger role in SET recruitment.
- Must emphasise the career variety and prospects.
- Governments must recognise the funding difficulties.
- Universities need to respond with better ways of teaching, recognising their new roles.
- More good maths & physics teachers are required.
- An ongoing PR job where everyone needs to be involved.

More needs to be done!



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of Engineering

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