The Challenge from Industry

The Brussels definition of INDUSTRY is “any activity of social or economic value”.

All industries confront a range of INTERDISCIPLINARY scientific challenges, many of which have an interface with Mathematics.

The Range of Problems I

Large industries usually have trained mathematical staff, which eases problem identification.

Traditional examples:

- oil extraction
- semiconductor fabrication
- glass manufacture

New examples:

- marketing
- management
- risk

The Range of Problems II

Small industries mostly do not know about mathematics

Examples:

- lens grinding
- tyre shredding
- cow milking (L.S.)

FINANCIAL TIMES

MONDAY FEBRUARY 13 2006

Mathematics offers business a formula for success

By Clive Cookson, Science Editor

Mathematicians have come up with an impressive multiplication formula for British commerce and industry: spend a few million pounds promoting the use of maths as a strategic tool, and add billions of pounds of value to businesses.

That is the thinking about a new government-industry consortium, the Mathematics Knowledge Transfer Network.

The network aims to boost the use of maths throughout the economy from grocery distribution to banking, telecoms to manufacturing.

The Department of Trade and Industry will make a core investment of £1.5m in the network's infrastructure over three years, with other partners contributing £3.5m.

Industry is expected to increase research and development spending by a further £7m as a result of the project. But Robert Leese, the consortium manager, said the indirect benefits could be hundreds or thousands of times greater.

"It is already recognised that the use of mathematics in the R&D process adds billions of pounds of value to UK business," said Mr Leese, who directs the Smith Institute for Industrial Mathematics in Guildford. "I predict the newly-formed KTN will multiply that value by two, three or perhaps even four times."

Mr Leese added: "I do not think many businesses are fully aware of the benefits that maths can bring. Few companies recognise that they have mathematical expertise in-house, and few universities are promoting their maths departments effectively to industry."

Lenny Smith, an American mathematician with academic appointments at the London School of Economics and Oxford University, said: "The quality of mathematics and the ability to do ground-breaking research in the UK are second to none."

But Prof Smith, who works with industry on both sides of the Atlantic, added that UK companies were slower than their US counterparts to apply mathematical ideas.

Huge savings can be made by applying algorithms – mathematical rules – to existing information, according to Prof Smith. For example, the retailing and logistics sectors could find more efficient ways to move goods around the country. "Maths can help Adnams brewery decide how best to collect its empty beer kegs or Sainsbury's decide where to sell two truckloads of lettuce in Birmingham," he said.

Unilever, one of 12 companies on the network industrial steering committee, has recently made extensive use of maths. It says statistical analysis of the relationships between advertising campaigns, sales and market share has made Unilever advertising campaigns 15 per cent more efficient.

"We are also borrowing mathematical simulation methods used in the film industry and gaming world, such as agent-based methods, to model the psychology of how shoppers choose one brand over another," said Shail Patel, mathematical and psychological sciences leader for Unilever Research. "Mathematics is universal as, unlike most other disciplines, it can add value to any function within Unilever."

Mr Leese is most enthusiastic about the ability of maths to "shine a torch" down possible R&D routes so that managers can decide quickly which are dead ends and which should be pursued. "The whole concept of mathematics 'accelerating' the innovation process is simple to state," he said. "It both provides an earlier return on investment in R&D and cuts down on wasted R&D spend."

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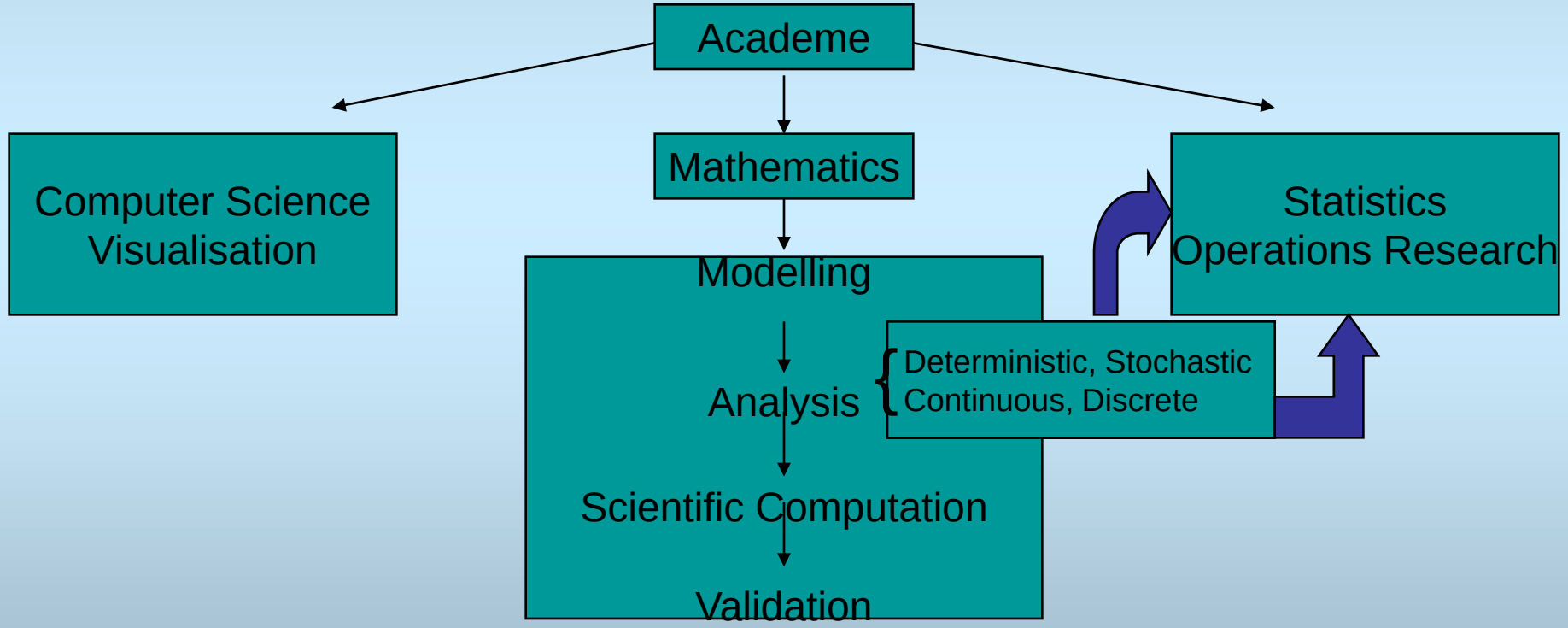
The Mathematical Resources

- Bodies of Expertise in Large Industries
- Isolated Researchers in SMES



All inspired by

Often adds to

} Mathematical Knowledge

The Academic Response to the Challenges

1. Problem Solving

Activity	Support
• Consultancy (especially U.S.)	• Industry
• Study Groups (1968)	• Industry, Academic, Government
• Clinics (1974)	• Industry, Academic
• Coordinating Frameworks (1984)	• Academic
• Resource Multinational Collaboration (2005)	• Government

Training

- Masters Courses
- Collaborative Ph.D
- Modelling Camps
- Modelling Competitions
- Internships

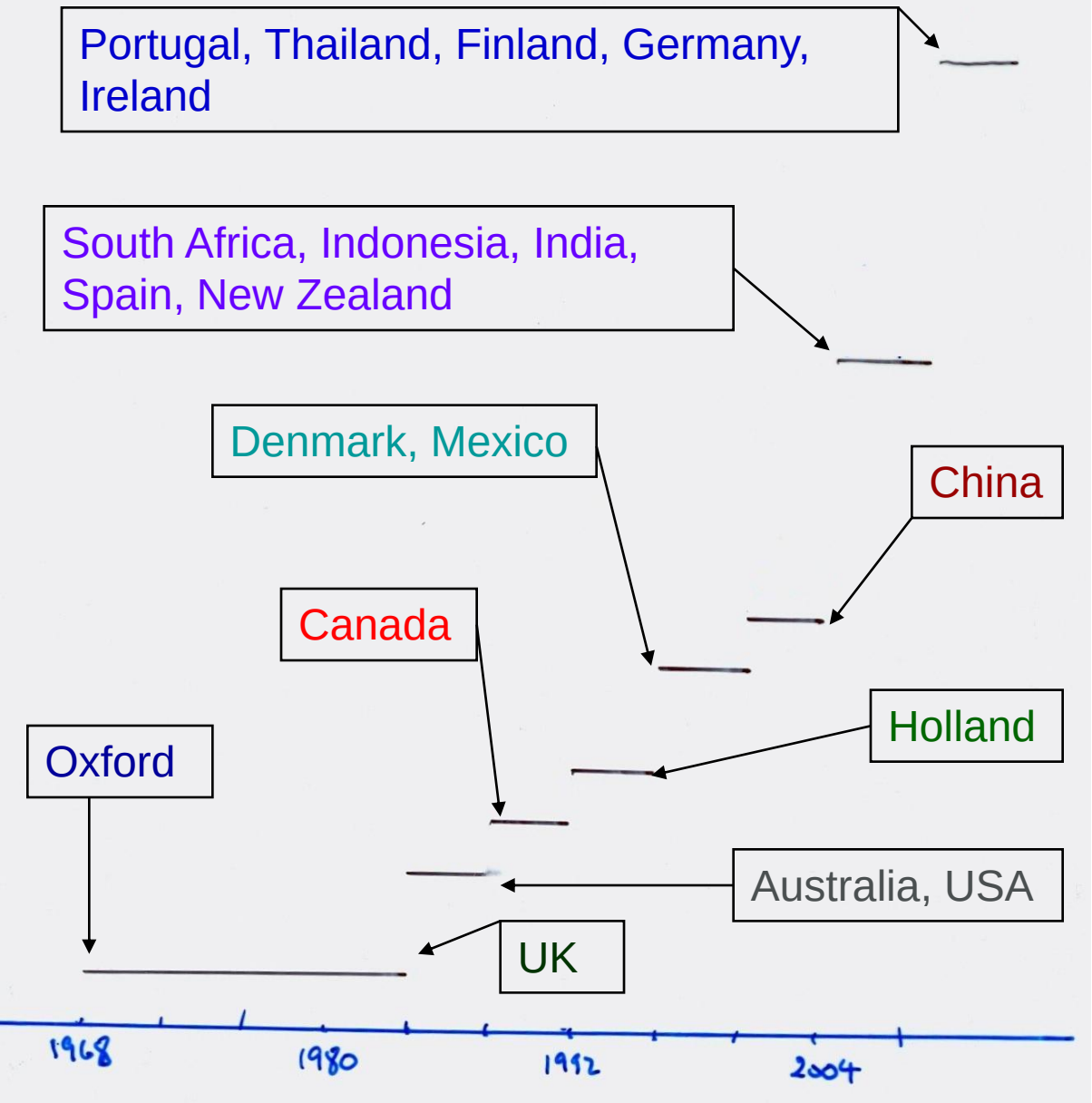
All Organised by academic departments/centres

Study Groups with Industry

Format:

- Problem Presentation by Industrial Researchers;
- Mathematical Scientists gravitate to problems of greatest interest;
- Brainstorming;
- Reporting back, report writing

Study Group Growth



http://miis.maths.ox.ac.uk/

29th European Study Group with Industry, Oxford 1996

Problems

1. Grid frequency dynamics (British Energy)
2. Mobile radio system design (BT)
3. Electrostatic painting (Courtaulds)
4. Pattern design in paper cutting (Greycon)
5. Screen printing (Du Pont)
6. Modelling homeless populations (Shelter)
7. Gas release in sludge (Pacific Northwest National Laboratory).

Results

- Detailed report on each project
- 2 PhD projects (3,1)
- 1 Postdoc funded by BT (2)
- 2 MSc projects (1)
- Several academic publications (5,6)
- Short consultancy (4)
- New ideas for the industrial scientists (7)

OCIAM 

Coordinating Frameworks

- Euro. Consortium Maths Industry (1984) (A) http://www.ecmi-indmath.org/
- ITWM Kaiserslautern (Fraunhofer) (1996) (I,G) http://www.itwm.fraunhofer.de/en/zentral/index/
- Smith Institute UK (Faraday, KTN) (1993) (I,G) http://www.smithinst.co.uk/
- MITACS Canada (1999) (I,G) http://www.mitacs.math.ca/main.php
- AMSI Australia (2005) (I,G) http://www.amsi.org.au/

(Bedlevo (2006) was Polish nucleation point?)

Resourced Multinational Collaboration

- NETIAM (2004) (EU)
- OECD (2007/8/9) (http://www.oecd.org/)
- King Abdullah University of Science and Technology (2008) (OCCAM)