

Professor E J Thomas  
Vice-Chancellor, University of Bristol

# Structural Issues Impacting Upon The Development of University Research – a UK Perspective

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# Structural Factors Affecting Research in the UK

- UK performance
- Factors
  - location of research activity
  - funding mechanisms
  - selectivity
  - collaboration
  - other
- Assessment

# Sources

- European Commission. Towards a European Research Area. Science Technology and Innovation Key Figures 2002
- UK Research Office, Brussels
- Higher Education Statistics Agency, UK
- Benchmarking of the International Standing of Research in England, Adams et al 1997
- Role of Selectivity and the Characteristics of Excellence, Adams et al 2000
- Collaborative Approaches to Research Smith & Katz (with Adams et al) 2000

# Performance Rebased to World Average

	<u>England</u>	<u>USA</u>
Medicine	1.09	1.35
Pre-Clinical Sciences	1.41	1.45
Biological Sciences	1.24	1.46
Physical Sciences	1.14	1.58
Mathematics	1.22	1.41
Engineering	0.97	1.34
Social Sciences	0.81	1.25

# Bibliometric Performance Impact Factors

	88 - 92	89 - 93	90 - 94	91 - 95	92 - 96
Clin Med	8.43	8.9	9.04	9.21	9.6
Biochem	3.84	3.9	4.16	4.32	4.46
Chem	3.01	3.11	3.18	3.16	3.38
Elec Eng	4.98	5.19	5.41	5.59	6.06

# R & D Intensity % age GDP

Sweden	3.78
Japan	2.98
USA	2.69
Germany	2.48
France	2.15
Netherlands	2.02
UK	1.86

# R & D Investment

## Average Annual Real Growth

Sweden	5.1
Japan	2.8
USA	5.7
Germany	3.8
France	1.0
Netherlands	2.02
UK	1.8

# Researchers per 1,000 Labour Force

Sweden	9.1
Japan	9.26
USA	8.08
Germany	6.45
France	6.2
Netherlands	5.15
UK	5.4



# Annual Growth in Researchers

Sweden	4.35
Japan	2.57
USA	6.21
Germany	2.51
France	1.5
Netherlands	4.52
UK	2.66

# New S & T PhDs per 1,000 pop

Sweden	1.24
Japan	0.24
USA	0.48
Germany	0.81
France	0.76
Netherlands	0.34
UK	0.68

# Annual Growth in New S & T PhDs

Sweden	4.29
Japan	0.74
USA	0.07
Germany	2.75
France	1.05
Netherlands	4.52
UK	5.24

# UK Position Summary

R & D % GDP	R & D Growth	Res /1,000	Growth in Res	New PhDs	Growth in PhDs
					●
			●	●	
	●	●			
●					

# UK Research Performance Conclusions

The UK performs well in research using objective international criteria. That performance has improved in the last 20 years in spite of low government investment in R & D and low annual growth in that investment

Why?

# Structural Factors

- Location of research activity
- Funding mechanisms
- Selectivity
- Collaboration
- Other

# Location of Research

- Higher Education
- Institutes/Government
- Business enterprise

# %age R & D Spend by Sector

	UK	Germany	France	Japan	USA
Govt	11	14	20	9	7
Business	68	69	62	72	76
HE	20	17	17	14	14



# R & D Spend – Changes in % GDP per Sector

	Year	UK	Germ	France	Japan	USA
Govt	88	0.28	0.36	0.56	0.25	0.29
	99	0.2	0.34	0.43	0.28	0.19
Business	88	1.44	2.07	1.33	1.93	1.92
	99	1.24	1.63	1.35	2.17	2.01
HE	88	0.33	0.41	0.33	0.35	0.4
	99	0.37	0.41	0.37	0.42	0.37

# Location

- UK decrease in Government funding
- Increase in HE funding
- UK continues to perform well
- ? Related to management of research within the sector

# Structural Factors

- Location of research activity
- Funding mechanisms

# UK Funding by Sector 1999 (£s billion)

Government departments	2.3
Research Councils	<b>2.0</b>
HEFC(E)	<b>1.15</b>
Business	8.24
Charities	<b>0.7</b>
Abroad	2.93

# Structural Factors

- Location of research activity
- Funding mechanisms
- Selectivity

# Selectivity

The focusing of research staff and funding in a limited number of institutions to create critical mass, efficiencies and co-ordinated research planning

# Centre of Research Excellence

- Critical mass of people and activity
- Stimulating research culture - a “buzz”
- Client satisfaction
- High esteem from peer group
- Pushing back the boundaries rather than filling in gaps in knowledge

# University Groups

- U-M: universities with medical schools
- U-R: non-medical universities funded by UGC
- U-P: former polytechnics
- U-C: other HEIs



# %age of Grants and Contracts: U-M Group

Year	80	84	88	93
%age	75.2	74	75.2	78.4

# %age Share of Research-only Staff: U-M Group

Year	80	84	87	90	94	97
%age	70.5	72	72.5	74	76.5	79

# Size compared with Score

	Chemistry	Physics	Earth Sciences
Smallest	1.4	2.54	2.83
2nd Quart	3.07	3.79	2.67
3rd Quart	3.87	4.04	4.25
Largest	4.52	4.86	4.57

# Volume and Impact

- High impact at high volume, low impact at low volume: Clinical Sciences, Biological Sciences
- Higher impact at high volume, variable impact at low volume: Engineering, Social Sciences
- No clear pattern: Arts and Humanities, Mathematics

# Concentration of Output into Multidisciplinary Journals, e.g. *Nature*

	Sources	Cites	% S U O A
Cambridge	481	1753	10.6
Oxford	428	1798	9.5
UCL	322	1060	7.1
Imperial	195	596	4.3
Leeds	156	446	3.4
Bristol	133	598	2.9
Sheffield	125	350	2.8
Manchester	107	268	2.4
Q M W	106	258	2.3
Nottingham	101	278	2.2

47.5

# Distribution of SUOA relative to world average bibliometric impact

	<u>Clinical</u>	<u>Bio Sci</u>	<u>Environ</u>
% Institutions above	23.6	20.1	24.1
% Output above	69.1	56.3	65.4

# Selectivity Institutional Case Studies

- More conscious and active management of the research environment
- Quantity of research measurably increased
- More likely to communicate outputs
- Quality issues complex but less wastage, more purpose and more overt support for promising ideas
- Research training increased and improved

# Selectivity - Conclusions

- Over recent years there has been a significant concentration of resources and excellence
- Peak of research performance has improved
- Resources are concentrated in institutions with above-average performance and which contribute to the bulk of UK research productivity



# Structural Factors

- Location of research activity
- Funding mechanisms
- Selectivity
- Collaboration

# % Collaborative

	1981	1994
>1 author	76	88
>1 institution	35	55

# Collaboration

- Multiple author and multi-institutional collaborations have increased linearly between 1981-94
- Evidence shows that collaboration has been increasing since the 1960s
- Life Sciences the highest %
- Larger institutions collaborate more

# Structural Factors

- Location of research activity
- Funding mechanisms
- Selectivity
- Collaboration
- Other

# Other Factors

- English Language
- Culture and tradition
- Elite secondary education
- Flexible labour market

# Overall Conclusions

- UK research performance is excellent and improving
- Increasingly being located in HE
- High proportion of competitive, peer-reviewed funding
- Significant increase in selectivity leading to higher output of higher quality from fewer institutions
- Increased national and international collaboration, especially from larger institutions

# Structural Factors

- Location of research activity
- Funding mechanisms
- Selectivity
- Collaboration
- Other
- Assessment

# Research Assessment Exercises

- 1986
- 1989
- 1992
- 1996
- 2001



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# RAE Process

- Review the output of every active researcher in HE
- Disciplinary Units of Assessment - 68
- Review panel for each UoA including international members
- Four publications, grant income, PhD studentships
- RA5 - written submission describing the research and the strategy

# Gradings

5\*: international in  $> 50\%$ , national in the rest

5: international in  $< 50\%$ , national in the rest

4: national in virtually all, some international

3a: national in 66%, possibly some international

3b: national in  $> 50\%$

2: national in  $< 50\%$

# Percentage of Staff in Grade

Grade	1996	2001
1	3	1
2	9	2
3b	11	5
3a	18	12
4	<b>28</b>	25
5	20	<b>36</b>
5*	11	19

# 5\* and 5 Departments

Cambridge	48
Oxford	42
UCL	40
Manchester	37
Bristol	36
Sheffield	35
Birmingham	32
Edinburgh	28

# Research Power

Oxford	13314
Cambridge	12224
University College	10814
Edinburgh	8137
Imperial	7820
Manchester	7339
Kings College, London	6780
Leeds	6563
Bristol	6074

# RAE – Strengths

- Hard-wired research planning in HE
- Led to more focused and thematic areas
- Poor research atrophied
- Produced data that were helpful in negotiations with Government
- Could be used as a tool for producing internal change

# Conclusions

- UK is a strong and improving research environment
- Not related to investment
- Typified by increased selectivity and collaboration and location in HE
- Research assessment and active management of the national research environment are very important factors