The Royal Academy of Engineering

Strategic Science Provision in English Universities

Response to the House of Commons Science and Technology Committee

January 2005

1. The impact of HEFCE's research funding formulae, as applied to Research Assessment Exercise ratings, on the financial viability of university science departments

1.1 University science departments receive their funding from several sources including the monies allocated through the RAE assessment process and project based research funded by the Research Councils. It is now recognised that these funds in total have been inadequate to cover the overheads and therefore it is an over simplification to put the blame for the closure of departments solely at the door of the RAE process.

1.2 Whilst the RAE process has been beneficial in encouraging UK Universities to take research activity seriously and improve its quality, there are several issues with the funding formulae that require greater attention.

1.3 One issue is that the funding formulae are currently unable to reward pockets of excellence within departments. Such pockets certainly enhance the knowledge base and wealth generation in the UK but are often only recognised at an international level. Because they are part of a larger department which might not be of the same research standing, but classified at the same grading, they are subject to lower funding. As the financial stability of the whole department is reliant on a good RAE grading, an unsatisfactory performance can ultimately lead to closure. Proposals for RAE 2008 to replace the single rating with a Quality profile enabling a small high quality group to score more highly are welcome and should be endorsed.

1.4 Even higher rated departments are not immune from closures. Reading University, for example, was forced to close its undergraduate degree programmes in mechanical engineering despite receiving an RAE grade 5 in 2001. Budget reallocations have not helped to ease this situation. In the 2001 RAE, for example, one department rated 5 lost £0.25m from its annual income due to a budget reallocation between grades. Clearly the funding formulae need to ensure consistency in funding streams so that departments can plan for their own financial stability.

1.5 The impact of HEFCE's research funding formulae is just one of a number of factors which influence the financial viability of science departments. The other major factors are the teaching grant and demand for undergraduate and post-graduate teaching places and decisions taken by the Vice Chancellor on how to allocate the money. There are cases where departments have been forced to close due to fluctuations in demand for teaching places and a lack of research funding due to a lower RAE score. What is needed is a funded safety net to allow departments to restructure to meet new demands rather than forcing them to use their own resources.

2. The desirability of increasing the concentration of research in a small number of university departments, and the consequences of such a trend

2.1 Views on this subject, even within the Royal Academy, are somewhat polarised. Whilst from a purely research perspective there are some strong arguments for encouraging further concentration, there are also significant negative implications. Greater analysis of the costs and benefits of concentration needs to be taken into consideration before pursuing such a strategy.

2.2 The benefits of concentration are that it prevents resources from being spread too thinly and brings high quality expertise together in better funded facilities. This approach can work as can be seen in the United States where only a handful of top engineering schools carry out the majority of the research. Concentration of research has also been occurring in computer science departments in the UK. There are over 100 departments across the country and uniform research funding across all of these could potentially weaken the research and remove the financial motivation for the best to stay at the top. Whilst concentration of funding has had some success, it is the view of many that it has gone far enough and further concentration would adversely impact on the long-term capacity of the system to produce top-quality researchers. In other subjects such as materials there are already too few departments of significant size to satisfy future needs.

2.3 Once consequence of further concentrating research is that a two tier system could be created where the highest ranked departments carried out most of the research and the remainder focused on teaching. As cutting edge research is invariably the basis for cutting edge teaching there are quality implications for those departments which find themselves suddenly without research funding. In addition, the departments which do not qualify for the top tier will be condemned by implication as not providing the best teaching.

2.4 Innovation can arise wherever there are talented individuals which may not necessarily be in the areas of concentration. It is often the case that new initiatives come from other than the big ‘world class’ departments and often smaller departments act as breeding grounds for ambitious young researchers. A concentration policy, too crudely applied, could damage the ability of young researchers in less favoured institutions to win funding and affect the flow of talent.

3. The implications for university science teaching of changes in the weightings given to science subjects in the teaching funding formula

3.1 Currently, SET subjects are seriously disadvantaged in the weightings considering the scope and breadth that they are required to cover. They receive less than 50 per cent of the funding for medicine despite being equally, if not more, expensive in terms of resources for equipment and laboratory staff and the cost of industrial projects and design. The weightings used in the current funding model do not reflect this adequately and this is another reason for lack of financial robustness in these departments. If the UK believes that SET is vital to the economy then sufficient resources should be made available to see that it is adequately funded.

3.2 In addition, the funding per student for teaching is too low for many science and engineering departments. As a general trend, for every home or EU student in the physical sciences and engineering, the amount received per student for teaching is less than the amount the department spends. For example, the recent press coverage of the implications of the Oxford University deficit indicates a gap of about £10k per student per annum. Even with £3k per annum in additional student fees, the funding gap will be significant, and there are real concerns about the impact that such additional fees will have on student uptake of 4 year courses in science and engineering.

3.3 Many departments are therefore being forced to subsidise teaching from overseas student fees and research income. However, without sufficient numbers of oversea students or a high research rating they cannot do this, potentially resulting in department closures. The weightings given to science and engineering subjects in the teaching funding formula need to be substantially increased in order to effectively tackle this problem.

3.4 The weightings have had a particularly adverse implication for computer science, where the primary classification of teaching has been re-banded to a lower funding level at a time when recruitment to computing courses has become very difficult. The viability of many of the UK's computing departments, particularly those most dependent on teaching for income, is now being called into question.

4. The optimal balance between teaching and research provision in universities, giving particular consideration to the desirability and financial viability of teaching-only science departments

4.1 As highlighted in question two, there is a mutually reinforcing relationship between teaching and research which should be maintained. If the UK is to remain competitive at the industrial level then it must have access to the best trained graduates who in turn need to have access to up to date SET knowledge and this can only come from vibrant research. Also, if UK universities are to attract the best overseas students in sufficient numbers then they have to prove that the education system, especially higher education, is at the cutting edge. It cannot do so without a sound and broad research base.

4.2 In terms of an optimal balance, all universities should be encouraged to engage in some research, from close-to-market commercial research to more 'blue-sky' work. The Royal Academy of Engineering received one suggestion that leading research departments should aim to achieve about 2:1 research to teaching income whilst those with less of a research focus should still aim to achieve 1:2. However, it must be recognised that the balance depends strongly in the nature of the research – computing is very different from civil engineering which is very different from materials. However, maintaining some sort of balance between research and teaching is the key to achieving overall financial robustness.

5. The importance of maintaining a regional capacity in university science teaching and research

5.1 Maintaining regional capacity is a highly important issue in the context of increasing science and engineering department closures and rising tuition fees. Students are being forced either to travel to university or not study at all. Clearly this has implications for the already low numbers of SET graduates but also for future generations of students who will be disadvantaged by lack of provision.

5.2 Allowing the loss of regional capacity is currently encouraging the concentration of university capacity in the south east. This is undesirable as it generates instability in national demographics and also has implications for local economic development as many students who attend university in their region are likely, at least initially, to take up employment in that region. The solution is to establish world-class universities in the regions rather than diverting funding from and weakening those already strong in the south-east.

5.3 A national strategy for SET would provide much needed context for the development of regional capacity. Regional capacity in core subjects could be part of a national research strategy in science and engineering. Such a strategy should also recognise that there are certain areas where the UK needs to maintain an international presence, for example in ship design or nuclear power plant design, and the concentration of teaching and research in a national centre may be justified.

6. The extent to which the Government should intervene to ensure continuing provision of subjects of strategic national or regional importance; and the mechanisms it should use for this purpose.

6.1 It is widely recognized that the UK currently faces a serious shortage in the number of physical science and engineering graduates needed to support industry and academia. The core problem originates in schools where an insufficient proportion of the population are being trained in science and maths. This trend is compounded at university level by a lack of government support for SET subjects and the increasing number of departments under threat of closure.

6.2 Significant government intervention is needed to reverse this trend and there are several mechanisms government can employ to achieve this. As a priority a strategy should be established to encourage better teaching of physical sciences and maths in schools, with appropriately qualified graduates going into these teaching positions. Incentives also need to be given to students to take science and engineering disciplines at university.

6.3 Offering differential "top-up" fees, or developing a national scheme to award government-funded science scholarships in preference to other disciplines are some examples of such incentives. Top graduates could also be retained in engineering and research by waiving fees which only have to be repaid in the event of the graduate accepting a non-engineering or research related position. Tax incentives could also be given to industry to sponsor scholarships in science and engineering.

6.4 Whilst government intervention is to be welcomed it is imperative that is it based on good advice. A good example of such advice would be the “Roberts Report” on SET. Such in-depth reviews need to be encouraged and their recommendations acted upon.

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28/01/05