ANNEX A: LIST OF RECOMMENDATIONS BY CHAPTER

Chapter 2: School and Further Education

Recommendation 2.1: The participation of women in science and engineering

The Review notes that, despite some recent progress, the proportion of girls studying mathematics and the physical sciences post-16 is still considerably lower than that of boys, which contributes to the under-representation of women in science and engineering more generally. The Review is clear that the under-participation of women in SET is damaging the UK's supply of scientists and engineers, and a number of the recommendations set out in this report should have an important influence on the participation of women in science and engineering.

The Review is aware of a separate study led by Baroness Susan Greenfield, who has been asked by the Government to recommend how to achieve a step change in the effectiveness of measures being used to increase the participation of women in science and engineering. This Review has therefore sought not to duplicate the work of that study but firmly believes that action is required.

Recommendation 2.2: The participation of ethnic minority groups in science and engineering

The Review is disappointed by the lack of awareness and analysis of differences in achievement and participation in science and engineering between ethnic groups. It is difficult to establish the root causes of these differences, based on the evidence available. However, the Review believes that they are significant and therefore recommends that the Government investigate this issue fully in schools, further education and higher education.

Recommendation 2.3: Primary school teachers

The Review recommends that the Government ensure that primary school teachers receive greater subject-specific training (in particular, in relation to the physical sciences and mathematics) both in their initial training and through Continuing Professional Development to enable primary teachers to build on the progress they have made so far. Furthermore, the Government should review, in three years' time, the progress made in improving primary school teachers' confidence in teaching all areas of the mathematics and science curricula, and take further action as necessary.

As Chapter 2 makes clear, many of the recommendations made on issues relating to secondary schools also apply to further education. For ease of reading, the recommendations are phrased in terms of secondary schools, but the intention of the Review is that the further education sector should be covered, wherever appropriate, by these recommendations.

Recommendation 2.4: Secondary school science teachers' training

The Review recommends that in order to enhance the quality of teaching across the sciences – and in the physical sciences in particular – the Government should act to improve significantly the subject-specific training and support given to science trainee teachers on initial teacher training and other teacher entry programmes. Furthermore, the Government should review, in three years' time, the progress made in improving secondary school teachers' confidence in teaching all areas of the science curriculum, and take further action as necessary.

The Review also recommends that in recruiting science graduates the Government should pay more attention to their areas of specialism (*e.g.* physics, chemistry or biology) to ensure an adequate supply of teachers able to teach the individual sciences (particularly physics and chemistry) at higher levels.

Recommendation 2.5: Teachers' remuneration

The Review recommends that, to solve the serious shortages in mathematics, science, ICT and D&T teachers, more must be done to address the pay and other incentives offered to teachers in these subjects. The Government, schools and colleges must compete for graduates in these disciplines in the labour market by, amongst other measures, providing more attractive remuneration for teachers in these subjects to better enable schools to attract graduates who can earn higher salaries in other sectors of the economy. This will require head teachers and governing bodies to pay teachers in shortage subjects more than other teachers, which is the economically efficient response to shortages in supply.

The Review therefore recommends that the Government tackle such recruitment and retention problems through increasing the remuneration offered to teachers of these shortage subjects – and also that head teachers and governing bodies use all the pay flexibility at their disposal. Furthermore, the Review recommends that this additional remuneration be linked – wherever possible – to teachers' take-up of CPD activities and opportunities, thereby rewarding those teachers who make particular efforts to improve further their subject knowledge and teaching style.

Recommendation 2.6: Secondary school teachers' Continuing Professional Development (CPD)

The Review recommends that the Government improve science teachers' access to, and take up of, subject related CPD, which will benefit their teaching and also act to improve retention. In particular, the Review recommends that all science teachers be incentivised to undertake CPD, and that the range of recognised CPD activities be as broad as possible. For example, it should include the possibility of participating in scientific research carried out in industry and universities. The Review welcomes the Government's commitment to a National Centre for Excellence in Science Teaching. It also notes the interest of the Wellcome Trust and hopes that the Government and the Trust can form the sort of partnership that has been so fruitful in other areas of science policy.

Recommendation 2.7: School laboratories

School science and D&T laboratories are a vital part of pupils' learning experiences in these subjects, and should play an important role in encouraging pupils to study these subjects at higher levels. However, it is clear that for many pupils this is not the case. To address this, the Review recommends that the Government and Local Education Authorities prioritise school science and D&T laboratories, and ensure that investment is made available to bring all such laboratories up to a satisfactory standard (as measured by OFSTED) by 2005. Furthermore, the Review recommends that these laboratories should be brought up to a good or excellent standard (again, as measured by OFSTED) by 2010; a standard which is representative of the world of science and technology today and that will help to inspire and motivate pupils to study these subjects further. The Government should take all appropriate steps to ensure that these targets are met.

Recommendation 2.8: Teaching assistants

The Review is convinced that the high pupil-to-staff ratios in schools in England – particularly in practical classes – is having an adverse effect on the quality of pupils' science and D&T education, and in turn on the supply of science and engineering skills. The Review believes these high pupil-to-staff ratios in practical classes are best addressed through the employment of skilled teaching assistants acting to support the teacher, and that science and engineering undergraduates and postgraduates are well placed to support teachers in this way since they have a good recent understanding not only of the subject but also of the school environment. They can also provide important role models for pupils.

The Review therefore recommends that the Government establish a major new programme, paying undergraduate and postgraduate students to support science and D&T teachers. The scheme should be implemented alongside the Researchers in Residence scheme, and should be open to postgraduates as well as undergraduates. The Government should pay students on a competitive footing with other sources of employment open to them. The Government should set an ambitious target for the number of science and engineering students participating in such a scheme by 2005.

The precise role of the teaching assistants should be for schools, universities and the students to decide locally, on the basis of guidance from the Government. Examples of possible roles could be direct support to teachers in supervising practical work, giving demonstrations or supporting science and D&T technicians. Naturally, it will be important to ensure that those participating have the skills and training to work in these capacities.

Recommendation 2.9: The science curriculum

The science curriculum – particularly in the physical sciences – is not, at present, sufficiently approachable nor appealing to all pupils between the ages of 11 and 16. This is a significant factor in the declining numbers of pupils taking these subjects at higher levels, and is widely thought to be a particularly important factor in discouraging girls.

The Review therefore welcomes both the QCA's ongoing work to modernise the science curriculum and the Government's Key Stage 3 strategy. These are important elements in making the study of science more attractive to pupils, and, in turn, helping to enthuse pupils to study science and related subjects at a higher level. The Review recommends that the Government ensure that these changes deliver significant improvements to the way that the sciences (particularly the physical sciences) are taught. In particular:

- improving the ability of all pupils to relate the science they study to the world around them and to potential career opportunities;
- encouraging appropriate links to be made with other subjects (particularly D&T);
- ensuring that, while pupils continue to study the fundamental principles of science, the curricula and assessments are not dominated unhealthily by reliance on the overall volume of scientific knowledge.

The Review notes that modernising the curriculum must go hand-in-hand with providing teachers with the necessary support and training to teach the new curriculum in a way that appeals to all pupils (especially girls).

The Review further recommends that the Government should review, in three years' time, the progress in improving the attractiveness and relevance of the mathematics and science curriculum, and take further action as necessary.

Finally, the Review welcomes the QCA's proposals for reforming GCSE science, which are a necessary and positive step in increasing the appeal of science to pupils. However, it will be important to support schools and colleges in dealing with what is likely to be a more varied intake to A- and AS-level courses, and enable pupils successfully to make the transition to A- and AS-level science.

Recommendation 2.10: Transition from GCSE to A-level

The Review welcomes the proactive approach of the QCA in considering the transition from GCSE science and mathematics to AS- and A-levels in these subjects. However, the consultation process revealed that the issue may not yet have been fully addressed and the Review therefore recommends that the Government give it further consideration, and take suitable action to allow pupils to make the transition from GCSE to AS- and A-level study – particularly in the physical sciences and mathematics – smoothly.

Recommendation 2.11: Difficulty of subjects

The Review welcomes the attention that the QCA has given to the issue of inter-subject standards, and urges the Government to undertake definitive research into the greater apparent difficulty of science and mathematics A-levels and to take appropriate subsequent action. It is essential that pupils have a broadly equal chance to achieve high grades in science and mathematics as they would in other subjects. Without this, fewer pupils will choose to study science and mathematics at higher levels. The Review is firm that arguments about the merits of 'levelling up' or 'dumbing down' are a distraction – if pupils generally find it more difficult to achieve high marks in science and mathematics, this needs to be corrected. The Review believes that this can and should be done without compromising the core knowledge and skills needed for studying science and engineering courses in higher education.

Recommendation 2.12: Enhancing the curriculum

The profusion of independent schemes aimed at enthusing and educating pupils in science and engineering (for example, the Industrial Trust Scheme and CREST), and the lack of support that schools and teachers have in identifying those most suited to their pupils, is inhibiting the collective effect of these schemes. The Review therefore recommends that the Government establish a single recognised channel through which schools access these independently-provided schemes. This will help schools and teachers to identify the schemes most suited to pupils at different ages in different subjects, thereby lowering the burden on teachers. Without better co-ordination (and rationalisation) of the existing schemes, important opportunities and resources will continue to be wasted.

The Review recommends that SETNET and its network of SETPoints, be given this responsibility in the areas of science technology, engineering and mathematics, while still recognising the wider role of the Education Business Links Consortia in England. However, if SETNET is to fulfil this function (and deserve the additional funding that this Review recommends the Government provide), it is important that it emphasises all areas of science and engineering equally, and also that those in the science, engineering, IT, technology and mathematics communities (particularly the scientific community) accept SETNET as the channel of communication. SETNET should work with the proposed idea of a National Centre for Excellence in Science Teaching in delivering this.

Recommendation 2.13: Improving the perception of careers in science and engineering

The Review believes that further action is needed from the Government, but also from businesses and others in scientific and technical fields, to ensure that pupils (especially girls) receive accurate and positive advice about the rewards (and the breadth of careers arising) from studying science and engineering. Specifically, the Review recommends that the Government establish a small central team of advisers (possibly within the new Connexions service, but working closely with SETNET) to support existing advisers, teachers and parents in advising pupils. Furthermore, the Government should review, in three years' time, the progress in improving pupils' knowledge of the rewards and the breadth of careers arising from studying science and engineering, and take further action as necessary.

Chapter 3: Undergraduate education

Recommendation 3.1: Quality of SET A-level students as degree-level entrants

Students sometimes struggle to make the transition from A-level study to degree level study in science, engineering and mathematics, since undergraduate courses often do not pick up where the students' A-level courses ended. Furthermore, the increasing modularisation of A-level courses has led to students entering higher education with wider variation in subject knowledge (differences in the mathematical knowledge of students are seen to cause particular problems in mathematics, physical science and engineering degrees). The Review recommends that to help students – particularly those in the past least likely to participate in higher education – make the transition from A-level study to degree level study in science, engineering and mathematics:

- A-level awarding bodies and the HE sector should review science, engineering and (in particular) mathematics education at the boundary between school/further education and higher education, and adjust their courses accordingly to ensure that this transition can be made smoothly; and
- the Government should fund HEIs to use new 'entry support courses' and e-learning programmes to 'bridge' any gaps between students' A-level courses and their degree courses.

Furthermore, the Government should in three years' time review progress in reducing the gaps between A-level and degree-level courses – to ensure that students are not discouraged from studying these subjects, and retain interest in them – and take further action as necessary.

Recommendation 3.2: Undergraduate course structure

Updating the nature and content of undergraduate courses to reflect the latest developments in science and engineering (through having lecturers who can draw on recent experience of work environments other than HEIs, and through explicit changes in course content) has the benefit of improving the attractiveness and relevance of the course to both students and employers. Accordingly, the Review recommends that employers and HEIs work more closely together, for example through:

- increasing the number of industrial placements offered to academic staff;
- encouraging industrialists to spend time in universities;
- encouraging greater engagement between businesses and careers services and, in turn, between careers services and science and engineering departments; and
- encouraging universities to be more innovative in course design in science and engineering.

These actions by HEIs and employers must be supported by those bodies that accredit science and engineering courses – for example, the Engineering and Technology Board and professional bodies which are members of the Science Council – who must work with universities to drive forward innovation in course design, and not allow the

accrediting processes inadvertently to inhibit it. The Government should facilitate these forms of HEI/employer interactions through 'third stream' funding such as the Higher Education Innovation Fund (HEIF). Furthermore, the Government should in three years' time review progress in this area and take action as necessary to further improve HEI/employer interactions.

Recommendation 3.3: University teaching laboratories

The Review recommends that the Government should introduce a major new stream of additional capital expenditure to tackle the backlog in the equipping and refurbishment of university teaching laboratories. The priority should be to ensure the availability of up-to-date equipment and that then, by 2010, all science and engineering laboratories should be classed as at a good standard or better, as measured by HEFCE. In delivering this recommendation, the Review believes it is important that the teaching infrastructure capital stream complements research infrastructure funding to facilitate the building, refurbishment or equipping of joint research and teaching facilities, where appropriate.

Recommendation 3.4: Recurrent funding for teaching

In order to ensure that in future higher education institutions can and do invest properly in science and engineering teaching laboratories, the Review recommends that HEFCE should formally review, and revise appropriately, the subject teaching premia for science and engineering subjects. The revisions should ensure that the funding of undergraduate study accurately reflects the costs – including paying the market rate for staff, as well as the capital costs – involved in teaching science and engineering subjects.

Recommendation 3.5: Undergraduate student funding

While student debt does not in general appear to be deterring potential students from undergraduate education, at the margin some undergraduates may be deterred from science and engineering courses, as they involve longer hours than other courses and as a result students find it more difficult to supplement their income by working part-time. In order for this not to deter the most disadvantaged students from studying science and engineering (and other courses with long 'contact hours'), and to assist with widening participation, the Review recommends that the Government (through its guidance to HEIs) should ensure that the Access Funds and Hardship Funds adequately provide for students on courses involving a high number of contact hours. The Review recommends that additional funding should be provided to accommodate this, and that HEFCE monitor the targeting of this additional funding to ensure it reaches those most in need.

The Review also recommends that the Government closely monitor the impact that an additional year of student debt has on students' choices of course, to ensure that the student funding system at undergraduate level is not discouraging students from studying (the longer) physical science and engineering courses.

Recommendation 3.6: University careers advisory services

The Review welcomes the recommendations of the Harris report on improving university careers advisory services. It is important that science and engineering students have accurate, up-to-date careers advice on the rewards and range of opportunities available to them (particularly opportunities in research and development). In particular, the Review endorses the recommendations in his report aimed at improving the links between careers advisory services and businesses, particularly small businesses, which will require action by both HEIs and by businesses.

Chapter 4: Postgraduate education

Recommendation 4.1: PhD stipends

In order to recruit the best students to PhD courses, it is vital that PhD stipends keep pace with graduates' salary expectations, particularly given the increasing importance of student debt on graduates' career choices. It is also important that stipends better reflect the relative supply of, and market demand for, graduates in different disciplines. The Review therefore recommends that the Government and the Research Councils raise the average stipend paid to the students they fund over time to the tax-free equivalent of the average graduate starting salary (currently equivalent to just over £12,000), with variations in PhDs stipends to encourage recruitment in subjects where this is a problem. Furthermore, the Review recommends that a *minimum* PhD stipend of £10,000 is established, to ensure that HEIs do not use this extra flexibility to attract extra PhD students at the expense of quality.

Recommendation 4.2: PhD training elements

Despite the welcome current moves by the Funding Councils to improve the quality of PhD training, institutions are not adapting quickly enough to the needs of industry or the expectations of potential students. The Review therefore believes that the training elements of a PhD – particularly training in transferable skills – need to be strengthened considerably. In particular, the Review recommends that HEFCE and the Research Councils, as major funders of PhD students, should make all funding related to PhD students conditional on students' training meeting stringent minimum standards. These minimum standards should include the provision of at least two weeks' dedicated training a year, principally in transferable skills, for which additional funding should be provided and over which the student should be given some control. There should be no requirement on the student to choose training at their host institution. The minimum standards should also include the requirement that HEIs – and other organisations in which PhD students work – reward good supervision of PhD students, and ensure that these principles are reflected in their human resources strategies and staff appraisal processes.

Furthermore, in order to assure employers of the quality of PhD students, as part of these standards the Review recommends that institutions should introduce or tighten their procedures for the transfer of students to the PhD. In particular, the Review believes that HEIs must encourage PhD projects that test or develop the creativity prized by employers.

Recommendation 4.3: Length and nature of PhD programmes

The Review believes that measures should be put in place to help nurture a diverse range of PhD programmes to train able students in research methods and technical skills, and help them acquire the advanced knowledge and transferable skills they will need in their future careers. This should include encouraging part-time working and the gaining of experience in business R&D. Individual institutions should be given flexibility to offer a range of provision. The Review therefore recommends that:

- the Government and the Research Councils should fund their present numbers of PhD students on the basis that the average full-time student requires funding for $3^1/_2$ years;
- it should be possible for the institution to use the funding flexibly to run three- and four-year full-time programmes (and also study of intermediate length) to support longer and more challenging projects, advanced courses and transferable skills training;
- both three- and four-year courses should be examined to the same standards, which should be at least as high as the current standards; and
- students should be able to exit early from PhDs (subject to satisfactory performance) with an MRes or an MPhil.

The Review believes that the EPSRC's doctoral training grants system represents a good way of achieving this flexibility, and urges other Research Councils to implement similar mechanisms.

Recommendation 4.4: EU PhD students

The Review would welcome the extension of PhD maintenance awards to EU students by the Research Councils as a means of maintaining and improving the quality of research in the UK. The effect of this on the number and quality of UK PhD students should be closely monitored in order to ensure suifficient supply of PhD holders for the needs of the UK economy.

Chapter 5: Employment in higher education

Recommendation 5.1: Academic Fellowships

The Review believes that there should be a clearer path for those who have completed PhDs into academic lectureships. This should be achieved through creating Fellowships that allow those involved to move from principally research-based work towards the role of lecturer, with an added role of reach-out to schools (for example, becoming a Science and Engineering Ambassador) and helping to widen access to higher education. The Review therefore recommends that the Government provide funds to establish a significant number (the Review believes 200 a year) of prestigious academic Fellowships to be administered by the Research Councils. The Fellowships should last for five years and should be designed to prepare people explicitly for an academic career, to be distributed and awarded on the basis of academic excellence across the range of subjects considered in this Review. The Research Councils should work with the funders of similar schemes (for example, The Royal Society and the Wellcome Trust) in introducing these Fellowships.

Recommendation 5.2: Industry secondments for postdoctoral researchers

The Review recommends that HEFCE and the Research Councils evaluate schemes such as the Research Assistants Industry Secondments run by the EPSRC as the basis for a wider mechanism for encouraging postdoctoral researchers into industrial careers, and as a mechanism for knowledge transfer.

Recommendation 5.3: A vision for postdoctoral researchers

It is important for postdoctoral researchers to be able to develop individual career paths, reflecting the different career destinations – Industrial, Academic and Research Associate – open to them, and that funding arrangements reflect the development of these career paths. The Review believes that enabling the individual to establish a clear career path, and a development plan to take them along it, is critical to improving the attractiveness of postdoctoral research. The Review therefore recommends that HEIs take responsibility for ensuring that all their postdoctoral researchers have a clear career development plan and have access to appropriate training opportunities – for example, of at least two weeks per year. The Review further recommends that all relevant funding from HEFCE and the Research Councils be made conditional on HEIs implementing these recommendations.

Recommendation 5.4: Postdoctoral researchers' salaries

In addition to establishing clearer career progression, the Review recommends that Research Councils should significantly increase salaries – particularly starting salaries – for the science and engineering postdoctoral researchers it funds, and sponsors of research in HEIs and PSREs should expect to follow suit. The Review considers that the starting salary for postdoctoral researchers should move in the near future to at least £20,000, and that further increases should be available to solve recruitment and retention problems in disciplines where there are shortages due to high market demand (for example, mathematics).

Recommendation 5.5: Academic salaries

As with contract researchers, there is a need for universities to improve salaries – particularly starting salaries – for many scientists and engineers. The Review is clear that universities must use all the flexibility at their disposal differentially to increase salaries, especially for those engaged in research of international quality, where market conditions make it necessary for recruitment and retention purposes. The Government should assist by providing additional funding to permit universities to respond to market pressures. As a first step, the HEFCE funding currently dedicated to the human resources strategy should be made permanent. Further additional funding for recruitment and retention, which will vary between institutions, should initially be part of a separate stream linked to the existing human resources strategy fund and appropriately focussed towards research excellence. However, once more market-based systems have been embedded, the funds should be incorporated into core funding for research and also into revised subject teaching premia.

Chapter 6: Scientists and engineers in R&D

Recommendation 6.1: Attractiveness of careers in R&D

Responding to the challenge of improving the attractiveness of jobs in R&D to match or surpass all other opportunities open to the best science and engineering graduates and postgraduates is crucial to individual businesses' future success – since their R&D underpins their future products, services and, ultimately, their future sales and profits.

Through consultation with businesses and scientists and engineers themselves, the Review has identified a number of issues related to work in R&D that employers must address in order to be able to attract the best science and engineering graduates and postgraduates.

- **Initial pay.** Starting salaries are an increasingly important factor in students' career choices, in part due to the effect of student debt and students' increasing commercial awareness. The starting salaries and bonuses paid to scientists and engineers working in R&D are often not as high as they could receive in other sectors or occupations. While it may not be necessary to match the highest salaries paid elsewhere, the Review is clear that businesses will ultimately need to raise the salaries and other financial rewards they offer if they are to compete for the best scientists and engineers (particularly those with an entrepreneurial spark or good commercial awareness). This goes hand-in-hand with the need for businesses to look at R&D not as a cost, but as an investment in their future survival and growth.
- **Salary progression.** Similarly, retention in an increasingly mobile workforce relies upon salary progression that compares well with the other opportunities available. Evidence suggests that the salary progression for scientists and engineers in R&D does not compare favourably with that for their counterparts in other sectors.
- **Career structure.** Science and engineering graduates and postgraduates can be put off entering R&D due to unattractive career structures – with short-term contracts, low levels of responsibility, few chances for progression within R&D and poor job design (*e.g.* jobs that do not use their skills to the full). It is clear

from the Review's consultation that many employers can do more to improve the career structures of scientists and engineers, through addressing these and other influential factors.

- **Training and professional development.** Scientists and engineers working in research do so partly because of their interest in the subject, and it is therefore key that they can stay in touch with the latest developments in their field. Employers should do all they can to provide time and resources to allow them to do this, and partake in CPD activities, which will also bring benefits in terms of recruitment and retention. There is a role for the Government and for trades unions in helping to make sure that smaller businesses are able to provide sufficient training and CPD to research employees.
- **Recruitment mechanisms.** The Review believes that many R&D businesses must improve their recruitment mechanisms to compete better with other employers. For most R&D businesses, especially the smaller ones, increasing marketing efforts and taking opportunities to widen the number of students they make contact with should improve their ability to recruit the scientists and engineers they need. R&D businesses must also take responsibility for improving the perception of jobs in R&D.

The Review is clear that the response of R&D employers to these challenges is crucial in providing an adequate supply of scientists and engineers for R&D. Without improved and more attractive opportunities to work in R&D, the UK's best scientists and engineers will doubtless be tempted elsewhere, since the demand for their skills – and the rewards offered – will only grow over time.

Recommendation 6.2: The challenge to employers

The Review recommends that the Government should establish a group of R&D employers to support and monitor employers' responses to the challenge of improving the pay, career structures and working experiences for scientists and engineers in R&D. The group should include representatives from businesses (large, medium and small) and others that employ scientists and engineers in an R&D capacity.

The Review believes the group must act as a driving force in taking the recommendations in this report forward, and should publish a report, before the next public spending review, setting out the response of employers to the challenges identified by this Review. The group might also play a key role in considering cross-regional and national R&D skills needs, referred to in Recommendation 6.4.

Recommendation 6.3: Skills planning

It is clear that although many businesses may plan their R&D projects a number of years in advance, they often do not plan their skills needs for this research more than a year ahead. Although there are difficulties in detailed skills planning, the Review believes that R&D businesses must do more to establish what science and engineering skills they will need for future research projects in order for them to be able to recruit the skilled scientists and engineers they need with less difficulty.

Recommendation 6.4: Skills dialogue

The Review believes that the supply of skills to R&D businesses can be improved through more coherent skills dialogue between these businesses and universities. The Regional Development Agencies (RDAs) should take a leading role in the coordination of regional dialogue between businesses and HEIs through the new FRESAs (Frameworks for Regional Employment and Skills Action) to ensure that demand for higher level skills at a regional level can be met.

Furthermore, the Review recommends that the sector skills councils (which, the Review believes, should be represented in FRESAs) work with the Learning and Skills Council, trade associations and other business groups to identify – based on the regional skills discussions – evolving cross-regional and national R&D-related skills needs.

Recommendation 6.5: Business involvement in higher education

Although universities need to be proactive in ensuring that courses are as relevant to business as possible, the Review believes that businesses must become more actively involved in university course design. In particular, the Review recommends that employers' bodies – for example, the CBI and trade associations – and the Government work to encourage more R&D businesses to participate in providing work placements for SET graduates and postgraduates (for example, in sandwich year courses).

Recommendation 6.6: Research collaboration between business and higher education

There are a number of Government sponsored schemes that act to encourage research collaboration between businesses and HEIs. However, the Review feels that the collective impact of these schemes is not as great as it should be. The Review therefore recommends that the Department of Trade and Industry, as part of its increased focus on innovation and skills, and more effective delivery of business support, should evaluate the success of existing initiatives in this area – in particular, paying attention to whether the training elements of these schemes are sufficiently supported and prioritised and the extent to which they play a strong role in employer-university communication and collaboration.

Recommendation 6.7: Innovation Partnerships for collaborative research

The Review recommends that the Government, while retaining successful initiatives, should develop stronger, more coherent and more substantial "Innovation Partnerships" to boost research collaboration between universities and businesses. The Review believes that these should incorporate the following principles:

- that the research be business-led and focussed on commercially-oriented R&D;
- that the partnerships be based on clusters of businesses with particular research interests, either nationally or regionally;
- that the Government invest in each partnership alongside the prime funders (business, higher education and RDAs);
- that each partnership could be virtual or could have a physical centre, depending on the nature of the research and the participants in the partnership; and
- that each partnership should have an explicit, core aim of prioritising skills training for SET students and graduates, building a critical mass of SET students and graduates with experience in commercial R&D, and encouraging the interchange of people and technology between business and academia.

Recommendation 6.8: Migration and work permits

The Review welcomes the Government's campaign to raise HEIs' and overseas students' awareness of the recent improvements to the work permit system. However, given the lack of knowledge of these changes shown by businesses during the course of its consultation, the Review recommends that this campaign be extended to cover the business community, including smaller and medium-sized businesses engaged in R&D. Through this, more UK businesses will be able to draw upon worldwide scientific expertise in driving forward their R&D.

Final remarks (repeated from the executive summary)

The recommendations set out in this report, which represent challenges for the Government, for employers and for the education system, are designed to help secure a strong supply of people with science and engineering skills. The Review believes that implementing these recommendations will be a crucial element in achieving the Government's agenda for raising the R&D and innovation performance of the UK to match the world's best.

The Review is clear that progress towards the goals set out in the report must be reviewed regularly in order to ensure that the UK's R&D and innovation performance can grow as intended. In particular, the Review recommends that that the Government should review progress on improving the supply of scientists and engineers, encompassing all the areas identified by this Review, in three years' time, and take any further necessary action to continue the process of improvement.