The UK's changing research base for construction: the impact of recent government policy

FACTORS ARE IDENTIFIED WHICH MAY DESTABILIZE THE CAPACITY AND CAPABILITY OF THE UK CONSTRUCTION R&D BASE

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Recent government policy on construction R&D in the UK is presented as having been a contradictory amalgam involving, simultaneously, government intervention and disengagement. Confusingly, both parts of the policy appear to have been aimed at the same purpose – increasing the responsiveness of the sector's R&D activities to market forces. Given the noted reluctance of the UK's private sector to assume responsibility for such activities over the past two decades, there is little to suggest that this policy will prove successful. A more likely outcome, in the short to medium term at least, is that the speed and extent of apparent government retreat from funding could, in combination with other current changes, destabilize both the capacity and the capability of Britain's construction R&D base.

De l'avis de l'auteur, la politique récemment menée par le Gouvernement du Royaume-Uni en matière de R&D dans le secteur du bâtiment est un amalgame contradictoire qui met en présence simultanément l'intervention du Gouvernement et son désengagement. Entrangement, ces deux facettes de la politique semblent orientées vers le même objectif, à savoir, mieux sensibiliser les activités de R&D de ce secteur aux forces du marché. Compte tenu du pen d'enthousiasme du secteur privé du Royanne-Uni à assumer des responsabilités vis-à-vis de telles activités au cours des vingt dernières annèes, rien ne laisse présager que cette politique sera couronnée de succès. En revanche, il est plus probable, à court ou à moyen terme au moins, que la célérité du Gouvernement à se retirer de façon importante du financement, combinée à d'autres changements qui se produisent actuellement, aura pour effet de déstabiliser les capacités et les aptitudes de la base de R&D de la construction au Royanne-Uni.

Keywords: R&D, research policy, research infrastructure, research funding, public policy, trends, privatization, UK

Introduction

In this paper I seek to describe, working from published sources, the current state of the UK's research base for the construction industry. This has been subject to significant changes over the past ten to fifteen years, both to its funding and delivery systems. While such changes show no signs of abating, their impact and longer term significance is, as yet, far from clear. This paper is focused on:

1. the reported decline in funding for construction R&D provided by the private sector, compounded by a parallel collapse in local authority funding;
2. the emergence of a more centrally formulated, top-down, research strategy for the industry as a whole, prepared in the wake of the UK's Technology Foresight programme;
3. the accumulating impact of the Research Assessment Exercises on the contribution made to the research base by the UK's higher education institutions; and
4. the consequences of the privatization of the Building Research Establishment – the government agency which housed the UK's largest national capability for R&D in construction – alongside the more

recently announced, apparent cut in government funding for construction research and innovation.

What are the combined effect of these changes on construction R&D? And what will be their net consequences in the short to medium, let alone long, term for the construction industry as a whole? In this paper, I argue that, in sum, they risk destablizing Britain's research base in construction whose funding is already weak in comparison to its major international competitors.

R&D and the UK construction industry

The capacity for R&D, and its engagement with mainstream operations and activities, are less developed in construction than in many other sectors of the UK economy {1, p. 250} with a comparable impact on GDP (over 6% in 1992). As Innovation Policy Research Associates advised the Conservative government {2, p. 3}:

> Construction is an assembly industry. Much technical change aimed at improving products or reducing costs is embodied in inputs acquired from suppliers, thus reflecting R&D carried out by suppliers. In contrast to many other assembly industries such as automobiles or aerospace, construction firms are relatively small and suppliers are relatively large. Construction firms are heavily dependent on technological developments deriving from suppliers. Many construction firms do not have the technical competence to cope with new technologies or carry out R&D.

Accordingly, much R&D eventually captured and applied within construction comes from outside the sector – and this contribution is increasing {3, p. 1}. It comes from firms whose priorities, primarily at least, may not be in construction or even UK-based. Construction technology in the UK is also seen as being highly dependent on expenditure by government, with a long-term prognosis for reducing budgets and more competition for scarce funds {*ibid.*}. When KPMG studied building research for the Construction Industry Council (an umbrella organization representing construction professionals), it concluded {4, p. 80}:

> As a large proportion of the funds going to research ... comes from the Government via the Department of the Environment, the contribution of industry to joint research and dissemination activities is inadequate ... given the importance of the building industry in terms of GDP and fixed capital formation ...

1994 is the last year for which figures have been published on investment in construction R&D in Britain. Investment then stood £236 m; 19% higher than in 1990 but a 2% drop in real terms {5, p. 1}. £97 m or 41% of this total was invested by private sector companies on in-house construction-related R&D. In real terms, such investment fell by 16% between 1990 and 1994 {5, p. 16}, although this ignores work commissioned outside the sector. While materials, equipment and component suppliers remain the major private sector investors in R&D, overall UK investment continues to fail to match the levels of our international competitors {6, p. 31; 5, p. 39}. According to figures published by the Organisation for Economic Co-operation and Development {7, 8}, only Canada, Spain and Italy have lower levels of private sector investment. The UK's main European competitors invest three or more times as much – Japan 17 times more. Indicators of national technological strength in construction shows {9, p. 9} a consistent picture of the UK's decline relative to its major competitors.

Against this background, the R&D Committee of the Construction Industry Council, with government backing, commissioned work {10, p. 1} to:

> ... help senior construction executives to appreciate that it is in their companies' interests to adopt a longer term business perspective and to develop the capability to manage innovation in systematic manner.

Its final report concluded {*ibid.*} that ''the majority of construction firms would only be in a position to benefit from investment in R&D after they had developed an innovation strategy.'' As a consequence, there is now a stronger primary focus on what is variously termed 'creating a culture of innovation' {11, p. 6} or 'creating a climate of innovation in construction' {12} than on increasing the sector's own R&D capacity.

The UK construction research base

This research base has been described {6, p. 10} as being composed of five principal components:

1. government research establishments such as the Building Research Establishment (BRE);
2. higher education institutions – for all practical purposes, the UK's universities;
3. non-profit research organizations, such as the Construction Information Research and Information Association (CIRIA) – joined very recently by the newly formed Foundation for the Built Environment, (see below);
4. commercial or contract research organizations; and
5. the in-house capacity of private companies.

Unfortunately, these classifications have not been applied consistently to collated data about R&D in the UK. The most recently published figures {5, p. 25} redefine the five components as:

1. BRE and the Transport Research Laboratory, listed separately;
2. universities;
3. other research organizations;
4. consultants; and
5. companies' own research facilities.

While three of the categories in this second list map easily on to the DOE's earlier 1992 classification, the correspondence between the third and fourth seems more problematic. In Table 1, both sets of data have been amalgamated using the 1992 classifications where these are more explicit.

Methodological discussions in the two DOE reports on the funding of construction R&D {2, p. 26; 5, p. 15} demonstrate that calculating investment by private companies is fraught with difficulties, partly because too few disclose their R&D expenditure, partly because it is difficult to estimate how much of this relates

Table 1. R&D income of major construction research organizations, 1989–1994

Organization	1989[1]	1990[2]	1992[2]	1994[2]
Government Research Establishments				
BRE[3]	[34	26	31	34
TRL[4]	[....	7	9	8
Higher Education Institutions	24	33	39	54
Non-profit Research Organizations	8	26	32	33
Contract Research Organizations	12	10	12	10
Private Companies	62.5	96	92	97
Totals	140.5	198	215	236

1. Current prices, £m, taken from {2, p. 10}
2. Current prices, £m, taken from {5, p. 3}
3. Building Research Establishment
4. Transport Research Laboratory

to construction activities. However both reports suggest such investment continues to decline in real terms. Contractors, for instance, are identified as having reduced their in-house research facilities by over 50% between 1990 and 1994 {5, p. 1}. Income for R&D conducted by contract research organizations (called consultants in 1996) has remained flat. Half of the £10m listed in Table 1 came via extra-mural contracts placed by BRE and TRL, to the value of £4m and £1m, respectively {*ibid.* p. 29}. Income among non-profit research organizations has grown. CIRIA {13 p. 3}, for instance, had a total turnover of over £2.5m in 1995 although this also includes income from sale of publications and from running events. The Building Services, Research and Information Association was cited {5, p. 30} as having a research income of £2.5m for 1994/5.

While the DOE's categories for describing the UK's research base are useful, especially for tracking where investment is spent, they are also limiting. First, they are only input-orientated. R&D is characterized solely in terms of its funding without any corresponding attention to output, to deliverables and their efficacy, to the impact or consequences of research. This is a serious weakness. Second, they could easily lead to an underestimate of the UK's overall R&D capacity. This is because the categories are solely concerned with the supply side of research and run the danger of implying a simple linear model of the kind shown in Fig. 1.

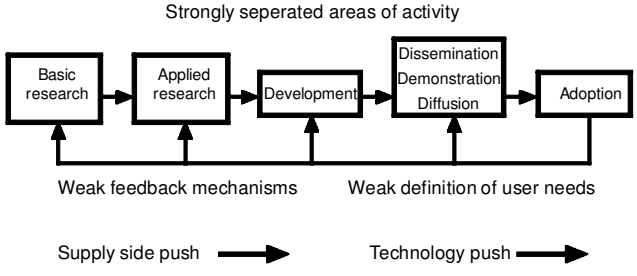

Fig. 1. A linear model of research [14].

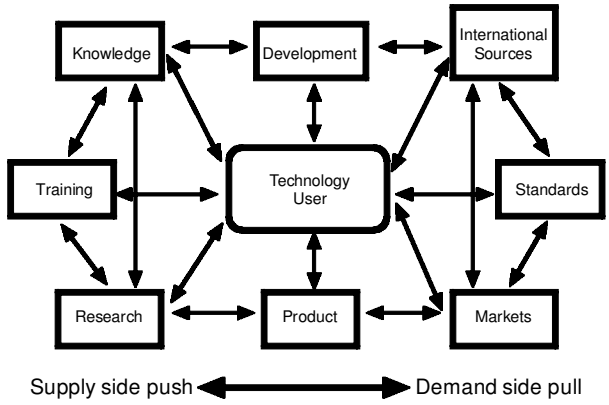

Fig. 2. An interactionist model of research [14].

As a result, the categories neither draw attention to any demand side pull for research, nor suggest the role that users can play in research through strong and clear statement of their needs. This too is a serious weakness. Demand side pull, when accompanied by a clear articulation of users' needs, is an important component of any industrial sector's research capability. Figure 2 illustrates a more interactionist model of research. This attempts to capture both demand side pull and supply side push as well as indicating the variety of sources from which research initiatives can spring.

This interactionist model shares characteristics with Gibbons *et al.* {15} formulation of a newly emergent mode of research practice, with an emphasis on short-lived research teams coming together to work on real-world problems, set and solved by actors involved in the context in which the results have to be applied. This mode is increasingly characteristic of research funded by both government departments and research councils in Britain.

Conservative Government policy on construction-related R&D in the UK

Whatever model of research practice we adopt, it remains inescapable that construction R&D in the UK has remained heavily, perhaps overly, dependent on government funding. And this is dominated by just four organizations:

1. the Department of the Environment (£38.1m);
2. the Department of Transport via the now separate Highways Agency (£14.3m);
3. the Research Councils (£20m), especially the Engineering and Physical Science Research Council; and
4. the Higher Education Funding Councils (£8.0m);

all figures for 1994/5 at current prices {5, p. 1}. Local authority funding used to be significant (£9.0m in 1989) but is no longer (£0.5m in 1994/5).

Much of the thrust of the previous Conservative Government's policy can be seen as attempts:

1. to halt and, if possible, reverse the declining proportion of construction R&D contributed by the private sector, and

2. to co-ordinate, integrate and, especially, to target joint public and private sector investment to maximize its effect.

A major driving force behind this process has been the UK's *Technology Foresight* programme, now re-christened simply *Foresight*, announced in the 1993 UK government White Paper on Science, Engineering and Technology, *Realising Our Potential* {16}.

The programme's aims are: to encourage mutual understanding and collaboration between science and business; to inform decisions about priorities in publicly-funded science, engineering and technology; and to influence business strategies {17, p. 1}. Behind these lies the specific objective of identifying areas where new developments will yield the greatest long-term social and economic benefits to Britain. Work has been undertaken by a Construction Panel which brings together representatives from central government, universities, major construction companies (materials manufacturers, contractors, and consultants) and trade associations. Having consulted widely, the Panel published a sector report in 1995. This sought {9, p. 14} to promote a 'holistic approach' for tackling a range of challenges – the first being to reduce costs, add value and sharpen international competitiveness. The Panel's mission statement is now {11, p. 4}:

> To help establish an innovative and forward thinking culture in the UK construction industry as an essential ingredient in the industry's future competitiveness and profitability and an integral component of wealth creation and an enhanced quality of life.

In parallel to Foresight, the government established the Construction Research and Innovation Strategy Panel (CRISP): it reports to the Construction Industry Board, a partnership between the construction industry, its clients, and the government {18} which has the task of implementing the recommendations of the influential Latham review, *Constructing the Team* {19}. CRISP is charged {20, p. 4} with implementing a 'whole industry research strategy' (WIRS), one of whose aims is to realize the benefits of research by directing both private sector and government funding towards projects offering the greatest value {*ibid.*, p. 5}. Key R&D priorities have been identified {12, p. 3} for construction through six WIRS themes: motivation, process, performance, commercial framework, regulatory, and futures. CRISP {13, p. 3} has two main objectives:

1. encouraging competitiveness through the appropriate use of research and innovation, acting in support of the Latham review; and
2. identifying the construction community's research and innovation priorities, and promoting these to major funders.

WIRS and the construction community

CRISP is intended to represent 'the whole construction community' but it is difficult to see how it is expected to achieve this. Examination of the participants in the Foresight and CRISP panels suggests they are typically drawn from central government and large private sector companies. In this sense alone, they are highly unrepresentative of the UK construction sector as whole. This contains, according to the latest figures published by the Department of Trade and Industry {21, p. 10}, 847 911 enterprises, only 252 of which have more than 250 employees. By comparison, the overwhelming majority, 834 235, have less than 10 employees. From this perspective, construction in the UK looks like a sector almost exclusively composed of small to medium enterprises (SMEs). It is an animal with a very small head but very large body.

If CRISP's purpose were to evolve a strategy for the 'whole construction community' capable of engaging with the needs of the entire animal, then it would have to be built, at least in part, from the bottom-up, involving SMEs. Despite the presence of trade associations on CRISP, WIRS is clearly a centrally defined strategy imposed from the top-down. Its authors may assume that WIRS will impact on the bulk of enterprises in the sector through some form of 'trickle down' effect, though the efficacy of this has long since been called into question in other areas of social and economic policy in Britain {22, p. 203}. However, the precise mechanisms through which such an effect is expected to operate remain unclear, especially since supply chain pressures are weaker in construction than in other industrial sectors {23}. As currently constituted, the Foresight Construction Panel and CRISP are arenas in which central government and major players in the sector meet to collaborate in joint forward planning, based on their own needs and perspectives. Indeed, the Foresight Construction Panel has been explicit about its 'big business' orientation. Under the heading 'Engaging industry', it has reported {11. p. 9}:

> The panel will target the chief executives of the top five construction companies. It will also seek to influence the top management of the major contractors, consultants, building materials producers and component manufacturers.

The implications of this top-down formulation of Britain's 'research and innovation' agenda for the construction sector's small and medium sized enterprises have yet to be made explicit. Likewise the precise mechanisms for converting private sector participation in forward planning into increased investment in R&D – even just at the level of the 'leading edge' companies involved – also remain undefined.

Foresight and the research councils

Foresight has had a major impact on the policies and priorities of the UK's research councils which began preparing their responses to Technology Foresight programme in 1994. Typically, they reported the programme {24} as feeding directly into their forward planning cycles. For example, the Engineering and Physical Science Research Council (EPSRC) suggested {*ibid.*, p. 8} convergence between its own specific objectives and those recommendations coming from the Foresight Sector Panels relevant to its remit, so that its future priorities would fully reflect these. Indeed, alone among the research councils,

ESPRC identified itself as responding directly to all eleven of the key topic areas proposed by Technology Foresight {*ibid.*, Annex A}. More recently, it has stated {42}:

> The EPSRC serves as the agency of Government, and seeks to implement the policy given to it by the Government within the funding provided ... (and) it must satisfy the OST that the policy is being implemented successfully.

This formulation presents the Research Council as simply one amongst several mechanisms for delivering central government policy. This is reportedly achieved {*ibid.*} through advice the Research Council receives from its Technical Opportunities Panel and its User Panel, both of which take guidance from Foresight as well as consulting widely. This has led directly, for instance, to funds being made available for the EPSRC/DOE Link research programme on *Meeting Clients' Needs through Standardisation*. The government has also used a new initiative, *Foresight Challenge* awards, to further Foresight directly. Managed by the research councils, these awards are distributed to promote priorities identified by Foresight and to encourage funding from the private sector. So, for example, the government announced {25} funding of £30m over the following four years to be matched by £62m from the private sector, a small proportion of which related to construction.

The universities and the Research Assessment Exercise

The traditional recipients of research council funding are academics in the UK's higher education institutions. There are more than 90 universities in the UK with departments which perform R&D related to the construction industry {5, p. 26}. After in-house capacity in the private sector, universities are the construction industry's largest resource for R&D. In 1994, they undertook 23% of all construction R&D, up from 17% in 1990 {*ibid.*, p. 28}, see Table 1. £20m of this came from the research councils, mostly from EPSRC whose contributions doubled between 1990 and 1994.

Universities are also the fastest growing part of the UK research base, increasing by 60% between 1990 and 1994, at current prices {*ibid.*, p. 38}. In part, this growth is a response to the Research Assessment Exercises conducted by Britain's four Higher Education Funding Councils {26}. Like Foresight, the RAE is a major driver for change within the UK's construction research base because the government wishes to see selectivity in the allocation of research resources based on assessments of the quality of research {27, p. 11}. The purpose of the RAEs, conducted every four years or so since 1988 with the last in 1996, is to assess the quality of research in university departments to inform the Councils' decisions about the distribution of funding for research. University departments made submissions to the assessment panel appropriate to their research activities, such as to the Built Environment and Planning Panel or the Civil Engineering Panel for construction-related departments. These submissions included:

- the names of active researchers;
- details of publications or other forms of research output;
- information about numbers of research students, studentships, and research income during the assessment period; and
- a statement of the department's research achievements, arrangements for supporting and promoting research, and indicators of external recognition.

Assessments were made against a common rating scale of 5*,, 5, 4, 3a, 3b, 2 and 1, with the first being the highest and indicating research of predominantly international excellence. Submissions were rated against four criteria: quality of output, extent of postgraduate activity, evidence of esteem by external funders, and evidence of vitality in the department concerned {27, p. 7}.

The Built Environment Panel received submissions from 55 departments, listing 831 'active' researchers and citing 3202 research outputs. The Civil Engineering Panel received submissions from 43 departments. Table 2 shows the distribution of ratings awarded. In comparison with previous RAEs, the 1996 exercise has been judged by the chairman of the Built Environment panel {27, p. 11} to show marked improvement. It revealed both an increase in research funding from research councils, industry, commerce and other funding bodies and increased collaboration between academics and industrial partners. However, even in the few departments (< 13%) which were highly rated at 5 and 5*, the average research income per active researcher was only £27 276, £7458 of which typically came from research councils. Nearly two-thirds of departments (64%) were rated below the mid-point on the scale, 3b, compared with only a quarter above. Built Environment also performed poorly when compared with other disciplines, at 63rd coming just six places above Nursing, and Cultural and Media Studies which were bottom {28}. Civil Engineering fared better. Only 44% of departments were rated below mid-point on the scale, compared with 51% above. These ratings have reportedly {29, p. 10} sent 'shock waves' through some university departments. Taken at face value, the ratings suggest that, while universities may be the fastest growing component of the UK's construction research base, they do not necessarily possess, either individually or collectively, a strong construction-related research capability. If both private and public sector clients become more selective about whom they choose to fund, some university-based researchers are likely to be forced to leave 'the market place'.

Table 2. Summary of ratings awarded in 1996 Research Assessment Exercise

Rating	1	2	3a	3b	4	5	5*
Built Environment Panel Frequency	14	13	8	6	7	5	2
Civil Engineering Panel Frequency	5	4	10	2	12	7	3

Calculated from {26}.

The privatization of the Building Research Establishment

Another major change currently affecting the funding and delivery of construction R&D in Britain is the recent privatization of the Building Research Establishment. This has long been the principal organization in the UK carrying out research into building and construction, with 700 full-time equivalent staff in January 1997 prior to privatization. Its main role has been to advise and carry out research for the government, principally the Department of the Environment {30, p. 1}. In 1994, it had an income of £34m, see Table 1, mainly from just two sources: £18.4m from the DOE's Construction Sponsorship Directorate, the largest public sector contributor to construction R&D in the UK, and £7.4m from the DOE's Energy and Environmental Management Directorate in support of its Best Practice programme. In 1994, the DOE's share of the BRE's income was 86%, with the private sector contributing just 9% of its funding {5, p. 28}. By 1995, BRE's income had risen to £41.5 million, with only 8.4% identified as coming from non-government sources {30, p. 29}.

In April 1996, the Conservative Government declared its intention to transfer the BRE to the private sector by February 1997. Following a proposal from CRISP, the Construction Industry Council set up a National Centre for Construction. This was intended both 'to take responsibility for progressing plans for transferring the BRE into the private sector' {31} and 'to have responsibility for implementing construction's Whole Industry Research Strategy' {32}. The NCfC was meant to be 'much more than a privatised BRE', demonstrating 'real industry ownership' {33} of benefit to 'the industry, its clients and the country as a whole' {34}. However, the government rejected this joint approach on behalf of the construction industry and, in January 1997, eventually announced that a BRE Management Bid team was its preferred purchaser of the BRE {35}.

BRE Ltd now carries out all the trading activities of BRE and is owned by the Foundation for the Built Environment Ltd, a non-profit-distributing body whose 125 members are drawn from a wide spectrum: professionals, contractors, materials and product suppliers, housing, building owners and managers, and universities {36}. According to its Deputy Chairman {37}:

> The Foundation will use its income to promote its objectives through funding research, scholarships, seminars, etc. It is expected that most of these activities will be undertaken by BRE.

The ownership structure created is intended to guarantee BRE Ltd's independence of specific commercial interests and to protect its reputation for objectivity and impartiality.

Although details of the sale of BRE have not been made public, it is widely suggested that the BRE Ltd has been guaranteed government-funded work over a five year period, expected to total around £75m. This suggestion cannot be verified. Such guarantees are matters covered by agreements made at the time of privatization and are confidential to the parties involved. However, for its first year of operation, government-funding has been announced as £28.1m (plus £3.9m to be let through extra-mural contratcs), see Table 3. Hence there would appear to be a £9.5m (or 23%) cut in funding for BRE Ltd in comparison with BRE's in 1995, from £41.5 to £32m. This cut could have two implications:

- a reduction in the range or depth (or both) in the R&D undertaken by BRE Ltd for government; or
- BRE Ltd will have to compete for the additional work (represented by this cut) against other research organizations.

Beyond this, BRE Ltd will have to attract private sector funding to make up any remaining shortfall, see Fig. 3. Success in doing so will be hard to achieve. First, it will require a reversal of the seemingly inexorable decline in private sector funding for construction R&D over the past ten to fifteen years, as catalogued by the DOE {2, 5, 6}. Conversely, prior to privatization, BRE was not allowed to cost research projects undertaken for the private sector at marginal pricing, a considerable aid to attracting such work. Post-privatization, it

Table 3. Income of the Foundation for the Built Environment (BRE Ltd), 1997/8[1]

Source	£m
Construction Sponsorship Directorate	16.1
Energy and Environmental Directorate	3.9[2]
Housing	1.6
Environmental Protection	1.6
Miscellaneous	1.3
Private sector and EU	3.6
Total	28.1
Currently secured	26+

1. Taken from {38}.
2. Net figure; another £3.9m has to be let by BRE Ltd through extra-mural contracts

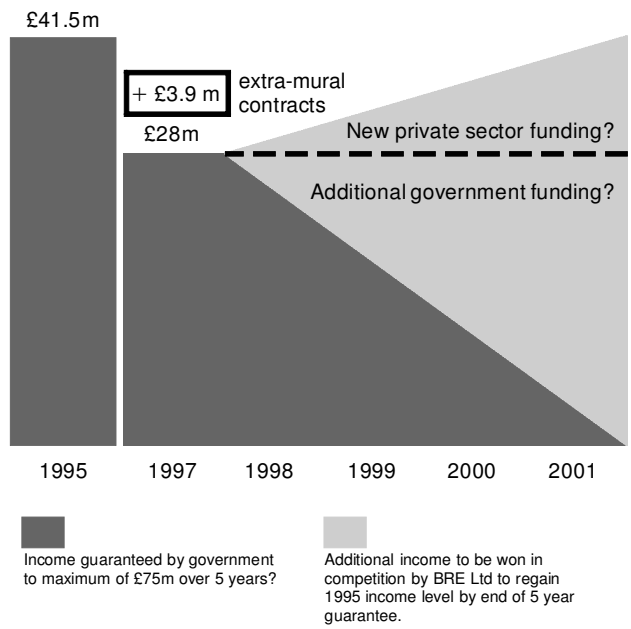

Fig. 3. Scenarios for BRE Ltd's income: 1997–2001.

will be able to do so if it chooses enhancing BRE Ltd's chances of winning this type of work.

An uncertain future for R&D funding in the UK

One early casualty of the Conservative Government's recasting of its funding for R&D appears to have been the Department of the Environment's own Partners in Technology (PIT) programme. This is a collaborative R&D scheme, involving joint government/industry funding to support a broad range of industry-relevant projects on innovation, research and technical development for the construction sector. It has been open to construction firms, industry bodies, research and technology organizations, as well as universities {39, p. 2} and is operated within the Whole Industry Research Strategy. By 1996, PIT was attracting a wide response from the construction industry, with 663 proposals from 170 applicants, involving 650 organizations as named partners. However, because of financial developments within the DOE, the available budget for new projects was eventually more than halved from £7.8m in 1996/7 to £3.6m in 1997/8 {40, p. 1}.

This reduction in PIT funding was, in material terms, a minor matter (around 1.5% of total expenditure on construction R&D). But, symbolically, it was highly potent. It not only severely dented the reputation of the PIT scheme but also called into question the Conservative Government's own commitment to creating and maintaining a research and innovation culture within the industry. These cuts in available BRE and PIT funds may well have other knock-on effects. In future, other casualties could be research organizations which have estimated their work force and work load (and hence their income) on the basis of successfully acquiring PIT funding, as they may have done in previous years. To these need to be added research organizations which have, historically, received extra-mural contracts from the BRE – or even the DOE itself. For, as the Parliamentary Under Secretary of State for Construction of the Labour government elected in May has recently announced {41}, the DOE's level of funding for 'construction innovation and research' in 1997/8 is £23m. If this is indeed the departmental spend, and not just that for the Construction Sponsorship Directorate, it is £15m less than in 1994/5 – effectively a 40% cut.

Construction R&D will have to respond rapidly, given the unheralded nature of this announcement, since it is now being asked to operate in new and very different circumstances. With a privatized BRE Ltd seeking additional R&D funding from government and from the private sector, both the rules of the game and the size of the available cake have been changed at the same time. The immediate consequences of these changes for non-profit and contract research organizations are not clear but could be bleak. Nor are universities immune from them. EPSRC has decided that, because the Foundation for the Built Environment has non-profit-distributing status, BRE Ltd is now eligible to bid for and be the grant holders of awards made under the Research Council's managed programmes (EPSRC, private communication, May 1997). Potentially, at least, this gives BRE Ltd access to a previously protected source of research funding traditionally reserved for higher education institutions in the UK. If nothing else, this presents universities with a new competitor for available research council funding at a time when it has become a prerequisite of a high RAE rating.

Conclusions

Two clear but contradictory trends can be seen acting on construction R&D in Britain. The first of these is towards centralization, collaboration and concentration. Research policy since Foresight has become increasingly targeted via the co-incidence of purpose between the Foresight Construction Panel, CRISP's Whole Industry Research Strategy, and their impact on the managed programmes of the UK's research councils. The prime mover here has been central government through its policy on science and technology. Within construction, policy-making under the Conservative Government became more focused and, ultimately, rested in fewer hands – despite the CRISP and Foresight panels' commitment to representation and consultation. A joint 'research and innovation' agenda for construction has been shaped and is being put into place through an alliance between central government and the sector's major players – its 'big business' leaders, despite their unrepresentativeness in an industry composed almost entirely of SMEs. The trend towards centralization is being reinforced by Britain's Research Assessment Exercises in higher education. Here the focus on funding universities through selectivity based on high performance is concentrating funding on existing centres of excellence while, simultaneously, pushing more UK academics to become research 'active'. This is expanding the size of the UK's research base without necessarily increasing its quality or even its capability. The RAEs may also result in academics designing research projects whose time horizons are short and whose scope and nature, under the influence of Foresight, become more constrained and less innovative in order to secure increasingly pigeon-holed funding.

The second trend is towards disengagement and destabilization. This is seemingly happening in both the private and public sectors. As a whole, private companies are reported by government as having retreated, reducing their own in-house capacity to undertake R&D and continuing to disengage from investing in R&D undertaken elsewhere in the construction research base. This has decreased both the size of the base and its capability, for instance, through the reduction in contractors' in-house research facilities. The Conservative Government tried to redress this trend both by seeking alliances with the private sector's major players and increasingly by seeking joint funding through its funding sources and their eligibility criteria and mechanisms. However, at the same time, the Conservative Government signalled a level of disengagement from both policy-making and funding for construction R&D by seeking to make these more market responsive, driven and supported. Until recently, the strongest signal of

government retreat was the manner of privatization chosen for the BRE. This was signalled through both the act of privatization itself and through the re-location of BRE in private, Management Bid team, hands rather than its collective incorporation through the proffered National Centre for Construction.

In conjunction, these trends could prove significant on three counts.

1. The reduced funds available to BRE Ltd, like the smaller but parallel loss of funds to PIT programme, called into question the Conservative Government's commitment to a major component of its own policy – collaborating to creating a climate for innovation in Britain's construction industry through partnership with the private sector. The halving of PIT funding sent the message that central government could not be trusted to keep its side of the bargain here.
2. This signal may have been compounded by the 40% reduction in funding for construction research and innovation just announced by the new Labour Government. It now needs to make clear whether this level of funding, if correct, has simply been inherited from the previous Conservative Government or is an accurate expression of its own forward planning.
3. If central government funding for R&D is being reduced, this could jeopardize not just the future of the newly privatized BRE Ltd but also all those other components of Britain's research base which depend (whether directly or indirectly) on government support for their continued viability.

Individually, the trends and changes charted in this paper are important. But it is in their combined effects that they are most significant. Both alone and jointly, they deserve a great deal more attention and detailed scrutiny. For their consequences could be pernicious. The private sector remains a major funder of construction R&D in Britain. A construction sector increasingly reliant on private funding for its R&D might develop a progressive, self-reinforcing, dynamic. Conversely, it could become beset by the hoarding of rare skills and expensively won information delivered by R&D with a narrow, financially driven, focus and extremely short time horizons. Historically, the UK Government has come to play an overly dominant role in construction R&D, preventing 'the market' from developing other sources of funding. So one problem for the UK's construction sector is that central government has, for too long, been too big a player in its R&D, especially in comparison with other sectors and our international competitors. What can and should be the separate remits of central government and the private sector when it comes to supporting construction R&D in the UK? These are legitimate subjects for inquiry and subsequent action – as is definition of those areas in which they can and should collaborate. Precipitate retreat by central government, without public debate and clearly articulated plans for managing any adverse consequences, could simply provoke an even bigger problem.

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References

1. Ashworth, A. (1993) *The Construction Industry of Great Britain*, Newnes, Oxford.
2. Department of the Environment (1992) Construction R&D: analysis of private and public sector funding of research and development in the UK construction sector - source document, prepared by Innovation Policy Research Associates for the Construction Sponsorship Directorate , DOE, London.
3. Technopolis Ltd (1995) UK National Technology Foresight Programme: Assessment report for the Construction Panel, prepared for the Construction Panel and the Department of the Environment, Technopolis, Brighton.
4. KPMG (1991) Building research and postgraduate education, report to the Construction Industry Council, KPMG Management Consulting, London.
5. Department of the Environment (1996) The funding and provision of research and development in the UK construction sector, prepared by Construction Forecasting and Research for the Construction Sponsorship Directorate, DOE, London.
6. Department of the Environment (1992) Construction R&D: analysis of private and public sector funding of research and development in the UK construction sector-main findings, prepared by Innovation Policy Research Associates for the Construction Sponsorship Directorate , DOE, London.
7. Organisation for Economic Co-operation and Development (1995) National Accounts, Volume 2: 1981–93, OECD, Paris.
8. Organisation for Economic Co-operation and Development (1996) OECD Analytical Business Enterprise R&D: 1973–93, OECD, Paris.
9. Office of Science and Technology (1995) Technology Foresight: Progress Through Partnership 2 - Construction, OST, HMSO, London.
10. Construction Industry Council (1995) Profit from innovation, prepared by Innovation Policy Research Associates Ltd, CIC, London.
11. Office of Science and Technology (1997) *Winning through Foresight: Action for construction*, OST, Department of Trade and Industry, London.
12. Construction Industry Research and Innovation Strategy Panel (1997) Creating a climate of innovation in construction, CRISP Motivation Group, Garston, Watford.
13. Construction Industry Research and Innovation Strategy Panel (1996) Building productivity and profits into the construction industry, CRISP, Garston, Watford.
14. Cooper, I. (1996) The UK construction industry's research capability, presentation to *New Way of Working Conference*, sponsored by the Construction Industry Council and the Department of the Environment, Scandic Crown Hotel, Nelson Dock, London, 15–16 January, 1996.
15. Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P. and Trow, M. (1994) *The New Production of Knowledge: the Dynamics of Science and Research in Contemporary Societies*, Sage, London.
16. UK Government White Paper (1993) *Realising Our Potential*, Cm 2250, HMSO, London.

17. Office of Science and Technology (1996) Foresight: First Progress Report, OST, Department of Trade and Industry, London.
18. Construction Industry Board (1997) The Construction Industry Board, Press Release, 18 June 1997, CIB, London.
19. Latham, M. (Chairman) (1994) *Constructing the Team*, Department of the Environment, London.
20. Anon. (DOE?) (1995) An introduction to the whole industry research strategy.
21. Department of Trade and Industry (1996) Small and medium sized enterprises (SME) statistics for the United Kingdom: 1994, Statistical Bulletin, DTI, London.
22. Abel-Smith, B and Titmus, K. (1987) *The Philosophy of Welfare: the Selected Writings of Richard M. Titmus.* Allen & Unwin, London.
23. Holti, R. and Standing, H. (1996) *Supply chain management and construction*, Tavistock Institute, London
24. Office of Science and Technology (1995) The research councils' response to the recommendation of the Technology Foresight initiative, OST, Cabinet Office, London.
25. Department of Trade and Industry (1996) Extend Quality of Life initiative features prominently in £90 million Foresight Challenge awards, Press notice P/96/473, DIT, London.
26. Higher Education Funding Councils (1996) The 1996 Research Assessment Exercise: the outcome, RAE 96 1/96, HEFCE, Bristol.
27. Brandon, P. (1997) 1996 Research Assessment Exercise: the Built Environment and Planning Panel, Research & Graduate College, University of Salford.
28. Times Higher Education Supplement (1996) Results of the 1996 RAE: special pull out, *Times Higher Education Supplement*, No. 1259, 20 December, 1996.
29. Carolin, P. (1997) United Kingdom research assessed, *Architectural Research Quarterly*, **2**, 6–11.
30. Building Research Establishment, 1995, Annual Review 1995, BRE, Garston, Watford.
31. National Centre for Construction (1996) NCfC welcomes BRE Management Team's commitment to join national centre, Press Release, NCfC, London.
32. Construction Industry Council (undated) The National Centre for Construction: a brief history, CIC, London.
33. Construction Industry Council (1996) 'BRE foundations' must demonstrate real industry ownership, Press Release 96/20, 16 December 1996, CIC, London.
34. Construction Industry Council (undated) The National Centre for Construction: preparing construction for the 21st century, CIC, London.
35. Department of the Environment (1997) Robert Jones announces preferred purchaser for BRE privatisation, News Release 038, DOE, London.
36. Foundation for the Built Environment (1997) First Assembly: Members of the Foundation for the Built Environment, FBE, Garston, Watford, 1July, 1997.
37. Courtney, R., (1997), The Foundation for the Built Environment, BRE Ltd, Garston, Watford.
38. Foundation for the Built Environment (1997) First Assembly: Deputy Chairman's presentation, FBE, Garston, Watford, 1July, 1997.
39. Department of Environment (1995) Partners in Technology: Guidelines for Proposers, Construction Sponsorship Directorate, DOE, London.
40. Technopolis Ltd (1997) Closing report for the PIT 1996 Appraisal Exercise, prepared for the Construction Sponsorship Directorate of the Department of the Environment, Technopolis, Brighton.
41. Raynsford, N. (1997) Promoting innovation in the construction industry, circular letter 5/6/97, Department of the Environment, London.
42. Engineering and Physical Sciences Research Council (1996) *EPSRC's Response to Foresight*, EPSRC, Swindon.