

Innovation in Construction Services

**A scoping study for BERR of
potential research**

**Richard G Saxon CBE
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1. Introduction.

On July 25th 2007 the Construction Support Unit of BERR issued the brief for a scoping study for research into Innovation in Construction Services. A Construction Services Innovation Action Group was proposed by the Secretary of State, to follow up the ideas prompted by a study on service innovation by the National Endowment for Science, Technology and the Arts (NESTA). NESTA observed that construction was one of several industries where innovation did not appear to flow from conventional and trackable Research and Development into technology but perhaps lay in informal, 'hidden' work by service professionals, meeting challenges project by project. The BERR brief suggested a concentration on the interaction between construction customers, usually referred to as 'clients', and their professional advisors. Advisors are a wide and growing group, ranging from legal, property, public relations and financial professionals through the construction industry's design and management professions to experts in building operation and use where they are retained by the client. Most are sector specialists in one of the major areas of this sprawling industry, called upon to help clients with the definition of their need as well as with delivering solutions. The construction industry has clearly developed and improved its performance in the years since the Latham Review of 1994 and the Egan Review of 1998. The improvements have been driven by repeater clients, by pro-active contractors and by client-advising professionals. Contractors have taken a lead in improving project performance by integrating supply chains (the many firms providing design, specialist construction and building products). How the advisors have contributed and how they might be supported to continue towards meeting unmet targets and changing priorities is the subject of the proposed research. The anecdotal evidence that client skill, and the quality of advisor support, is crucial to much innovation and to achieving best value in projects is to be investigated.

2. The questions to be asked.

Construction is a service industry, so defined because it tailors its projects to fit customers' needs on a one-off basis. The service element in its work is enlarging and changing as customers seek more support and better outcomes and regulators increase obligations. Innovation seems to be occurring on projects through the roles of client advisers and construction professionals interacting with clients and each other. The level and rate of innovation differs greatly due to varying factors and to differences between client sectors. This scoping study attempts to identify the key issues and the anticipated benefits of a full study of innovation in construction services.

The questions at the heart of the research are:

1. How does (service) innovation happen in construction projects?
2. How does the context help or hinder innovation?
3. What are the drivers of and barriers to innovation?
4. What could be the scope for innovation if barriers were reduced?
5. How could the government, as customer, regulator and industry sponsor, play a role in stimulating innovation?

3. The objectives of innovation.

There can be said to be 5 kinds of objective for service innovation, though these are not mutually exclusive:

1. Improving occupier or owner performance: the built environment supports value added by occupiers of perhaps 30 times construction cost over its lifetime; innovative configuration or service provision can improve outcomes.
2. Improving externalities: innovation reducing negative or improving positive impacts is often driven by regulation or corporate responsibility motives.
3. Improving whole-life value: operating cost can be several times greater over service life than initial cost; this is a prime area for innovation as understanding improves.
4. Improving project performance: reducing Capex, time, defects, accidents, risk and unpredictability, improving productivity and

profitability: innovations aimed at performance as measured by Key Performance Indicators.

5. Improving the image of one or more stakeholders: innovations done to distinguish a building, its clients or suppliers in the market of reputation.

4. Innovation in service offerings.

In addition to innovation intended to improve customer and societal outcomes, there has also been innovation in ways of offering the component skills and services of professionals. Traditional service patterns, dominant before 1990, involved clients retaining advisors from multiple separate firms, appointing a contractor by competitive tender when design was advanced and arranging project, finance and operational management themselves. Many new varieties of procurement have been tried in recent times, including giving much more responsibility to contractors to deliver design as well as construction, and sometimes also finance and operational services. Professional skills offered to the client have been packaged in multi-discipline combinations led by managers, architects, surveyors or engineers, developers and constructors. Design teams appointed by the client have often been 'novated' (reappointed as if they had always worked for the contractor) to contractors at the latter's assumption of project risk. Some clients have created in-house advisor teams to support continuing programmes. Others have outsourced former in-house teams. Yet others have formed long term 'framework agreements' with advisor firms to provide service on call. Better collaboration and risk management have been much sought after, with new contract forms vying with or combined with the concept of 'partnering' to achieve these goals. Innovations continue to be made in this way, aimed at the client's varied interests and at improving the financial performance of service providers. This has all happened in the context of changing client organisations ranging from highly expert supermarket development teams to local health care trusts with no experience as construction clients. Public clients have been offered guidance based on the government interpretation of the Egan Review, with the Office of Government Commerce setting out a system of Gateway Reviews to ensure that projects do not progress to the next stage before they are ready. Clients have also made use of independent advisors or enablers, not part of the project supply team, to help them define and set up a project and select the suppliers.

5.0 Interactions in the client-advisor team

Four sectors of the industry have been looked at to identify the drivers and inhibitors of service innovation and to look for area where government action would be worthwhile. These sectors were picked for their distinctive patterns of interaction between clients and their professional advisors and for the potential for case studies of innovative projects. In all sectors the key service players around the client can range from legal, financial and property advisors through the design and management professions to service professionals within the construction supply chain and involved in running the building in use. Levels of client skill and confidence and the participation of users differ greatly from sector to sector.

5.1 Housing

The high density, mixed tenure development types created by private developers and Registered Social Landlords (Housing Associations) are selected for study because of the considerable demand for them in the South-East and the pressure for innovation in sustainability and in modern methods of construction (MMC). Developer clients, with creative exceptions, are pushed by regulatory pressures, contractor offerings and design ideas presented to them. The pattern of client-advisor interactions can look like this:

1. Private house-builder/ developer identifies potential scheme, probably with estates advice on the right position in the market;
2. Architect, cost consultant and planning consultant are retained to study feasibility; legal and financial advisors join in.
3. Local authority input causes a partnership with a Registered Social Landlord (RSL) to create the 'affordable' element required. The RSL's advisors influence the scheme.
4. Modern Method of Construction (MMC) approach identified and a supplier engaged to develop the concept with the client's team, to which engineers are added to achieve compliance with Energy Code;
5. Planning application made on the basis of the scheme developed;
6. Main contractor, if not house-builder's own team, engaged with MMC supplier nominated to them;

7. Estates team market the scheme to sell it off-plan and finance the project. Purchasers may order modified fitout or do their own from shell.

Issues constraining innovation identified so far include:

- Lack of conventional R&D and the inaccessibility of tax relief on investment in innovation.
- Conservatism of developers in a market where everything will sell.
- Poor contractor skills in professional team leadership and incorporation of MMC specialist contractors' contribution.
- Lack of order flow for investors in MMC factories.
- Failure to retain successful teams for repeat performance
- Weakening technical skills in the professions and lack of awareness of overseas progress.

Several case studies of recent projects have been identified.

5.2 Schools

The major programme of state school replacement is exposing inexpert client groups to great pressure. The chosen procurement routes are accused of inhibiting good briefmaking and design and whole-life value is elusive for lack of tools and feedback data. The model sequence of client interactions with advisors can run as follows:

1. Local authority education committee identifies Pathfinder project (outside BSF main programme);
2. Educational advisors appointed, plus CBE Enabler to advise on procurement and selection of designers;
3. CBE Enabler recommends Independent Client Advisor to help for the duration of the project;
4. ICA leads initial briefmaking and feasibility studies to define the project and its siting, setting a brief based on the Design Quality Indicator (DQI);
5. ICA facilitates selection process of designers, cost advisors, ICT providers, project managers and constructors, chosen from a pre-

- qualified framework, assembling a team of many skills to take the brief and develop the concept through to client acceptance (through DQI sessions), planning permission and regulation approval. The constructors work as consultants during a two-stage process;
6. The scheme is developed to a high level of certainty and converted to a contractor-led, fixed price contract with the design team novated. The client retains the cost advisor and project manager, alongside the ICA as monitor. A DQI on completion creates feedback.

Issues to consider include:

- The mixture of radicalism and conservatism in the hundreds of educational client and user groups.
- The lack of early involvement of independent client advisors and the reliance on CABA Enablers to control quality.
- Innovations in pedagogy and a desire to involve schoolchildren as clients, both drivers of innovative response
- Scope for better outcomes from better concepts
- The need for structured feedback (from Office of Government Commerce Gateway 5) as a source of value knowledge
- The need for continuous improvement in procurement approaches and in both client and supplier skills
- The potential for standardisation of specification and of some layouts and dimensions.
- The additional scope for innovation provided by the church and academy schools on the edge of the state system.

Case studies have been nominated from across the sector spectrum.

5.3 Office buildings.

Commercial office development, centred in and around London, is a sector with expert clients but only indirect occupant involvement at the construction stage. The market is very competitive, with supply often ahead of demand. The scope to build high-rise blocks in the City and Canary Wharf has triggered a wave of ambitious, innovative projects where involvement of signature architects is

often seen as essential to winning permission. There are also cases of systematic innovation over long periods by established teams. The advisor-client pattern on a project can look like this:

1. Developer identifies potential project, with estates advice;
2. Architect, space-planning advisor, cost consultant and planning consultant appointed to explore the potential; legal and financial advisors are engaged.
3. Planning permission is sought on an outline concept;
4. Marketing/letting consultants seek a pre-let tenant and probably a funding partner. Tenant and funder advisory teams influence the concept, often in contrary ways;
5. A construction partner is appointed once the project looks likely to go ahead, with their advisors and input also from specialist constructors and cladding consultants; the project is value-engineered;
6. The developed scheme design returns to the planning committee for re-approval.
7. The constructor takes over the client's design team to do detail design and documentation of the 'shell and core', with the client retaining cost advice.
8. The tenant's design team carries out their subproject, with their own Facility Manager's input, fitting out from bare shell stage. The work is often done by the main constructor. Fitout cost can equal the cost of the shell.

Issues identified include:

- The pressure from new and planned regulations where uncertainty of intent and of practicability is considerable (e.g. 10% renewable energy to be gathered on site)
- Competition between major long-term commercial developers, often using innovation as a weapon and using established teams.
- Relative decline of owner-occupier development which is typically more innovative than commercial building

- Use of formally inventive designers pushing design and construction technology, creating on-project R&D
- Conservatism of the estates advisors and the dominance of investment value criteria over use value
- Strong international awareness of all involved
- Shortage of preferred contractors, leading to an exploitable situation on their early involvement
- Innovations forced by skill shortages and sometimes imported from other industries.
- Successful long-term value-management by some teams in continuously improving the product whilst containing cost.
- The value of the British Council for Offices (BCO), a cross-industry society, as a research focus and diffuser of innovations down to later adopters.

Case studies suggested include a proposed City high-rise, a business park and a corporate headquarters as a contrast.

5.4 Retail development

The retail development sector has similarities to the office development sector but also significant differences and much longer development cycles. Retail development is now largely confined to town centres by government policy and has become the key animator or regenerator of centres. Mixed use is now typical, with leisure and residential often as major elements. Sustainability concerns are affecting both local authority and developer ideas increasingly. The past decade has seen continuous innovation in what is proposed and in how teams are organised to do it. The pattern of advisor-client interactions can look like this:

1. developer client appoints estates advisors to consider a potential project; if it looks interesting -
2. A feasibility team of architect, cost consultant and planning consultant is appointed to develop the brief and explores the site issues; legal and financial advisors join in.

3. A funding partner may be sought, though this can happen at different times. The funder's advisors overlay ideas on the client's team.
4. Pre-let anchor tenants will be sought. Their advisors overlay ideas. There is legal work to create agreements throughout the project.
5. Engineering consultants are added to develop the necessary ideas to submit at the planning application stage. Centre management, branding, traffic and environmental consultants may be added. Public consultation consultants will probably be employed with their feedback contributing.
6. The scheme progresses through planning. By the time it is cleared 6-9 years may well have elapsed from step 1, with the scheme changing radically as time passes, both reactively and proactively.
7. Constructors are engaged and review the design for buildability and cost reduction. A contractor-employed executive design team may enter, with the client's team retained as advisors.
8. During construction the letting campaign produces a stream of tenant change requirements to the shell and service provisions, processed through the client's team to the constructor's.
9. Tenant fit-outs from bare shell are sophisticated mini-projects, fitting into the rules set by the client. Completion is typically 11 years after step 1.

There are complex interactions involved and sub-teams of advisors working with sub-clients (funders, insurers, tenants and constructors). The sort of innovations occurring in the recent past, and the issues arising now are:

- The move away from monolithic, enclosed centres to separate blocks along open or canopied streets with mixed uses;
- 'Laminating' of housing around blank retail and parking volumes;
- Masterplans with separate architects for each building, though usually with common engineers and contractors.
- 'Sustainability' solutions such as natural ventilation, day lit stores, combined cooling, heating and power systems (CCHP) across whole districts of mixed uses, green or parkland roofs;

- Introduction of useful product advances to achieve goals;
- Early (post planning permission) involvement of constructors with their own design teams acting as executives of the client's concept design;
- Use of advanced CAD techniques for visualisation, simulation, co-ordination and rehearsal of construction.
- The dependence of this development model on the continuance of PPG6 and its prevention of low cost out-of-town development.

Government influence on the sector centres on its planning policy regime and the increasing importance of planning and building regulation sustainability rules. Both drive and constrain innovation by advisor-client teams and their constructor partners. Some research sponsored by the British Council of Shopping Centres (BCSC), a cross-industry society, has clarified ideas and rationale for wider adoption.

Case studies of recently completed and ongoing retail projects are identified.

6. Conjectures for testing

Several common themes emerged from scoping interviews which could be tested in formal research:

- Innovation comes largely from a self-selected 'pioneer' group of clients, consultants and suppliers who seek each other out. The rest of the market may adopt innovations when they are deemed proven.
- The motivation of the pioneer innovators is both the creative urge and the desire for market positioning.
- Much innovation is project-specific and is not always captured as reusable knowledge.
- Main drivers of innovations are market and regulatory changes, including supply shortages.
- Stimulants include client confidence; long-term programmes and teams; use of 'pioneer' professionals.

- Inhibitors include lack of client confidence; risk-aversion; public procurement policies; team discontinuity; market failure to back regulations with research or to maintain standards documents; distortions from the VAT and PII regimes.

7. Potential for government action in support of service innovation

There has been considerable progress in the construction industry since the Latham review of 1994 and the later Egan Review of 1998. Many changes have been introduced under both government aegis and changed industry culture. There is scope for further action is to build upon the successes of the past 13 years and rebalance emphasis. This also occurred a few years ago with the introduction of sustainability thinking into the mix of policies. Arguably there is now room for more emphasis on enabling construction to create better outcomes for society and the economy through innovations in service provision. Customers still get outcomes related more to their skill level than to their needs.

Areas where development is possible in the next few years include:

1. Stronger pre-project and early-stage consultancy support to clients, better identifying needs and value propositions;
2. Better whole-life-cycle service offers and procurement options;
3. Sophisticated ICT support to briefmaking, design, construction and building operation, enabling users and regulators to sign off on simulations of proposals, constructors to gain speed, reduce risk and avoid defects and building managers to cut costs;
4. Project insurance offers supporting more innovation and better teamwork and giving better protection to clients;
5. Introduction of technologies for new and refurbished buildings to achieve major reductions in waste and fossil energy need;

In these areas are the answers to the question “What could be the scope for innovation if barriers were reduced?” The extent to which these innovations will arrive anyway as a result of market forces will always be debated. However, with the fragmented and short-termist nature of the industry inhibiting investment, there is a list of potential actions for the government as client, regulator and industry sponsor which could combat market failures:

- Building up inexperienced public and private clients' skills and supporting them with strategic client advice services from the first moment;
- Promoting continuous improvement in public procurement methods to achieve more effective client relationships with their advisory team and more effective outcomes;
- Developing the scope and accessibility of feedback from public projects through the Gateway 5 (post project evaluation) protocol; encouraging accessible private sector feedback records.
- Encouraging the early engagement of facility management (FM) advice to address whole-life costs and value at design stage;
- Increasing UK awareness of international achievements in construction service innovation;
- Ensuring that proposed regulations are backed by adequate research and affordable model solutions to enable effective innovation in response;
- Supporting pilot projects for promising but initially uneconomic technologies;
- Making R&D tax relief more accessible to innovators;
- Supporting the maintenance and expansion of national Standards where the market falls down, to empower innovators and maintain international competitiveness in construction intellectual property;
- Improving and integrating regulation methods and preventing local variations which inhibit the innovator offering a product across the country;
- Promoting the use of IBIM (interoperable building information modelling) as a major platform for innovation in product and process, from start to post completion;

- Promoting the emergence of project insurance, to overcome the divisive and anti-innovation effects of present professional insurance methods on client advisors;
- Removing the distortions created by the VAT regime on advice given to clients;

8. Scope of the proposed Research

The research work this autumn is limited in scope by the time and data available. Of the five objectives of innovation listed at the start, the fourth objective group, focussed on the achievement of better project performance, is most ready to be studied. The set of 'Demonstration Project' case studies collected by the Movement for Innovation (M4I), now part of Constructing Excellence, is a source for studying the service innovation component and its drivers and inhibitors. The Demonstration Projects proved the Key Performance Indicator concept for measuring construction project performance and the nominated projects out-performed industry averages significantly. This out-performance may well have been the result of service innovations, in organisation, methodology and leadership. The recorded problems of the industry in learning from these well-publicised demonstration projects illustrates barriers to diffusion of innovation. The question of how the better performance was achieved was not part of the studies.

Projects from the four sectors looked at in this scoping study might be selected for this initial study. It may be necessary to re-visit the selected cases to find answers to questions, like how the teams innovated, which were not asked at the time. The analysis of this data can then be set before a cross-industry group to validate the information emerging and the recommendations for government action.

The other innovation objectives justify further study when possible. Metrics to analyse them are becoming available, in the following ways:

1. Improvements to occupier performance: the 'Functionality' scores in the Design Quality Indicator (DQI) will be valuable, available for 800

projects in the Construction Industry Council (CIC) database. This will identify likely innovators. Post Occupancy Evaluation (POE) data from Gateway 5 records will become available, illustrating how far projects achieved their functionality goals. The service innovations involved and issues raised would need to be uncovered;

2. Improvements in externalities: the 'Build Quality' and 'Impact' scores from DQI records will be useful, as will 'Excellent' BREEAM scores, in revealing innovators. These can then be matched with case studies of the innovation pattern.
3. Reduction in Whole-Life Cost (WLC): 'Build Quality' scores from the DQI will indicate promising schemes. Application of the forthcoming Treasury Green Book Supplement method for assessment of WLC, compared to POE data, can be related to case stories. A standard measurement method, to ISO 15686, has been adopted.

It is the contention of this scoping study that there is a case for the fuller research and for departmental action to enhance the progress of the last decade and more. The major potential change is for the industry's sponsor department to see better how it can improve construction's ability to serve the national interest, and to do so through considering much wider ranging issues than the uptake of new technology.

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Appendix.

This scoping study was carried out with support from the BERR Construction Support Unit and with input from a wide group of consultees across the industry. Structured interviews were held with the following people, recognised as 'thought leaders' in their customer sectors:

Housing: James Pickard of Cartwright Pickard Architects.

Schools: Sunand Prasad of Penoyre and Prasad.

Offices: Karen Cook of Kohn Pederson Fox and Peter Williams of Arup.

Retail: Jeremy Sweet of Building Design Partnership.

Projects suggested for case study at the appropriate stage were:

Housing:

- Caledonian Winton project at Kings Cross;
- £60,000 home prototypes
- White City shared ownership scheme.

Schools:

- Jo Richardson School, Barking;
- Bexley Academy;
- Minster CofE school, Southwell

Offices:

- Pinnacle Tower, City of London;
- Chiswick Park development;
- Roche HQ, Welwyn

Retail:

- Chapelfields, Norwich;
- Paradise Street, Liverpool
- Tesco project, Tolworth, Kingston.



Richard G Saxon CBE
BArch (Hons Lpool) MCD RIBA MCI MIOB FRSA

consultancy for the built environment

richard@saxoncbe.com www.saxoncbe.com
t +44(0)20 7585 1976 m +44(0)7768 482 838
9 Whistlers Avenue London SW11 3TS UK