Innovation in the cladding industry

Report authors

John Connaughton	*Davis Langdon and Everest Consultancy*
Neil Jarrett	*Construction Innovation and Research Management Division, Department of the Environment*
Elizabeth Shove	*Centre for the Study of Environmental Change, Lancaster University*

FOREWORD

This report describes a study carried out for the Department of the Environment (DoE) to guide its sponsorship of the cladding industry and to test a methodology for similar studies relating to other areas of construction. The study is one of many current DoE initiatives contributing to improving the use of construction research.

The aim is to understand the business environment, culture, and attitudes shaping the industry and influencing its ability and desire to innovate. The study analyses the organisation and economics of the UK cladding industry, attending to its strengths, weaknesses, and opportunities for innovation.

Process maps showing interactions between organisations involved in the cladding industry are used to:

- evaluate the need and scope for cultural and organisational change to increase innovation within the cladding sector
- evaluate research options
- understand the potential for improving the competitiveness of UK plc

The resulting analysis can be used to evaluate the potential impact of research proposals submitted to the DoE and provides background information for the formulation of research strategies in the cladding industry.

CONTENTS

EXECUTIVE SUMMARY

Changing the UK cladding industry

The following issues affecting improvement of the UK cladding industry have been studied:

- The influence on competitiveness and innovation of the commercial priorities of organisations, risk and liability, and organisational structure.
- Issues affecting the industry's motivation to change.
- The economic strengths and weaknesses of the UK cladding industry.
- The need for changes in the structure and organisation of the UK cladding industry to improve the use of research results.

The study evaluates the relationship between cladding research and cladding practice. Its findings have significant implications for future patterns of government funding in support of the cladding sector and throughout the construction industry as a whole. Much government funded research is not used because:

- It does not fit with the commercial priorities of key parts of the industry.
- Researchers, and industry representatives that advise on research priorities, often do not take account of organisational and commercial constraints that can prohibit the effective use of research results.
- Many subjects that appear beneficial to researchers, are totally inappropriate for solving the problems that they set out to address.
- The UK cladding industry is weak and fragmented and often not in a position to exploit research results.

Current patterns of R&D and needs of the cladding industry

Current research and development in the cladding sector largely mirrors the technical and organisational concerns expressed by the UK industry. Specific projects include the development of testing procedures and of dynamic and intelligent facades, and the improvement of fixings and sealants. It is often wrongly believed that the innovations resulting from such research will be introduced by architects and specifiers in response to their clients' requirements, and that these innovations will 'trickle down' to the systems designers, fabricators and installers that comprise the cladding industry.

Although architects and specifiers remain an important route to innovation, the limits to that innovation are fixed by the interests and commercial preoccupations of other sectors of the industry, particularly the systems designers. Technical change is likely to be initiated at several different levels throughout the industry, often in response to non-technical priorities such as speed of assembly, marketability and speed of cash flow. For example, from the systems designer's point of view, the only worthwhile innovations are those that are attractive to fabricators or that meet the particular requirements of architects and specifiers. The fabricator's scope for innovation, on the other hand, is limited to devising novel fabrication techniques that will improve competitiveness.

The influence of the strength of the UK cladding industry

Innovation is not motivated by the structure of the UK industry. Despite the presence of several major systems design companies, the UK industry is relatively weak and fragmented. It experiences considerable competition from the UK-based subsidiaries of European and other outside systems designers, many of which benefit more from the findings of UK research than the UK companies themselves.

Implications for government support

There is unlikely to be a miracle cure to help the UK cladding industry. Investing in research in the forlorn hope that the industry will one day expand to compete against large European companies is unlikely to give high pay offs from government research funding.

There are two major implications for research funding arising from this study:

- There is little point in funding technological research if the industry for which the research findings are intended is unable for structural, financial and organisational reasons to benefit.
- Future research aimed at improving the performance of cladding systems and the competitive position of UK suppliers should focus more on improving the links between specification, design and manufacture. In particular on improving the links within the UK cladding industry, particularly those between systems designers and fabricators.

1. Background

Patterns of Government funding for building research in the UK are changing, and greater emphasis is now being placed on joint-venture projects with funding from industry. This has implications for the type of research being carried out. Government organisations, higher education research establishments and industrial research departments are all focusing less on generic research and more on collaborative projects designed to meet the specific requirements of the industries involved.

The Department of the Environment's (DoE) Construction Innovation Research Management (CIRM) Division has recently completed an assessment of the potential need for research and innovation to help the UK cladding industry. The objective is to ensure that future funding is directed towards those research projects that will enhance the competitiveness and performance of the UK industry and its construction clients.

To maximise the effectiveness of its support, CIRM is focusing on two main research areas:

- activities designed to meet the cladding industry's need for improved product quality, reduced costs and shorter installation times;
- studies of the economics and structure of the industry to determine the ability of the UK industry to benefit from research.

This report establishes the link between the cladding industry's needs and the take-up of research findings. Until recently, most building researchers assumed that the technical improvements resulting from their carefully conducted research would be automatically adopted once industry was properly informed. When it became evident that this was not the case, the response was to place a much greater emphasis on promotional activities designed to 'get the message across'. This, however, merely highlighted both the limited relevance of much of what was being promoted and the scattered and fragmented nature of the 'market' for information.

In 1993, the Government White Paper on Science and Technology, *'Realising Our Potential'*, clearly reiterated the link between the selective funding of research projects related to the needs of industry and the subsequent adoption of the results [1]. The same shift in emphasis was noted in the DoE's Application Strategy for 1995: 'user needs must be considered at the start of every research project and re-evaluated throughout the project' [2].

This project evaluates the relationship between cladding research and cladding practice, and assesses the relevance of current theories of technical change and innovation to the cladding industry.

Its findings have significant implications for future patterns of research funding, not only in the cladding sector but in the construction industry as a whole.

2. Study aim, rationale and methodology

2.1 Aim and rationale

The main purpose of this pilot study is to establish an understanding of the socio-economic circumstances that limit or encourage technical innovation within one component (the cladding sector) of the building industry. This involves:

- examining the structure of the cladding sector;
- detailing the interactions involved in its operation and showing how these influence innovation.

The findings allow those responsible for research funding, whether Government or independent organisations, to improve the relevance and application of the research projects supported, thereby furthering the development and adoption of appropriate new techniques. They also highlight for Government the more significant opportunities for supporting the industry to achieve its goal of increasing competitiveness. Both the industry and its users are likely to benefit.

The cladding industry was selected for the study for several reasons:

- The British cladding industry appears to be lagging behind its European counterparts. Cladding systems have a poor reputation in terms of weather tightness and performance, suggesting that there is scope for innovation and improvement.

- Cladding systems depend on the effective combination of a number of separate elements (glass, gaskets, sections, sealants, panels and fittings) that are designed, sold and assembled by a range of quite separate organisations.
- The organisations involved, which include aluminium extruders, systems designers, fabricators and main contractors, vary considerably in size and type. Some are national: others are international. Some are specialist: others offer a more general range of services. Some are large: others are small.
- Priorities vary from one end of the market to the other. At the top end of the market, both clients and specifiers are usually concerned with the aesthetics of the chosen cladding system as well as its technical performance. More standardised systems appear to reflect other priorities. Varying priorities are likely to have a bearing on the processes of technical innovation.

2.2 Methodology

The study has focused on non-structural aluminium-based cladding systems. Relevant information has been obtained from a telephone survey of cladding companies (details are given in Appendix 1) and 16 interviews ranging across the whole of the industry, from clients and architects to fabricators and main contractors. Particular attention has been given both to the economic concerns of the different types of organisation and to their potential for encouraging innovation. The views of researchers have also been considered. Appendix 1 gives some information on the strengths and key markets of UK cladding companies and UK based subsidiaries of foreign companies.

3. Current patterns of research and development

The current pattern of research and development in the cladding industry largely mirrors the technical and organisational concerns identified by the UK industry – weather tightness, standards of workmanship, foreign competition and under-capitalisation within the industry.

The Centre for Window and Cladding Technology (CWCT) responds specifically to the research needs of its industry sponsors [3], feeding the results back to its members and to others in the form of reports, standards and guides, for example the 1993 Standard and Guide to Good Practice for Curtain Walling [4].

Other research is tackling the industry's problems and opportunities from an engineering perspective, for example:

- the development of testing procedures (Building Research Establishment) . . . . . ;
- the development of dynamic and intelligent facades, a CD funded project seeks to transfer advanced technology from high tech industries to the cladding industry (Arup Facade Engineering);
- fixings and sealants (Construction Industry Research and Information Association).

The consensus view is that the industry faces a set of issues that can and should be studied to develop a generalised, broadly relevant knowledge base. This view is summarised in a recent (1994) statement from the Cladding Development Group at BRE:

> 'The mission for the research at BRE will be to establish and advance the basis for the design of cladding systems. The disparate functions of cladding systems will be considered within a complete engineering framework with advances in design founded on a proven and reliable knowledge base.' [5].

4. Innovation in the cladding industry: the conventional view

Innovation within the cladding industry is widely believed to originate in the activities of architects and specifiers (Fig 1). It is they who advise the client as to the options available. It is they who set the requirements and targets in terms of appearance and performance that the industry must then meet. In the conventional view, the introduction of innovative ideas and techniques depends on their beliefs and practices and on the preferences and priorities of their clients.

Subsequent diffusion of the new techniques has frequently been assumed to follow a linear pattern. Innovations, which are normally both more costly and more risky than tried and tested solutions, are applied first to high-status buildings. New technologies are expected to 'trickle down' until adopted by those working on less prestigious projects. Relative costs and the perceptions of risk are believed to be the critical determinants affecting the speed of this diffusion.

Organisation	Activities
The Client ↓	Commissions the building and sets the standards in terms of cost, building performance and value for money.
The Architect/Specifier ↓	Interprets the client's needs, designs and specifies the performance of the cladding system and, where appropriate, introduces new techniques.
The Systems Designer ↓	Designs and develops the system in response to the architect's specifications.
The Fabricator	Manufactures and installs the system.
Other participants, for example main contractors, glazing manufacturers and gasket and sealant makers, have a marginal role.	

Fig 1 Decision-making and innovation: the conventional view

5. Innovation in the cladding industry: the role of the main industry players

Although the hierarchical innovation and diffusion patterns described above are widely held to exist within the cladding industry, the study results showed few signs of any linear sequence of influence and little evidence of the trickling down of new ideas or any progressive reduction in cost and risk. Innovation can be initiated by various industry players – systems designers, fabricators and architects/cladding consultants.

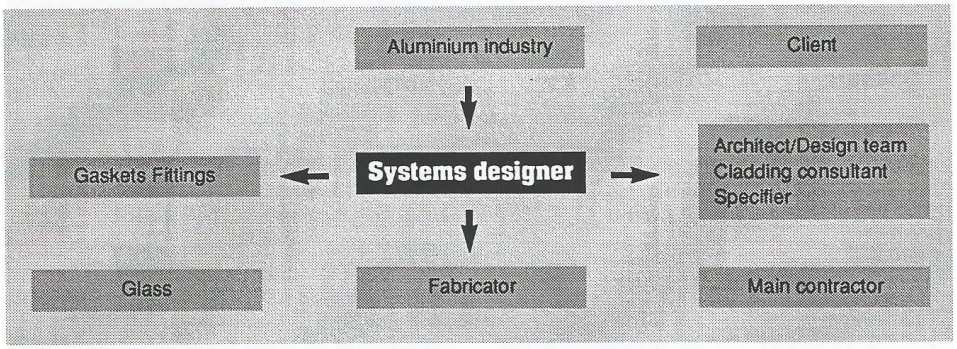
The role and innovation potential of each of the main industry players is summarised in the following paragraphs and diagrams. Further details are given in Appendix 2.

5.1 The Systems Designer

Systems designers are responsible for designing the aluminium sections used for cladding and the methods to be used in their fabrication and assembly. Their business depends on establishing close links both with fabricators and with those responsible for design and specification (Fig 2) . The first allows designs to be turned into workable buildings. The second ensures a supply of work for the systems designers and 'their' fabricators.

Systems designers achieve close links with fabricators in one of two ways:

- by designing systems that allow fabricators to shop around for the necessary components;



Key features:

- Systems designers depend on a reliable network of 'good' fabricators.
- Systems designers seek to secure firm specifications for their systems. They achieve this using targeted sales literature and by providing attractive package deals for architects and specifiers.
- Systems designers compete with each other both for specifications and for the services of fabricators.
- Worthwhile innovation from the systems designer's point of view is of two types:
  - innovation that is attractive to 'their' fabricators and therefore likely to strengthen the links between systems designers and fabricators;
  - innovation that is likely to meet the perceived needs of architects and specifiers, thereby strengthening the case for using the systems designer's standard product.

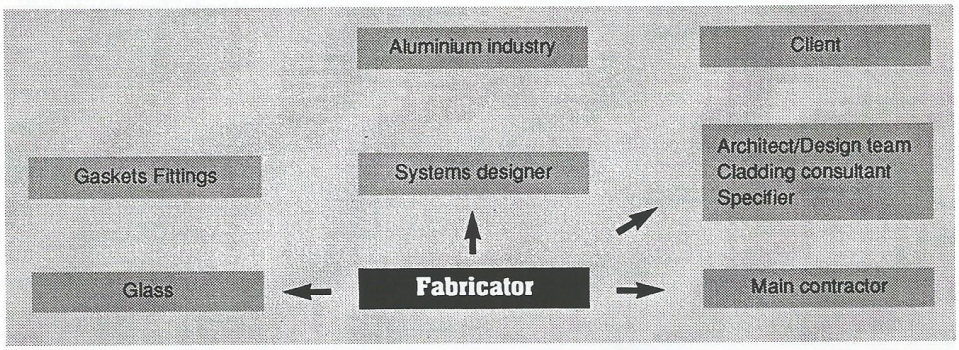
Fig 2 The role and innovation potential of the systems designer

- by developing systems that only function with the range of components for which the systems designer is the exclusive supplier.

Systems designers promote their cladding system as a unique solution to a range of whole-building design problems. Their influence on innovation is considerable and can operate both at the system level and at the material or component and material/component interface levels. Their main concern is with system performance, but they are constrained both by their knowledge and experience of what works and by the resources they have already invested in the development of their system.

The only worthwhile innovations from the systems designer's point of view are:

- those that are attractive to fabricators – reducing overheads and costs or facilitating the fabrication/installation process;



Key features:

- Fabricators obtain their work in one of two ways:
  - by maintaining close links with one or more specific systems designers, despite the potential dangers of close dependence;
  - by developing and maintaining contacts with architects and design teams and with main contractors (the fabricator's real customer).
- Fabricators compete with each other in terms of the efficiency with which they install standard systems and/or in terms of their ability to manage cash flows and strike good deals with other suppliers.
- UK fabrication companies are relatively small but represent a critical financial link in the process of buying and selling hardware. Their size means that they rarely have the capital or resources appropriate to the major cladding contracts. Such contracts often go to foreign firms.
- Fabricators occupy a relatively 'exposed' position in terms of detailed design responsibility.
- Innovation is limited to the internal development of fabricating techniques that will give individual companies a competitive edge.
- Innovations introduced by architects or systems designers will only succeed if they are acceptable to the industry's fabricators.

Fig 3 The role and innovation potential of the fabricator

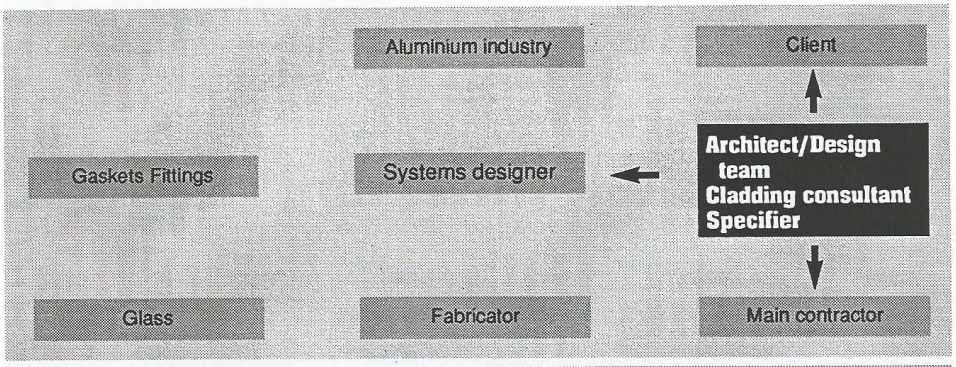
- those that meet the particular requirements of architects and specifiers, thereby encouraging the adoption of the systems designer's systems.

5.2 The Fabricator

Fabrication companies are responsible for fabricating and installing specified cladding systems. They obtain their work:

- by maintaining close links with one – occasionally more – specific systems designers, thereby limiting the competition and reducing the time spent in tendering for contracts;
- by developing contacts with architects and design teams, thereby complementing and sometimes duplicating the sales efforts of systems designers;
- by establishing good relationships with main contractors who may be in a position to modify specifications to their benefit (Fig 4).

These companies operate in a highly competitive environment in which profit levels depend on speed and efficiency and on the use that is made of opportunities to shop around for glass and, where possible, other component parts. They rely on their own knowledge and developed expertise to retain their competitive edge. They also face a number of difficulties:



Key features:

- Architects tend to have an idealised view of the cladding industry that does not conform with reality.
- Architects maintain links with systems designers in the cladding industry because cladding has a considerable impact on the building's appearance.
- Architects remain wary of sales pressure related to standardised cladding systems, particularly for work at the upper end of the market where buildings are required to be distinctive.
- Architects will sometimes use the services of a cladding consultant, particularly for prestige jobs at the upper end of the market.
- Although architects and their clients can stimulate innovation, particularly at the upper end of the cladding market, it is the systems designers who ultimately set the boundaries of what is and what is not possible.
- At the lower end of the market architects depend on systems designers for advice. They should therefore be regarded less as the initiators of innovation and more as the victims of the industry, particularly its systems designers.

Fig 4 The role and innovation potential of the architect/cladding consultant

- involvement with a single systems designer can give rise to timetabling problems if delivery of the necessary sections is unreliable;
- they rarely have sufficient capital or resources to tackle major jobs;
- they may be held liable for system failure if they depart from the detail of the system specified.

Fabricators are concerned with system installation and buildability. Their scope for innovation is therefore limited to the devising of novel fabrication techniques that will give them a competitive edge by reducing their installation costs. They are unlikely to share this hard-won expertise with potential competitors or to participate in novel collaborative ventures.

5.3 The Architect/Cladding Consultant

The role of the architect is to translate the client's requirements into a design that is both acceptable to the client and practicable for the systems designer (Fig 4). Because of their concern with building image and performance, architects tend to be wary of standardised cladding systems, expecting systems designers to be imaginative and innovative in meeting their requirements. This approach suggests that they are not always fully conversant with the industry's existing structure.

Architects are to some extent responsible for innovation, particularly at the upper end of the cladding market where style is of real commercial significance. Their interest is strongly project-specific and mainly at the system performance level. They view the cladding system as part of a larger building 'system' and as part of the solution to a unique design problem. The ultimate boundaries, however, are set by the systems designers. It is they who determine what is on offer and what makes sense commercially both for themselves and for their fabricators. Elsewhere in the market, the systems designers are even more 'in control', providing standard solutions while recognising that architects must retain a sense of responsibility as well as a liability for the finished design.

5.4 The Main Contractor

The main contractor is an important link between the design/specification process and fabrication/installation (Fig 5). Although their role varies with the type of contract and the kind of service provided, main contractors frequently occupy a position of some power. They can often influence the final specification, and their selection of fabricators is limited to those they perceive to be financially healthy.

Most main contractors remain wary of new technologies with their perceived potential for failure. When faced with an unusual specification, most will try to make the scheme work. Others will respond by seeking to ensure that any liability falls elsewhere, should problems arise.

6. Identifying the opportunities for future innovation in the cladding industry

Innovation within the cladding industry can take place at three different levels:

- at the materials or components level, to enhance performance and reduce relative costs;
- at the material/component interface, to enhance performance;
- at the cladding system level, to enhance performance and possibly, though not necessarily, to reduce costs.

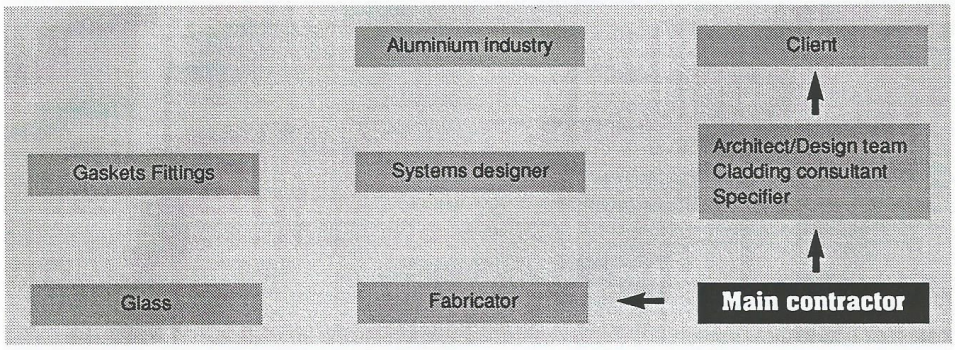
Important opportunities for innovation can also arise upstream of the construction process, with each component manufacturer seeking to improve manufacturing performance and/or reduce costs.

6.1 The potential for innovation of each project type

It is possible to identify three broad types of project, each with its own potential for innovation:

- *Prestige projects* involve technically complex cladding systems that are either largely bespoke or require the considerable modification of existing standard systems. They have a number of key features:
  - financial freedom to customise existing systems;
  - cladding consultants as the interface between architects/clients and systems designers;
  - a fabricator who is likely to be a nominated sub-contractor to the main contractor.

  Prestige projects provide both the architect/cladding consultant and the systems



Key features:

- The main contractor provides the link between design/specification and fabrication/installation.
- Main contractors, as the immediate customers of the industry's fabricators, are in positions of some power. Their influence over the final specification can have serious implications for the survival or closure of individual fabricating companies.
- Main contractors contract work only to fabricating companies they believe to be financially sound and to have a good performance record.
- Main contractors are wary of new technologies and their perceived potential for technical failure. They give careful consideration to liability issues.

Fig 5 The role and innovation potential of the main contractor

Table 1 The opportunities for innovation

Level of innovation	Purpose of innovation	
	To enhance performance	To reduce relative cost
Material/component	Project type: Prestige Key participant: Systems designer	Project type: Standard Key participant: Fabricator
Material/component interface	Project type: Mid-range Key participant: Systems designer	
Whole system	Project type: Prestige Key participants: Architect/designer and Systems designer	Project type: Standard Key participants: Fabricator and Systems designer

designer with opportunities for enhancing whole-system performance. This, in turn, may require innovation at the individual materials/components level and during system installation. However, the more such innovations depart from standardised systems design, the less likely they are to be applicable at the wider level.

- *Mid-range projects* involve only minor modifications to existing standard systems. Their key features include:
  - a restricted budget;
  - modification of the cladding by the systems designer to meet architect's requirements/ specifications;
  - a fabricator who may be a nominated sub-contractor to the main contractor.

  The mid-range project provides an opportunity for the systems designer to enhance whole-system performance and, in particular, to undertake incremental improvements to the interfaces between system materials/components. Because the degree of departure from standardised systems is less, the replication potential for any innovation is very much greater.

- *Standard projects* involve economical, off-the-shelf cladding systems requiring little or no modification. Their key features include:
  - a very restricted budget;
  - designs standardised by the systems designer with little input from the architect;
  - a fabricator who may be a domestic sub-contractor to the main contractor;
  - a main contractor who may exert a strong influence over the buildability and cost of the cladding system installed.

  The standard project offers limited scope for innovation in systems design. The greatest requirement is for economy and efficiency of installation, and the fabricator will therefore seek to reduce costs by improving the buildability of the whole system or by using lower-cost materials/components where appropriate.

These findings are summarised in Table 1.

6.2 The innovation potential offered by the current research environment

Research currently funded by the Department of the Environment or identified in the CWCT review of research needs tends to fall into one of four categories:

- research that seek to understand a specific problem or process, one of the most significant being weathertightness;
- research devoted to the development of advanced products or techniques;
- the development of test methods for assessing fitness for purpose;
- the preparation of standards and good practice guidance to encourage the take-up of research or best practice.

Research into weathertightness

Many weather-tightness problems occur either because of difficulties encountered when adapting standard cladding systems to complex building shapes or, more frequently, because of the complexities associated with one-off bespoke designs. Common failures involve the ingress of water or air through joints. Most appear to occur within 12 months of installation due to poor design and/or workmanship.

Three common cladding scenarios have been identified:

- Standard systems used in standard applications. Standard systems are self-regulating. Problems with new systems are rectified by the systems designer, minimising the likelihood of similar faults in future systems.
- Standard systems adapted to non-standard applications. Failure may occur if the systems selected were inappropriate for the non-standard building. Defects are reduced by improving the system selection process.
- One-off bespoke arrangements. Failure usually associated with poor design or workmanship. Poor workmanship can usually be alleviated by paying more attention to fabrication and installation at the design stage.

The problems that arise in the second and third of these scenarios are clearly the result of inadequate interaction between those operating in the cladding industry's three main design environments: building design, cladding system design and fabrication detail. The solution lies in integrating the design, manufacture and construction processes rather than in developing new technological solutions through the research proposed in the CWCT review. There appears to be no ready home for generalised technical advice, and research geared towards the production of such advice is unlikely to have any significant impact on installation quality.

The development of innovative products

One of DoE's main aims in funding research is to increase the competitiveness of UK goods and services. Several innovative cladding projects have recently been funded by the DoE 'Partners in Technology' programme, and the challenge for DoE is to ensure that technologies such as those being developed in the Ove Arup project (see Section 4) can be exploited to the UK's advantage.

The findings of this study suggest that the UK cladding industry is unlikely to benefit from such research. Its individual component organisations are too small either to finance the exploitation of the new technologies or to carry the risks associated with bringing advanced systems to market. Fabricators do not have the capacity to invest in training or in the implementation of innovative technologies or techniques. Their primary concern is to stay in business. Even the usually more profitable systems design firms are largely concerned with maintaining profit levels.

The UK industry contrasts strongly with the equivalent industry in mainland Europe and the USA. There, cladding companies that operate in the wider European or world markets are in a better position both to carry out their own research in-house and to exploit the findings of research carried out elsewhere. Paradoxically, UK technological research such as that represented by the Arup project is more likely to benefit foreign competitors than the UK cladding and construction industry.

The adoption of research findings

Current research output usually takes the form of technical reports, standards and scientific papers. CWCT reports are sent to CWCT members. Other DoE-funded work may only be distributed within DoE. This approach to dissemination is unlikely to result in action at the industry level. Little attention has been paid to identifying the key decision makers to whom relevant information should be targeted. Still less attention has been paid to the different and sometimes conflicting interests of the industry's component organisations.

6.3 The innovation process in practice

The innovation process in the UK cladding industry can be summarised as follows:

- Technical change is initiated at a number of different levels throughout the industry, often in response to what appear to be the non-technical priorities (speed of assembly, image, marketability, speed of cash flow) of the various types of organisation (Fig 6).
- Relatively little change is stimulated by questions relating to the ultimate technical performance of the building or to issues of weathertightness and durability. This is probably because there is no one sector of the cladding industry to which such questions really make sense.

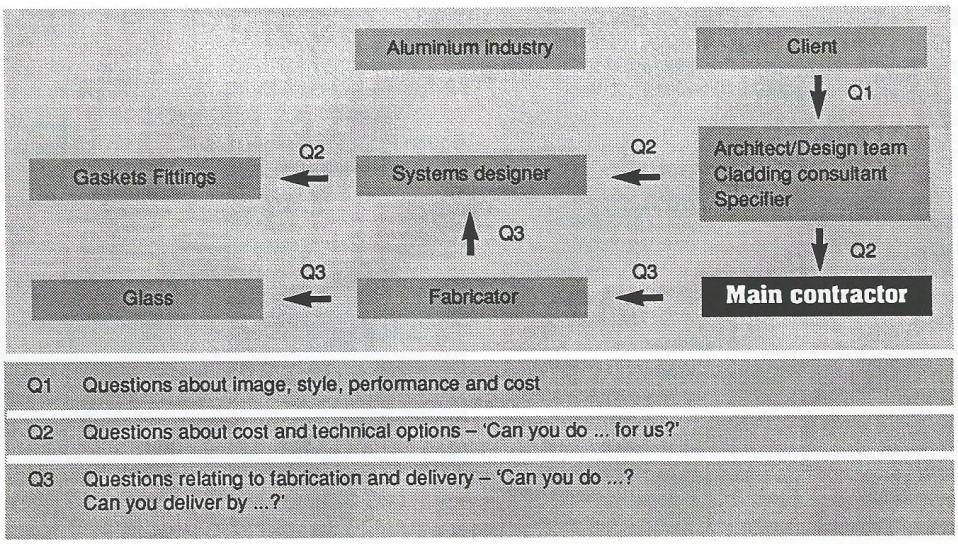


Fig 6 Questions that are likely to stimulate change

- Architects and specifiers remain a potentially important route to innovation. However, the limits to that innovation are fixed not by the specifier but by the interests and commercial preoccupations of other sectors of the industry. Architects have little control, for instance, over the range of cladding options available. The systems illustrated in the glossy brochures offer practical working answers to what are essentially systems-design questions: they also reflect the interest of other sectors of the industry in changes that can improve their own performance and profitability. Nor do architects control the way in which individual systems are sold, presented and prefabricated. Even apparently firm specifications may be modified and redefined to accommodate the interests of lump-sum contractors, competing systems designers or rival fabricators.
- The fact that innovation is possible throughout the industry can create problems. Solutions devised in one section of the industry may create difficulties in others. For example, a fabricator might develop a neat way of fixing a 'fiddly' corner detail that eases his fabrication and installation task. However, this adaptation may run counter to the original system concept in which the corner detail was a deliberately designed selling point.
- The industry shows few signs of any downwards diffusion of ideas. Elite and costly projects for prestige clients are effectively designed and developed within an economic and organisational world of their own. The design solution adopted is not necessarily transferable to other schemes, and certainly not transferable to the more standardised world of routine cladding contracts at the lower end of the market. There is therefore little filtering down of ideas from one commercial environment to another.
- There is little evidence to support the view that all sectors of the cladding industry share a single economy with cost structures that allow economies of scale to influence prices. Each sector of the industry operates within its own quite distinct economic environment, and perceptions of financial and technical risk vary, depending on the way in which each sector really makes its money.

7. Implications for the industry

The study findings raise important questions both for the organisation and structure of the UK cladding industry and for the efficiency and competitiveness of the construction industry as a whole.

It is clear from the study that the UK industry is subject to considerable competition from the UK-based subsidiaries of foreign firms, particularly in the systems design area (see Appendix 1). Imports of construction materials and knowledge represent a direct loss of revenue to the UK construction industry – and consequent losses in research, development and innovation. Although imports are frequently seen in terms of their negative impact on the balance of trade, construction involves a great variety of skills, components and materials, and to seek self-sufficiency in all of these may not be the most appropriate means of improving the efficiency of the UK cladding and/or construction industries. In other words, it may be more efficient to import high quality prestige cladding systems when the need arises rather than to develop appropriate home-grown products with their supporting industrial infrastructure. Nevertheless, in national terms, such imports may need to be balanced – or exceeded – by exports of skills and products in other areas.

The real question here is whether UK cladding suppliers are able to compete outside of specialist markets in the design, manufacture and installation of different types of cladding. A more comprehensive examination of the strengths and weaknesses would help to identify areas for innovation in the UK cladding industry.

MAIN FINDINGS

The UK cladding industry is weak and unable to take up most conventional technology-based research results.

It is also clear from the study that the relatively weak and fragmented nature of the UK cladding industry is unlikely to stimulate innovation. This has long-term implications for clients' perceptions of the industry and for its competitiveness in the face of foreign competition. Improvement in this sphere is only likely to come about as a result of changes in the industry's structure. Improvements in cladding quality is more likely to result from a strengthening of the links between systems designers and manufacturers than from technology-based research.

As a result of these findings, the only research issues appear to be those that relate to redesigning the industry's structure or changing the process of cladding procurement, specification, design, manufacture and construction. Such a research strategy would be far removed from the one that exists today.

MAIN FINDINGS

The UK cladding industry is fragmented. This determines the way it innovates. Only changes in the industry's structure and interactions will change its capacity for innovative action.

These issues are typical of those influencing innovations in the wider construction industry.

8. The way forward

This pilot study has shown that, in most cases, the UK cladding industry is not in a position to exploit the results of technologically focused research. It has highlighted the major problem of inadequate integration of the various forms of design (whole building, system, component and fabrication).

The study findings should be used to influence the formulation and appraisal of research projects and improve the take-up of existing information. The focus of future actions should be on improving the links between systems design and fabrication. Until the appropriate links have been established, and the issues which affect the priority given to innovation and improvement (liability for instance) have been addressed, there is little point in investing in technology research that can only be exploited by foreign firms.

DoE and CWCT should use the findings from this study to reassess the research needs included in the CWCT strategy [3]. The revised strategy will include redefined priorities and should guide future DoE funding of collaborative research in support of the cladding industry.

Similar studies should also be applied in other parts of the construction industry to identify appropriate research strategies.

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