

ABSTRACT

Colleges as agents for construction innovation – a case study

Purpose – The purpose of this paper is to highlight the low level of adoption of innovative products in the UK and to illustrate, through a case study, an investigation into the potential for UK further education colleges (FECS) to extend their existing activity and develop a role as independent centres for specialist knowledge of innovative products

Design/methodology/approach – Two surveys were employed to test assumptions which had been previously published by Government departments (Departments of Business Enterprise and Regulatory Reform [BBERR] and Trade and Industry [Dti]) focused on the level of knowledge and experience of construction SMEs regarding innovative products and processes.

Six colleges collaborated and successfully bid for funding to test their ability to deliver a wider role in the construction community. Each appointed a full-time fully funded adviser to research, collect and diffuse information about a specific specialist area.

Findings –The results indicate that there is evidence of the need for independent sources of information about innovative products. The colleges have shown their ability to build knowledge and capacity to offer independent advice. The outcome indicates, however, that without an effective business case and the commitment of senior college management teams the sustainability of the role is unlikely.

Research Limitations/implications –A unique agreement to collaborate was an important factor throughout this project and would be a pre-requisite to any repetition of the model.

Practical implications – The provision of independent advice of this nature is not otherwise readily available in the UK for key SME suppliers [including designers, specifiers, clients and builders]. In the absence of such facilities the barriers to innovation identified are less likely to be reduced.

Originality/value – The originality of the research lies in determining a new role for locally accessible FECs and a new resource for SMEs engaged in designing and delivering construction projects.

Paper type – case study

Key Words - Construction Innovation; Independent Information; College Collaboration

Colleges as agents for construction innovation – a UK case study

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Introduction

Construction is one of the major economic activities in the UK, contributing 7-9% of Gross Value Added (GVA) involving in excess of 2.5 million workers, mainly employed by SMEs (House of Commons 2008a p5).

The supply side is fragmented; design and production are commonly segregated. Performance, as evaluated nationally through key performance indicators (KPI's) (Constructing Excellence 2010), indicates weak satisfaction level expressed by clients and consistent failure against cost and time targets.

Improvement has been the target for a range of reports since the 1960's, some initiated and sponsored by Government, others by sectors of the industry itself (Murray and Langford 2003). Improvement in the outputs of the construction industry, particularly environmental efficiency and reduction in carbon emissions depend heavily upon the adoption of products and processes which are innovative in the sense that they are new to construction.

The Department for Business Enterprise and Regulatory Reform (2010 p3) (DBERR) identified that achieving innovation will require new ways of working and acquisition of knowledge and skills. Slaughter (2000) identified manufacturers and suppliers as the primary source for construction-related innovations, but there are very few sources of independent information and advice about products and processes in construction which can be regarded to be innovative. The lack of such independent advice and information appears to engender caution in the design process. This paper highlights how Further Education Colleges (FECs) can adapt to provide an informed independent service for clients, designers and specialist contractors.

The nature of UK construction

The structure of the UK supply-side in particular is dominated by Small or Medium Enterprises (SMEs) and/or specialist providers and the demand-side dominated by occasional or on-off clients (House of Commons 2008a p20).

Referring to the latter White (2007) identified two distinct markets or category of client; firstly clients with continuous building programmes and secondly the numerically dominant market consisting of inexperienced clients with only once-in-a-lifetime engagement with the sector having little opportunity to initiate or to demand innovation of process or product. Along with this the occasional nature of most transactions does not encourage the development of established supply chains. The adoption of innovative construction-related products is seen to be very limited. The prevailing culture and structure underpinning construction has been described (McCaffer 2006) as an impediment to innovation whether this be innovation of process or innovation of products. White (2007) identified the fragmentation of the sector as the biggest single inhibitor of high performance.

In this regard it was recognised (House of Commons 2008b p20) that the structure of the construction industry and the nature of its work mean that the usual commercial drivers of R and D investment are either missing or very weak. In Response to Construction Matters (House of Commons 2008a p87) the Business and Enterprise Committee reported near universal acceptance that both the construction industry and the government invest too little in construction research and development. This low level of expenditure was highlighted by Reichstein et al (2005) who also concluded that many construction firms do not need to innovate in order to remain successful or viable.

Innovation and UK Construction

DBERR (2005) suggested that innovation in construction tends to occur to solve a particular problem; to make a design statement or to meet regulatory requirements. Innovation was recognised as a key driver of competitive advantage and of society's need for an efficient and sustainable sector.

The Department of Trade and Industry (2003) (DTi) believed that innovation needs to be at the heart of the industry's efforts to improve productivity and develop new capabilities, business and markets. Confirming this, the Chartered Institute of Building (2007) recognised that innovation was very important to the future of the industry and agreed that there must be further research into from where these innovations will come.

DBERR (2008) established targets to enhance the industry's capacity to innovate and increase the sustainability of both the construction process and its resultant assets. Improvement in environmental efficiency and reduction in carbon emissions appear to be dependent upon innovation and particularly the adoption of innovative products. This has been re-emphasised in The Low Carbon Construction Final Report (Department for Business Innovation and Skills 2010).

Construction products form a massive subset of the construction economy amounting to some £40billion pounds annually (nearly 40% of total construction output) (Construction Products Association 2010). This sector of the construction economy does invest in R and D and leads moves towards the development of innovative products aimed at the construction market.

The relatively low investment by the construction sector overall appears, however, to act as a force against the drive for innovation, although there are other barriers which have been identified by Government including high risk attached to innovative approaches which could save costs, time and carbon emissions (House of Commons 2008a p5).

Barriers to Innovation

The UK construction industry is seen, therefore, to be underperforming against an agenda focused upon improved efficiency and reduction in carbon emissions. This is recognised by Government, accepted by the industry itself and confirmed by industry-wide KPIs, but the usual drivers evident in most manufacturing sectors are weakened by the fragmented structure of the supply side. Consequently the adoption of innovative products and processes is at a low level and some barriers have been specifically highlighted by DBERR (2005) to include:

- Messages to the marketplace that are unclear; the vast majority of suppliers to the built environment are SMEs and their awareness of the global picture is limited.
- Inexperienced clients being unaware of the innovations they can demand from the supply side.
- Clients being risk averse and not wanting to be "experimented on" - issues of assurance for investors, insurers etc.
- Fragmented delivery – a fragmented decision-making process and fragmented supply chain.

Further Education Colleges as potential agents for innovation.

Further education colleges (FECs) are the primary sources of education and training in construction technology and skills in the UK. They have on-going engagement with the construction sector in their geographical area. In most cases they have strong links with employers.

Six colleges of Further Education Colleges throughout the East Midlands region, all members of the East Midlands New Technology Initiative Construction Network

(NTI)¹ collaborated in curriculum development and were sharing resources. They had burgeoning interest in innovative products and processes and in some cases they were developing particular expertise.

The Department of Innovation, Universities and Skills (DIUS) in 2008 invited bids for a two-year Pathfinder Project focused upon developing the potential of colleges as sources of specialist knowledge and advice for design and construction SMEs in the Region. The six colleges responded jointly and successfully to this invitation believing they could fulfil this role. The remit of each college was to develop expertise and to be prepared to offer an independent advisory service in a particular area of specialism. There was cross-college agreement to ensure no duplication of specialist area, resulting in each focusing on a different area of expertise.

The specialist areas adopted included electricity and energy renewables, modern methods of construction, solar, biomass and mini/micro combined heat and power (CHP), thermal mass, water management and weather compensating and dual fuel systems.

Aim and objectives

The aim of this research was to confirm the level of awareness and extent of adoption of innovative products and processes by SMEs, and to evaluate the claim that FECs could provide an active role as independent sources of specialist knowledge and advice to reduce the impact of perceived barriers to innovation.

The objectives of the investigation underpinning the project included:

- to define innovation for the purpose of the project.
- to establish across the supply chain the level of awareness and understanding of innovative construction products; the extent of the level of adoption of innovations; the sources of information about new products and processes and any barriers to adoption.
- to identify whether the barriers to innovation highlighted by the Department for Business Enterprise and Regulatory Reform (2005) were confirmed by the manufacturers or suppliers of such products or processes.
- to establish whether these FECs could successfully build capacity and provide an independent source of information.

Research Methodology

The definition of innovation adopted by The Chartered Institute of Building in their survey of 2007 (CIOB 2007) "the successful introduction of new technologies or procedures into industry" was adopted for the purposes of the project.

A survey of the wider supply chain in the East Midlands was adopted to seek to identify the level of awareness and understanding of innovative construction products, the level of their adoption, sources of information about new products and processes and to identify any perceived barriers to adoption of innovative products or processes.

To verify whether those barriers identified by DBERR (2005) were recognised or confirmed by manufacturers and suppliers it was considered necessary to survey their views based upon specific manufacturers or product types.

To evaluate whether the FECs could successfully provide an independent source of information each college appointed developed a focus on an agreed specialism and appointed a full-time specialist adviser. The relative success of this strategy was evaluated by the level of engagement over the two-year period of the project.

¹ East Midlands Construction NTI was an initiative funded by HEFCE and emda to support SMEs and Higher Education institutions by grants for the purchase of new technology equipment. NTI also enabled colleges to collaborate in the development and sharing of learning resources.

Survey of the Construction Supply Chain

To identify the level of awareness and understanding of innovative construction products, the level of their adoption, sources of information about new products and processes and to identify any perceived barriers a survey was administered of the wider supply chain in the East Midlands. The ranges of products which formed the subject of the survey were selected by the specialists appointed by each college. They included products and processes identified as innovative and which were appropriately certified or already adopted in Europe or the UK.

The target respondents included those who commission work, those who specify what is to be used and those who carry out the work. These roles within the construction supply chain were defined as following:

- **Client:** ultimate buyer or commissioner of construction projects or construction services.
- **Specialist:** specialist contractor, installer or expert tradesperson.
- **Specifier:** architect, designer or individual responsible for specifying products or processes to be incorporated in construction projects.

180 SMEs randomly selected across the East Midlands formed the sample for this survey and each was a Specialist, Client or Specifier as defined. At least five SMEs in each category were identified in each of the six areas of specialism.

Survey email

Prior to the survey, each identified person was contacted by telephone or email to seek their agreement to take part in the survey. Whilst the role of each respondent was pre-defined before issuing the survey, they were asked to confirm or define their own role in the construction industry in their reply to ensure the appropriate level of experience and seniority.

A total of 6 online surveys - one per area of specialism – were built using an online survey research tool (www.esurveyspro.com). The style of the survey tool enabled respondents to read a description of the innovative product and/or processes but also to see a photograph or diagram. Responses were requested to indicate whether respondents were aware of the products/processes their purpose and their claimed benefits; where they obtain information about innovative products or processes and what they believed were barriers to their widespread use. The overall response rate to the survey was 42.4%, (70 out of the 180 possible respondents).

Results

	Modern methods of construction - off site manufacture	Renewable energy	Solar, biomass, combined heat and power	Thermal mass	Waterless management systems	Weather compensating controls and dual fuel systems	Total
Specialist	14	4	8	1	4	2	33
Client	5	1	0	3	3	0	12
Specifier	1	7	5	8	4	0	25
Total	20	12	13	12	11	2	70

Table 1 Analysis of responses

Table 1 indicates the characteristics and spread of the responses. These responses provided a good spread across the specialisms except for weather compensating controls and dual fuel systems.

Table 2 indicates the level of awareness of the products presented in the survey tool. These responses illustrate a good level of knowledge across most areas of specialism but again the limited awareness of weather compensating controls and dual fuel systems is illustrated.

	Modern methods of construction - off site manufacture	Renewable energy	Solar, biomass, combined heat and power	Thermal mass	Waterless management systems	Weather compensating controls, electricity & energy efficiency	Total
Products knowledge	77	53	49	36	40	5	260
No product knowledge	22	7	16	36	4	3	88
Total	99	60	65	72	44	8	348

Table 2 Analysis of knowledge or lack of knowledge of products

	Price	Uncertainty	Insufficient certification/ approvals	no independent centre	never specified	no recommendation from specifier	concern over design liability insurance
Barriers (number)	112	130	37	68	38	21	15
Barriers (%)	26.6	30.9	8.8	16.2	9.0	5.0	3.6

Table 3 Barriers to adoption of innovative products

Table 3 highlights the perceived barriers to the adoption of the products. The majority of responses highlight price and uncertainty as key barriers but suggest that a lack of an independent centre is a further barrier.

general trade publications or journals	information from manufacturers	word of mouth from peers	internet	recommendations from clients
28.5	16.8	20.7	20.7	13.4

Table 5 how SMEs become aware of new/innovative products

Table 5 indicates the sources of information which were used by the respondents to learn about new products and processes. This indicates a relatively high dependence on traditional non-electronic sources.

Analysis of survey responses

- Specialists and Specifiers were well represented in the survey with a response rate respectively of 47.1% and 35.8%. Client organizations were less well represented.
- The results by area of specialism show that between 45% and 75% of respondents had knowledge of the products or processes, and consequently the adoption of innovative products or processes appears to vary with the nature of the product or process. The limited awareness of weather compensating controls and dual fuel systems perhaps representing the particularly new aspect of this work.
- In overall terms, the strongest barriers to the adoption of innovations included uncertainty, where the product or process has not been used before; the level of price and the lack of accessible independent centre. The respondents appear to assume that innovative products or processes are expensive.
- In terms of information sources used to obtain information on innovative product and processes, the survey indicates that the construction supply chain predominantly uses non-electronic sources such as general trade publications/journals.

Summary of survey findings

The findings confirmed a good level of knowledge of innovative products and processes but this varied across the specialism.

Enquiries about the barriers to adoption resulted in an indication that whilst awareness is relatively high uncertainty about the product or process forms a significant barrier along with a belief that innovative products are expensive. The concept of an accessible independent centre also appears to be seen as a potentially valuable resource likely to influence in the increase of adoption of innovative products as significant numbers of respondents recognised the lack of such a service as a barrier

Survey of Manufacturers and Suppliers of Innovative Products.

To verify whether those barriers identified by DBERR (2005) were recognised or confirmed by manufacturers and suppliers it was considered necessary to seek their views based upon specific manufacturers or product types through an electronic survey.

Advice was sought from a focus group consisting of architects, surveyors and construction managers. This group was asked to identify companies producing what were considered to be innovative products. The sample included 30 of the companies identified by the focus group and all 44 of the trade associations allied to the Construction Products Association. The survey asked for confirmation or otherwise of the barriers identified by DBERR (2005)

Within the survey the respondents were invited to make observations in addition to the closed questions.

Responses were received from seven trade associations and 12 producers.

Four barriers associated with the construction industry and identified by DBERR were found to be confirmed as indicated in Table 6.

Barrier identified by DBERR	Finding from survey
Messages to marketplace are unclear/limited awareness	Confirmed by trade associations Confirmed by manufacturers
Inexperienced clients	Confirmed by manufacturers
Risk adverse clients	Confirmed by trade associations
Fragmented delivery	Confirmed by trade associations

Table 6 Barriers to Innovation

The following observations were made and are summarised:

- Most trade associations believed that their members were innovative but that there is inherent reluctance to specify innovative products. They felt that this is largely due both to a resistance to change and a lack of awareness of new products. It was acknowledged that there is poor communication between supplier and specifier. There was a lack of certainty about the extent of opportunity for the members of the trade associations to engage with designers or contractors, but the associations commented that the sector is not set up to take risk because 'there are no prizes for getting things wrong'.
- Most product manufacturers emphasised reluctance in the sector to adopt innovative products but acknowledged a lack of opportunity to show or demonstrate new products or to engage with designers. In general the manufacturers felt that new products were only adopted when a number of other specifiers used them and they became generally accepted. They also questioned the motive for new products to be specified as the benefits would tend to fall to the building owner rather than the building designers.
- Both trade associations and manufacturers referred to British Board of Agrément Certification but indicated some lack of confidence in their effectiveness. Manufacturers seemed keen to obtain approval and certification, trade associations less enthusiastic. Whilst it was felt that some delay between innovation and certification occurred this was not seen as a particular barrier.

Summary of survey findings

Analysis of the barriers identified by the Department for Business Enterprise and Regulatory Reform (2005) and the responses of both trade associations and manufacturers suggested that a primary barrier was unclear messages and level of awareness about new products by clients and designers. There was also evidence that there is inherent reluctance on the part of designers to specify, or for clients to demand, new products.

Development of FECs as Independent Centres

Following the successful outcome from the bid to DIUS each college developed a strategy to focus on an agreed specialism and appointed a full-time specialist to lead their part of the project.

To enable the colleges to build capacity and knowledge these specialists completed a detailed investigation of products within their area of specialism which were on the market in Europe or the UK; which were approved by a recognised body [such as the BSI or British Board of Agrément], or alternatively were in regular and accepted use in a non-UK country. Each specialist produced an extensive report in their field enabling a range of products deemed 'approved' and innovative to be identified.

Once this was completed the colleges sought to raise awareness of their enhanced capacity and the existence of a resource for SMEs which was independent and free. To enable maximum engagement by attendees at awareness raising events the colleges each developed full size working display models and collected samples to enhance understanding of the products in their area of expertise.

In 2010, the colleges delivered road shows across the East Midlands. These events were free and were open to designers, contractors, specialist contractors, students and the general public. The road shows were attended by over 1,400 people. Each event included demonstration models and sample materials. Feedback collected at these events indicated that this was an effective approach to knowledge transfer.

A dedicated website was also developed to maximise dissemination of the reports produced by each college (<http://www.innovationinsustainableconstruction.co.uk/>). The website has realised some 1200 hits. A project book was also published showcasing the products and processes. (Morledge 2010). 1,000 copies of this book were made available through the colleges and distributed at no cost to SMEs, students or clients upon expression of interest. Some 500 FEC students have also been exposed to the models and to the research material within their courses.

Experience of FECs offering specialist advice

All colleges confirm that as the result of the project the curriculum has evolved and that the future workforce has been exposed to innovative products and processes which would not otherwise have been possible. College teaching staff have benefited from staff development events arranged both within their own college and with other colleges involved in the project.

Each college has had enquires over the range of their specialism from SMEs but the volume of these enquiries has been variable. The specialists employed by the colleges believe that is largely due to the lack of ability or willingness on the part of some of the colleges to provide further resources to raise on-going awareness of this potential role after the first funded year of the project.

Review the Role of FECs as agents for innovation

FECs commonly engage with construction SMEs with whom their students are employed and they maintain strong links through their primary role as educators and trainers of the workforce.

The development by the colleges of the role of an independent source of information has enabled them to share the knowledge and resources which they have developed with SMEs and with all other colleges engaged in the project. A valuable resource has been created and the standing of FECs in the construction community has been enhanced.

As the result of this project there have been at least 4,000 opportunities for students and SMEs to engage with information about innovative products and processes which would otherwise have been difficult for them to obtain.

However the project funding was for the first year of the project only. Whilst five of the colleges maintain the employment of their specialist an on-going commitment by colleges is needed for the role to be sustainable and for SMEs to be aware of its value. The development of a convincing business case to support this will be challenging in the context of FEC funding.

Conclusion

DBERR (2005) highlighted barriers to innovation to include a limited awareness of innovative products and/or processes both on the part of SMEs and on the part of inexperienced clients. Clients were seen as largely risk averse and unwilling to be used as the basis for experimentation.

Manufacturers suggested that a primary cause of barriers included a limited of awareness about new products by clients and designers and they identified an inherent reluctance on the part of designers to specify, or for clients to demand, new products.

The survey of the construction supply chain highlighted variability in the level of knowledge of innovative products and processes and identified uncertainty as a significant barrier to their adoption. The concept of an accessible independent centre was seen as a potentially valuable resource likely to influence an increase of adoption of innovative products as significant numbers of respondents recognised the lack of such a service as a barrier.

Whilst Slaughter (2000) observed that several publicly funded programmes to demonstrate new construction designs and technologies have been disappointed with the lack of widespread use and acceptance of the innovations she acknowledged that increasing the capacity of construction-related firms to identify and evaluate appropriate innovations could be an important area for government organizations.

This project has shown that if FECs are able to collaborate and willing to share resources they can successfully build capacity and to develop a valuable supplementary capability serving SMEs and their own students. The level of engagement with the colleges during its short life has indicated its potential. The specialists in the colleges involved with the project have indicated, based upon the level of engagement they have experienced, that they believe that with commitment and support this capability could be developed to become a sustainable service in parallel with their core activity.

Such a service would align with the belief by Department for Business Innovation and Skills (2010 p3) that new ways of acquisition of knowledge and skill are needed if innovation is to be achieved. There appears to be no other source of information and independent advice available within the construction sector.

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