

AN INVESTIGATION INTO THE BARRIERS TO INNOVATION AND THEIR RELEVANCE WITHIN THE CONSTRUCTION SECTOR

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The under-achievement of the construction industry indicates an urgent need for improving existing processes and working practices. Innovation, which might be described as the impact of new methods, services or products on the environment, is generally accepted as the key to unlocking the sector's potential. This has been the contention of many studies and reports. Despite this large potential, the construction industry and organisations in general, continue to have problems innovating effectively. Organisations largely experiment in innovation, without making a sustained effort to incorporate it within their business. The low level of implementation and adoption of new ideas in construction calls for further investigation of impediments to innovation. To enable the determination of strategies to reduce or remove barriers to innovation, a review of relevant literature has been carried out. This reveals the nature of innovation and establishes a conceptual framework. It also identifies generic factors affecting the adoption of innovation and informs research into barriers to innovation in construction.

Keywords: barriers to innovation, innovation, organisational culture, technology transfer.

INTRODUCTION

For most business organisations the link between innovation and competitive advantage is axiomatic. In an increasingly competitive world, it is argued that traditional sources of advantage such as distinct market positioning or access to non-imitable resources are being eroded. Instead, competitive advantage is better viewed as a dynamic capability - a function of the firm's ability to innovate, learn and continuously reposition itself more effectively than its rivals (Teece, Pisano and Shuen; 1997). Evidence from the United States, suggests that the ability of American firms to develop new products and services using innovative processes through the systematic exploitation of research results, the transfer and adaptation of technologies and the implementation of efficient management methodologies has been a key factor in maintaining a high level of economic growth.

Whilst the benefits of innovation have been acknowledged, similarly the existence of barriers to its application is also apparent. If innovation is of key importance to success in modern society, an investigation into factors that may impede its adoption is fundamentally important. An analysis of barriers or impediments to innovation provides insights into the dynamics of innovation processes and opens up opportunities for improving innovation activities and thus international competitiveness.

THE NATURE OF INNOVATION RESEARCH

A major difficulty in innovation research is that there is still a lack of consensus on a single definition of the concept. Zairi (1994: 27) makes reference to this by writing “*what makes innovation challenging is the fact that it is very difficult to agree on a common definition, and also to decide which firms are the most innovative and how to quantify innovation activity*”.

One main point of contention is whether innovation is a process (the transformation of an idea into a marketable product or service, a new or improved manufacturing or distribution process, or a new method of social service), or an outcome (a new or improved product, equipment or a service that is successful in the marketplace) (European Commission 1995). Another conflicting issue relates to the timing of an innovation relative to other firms in the industry. In this respect, some seek to restrict its meaning to instances where firms have been “*first to commercialise a new product or process in the market*” (Teece, 1987: 185). For others the emphasis is not upon whether the idea or the product is new per se, rather “*the perceived newness of the idea for the individual determines his or her reaction to it. If the idea seems new to the individual, it is an innovation*” (Rogers 1983: 11).

The Organisation for Economic Co-operation and Development (OECD) has been actively developing internationally accepted definitions and standards for the concepts of the knowledge economy. Below is how they approach the concept of innovation:

A set of “scientific, technical, commercial and financial steps necessary for the development and marketing of new or improved manufactured products, the commercial use of new or improved processes or equipment or the introduction of a new approach to a social service, R&D is only one of these steps” (OECD, 1981: 15-16)

This definition suggests two dimensions of innovation: product and process. The former refers to the development and implementation of new or improved products or services that are successful in the marketplace. The latter involves the application of new or improved methods of manufacture.

Recently, authors have begun to make a further distinction and identify organisational innovation as a separate dimension. Organisational innovation deals with innovation in management thinking. Successful organisational innovation should lead to the more effective use of human and physical resources (European Commission 1995).

In terms of type, innovation can be classified within three categories, discontinuous incremental progressive, and synthetic. Discontinuous innovation refers to the development and implementation of significantly new ideas, technologies, and processes. Incremental innovation is about providing added features, new versions or extensions to an otherwise standard product line. Finally, synthetic innovation involves combining current technologies to either create new products or significantly improve existing production processes (Tushman and Nadler 1986).

Research relating to innovation and technological change has been undertaken by many disciplines including social and occupational psychologists, personality theorists, sociologists, management scientists and organisational behaviourists (King 1990). The research also varies in its scope; innovation and technological change is investigated at individual, group and organisational (Tushman and Nadler 1986).

The broadness of the literature identified in the literature review underlines the need to establish parameters when undertaking research into the area of innovation.

THE BENEFITS OF INNOVATION

There is broad agreement between economists, from Adam Smith to Robert Slow via Ricardo, Marx, Marshall, Schumpeter and Keynes, on the importance of innovation for long-term economic growth, and international competitiveness (Freeman 1982; Dosi *et al.* 1988). According to the Organisation for Economic Co-operation and Development (OECD), long term growth depends upon “*building and maintaining an environment that is conducive to innovation and the application of new technologies*” (OECD 2001: 11). The OECD also provides evidence for this; their review, ‘Building On Innovative Economy in Europe: A Review of 12 Studies of Innovation Policy and Practice in Today’s Europe’ reveals that between 1970 and 1995 more than half of the total growth in Gross Domestic Product (GDP) of the developed countries resulted from innovation. This corroborated the work of Fagerberg (1987), which provided strong evidence that the contribution of industrial innovation to productivity and economic growth was eminent in twenty-seven countries. The U.S. Department of Labour (1989) adds further support, reporting that continuous investment in R&D contributed 0.49% per year to productivity growth in the manufacturing sector between 1948 and 1987 (Grossman and Helpman 1991).

There is particularly strong evidence for the benefits of innovation at the macro level. However, these may arguably also be established at the level of the firm, as innovation has a direct impact on the competitiveness of a firm and thus its performance. Business performance is enhanced because innovation enables organisations to, *inter alia*, “*improve the quality of their output, revitalise mature businesses, enter new markets, try out new technologies, and develop alternative applications for existing product categories*” (Dougherty 1996: 424). Evidence for the improvement in business performance from innovation can be directly observed, and has also been specifically studied. In 1992, the Cambridge Small Business Research Centre (SBRC) carried out a survey of over 2000 small and medium enterprises (SMEs) and reported a broad correlation between innovation and business performance. More recently, the 1997 CBI/NatWest Innovation Trends Survey shows that over 70% of the companies surveyed achieved performance gains - higher profits, increased market share or increased market penetration - as a result of innovation within the past three years. (CBI/NatWest 1997: 17)

The need for innovation within the construction sector is well recognised. The problems of the industry and areas of desired improvement have recently been outlined in keynote reports, including the Latham Report (1994) and the Egan Report (1998). The construction industry task force, in their interim report, highlighted particular objectives each of which may be achieved by the process of innovation (Egan 1998). The report called for;

- A reduction in capital construction costs
- A reduction in the time available from client approval to practical construction
- An increased number of projects completed on time and within budget
- A reduction in the number of defects on hand-over by contractor to the client
- A reduction in the number of accidents

- Increased productivity at all levels
- Increased turnover and profitability for construction firms

The benefits of innovation in the construction sector are thought to be immense, delivering – amongst other particular outcomes, better housing, improved living and working conditions, lower construction costs, effective environmental sustainability and a construction industry that is globally competitive and profitably sound. According to the Construction Research and Innovation Prospectus (2000) Radical change and continuous improvement in construction will result in “*a more profitable and competitive industry which provides better value to the customers (economic benefit), an industry which respects and treats its stakeholders fairly (social benefit); an industry one which minimises its impact on the consumption of energy and natural resources and on the environment (environmental)*” (CRIP 2000: 7)

BARRIERS TO INNOVATION

As a critical source of growth and maintaining competitive advantage at both the firm and national level, innovation is surely the key to success in modern society. Given the huge literature on this type of activity (Zairi 1994), given the fact that it is becoming more and more a managerial responsibility, one would expect business organisations to be increasingly innovative. This is, however, not the case. It is argued that many organisations are averse to the type of aggressive investment that innovation requires (Kuczmarski 1990), and also have difficulty shifting to new technologies; changing their strategic paradigm; breaking out of prevailing patterns of decision-making; and learning from experience. Organisations largely experiment in innovation, without making a sustained effort to incorporate it within their business (Dougherty 1996).

The importance of innovation has prompted considerable research into what stands in the way of implementation and adoption of new ideas, techniques and processes. The findings suggest that there are many barriers to innovation and that these are both internal (endogenous) and external (exogenous) to a firm (Piatier 1984). The external barriers to innovation include the lack of infrastructure, deficiencies in education and training systems, inappropriate legislation, an overall neglect and misuse of talents in society (OECD 1992; EC 1995). Some major internal barriers include top management isolation, intolerance of fanatics, short-term horizons, accounting practices, excessive rationalism, excessive bureaucracy, and inappropriate incentives (Quinn 1985).

Research projects on innovation usually distinguish categories of barriers to innovation. The OSLO Manual - OECD (1992: 38) – for example, lists barriers to innovation into four categories considered relevant in various countries. They include: market risks, financial restrictions, legal and bureaucratic barriers, and restrictions within the company

Similarly, the problem of innovation can be considered to operate at two different levels, macro, i.e. economic, and micro, i.e. firm. According to John Storey (2000: 347) “*there is a large literature exploring the barriers to innovation and this has identified a whole array of factors ranging from the macro-level ... to the micro level*”. The most relevant issues at the macro-level are thought to include the financial system and regulation. At the micro level the emphasis will be on organisational structures and cultures, communication, resources, team dynamics and individual

personality traits. The following considers barriers to innovation within the context of the categories identified above.

The Financial System

‘The financial system refers to the network of institutions, which connects the owners of financial capital to, that which ultimately gives them value’ (Tylecote 1996: 259). The most important aspect of innovation relevant to the financial system is its requirement for finance to accommodate a range of resource needs including physical capital, research and development, training and marketing.

The financial system can inhibit innovation in many ways. The simplest way in which the financial system may be a barrier to innovation, is where the effective cost of capital for innovation is set well above the general level of interest rates. Andrew Tylecote (1996) refers to this as an act of discrimination against innovation. Such discrimination is most likely to be suffered by SMEs since such organisations depend heavily upon loan capital from banks for investment purposes (Tylecote 1996).

Another difficulty of innovation, caused by the financial system, relates to the phenomenon of short-termism, which is especially a barrier to innovation in the UK and US economies. Short-termism takes place because a large number of investors in these two countries pay little attention to the management of the companies in which they invest. They are more focused upon how much profit they will obtain from their investments. When investors demand too high an immediate return from companies, managers are forced to maintain the dividend, at the expense of making provision for the future, especially by way of reducing expenditure on innovation (Budworth 1996). Short termism also takes place because managers are subject to control by the owners, or shareholders. This control might be exercised directly - for example, by voting in the annual general meeting – or indirectly, in which poor investment actions by management cause the share price to fall, rendering the firm susceptible to takeover bids. (Tylecote 1996)

Regulation

In the context of this research, the term regulation refers to the political and legal actions a government may consider necessary to oversee market activity and the behaviour of private actors in the economy. Such intervention by the government in the marketplace is usually justified on the basis of market failures and the need to ensure societal welfare. The Organisation for Economic and Co-operation and Development (OECD 1997) discusses three types of regulation including economic, social and administrative regulation. Economic regulation is intended to improve the efficiency of markets in delivering goods and services. Social regulation protects the environment and the safety and health of society at large. Finally, administrative regulation governs the practical functioning of the public and private sectors.

Regulation can put constraints on industrial organizations, on the market in which they can develop and on the way firms can interact with partners. A 1994 survey by the Union of industrial and Employer’s Confederations of Europe (UNICE 1995) of more than 2500 European companies reveals that regulations make it extremely difficult to minimise costs, organise in a flexible way, reduce time to market, and reduce uncertainty.

Inappropriate regulation may also discourage research efforts by firms and distort the choice of technologies that are exploited and adopted. Competition policy is an example of regulation, which influences the ability of organisations to exploit linkages

and improve collaboration with their customers and suppliers. The ability of innovating firms to co-operate, by striking necessary vertical and horizontal agreements or entering into alliances, often raises issues of antitrust (Jorde and Teece 1991).

Organisational Culture

The culture of an organisation is best thought of as a set of collective norms and beliefs called basic assumptions that members of an organisation possess, and which tend to cause them to act in certain ways (Morgan 1991). These values, and beliefs are manifested in many ways, such as the rites and routines that take place within an organisation, the language used, the stories, legends and myths that are told and retold and finally the symbols that are found throughout the company (Irani *et al.* 1997).

Corporate culture has a profound influence on the capability of an organisation to develop and implement or simply adopt new ideas, new technology, and new management techniques (Pervaiz 1998). The nature of this influence is thought to depend to a large extent on the norms that are widely held and shared by the organisation. If the right type of norms exists, then there will be a great tendency on the part of the organisation to promote innovation and technological change. If on the other hand the wrong culture prevails, no matter how good the intention of people trying to promote entrepreneurial behaviour, success will not be achieved.

An important element of organisational culture hindering innovation is that of unwillingness to face uncertainties and take risks. Innovation is by its very nature a risky activity (Kuczarski 1990). New theories, ideas and practices do not always work as expected and their use can have unintended consequences that are difficult, if not impossible, to predict. Incentives and rewards for innovators are too often given only to those people or organisations whose projects yield results that are immediately profitable. These incentives are well justified and should continue; however, the stigma of using innovations whose results or performance was not uniformly positive needs to be reduced.

Another important element of organisational culture that can inhibit innovation relates to the short-term orientation of some organisations (Hofstede 1993). These are largely reflective organisations, i.e. frequently looking back to the past. Their values tend to emphasise personal steadiness and respect for traditional practices. The rate of implementation and diffusion of new products, new technology or new ideas into these organisations will arguably be very low for the simple fact that innovation is about the introduction of novelty by breaking with existing power relationships and established routines (Tushman and O Reilly 1991).

Organisational Structure

Organisational structure is the way in which a firm or a public authority is structured in order to perform its activities. It refers, in particular, to the delineation of job titles and power relationships in an organisation. Organisational structure distinguishes types of organisations. It indicates whether a firm's activities are grouped together according to product or function, i.e. whether each of a firm's products is supported by its own functions of production, marketing and finance, and, it can also indicate whether an organisation is tall, i.e. involves many managements layers, or flat, i.e. involves only a few management levels (Daft 1992).

Research into the management of innovation distinguishes between mechanistic and organic types of organisations. The former is characterised with a clear hierarchy of

control in which responsibility for overall knowledge and control rests at the top; the latter, on the other hand, is based on continual adaptation and refining of individual tasks and a supportive rather than a restrictive nature of specialist knowledge (Burns and Stalker 1994). The main characteristics of mechanistic and organic types of organisation are listed in the table below:

Table 1: Comparison of the characteristics of organic and mechanistic structures

Organic structures	Mechanistic structures
Freedom from rules;	Little individual freedom of action;
Participative and informal;	Formal reporting;
Face to face communication;	Communication via the written word;
Non-hierarchical;	Hierarchical;
Flexibility with respect to changing needs;	Bureaucratic; many rules and set procedures
Willingness to take on external ideas;	Information flow upwards, directives flow
Information flow downwards as well as upwards;	downwards

This categorisation is very important in that it provides labels to describe the internal characteristics of an organisation. More specifically, it serves as a basis for measuring and comparing organisations. Key structural variables include centralisation, formalisation and complexity. Centralisation refers to the extent to which authority and decision-making is concentrated at the top of the organisational. Formalisation refers to the amount of written documentation in the organisation. Finally, complexity refers to the number of activities or subsystems within an organisation (King 1990).

There is some evidence that these variables have contrasting effects at the initiation and implementation stages of the innovation process. On the one hand, initiation of innovations requires low levels of centralisation and formalisation and high levels of complexity. On the other hand, implementation of new ideas requires high centralisation and formalisation and low complexity (King 1990).

BARRIERS TO INNOVATION WITHIN THE CONSTRUCTION SECTOR

Innovation within the construction sector is occurring and evidence of this can be found in the list of issues and activities that has emerged in recent years. However, notwithstanding such developments, within the context of the framework outlined above, evidence of the existence of barriers to innovation can be identified within the construction industry. Indeed, construction literature is full of explanations of barriers to innovation. Winch (1999), for example, considers the project-based nature of the construction industry as a significant barrier to innovation, Egan (1998) reports that the fragmentation of the construction industry inhibits performance improvement while Morledge (2000) points to the supply-side reluctance to embrace new ideas and the weak demand-side in terms of number of clients who have access to innovative or improved techniques. The report *Value for Money* (Gray 1996) underlines the problem of the need for bespoke designs with the design of highly engineered and non-standardised buildings and suggests that the production-oriented approach to building design and construction common in other countries should be extended to greater use in the UK. The tendency in construction toward the production of unique, non-standard products leading to buildings that are complex to construct, with each building requiring a new learning experience, may be regarded as a fundamental aspect of the industry's culture that, at the level of the firm, may be a significant barrier to innovation. Likewise, resistance to the adoption of recognised and proven methods of improving the service given to clients, be it from contractors or

consultants must be regarded as damaging and examples appear to be common in construction. One such example relates to the extent of use of the practice of Value Management. Despite the level of recognition and promotion given to this activity, there appears to be a hesitance by many practitioners to embrace the opportunity Value Management provides (Hogg 2000).

Recognition of barriers to innovation within the construction industry has also been given at a high institutional level. The Department of the Environment, Transport and the Regions (DETR) identified a £7.5m programme of research (Partners in Innovation) subtitled "Promoting Innovation in the Construction Industry". The programme identifies five business areas, one of which is the best practice business plan in which a key priority consists of 'Improving Understanding of Barriers to Innovation'. Likewise, the Construction Clients' Forum (now the confederation of construction clients), which was created in 1994 following the Latham Report, also gives priority to this. Their Construction Research and Innovation Panel (CRISP) believes that research is needed to identify the reasons preventing new ideas being adopted and ways in which clients can support innovation.

CONCLUSION AND FURTHER RESEARCH

Analysis of the literature thus far has provided a framework that may be adapted for further research. It has assisted in the development of concepts relating to the opportunities, benefits and barriers to innovation that will be used in the investigation of innovation within the construction sector.

The research has also underlined the opportunity for innovation within the construction sector and has provided evidence of barriers and their impact. This supports the case for continued investigation and provides direction for the furtherance of the aim of the research, which is to establish effective methods to mitigate barriers to innovation in construction.

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