

# MECHANISMS FOR EXPLOITING CONSTRUCTION INNOVATIONS TO GAIN COMPETITIVE ADVANTAGE

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The paper reports some findings of a 2-year study on innovation sponsored by the Economic and Social Research Council (ESRC) which involved four case studies from four different innovative construction organizations, over 50 ethnographic interviews, company archive documents and video capture of innovative processes and products. The study explored a variety of issues such as types and sources of construction innovations, innovation strategy, climate and culture for innovation, risks in innovation and the formation of internal and external linkages to exploit organizational innovations. This paper, however, focuses on the mechanisms which construction organizations put in place to successfully exploit and benefit from innovations. It also examines the importance of an innovation strategy for the successful management of innovations. The paper shows that the important mechanisms for exploiting construction innovations include collaboration and building capability, novelty, stretching basic model product/process, providing complexity in technologies and increasing entry barriers. Other mechanisms are, being focused on a particular market niche, the continuous movement of the cost performance frontier and the management of knowledge and intellectual capital assets. The study concludes that innovations provide competitive advantages for organizations when organizations fully exploit their dynamic capabilities by mobilizing knowledge, experience and technological skills within a supportive organizational context.

Keywords: competitive advantage, innovation strategy, intellectual capital, knowledge management.

## INTRODUCTION

Increasingly, innovation has become a source of competitive advantage to organizations. Baden-Fuller (1995) has documented how major innovations in strategy have had an important impact on corporate success. Organizations can also pursue many different strategies in an effort to develop a product portfolio that will give them a competitive advantage over their competitors. These strategies can be wide ranging, and call upon different skills and capabilities from the organization and its employees. Stewart (1994) suggests that an organization's capacity to innovate depends to a very considerable extent upon the knowledge and expertise possessed by its staff, assets 'that can vanish overnight'.

Although a great deal has been written in the general area of strategy, innovation and competitiveness, there is comparatively little written on strategies for exploiting construction innovations. Spender (1989) suggests that managers and strategy writers have mental models of the competitive process and that these models deeply influence how they think and behave. Baden-Fuller has noted three models of the competitive process (i.e. 'positioning', 'dominating' and 'contesting') in terms of innovation

strategy. The 'positioning' model of competition has a long history which has been associated with Bain (1951) in industrial economics, Ansoff (1965) in strategy and with Porter's seminal work on competitive strategy (Porter 1980). For the 'positioning' model, the structure of the industry is a vital component of the competitive outcomes for organizations. Good strategy involves choosing the industry and the competitive territory. The 'positioning' model also contends that different industries have differing profit potential, and there are potentially differential profits to be earned from different positions in the industry.

The 'dominance' model contends that the strength of the firm as measured by their resources and market share, are critical determinants of the competitive process. Good strategy involves pre-emption and successful amassing of resources (Boston Consulting Group 1968, Buzzell and Gale 1987). The 'contesting' viewpoint or 'competition as innovating' suggests that competition is a contest among competing approaches to the market. Firms compete on the basis of competencies and capabilities (Grant 1995; Teece and Pisano 1994).

In this paper, the strategies employed by construction organizations to exploit innovations are discussed. The ways, in which construction organizations have addressed each of the above strategies ('positioning', 'dominating' and 'contesting'), separately and in combination, are also explored. For this paper, innovation means the successful introduction, application and exploitation, within a role, group or organization, of an idea (process, product, technology, service and market), new to the relevant unit of adoption which is designed to significantly benefit the individual, the group or the organization.

## **METHODOLOGY**

This paper is based on a 2-year ESRC funded study which was completed in 1998. The study involved four UK construction companies that have won an Innovation Award in connection with their construction processes and/or products. These companies will be named as companies A, B, C and D to maintain anonymity. Table 1 gives a profile of these companies.

A case study approach was employed through which processes of innovations within these companies were studied. Issues such as challenges encountered during the innovation process, internal and external linkages, enabling mechanisms for innovation implementation, and the culture of teams and those of the companies were also explored. By adopting an ethnographic approach to interviewing personnel within the companies, 54 interviews were conducted with senior, middle and junior personnel from the four participating companies. Each of the interviews lasted for about 1<sup>1</sup>/<sub>2</sub> hours and was recorded for detailed analysis. The methodology for obtaining relevant information for the study also involved site visits and video capture of relevant aspects of the innovation processes and products. Archive documentation on the companies and their innovations was also obtained. This paper, however, only addresses the mechanisms which construction organizations put in place to exploit and benefit from innovations.

**Table 1:** A profile of the four innovative construction companies studied

Company	Turnover and number of employees	Main areas of business	Innovation(s)
A	£30m 425	Piling, underpinning, ground treatment, foundation engineering, landfill restoration, housing foundation packages. Has offices in UK and abroad.	Innovations in foundation engineering design, piling, precast concrete production, beams, floors and walls
B	£12m 80	Production and marketing of materials for concrete repairs, anchoring and fixing, precision grouting, industrial flooring, protection, external paving, façade renders and coatings, texturing and drylining. Has one office in UK only.	Automation in the production of dry cementitious materials for the building and construction industries
C	£30m 500	Works exclusively in the construction and property sector. Offers professional project management and construction management services. Has offices in UK and abroad	The use of digital information technology and team work in carrying out construction work
D	£30m 860	Multi-disciplinary practice active in all major sectors such as offices, retail, leisure, education, healthcare, urban design and renewal, arts heritage and conservation, transport and infrastructure. Has offices in UK and abroad.	The use of digital information technology and team work in carrying out construction work

## INNOVATION STRATEGY

An innovation strategy within construction firms involves its organizational processes, its present position and the ‘paths’ available to it. Baden-Fuller (1995) reminds us that the process of creating competitive advantage through strategic innovation is dependent on the capacity to manage change internally, and that this capacity is closely connected to the notion of corporate entrepreneurship.

Innovating, strategically, can be seen as continuous and central to the competitive process. This dynamic model considers firms as ‘slow-moving actors in a turbulent environment where the rules are uncertain and changing’ (Baden-Fuller 1995). Of course, this point of view contrasts with the neo-classical models of industry competition which is underpinned by the idea that firms are moving around in an environment where the ‘rules of the game’ are well known. In the study on which this paper is based, it was observed that construction organizations can both innovate strategically as well as in an environment where the ‘rules of the game’ are well known.

Any meaningful innovation strategy must have unequivocal support from the top and its objectives will need to be communicated and be accepted by the rank and file within the organization. An innovation strategy needs to sit naturally with the overall strategy of the organization. It will also have to be monitored and reviewed as appropriate.

Egbu *et al.* (1998a) assert that three main issues are important for construction organizations when formulating and implementing an innovation strategy. These are:

- Construction organizations need to determine their positions in terms of processes, services, products, technologies and markets. Although a company's technological strategy is not determined by a particular national system innovation, it is influenced by it and, therefore, needs to be considered. Organizations can use benchmarking procedures and other operational process measures such as market and client satisfaction surveys to measure their positions.
- Since an organization's innovation strategies are constrained by their current position, and by specific opportunities open to them in future based on their competencies, construction organizations will need to determine their technological trajectories or paths. This will involve due cognisance of strategic alternatives available, their attractiveness and opportunities and threats which lie ahead. It will therefore involve construction organizations giving due consideration to the core sectors which they are involved in, main sources of technology and main tasks of technological strategy.
- The organizational processes, which an organization adopts in integrating the transfer of knowledge and information across functional and divisional boundaries (strategic learning), is essential and needs to be consciously managed.

Since competitive advantage and financial success are bound up with industry dynamics, it is necessary to place strategy change in competitive context and identify what kinds of changes lead to strategic innovation, and when these changes result in benefits for the organization.

## **GAINING COMPETITIVE ADVANTAGE BY EXPLOITING ORGANIZATIONAL INNOVATIONS**

Porter's (1980) framework on strategy and competitive advantage and Teece and Pisano's (1994) framework on the dynamic capabilities of firm are well known. According to Porter, 'the goal of competitive strategy ... is to find a position in an industry where a company can best defend itself against these competitive forces [relations with suppliers, relations with buyers, new entrants, substitute products, and rivalry amongst established firms] or can influence them in its favour'. Teece and Pisano's (1994) views on the dynamic capabilities of the firm take account of the 'implementation' stage of a strategy, and the capabilities of organizations learning and changing in response to new and often unforeseen threats and opportunities. Due recognition is also given to competitive markets, firm's specific technology and organizational practices.

Although an organization's competitive advantage can come from various sources, such as size and assets, the four companies studied have been able to gain competitive advantage through their dynamic capabilities, by mobilizing knowledge, experience and technological skills. In the main, these have been achieved through one or combination of the following:

- Being focused on a particular market niche
- Novelty - offering something which no other organization can
- Complexity - difficulty associated with learning about their technologies, which keeps entry barriers high

- Robust design -stretching the basic model of a product/process over an extended life and reducing overall cost
- Continuous incremental innovation – continuous movement of the cost /performance frontier

A key feature of the construction industry is the domination of its product i.e. the outcome of the project (the physical building). In the four innovative companies studied, however, the ‘real’ innovation which changed the capability of the companies and which provided the competitive advantage is the shift to process from product. Company ‘A’ manufactures foundation systems which, with modularity, can be used in multiple project settings (i.e. less job and more process model). The foundation systems are adaptable to new problems and client requirements. Again, unlike most other civil engineering companies, Company ‘A’ manufactures most of its own machinery and invests heavily in R&D. The high cost of most of the machinery and their degree of technological complexity keep entry barriers high for organizations wishing to enter the same market niche as Company ‘A’. In producing dry cementitious materials for the construction industry, Company ‘B’ moved from a batch-based product to a blending and process approach. Companies ‘C’ and ‘D’ are involved in the development and use of information system process (i.e. Wide Area Network (WAN)) which is transferable from project to project. These four companies have tended to programme or ‘productionize’ the activities they undertake.

Although the construction innovations studied were relatively few, they tended to come from the service or supply chain position. This, to some extent, lends support to the view that most innovations take place at the edges of heterogeneous industries, such as the construction industry and not the core.

## **COLLABORATION AND BUILDING CAPABILITY**

In today’s construction environment of globalization of markets, intensification of competition and the growing complexity of relationships with clients, contractors, sub-contractors and suppliers, organizations are increasingly finding that they have to form effective collaboration with others if they are to successfully compete and remain profitable.

The importance of co-operation and collaboration to corporate success and in building organizational capabilities is well cited in the general literature on innovation. For example, Ross and Von Krogh (1996) identify networks as key sources for knowledge building, information and language sharing, and in the building of shared meanings. Perrow in Norhia and Eccles (1992) reviewed SE Asian co-operation which stresses trust building through joint determination of price, sharing of design, sharing of information, large scale collaboration (long term) and prompt payment.

Leonard-Barton (1995) also suggests that core capabilities are built through a knowledge building process which is clustered around four learning styles (present problem solving, future experimenting and prototyping, internal implementing and integrating, and external importing of knowledge). Grant (1995) sees resources and capabilities as keys to strategic advantage and notes that organizations must build and maintain capabilities if they are to innovate. Similarly, for Teece (1986), an important capability is the expertise to manage internal and external organizational complementary resources. Kay (1993) also identifies the architecture (structure), innovation reputation (brand) as key elements for success.

In considering the importance of co-operation and collaboration, Alter and Hague (1993) inform us of the need for adaptive efficiency and role boundary spanning when dealing with the different types of organizational co-operation and collaboration.

For the construction industry, the consequences of fragmentation and the importance of collaboration and co-operation were two principal areas examined by the Latham report (1994). These issues were also given due coverage in the Egan report (1998).

Tools for tackling fragmentation in construction such as partnering, framework agreements and alliances are now becoming increasingly used in the 'best practice firms' and innovative construction organizations (in place of traditional contract-based procurement). Partnering is a set of strategic actions that deliver vast improvements in construction performance. It is also driven by a clear understanding of mutual objectives and co-operative decision-making by a number of firms who are all focused on using feedback to continuously improve their joint performance (Bennett and Jayes 1998).

Company 'A' in our study has formed a partnership arrangement with McDonald's Restaurants for supply and fix of modularized foundation systems. "McDonald's Restaurants have demonstrated an ability to construct a fully-functioning restaurant on site in 24 hours, using a high degree of prefabrication and modularization" (Egan 1998). This same company maintains partnership arrangements with its suppliers and improved relationships with Building Regulators. Savings in the cost of buildings are one of the drivers for partnering as savings are shared by the partners.

The Egan Report has strongly argued that the repeated selection of new teams, as opposed to long term relationships, inhibits learning, innovation and the development of skilled and experienced teams. Through collaboration and by forming long term relationships, construction organizations are able to learn from projects, and to transfer knowledge to organization base and along the supply chain. This benefits all parties. It also strengthens the core competencies and capability of organizations.

For Company 'A', an important factor in the growth of its house foundation packages is to do with its concrete piles. These are generally light, and pre-cast piles are very suited to simple foundations, such as house foundations, in comparison to industrial foundations. The company further created growth for its own piling market. Pre-cast caps for beams (e.g. pre-cast T-beams) can easily and readily be put on top of the company's own concrete piles. Company 'A's ability to move and be successful in house foundation packages is in some measure a consequence of its ability to build and maintain capabilities from previous innovation products and processes in underpinning and piling. It is also a measure of its ability to transfer knowledge from innovation projects to organizational knowledge base as noted in the earlier discussion on the 'contesting' model of the competitive process in innovation strategy.

## **MANAGING KNOWLEDGE AND INTELLECTUAL CAPITAL**

Knowledge is increasingly being recognized as a vital organizational resource that gives market leverage (Amidon 1997, Nonaka and Takeuchi 1995). From an organizational perspective, effective knowledge management is about turning personal knowledge into corporate knowledge that can be widely shared and properly applied throughout the organization in such a way as to create competitive advantage to the organization.

The four companies studied have recognized the importance of an active process management of knowledge creation, gathering, storing and exploitation. The culture and climate (Egbu *et al.* 1998a, 1998b) and the mechanisms in place in these companies, allow for the possibility for knowledge to be readily shared and transferred from project to project and across project teams. Regular meetings, in-house seminars and workshops, de-briefing after end of projects, coaching and job rotation are some of the mechanisms used by the companies for transferring knowledge across project teams. Other mechanisms and activities include:

- Creation of knowledge teams, i.e. staff from all disciplines to develop or improve methods and processes
- Shareware – The provision of platforms, occasions and locations that encourage knowledge exchange
- The development of knowledge bases, such as best practices and market intelligence.

Two of the companies studied, Company A and D, are also in the process of putting in place collaborative technologies such as Intranets or GroupWare for rapid information access, and the introduction of knowledge webs (networks of experts who collaborate across divisions/ Strategic Business Units). Company A is also in the process of establishing Intellectual capital teams whose role includes the identification and auditing of intangible assets e.g. knowledge.

The processes associated with construction innovation are knowledge intensive. The innovation process generates new knowledge intensively, relying on individual human intelligence, and creativity and involving interactive learning. Since innovations, especially radical or ‘rule breaking’ innovations, are associated with challenging thinking, unlearning as well as learning, entrepreneurial organizations appear to need general learning capacity. As Baden-Fuller (1995) and Senge (1990) have emphasized, the ability to learn from others, from the organization around oneself and from one’s own past are critical elements in making progress.

## **MANAGING INNOVATION FOR COMPETITIVE ADVANTAGE: IMPORTANT ISSUES CONSIDERED BY ORGANIZATIONS**

There is no doubt that innovation is a complex social process. In addition, the processes and methods associated with quantifying the benefits/gains derived from innovations are not easy. The present study has, however, revealed some issues and mechanisms which innovative organizations consider and put in place for promoting and exploiting innovations so as to gain competitive advantage. These include:

- The creation of a common understanding of innovation and the need for all departments, not just R&D, to be actively involved and to contribute ideas to new processes, products, services, technologies and markets.
- Putting in place a recognizable and effective process of choosing and screening the best ideas for further development and exploitation.
- Once the ‘best idea’ is identified, the quickest and most efficient way of developing and progressing the idea is developed, with the support of every department (*akin to a Project Management approach*)

- Putting in place measures and mechanisms which make innovation more quantifiable. This tends to have the effect of stimulating an organization's capacity for more innovation. In conjunction with other strategies, it also has the added effect of institutionalizing innovation in organizations. Egbu *et al.* 1998c have identified some of the specific benefits derived through innovations by the four companies.

## CONCLUSIONS AND RECOMMENDATIONS

Although innovation in a construction environment is complex social process, when managed effectively it creates possibilities for competitive advantage. From an organizational point of view, this paper has shown that long-term collaboration is important in building core competencies and capabilities. Building and maintaining capability is vital for economic and competitive advantage. If the construction industry is to build and maintain capability, it has to change from an adversarial culture to a sharing culture. The issue of trust is important in this context. Construction organizations also exploit organizational innovations by being focused on a particular niche market, the continuous movement of the cost performance frontier, novelty, stretching basic model product/process, providing complexity in technologies thereby increasing entry barriers, and through effective management of knowledge and intellectual capital assets.

Gaining competitive advantage through innovation requires an integrative approach and a supportive organizational framework. The supportive organizational framework includes support from top management, and the creation of a conducive climate and culture for innovation. There is no 'quick-fix' to institutionalizing innovation in organizations. Innovation is a long-term agenda that needs investment in terms of finance, technology, systems, and people.

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