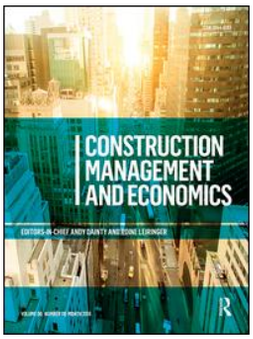

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Appropriate innovation in small construction firms

MARTIN SEXTON* and PETER BARRETT

Research Institute for the Built and Human Environment, Bridgewater Building, University of Salford, Salford, Greater Manchester, M7 9NU, UK

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Innovation-led performance improvement in the construction industry is significantly influenced by the innovation performance of small firms. There is a dearth of research investigating innovation from the perspective of the small construction firm. This paper contributes to this underdeveloped area by offering relevant empirically based results. The findings stress the important role that owners of firms play in successful innovation. The type of innovation undertaken, and the different organizational factors which are brought into play, is shown to depend on the characteristics of the interaction environment in which the firm is operating. Small construction firms need to incrementally nurture, or identify and move into, supportive enabling interaction environments. This is achieved through an integrated development of a firm's business strategy and market positioning, organization of work, technology and people. The process of innovation is demonstrated to be subject to cyclical peaks and troughs as the progress of the innovation competes with day-to-day pressures. Small construction firms have their own distinctive characteristics, which are profoundly different from those of large construction firms. The implication for policy is that any initiatives geared toward improving appropriate innovation need to appreciate these differences.

Keywords: Construction, innovation, small firms, research results

Introduction

The construction industry is being increasingly challenged to successfully innovate in order to satisfy better the aspirations and needs of society and clients, and improve competitiveness (Latham, 1994; DETR, 1998). The industry is generally driven by single and unique projects, each creating and disbanding project teams made up of varying combinations of large and small firms from across the supply chain spectrum (Tatum, 1986; Betts and Wood-Harper, 1994; Carty, 1995; Halpin and Woodhead, 1998). The scale of small firm activity in this collage of disjointed projects is considerable, with, in 1999, 99% of UK construction firms having 1–59 staff (DETR, 2000, Table 3.1), delivering some 52% of the industry's workload (DETR, 2000, Table 3.3). Therefore, any innovation-led performance improvement in the industry is significantly influenced by the innovation performance of small construction firms.

*Author for correspondence. E-mail: m.g.sexton@salford.ac.uk

There is a dearth of research investigating innovation from the perspective of the construction firm (Egbu *et al.*, 1998, p. 605; Gann and Salter, 2000, p. 955). Although it is acknowledged that construction firms have always demonstrated an ability to innovate (Slaughter, 1998), construction practitioners are now very much getting to grips with the need for, and management of, innovation as an *explicit* endeavour (CIC and DoE, 1996).

This need provided the motivation for the 18-month EPSRC IMI funded 'Innovation in Small Construction Firms' project. The aim of this paper is to contribute to this underdeveloped area of innovation in small construction firms by offering case study and action research project results that address, in part, key research questions identified from the relevant literature discussed in Sexton and Barrett (see pp. 613–22 of this Special Issue). The structure of this paper is as follows. First, significant issues from the literature will be presented. Second, the aims and the research methodology of the project will be briefly described. Third, principal findings from this

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project will be presented. Finally, conclusions and implications will be drawn.

Key issues from the literature

Sexton and Barrett (2003) furnished a conceptually organized synthesis of the general and construction specific literature pertaining to innovation in small construction firms. The discussion was structured around the generic innovation model, which argues that successful innovation *outcomes* are achieved through an appropriate innovation *focus* that is responsive to *contextual factors*, realized by appropriate organizational *capabilities* and channelled through effective and efficient innovation *processes*. The model is offered primarily as a way of structuring the literature review, although the review provided support for its general validity.

The synthesis identified a number of research questions structured round the generic innovation model. These questions are listed in Table 1. Research findings from the project are offered to address the questions set out in Table 1. The research aims and methodology employed to generate these findings are described in the next section.

Research methodology

The overall research process used in the 18-month project is given in Figure 1. The project was given direction through its 'research focus and objectives'. The basic research objectives were defined in such a fashion so that the research was focused, but broad enough to allow for flexibility and serendipity.

(1) To determine what innovation means for small construction firms, particularly with respect to:
   - what is the motivation to innovate; and
   - what constitutes appropriate innovation.

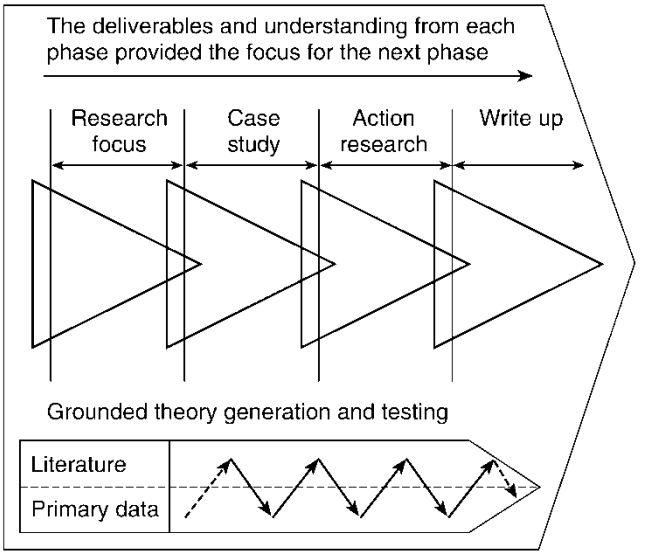

Figure 1 Overall project research methodology

(2) To investigate how small construction firms create, manage and exploit innovation.

These objectives were pursued through two main research phases: the case study phase, and the action research phase. Finally, the completed results were written up.

Two generic strands ran through this process. First, each phase provided progressive focus for the next stage: nested research objectives and methodologies were redefined to reflect our broadening and deepening understanding as the case study and action research phases progressed. Second, the improved understanding was a product of grounded theory generation and testing between the primary data from the fieldwork and secondary data from the general and construction specific innovation and associated literatures (Glaser and Strauss, 1967; Barrett and Stanley, 1999). The research was undertaken collaboratively with seven small construction firms.

Table 1 Research questions identified by Sexton and Barrett (2003)

Generic innovation model: focus and outcome of innovation
1. What generic strategic focus for innovation or definition of innovation does this motivation generate?
2. What is the general motivation for small construction firms to innovate?
3. What are common innovation outcomes in small construction firms?
Generic innovation model: organizational capabilities for innovation
1. What are the key capabilities for innovation in small construction firms?
2. How are these capabilities developed and used in innovation activity?
Generic innovation model: context of innovation
1. What are the key events external and internal to small construction firms that trigger innovation activity?
2. What is the appropriate emphasis between market-based innovation and resource-based innovation in small construction firms, and what conditions dictate this emphasis?
3. How do small construction firms sense and act upon the information generated from these key events
Generic innovation model: process of innovation
1. Are the processes of innovation in small construction firms rational and/or behavioural in nature

Small firms were defined as having between 10 and 49 staff (Loecher, 2000). Table 2 summarizes key characteristics of the participating firms.

In addition, two national construction firms (one contractor and one design consultant), contributed a large firm perspective and provided continuity from a previous project investigating innovation in large firms (Barrett and Sexton, 1998). Finally, the project benefited from the collaborative input from the National Federation of Builders and the Royal Institution of Chartered Surveyors, and international contribution from the Norwegian Building Research Institute and from VTT, Finland.

The six-month case study phase had two principal objectives:

(1) to obtain an overall picture of each of the firms and their innovation activity (albeit at a coarse-grained level at this stage); and in doing so enable the
(2) generation of hypotheses and models based on identified variables that appeared to be key to successful innovation and that would be subsequently tested in the action research phase.

Four semi-structured interviews were carried out with each of the seven small construction firms. Each interview focused on specific issues: general fact-finding about the firm; the organization of the firm; the main factors affecting innovation activity; and a specific example of an innovation. The interviews were recorded and transcribed and then sent to the interviewees for validation. The qualitative data was analysed using Decision Explorer, a cognitive-mapping software tool (http://www.banxia.com/demain.html). Maps were prepared for each of the firms, and a cross-case analysis carried out. This analysis led to the identification of significant factors and themes. Four workshops were held during the case study phase. The format of the workshops, in broad terms, was to debate and cross-fertilize insights and experiences, and to identify, develop, validate and generalize findings coming out of the case study data and cognitive maps (Hansen and Sjøholt, 1989; Vennix, 1996). The workshops were structured around a number of main questions that were informed by the fieldwork, namely: what are the key issues for effective innovation in small construction firms? What are the required improvements? What are the current drivers and obstacles for these improvements? How can these improvements be integrated into the strategies and cultures of the firms?

The purpose of the 10-month action research phase was to test, validate and further develop the interim findings from the case study phase on real world innovations chosen by the industrial partners. The action research process was adopted from Susman (1983). First of all,

Table 2 Key characteristics of participating small construction firms

Company	Est	No. owners	T/O (1999)	Staff no.	Principal business focus	Main fields of expertise/clients
Consultant A	1997	4	£1.25m	26	Architectural design & project management	All major commercial sectors (retail, office, financial and art/leisure fields)
Consultant B	1998	2	£0.44m	11	Quantity surveying and construction cost consultancy	Public and private sector clients
Consultant C	1981	3	–	20	Survey, design and building contract administration.	Mostly public sector, with some commercial and industrial clients
Consultant D	1990	4	£0.05m	20	Building services engineering	Mechanical, electrical and public health services, (including data and telecom systems) for commercial, health care, education and industrial projects
Contractor A	1981	2	£2m	25	General building contracting	Local authority and house association
Contractor B	1996	2	£3.2m	15	Management of building and engineering contracts	Blue-chip clients in petroleum, food retailing, commerce, industry and civil engineering
Contractor C	1985	2	£2.12m	25	Renovation and refurbishment. Quality fit out contractor, project management and subcontractor coordination	Mainly commercial and some industrial blue chip clients and local authorities

the innovation to form the focus of the action research in each of the firms was identified. The project team agreed that maximum benefit would be accrued to both the construction firms and the academic team, within the prevailing time and resource constraints of the project, if the chosen innovations were 'quick, tangible and measurable'. The chosen innovations varied across the firms, in both content and their stage of development – some innovations had already started before the action research phase, while others were started during the action research phase. The innovations included the development and implementation of health and safety cards on construction sites, the development of a company website, and the development of a web-based archive of photographs of completed buildings.

Once innovations were identified, data was collected through interviews to establish a more detailed diagnosis. The organizational factors of innovation model developed during the case study phase (see Figure 3) was used by the academic team to produce a template that was used by the small firm participants and the academic team to collaboratively develop possible ways to progress the innovation. An action plan was collaboratively agreed and implementation carried out. During this phase the following issues were addressed: how firms could best create or spot appropriate innovation; the link to business strategy; and how firms could manage/implement the innovation and maximize general organizational learning. The same research tools, as those used during the case study phase, enabled the action research to be rigorously recorded and analysed.

As with the case study phase, the action research benefited from workshops attended by all of the small firms and the academic team, and from the ongoing grounded theory-based dialogue.

Summary of research results

Innovation focus

What is the generic strategic focus for innovation or definition of innovation for small construction firms?

The practitioners involved in the project viewed successful innovation as *the effective generation and implementation of a new idea, which enhances overall organizational performance*. This definition was developed originally by (and for) large construction firms (Barrett and Sexton, 1998), but is considered by the practitioners to be sufficiently inclusive to accurately define innovation in small construction firms. Applying this definition to small construction firms, the following assumptions are emphasized and illustrated:

(1) *Idea*: ideas are taken to mean the starting point for innovation (for example, see Thompson, 1965). Ideas can be administrative in nature (for example, the organizational restructure and process changes to support partnering carried out by Contractor B) and technical in character (for example, the computerization of quantity surveying computation and report generating tasks by Contractor C).

(2) *New*: not all ideas are recognized as innovations and it is accepted that newness is a key distinguishing feature (for example, see Zaltman *et al.*, 1973). The idea only has to be new to a given firm, rather than new to the 'world'. Further, the newness aspect differentiates innovation from change. All innovation implies change, but not all change involves innovation. For a contractor, for example, a change in a materials supplier is not necessarily an innovation, but a change in the relationship between the contractor and the supplier from a project-to-project open tender situation to a long term 'partnering' type of relationship would constitute an innovation.

(3) *Effective generation and implementation*: innovation requires not only the generation of an idea (or transfer of a 'new' idea from outside the company), but also its successful implementation (for example, see Thompson, 1965). The implementation aspect differentiates innovation from invention (for example, see Monk, 1989).

(4) *Overall organizational performance*: innovation must improve organizational performance, either individually, or collectively through the supply chain (for example, see Kimberley, 1981). Innovations that improve some isolated aspect at the expense of overall performance are undesirable.

The key implication of this definition of innovation is that not all innovation *per se* is beneficial; rather, appropriate innovation is.

What is the general motivation for small construction firms to innovate?

The project indicated that the motivation to innovate in small construction firms follows a fluid hierarchy of 'motivational needs', as shown in Figure 2:

(1) *Survival*: small construction firms, owing to the type of markets they operate in and their lack of organizational resources and slack, concentrate foremost on project-based innovation focusing on survival.

(2) *Stability*: it is only once survival has been confidently achieved that firms are sufficiently motivated to look towards consolidating and stabilizing their market and/or resource position to ensure steady-state conditions over the medium term.

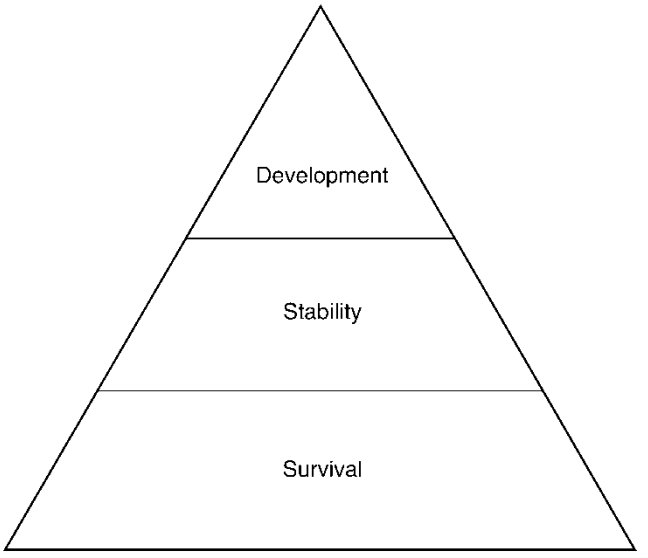

Figure 2 Hierarchy of motivational drivers for innovation

(3) *Development*: this stability provides the necessary motivation to exploit the prevailing stability and to develop and/or grow.

This type of hierarchy is consistent with arguments located in the stage theory research literature. Churchill and Lewis (1983) describe five stages through which small firms pass: existence, survival, success, take-off and resource maturity. The findings, however, depart from this literature, by emphasizing that survival, stability and development stages are not rigidly linear in progression, but cyclical in response to dynamic imbalances between shifting market-based and resource-based conditions. This dynamic and cyclical behaviour confirms that small construction firms remain more open to their external environments compared to large firms owing to their comparative lack of market and resource buffers. Further, there is a tendency in the stage theory literature that small firms strive for growth *per se*. The project findings indicate that the motivation to innovate is not solely to grow, but can be directed at creating sustainable steady-state development.

The principal implications of the findings on the motivation for small construction firms to innovate are threefold. First, small construction firms are not always motivated to innovate; when in 'survival' posture, firms will generally want to limit their exposure to the costs and risks of innovation as much as possible. Second, the hierarchy of motivational drivers for innovation are dynamic and cyclical; not a linear progression. Third, not all small construction firms want to grow indefinitely in size; firm size will stabilize at a level that is compatible with the owner's aspirations.

What are common innovation outcomes in small construction firms?

The findings provide numerous and diverse examples of innovation outcomes: client relationship development innovation; organization and management innovation at firm and project levels; technological innovation, etc. The principal outcome of innovation activity can be usefully grouped into two areas: improving the *effectiveness* of the firm, i.e. making sure that the firm is doing the right activities; and, improving the *efficiency* of the firm, i.e. making sure that the firm's activities are done well.

Organizational capabilities for innovation

What are the key capabilities for innovation in small construction firms?

A model of the organizational factors critical to successful innovation (see Figure 3) emerged from the project analysis. The variables which make up the model are defined as follows:

- *given environment* is that part of the business environment that firms are influenced by, but which they cannot influence themselves;
- *interaction environment* is that part of the business environment that firms can interact with and influence;
- *business strategy* is concerned with the overall purpose and longer term direction of the firm and its financial viability;
- *market positioning* is the chosen (or emergent) orientation towards desired target markets for the purpose of achieving sustainable profitability;

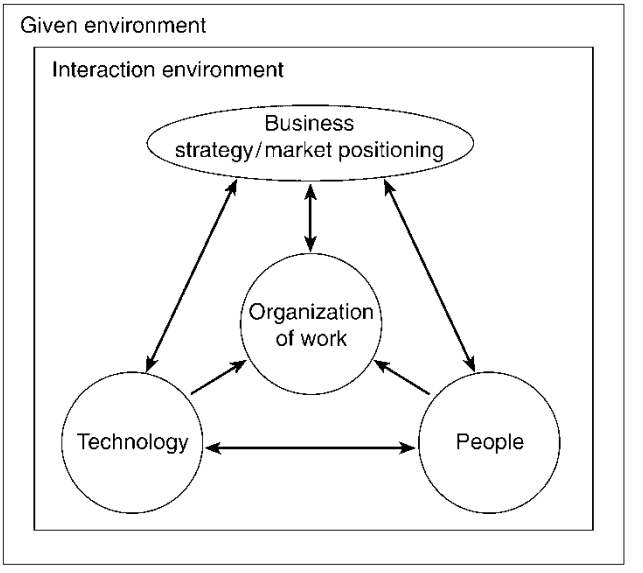

Figure 3 Organizational factors of innovation model

- *technology* is the machines, tools and work routines used to transform material and information inputs (for example, labour, raw materials, components, capital) into outputs (for example, products and services);
- *people* are viewed as possessing knowledge, skills and motivation to perform a variety of tasks required to do the work of the firm; and
- *organization of work* involves the creation and co-ordination of project teams and commercial networks both within the firm and across its business partners.

The model emphasizes and embraces both the holistic and systemic dimensions of innovation. The creation, management and exploitation of innovation involve consideration of not only the *content* of a chosen innovation, but also the management of the *process* of innovation and the *context* in which it occurs. The model considers two aspects of context: the inner and outer contexts of the firm. The inner context refers to the 'business strategy/market positioning', 'organization of work' and 'technology and people'. The outer context refers to the 'given' and 'interaction' business environments. The process of innovation refers to the actions, reactions and interactions of, and between, the variables in the outer and inner contexts.

How are these capabilities developed and used in innovation activity?

The *business strategy/market positioning* capability factor for innovation in small construction firms is shaped by three key characteristics. First, firms are more exposed to the whims and movements of their business environments than large firms and, in necessary response, their business strategies tend to be more 'soft focus' and reactive in nature. This perception endorses the literature which argues that small firms are often more agile and responsive than larger firms (for example, see Mansfield *et al.*, 1971; Rothwell, 1989; Nooteboom, 1994; Rothwell and Dodgson, 1994). Second, the greater vulnerability to the market amplifies the need for careful positioning in markets and development of strong, personal client relationships in order to spread the risk of variable workflows in any one market. These characteristics echo the need for 'client intimacy' (Treacy and Wiersema, 1995) and careful market positioning (for example, see Porter, 1991). Third, the dominant role of the owner(s) of small firms allows quick decision-making and innovation activity to take place in response to rapidly shifting market conditions and client demands; in effect, to creating an agile firm. This finding is consistent with the literature which argues that the managerial logic possessed by the principals of small firms have a considerable impact on the direction and implementation of strategy (for example, see Storey, 1986; Dodgson and Rothwell, 1991). However, the very political strength exercised by owners, which can stimulate agility, can bring about, if that individual lacks vision, an adversely myopic view of the 'best way' for the firm to operate.

The *technology* capability factor for innovation in small construction firms has three principal qualities. First, information technology is an increasingly import-ant *focus* for innovation in itself, and as an *enabler* for innovation. Second, 'soft' technologies, such as work routines, are particularly important. The required 'soft focus' and 'agility' of small firms to compete necessitates work routines that provide stability at the administrative core, and flexibility in project processes to adapt to rapidly changing market conditions and client needs. Gann (2000) echoes this finding by stressing a central challenge for construction firms is to analytically separate business and project processes in order to better understand them, but successfully integrate them in practice to produce seamless service delivery. Third, knowledge management is seen as a way to transfer tacit knowledge located in individuals to company knowledge. This is particularly important for small construction firms, as often a significant proportion of their knowledge about clients and work activities is embodied in a small number of individuals. The concentration of knowledge in a few staff renders small firms especially vulnerable to key members of staff leaving the firm (for example, see Barrett and Ostergren, 1991).

The *people* capability factor offers two important implications for innovation in small construction firms. First, the appropriate ability and motivation of staff is paramount for firms to create, manage and exploit innovation. Second, staff need to have a broad range of skills and experience to undertake multiple tasks. This flexibility is especially pertinent to small firms, who need to be 'agile' with limited, and often very stretched, staff resources. These general conclusions are consistent with Lawler (1973), who argued that performance was a function of ability and motivation, and that ability was, in turn, a function of aptitude, training and experience.

The *organization of work* capability factor identifies a number of significant implications for innovation in small construction firms. First, there is a fairly uniform pattern of allocation of work through the hierarchy process which establishes reporting and communication structures at corporate and project levels. These characteristics are consistent with Maister (1993) who stresses the hierarchical nature of the securing, co-ordinating and doing of work. Second, the resourcing of projects and the organization of project work is flexible in response to scarce organizational slack (in particular, limited staff resources) and the volatile and unpredictable characteristics of construction projects.

Context of innovation

What are the key events that trigger innovation activity in small construction firms?

Innovation activity in small construction firms is triggered predominantly by key events in its external business environments, rather than within the firm itself. Changing client needs and unpredictable project-specific conditions stimulates innovation activity in particular. These triggers for innovation are predominantly filtered and prioritized by the owner(s) of the firm. This significant role of the interaction environment is discussed more fully in the next question.

What is the appropriate emphasis between market-based innovation and resource-based innovation in small construction firms, and what conditions dictate this emphasis?

The findings identify two principal modes of innovation, shown in Figure 4, which aim to provide a better understanding of the shifting balance between market-based and resource-based innovation. The two *modes of innovation* are shown in the centre portion of the diagram. Mode 1 innovation focuses on progressing single project, cost-orientated relationships between the client and the firm – this mode of innovation is more driven by rapid change and uncertainty in the interaction environment, and the innovation is more market-based. Mode 2 innovation concentrates on progressing multiple project, value-orientated relationships between client and the firm – this mode of innovation is more aligned to improving the effectiveness of a firm's relationship with its clients – this mode of innovation stimulates an equal balance between market-based and resource-based innovation *market*, and enhancing the effectiveness of its *resources*.

The right-hand side of the diagram reinforces the notion that the mode of innovation is substantially determined by the nature of the *interaction environment*: an enabling interaction environment encourages Mode 2 innovation; and a constraining environment is conducive to Mode 1 innovation. An enabling interaction environment is one that the firm can influence to a significant extent, *enabling* the firm to innovate within a longer term and more secure context. A constraining interaction environment is one that a small construction firm can only influence to a limited extent, *constraining* the firm to innovation activity undertaken within a shorter and more insecure context.

The left hand side of the diagram identifies which factors of the organizational model are the primary focuses of (and levers for) innovation activity. Mode 2 innovation involves innovation in the 'business strategy/market positioning' variable that, in turn, will have implication for the remaining variables. Mode 1 innovation is where the 'business strategy/market positioning'

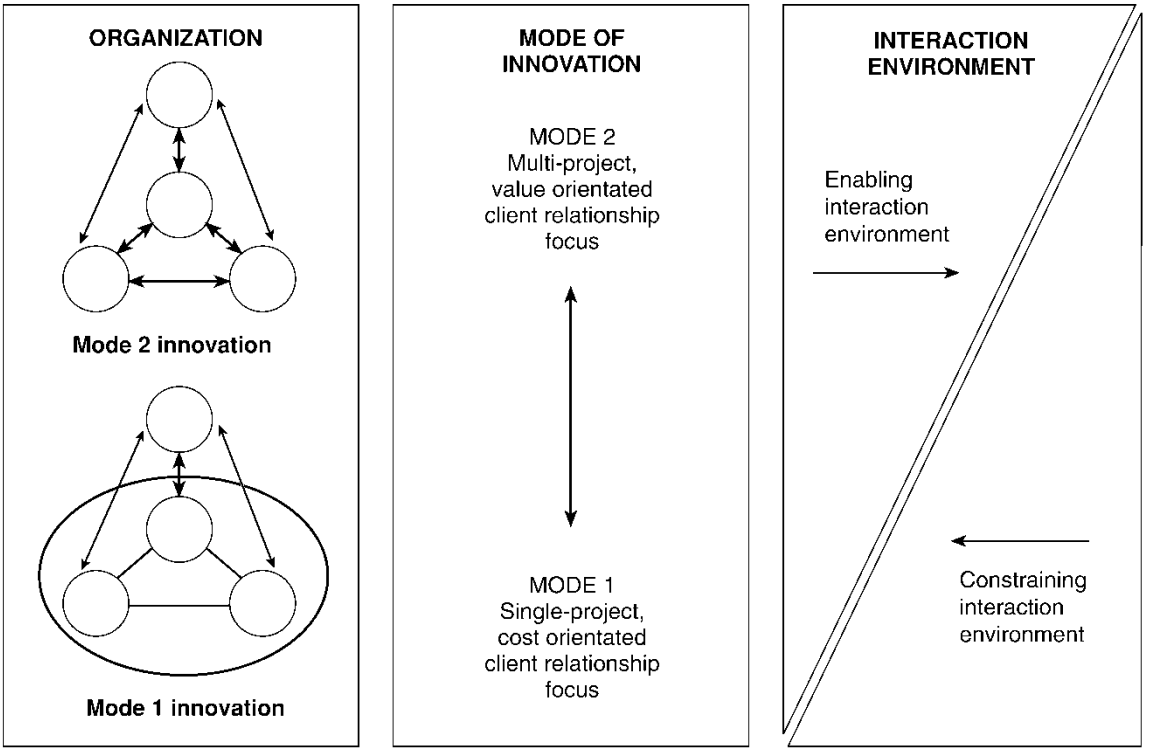

Figure 4 Mode 1 and mode 2 innovation

variable is relatively fixed, and the focus of the activity is in the 'organization of work', 'technology' and 'people' variables. Mode 1 and Mode 2 innovation presents a continuum, rather than a choice of two discrete types of innovation activity, i.e. 'hybrid' modes of innovation can be located between Mode 1 and Mode 2.

The key implication for small construction firms is that they should not move too rashly from Mode 1 innovation to Mode 2 innovation. Small construction firms need to nurture or move incrementally into supportive enabling interaction environments. This is achieved through careful and integrated consideration and development of all the variables in the organizational factors of innovation model (Figure 4). It would be potentially disastrous, for example, for a small construction firm to enter into a partnering relationship with a client without the necessary 'organization of work', 'technology' and 'people' to fully satisfy client and firm needs and expectations.

How do small construction firms sense and act upon the information generated from these key events?

Small construction firms make considerable effort in sensing key events within their client bases and their projects. Practitioners place the highest importance in developing client relationships and understanding client organizations. At a project level, small construction firms respond to changing client needs and unpredictable project challenges through flexible project work routines.

Process of innovation

Are the processes of innovation in small construction firms rational and/or behavioural in nature?

The rational view of the innovation process depicts innovation as being rigidly multistage and linear in nature. In contrast, the behavioural perspective sees the innovation process as being a nonlinear cycle of divergent and convergent activities. The findings portrayed the process of innovation as being behavioural and characterized, as shown in Figure 5, by an interplay between forces of 'action' and 'reaction' over time which progresses or inhibits the closing of the 'innovation gap' between the current level of performance and a desired level of performance.

There are a myriad of potential action and reaction forces in each of the organizational innovation variables; such as, strong senior management support for the innovation (action), resistance to change from staff (reaction), allocation of capital to purchase needed technology (action), and lack of appropriate work routines to coordinate and channel the innovation activity (reaction). Figure 5 presents a situation where the innovation is successful, i.e. the 'action' forces, over time, have overcome the 'reaction' forces. It is just as feasible, of course, for

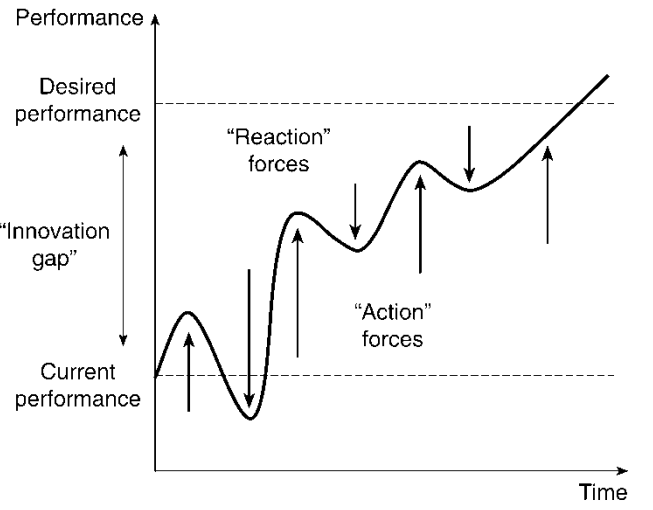

Figure 5 Action and reaction in innovation

the 'reaction' forces to be stronger than the 'action' forces, and for the innovation to fail.

The innovation process is thus often not an orderly, neat process, but a process that is subject to peaks and troughs as the progress of the innovation competes with day-to-day variability of workload and the often acute pressures on finite staff and financial resources. It is a process of planning, acting, learning and re-planning. The innovation process model, see Figure 6, offers a cyclical process of diagnosing, action planning, taking action, evaluating and specifying learning. The process has five parts:

(1) *Diagnosis*, where the issue (be it an opportunity or problem) forming the focus of the innovation activity is identified, and information is collected for a more detailed diagnosis. From this an:
(2) *Action plan* is prepared, where possible ways to progress the innovation are developed, and from which an agreed plan of action emerges. This provides the basis for:
(3) *Taking action* where the idea is put into practice. Once in practice:
(4) *Evaluation* takes place to determine whether the innovation has been a success or not. At this stage:
(5) *Specific learning* is undertaken where innovation is re-assessed, areas for improvement identified, and the process begins another cycle.

The cycle starts with sensing an opportunity or need to innovate in response to market, project and/or client conditions. These triggers for innovation are predominantly filtered and prioritized by the owner(s) of the firm. Innovation activity does not take place in five sequential stages; rather, as depicted in the outer ring of the Figure 6, the cycle can take place at each stage of the

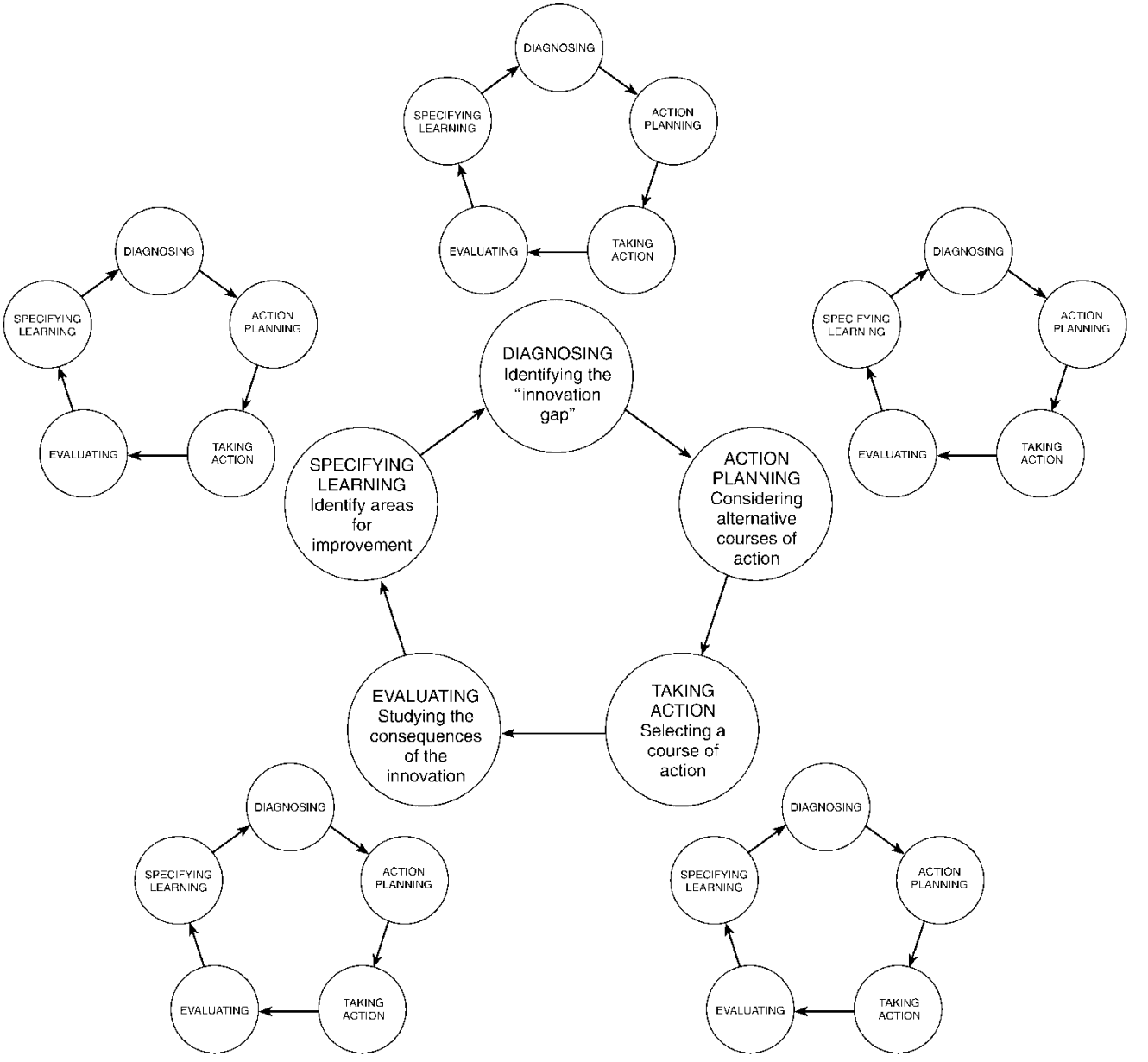

Figure 6 The process of innovation

'overall' process. The 'overall' process continues until the innovation is either successful, or it is decided that the innovation is not appropriate, and should not be continued.

Conclusion

The focus of this paper has been to broaden and deepen our understanding of innovation in small construction firms by offering case study and action research results from an 18-month 'Innovation in Small Construction Firms' project. The project identified the following aspects as being significant in influencing the motivation for, and ability of, small firms to successfully innovate:

- The owner(s) of small construction firms have the necessary power to ensure quick decision-making and innovation activity take place in response to rapidly shifting market conditions and client demands. These triggers for innovation are predominantly filtered and prioritized by the owner(s) of the firm. The dominant role of the owner, however, can constrain innovation activity if the owner does not have the necessary vision and systemic thinking when diagnosing and

progressing innovation activity. Innovation in one part of the business often has significant implications for other parts of the business that need to be considered and brought together in an integrated way.

- The type of innovation undertaken, and the different organizational factors that are brought into play depend to a significant extent on the characteristics of the interaction environment in which the firm is operating. The 'modes of innovation model' identifies two principal modes of innovation: Mode 1 – single-project, cost-orientated client relationships; and Mode 2 – multi-project, value-orientated client relationships. The mode of innovation is substantially determined by whether the interaction environment is enabling or constraining.

  The key implication for small construction firms is that they should not 'flip' from Mode 1 innovation to Mode 2 innovation. Small construction firms need to incrementally nurture, or identify and move into, supportive enabling interaction environments. This is achieved through careful and integrated consideration and development of all the variables in the 'organization model of innovation' in an integrated fashion: 'business strategy/market positioning', 'organization of work', 'technology' and 'people.'
- The process of innovation is behaviourial in nature, being a cyclical process of diagnosing, action planning, taking action, evaluating and specifying learning. The cycle starts with sensing an opportunity or need to innovate in response to market, project and/or client conditions. These triggers for innovation are predominantly filtered and prioritized by the owner(s) of the firm. The 'action and reaction in innovation' stresses that the innovation process is often not an orderly, neat process, but a process that is subject to peaks and troughs as the progress of the innovation competes with day-to-day variability of workload and the often acute pressures on finite staff and financial resources.

The project findings show that small construction firms have their own distinctive characteristics and needs from those of large construction firms. When compared to innovation in large construction firms (Barrett and Sexton, 1998), there is shared agreement on the definition of innovation – regardless of firm size, practitioners view innovation as needing to be action-orientated and delivering overall performance improvement. There is significant difference in emphasis, however, with the motivation, capacity and capability to innovate between large and small construction firm, in particular:

- the pivotal role of the owner(s) of small construction firms in triggering innovation compared to the less agile bureaucracy of large firms;
- the small firm focus on niche markets in contrast to the broader market segments which large firms occupy; and
- the lack of organizational slack that small firms have judged against large firms, which hamper their capacity for experimentation and for committing to investment strategies that will not give a return until the medium to long term.

The implication for government and institution policy is that any initiatives geared toward improving performance of construction firms need to appreciate and actively manage these differences; policies that are appropriate for large construction firms are not necessarily appropriate for small construction firms, and *vice versa*.

Finally, the findings from the project reinforce the dynamic nature of innovation. An innovative firm is not a stable solution to achieve, but a developmental process to keep active.

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References

Barrett, P. and Ostergren, K. (1991) The value of key persons in professional firms, in Barrett, P. and Males, R. (ed.) *Practice Management: New Perspectives for the Construction Professional*, E & FN Spon, London, pp. 314–21.

Barrett, P. and Sexton, M.G. (1998) *Integrating to Innovate: Report for the Construction Industry Council*, DETR/CIC, London.

Barrett, P. and Stanley, C. (1999) *Better Construction Briefing*, Blackwell Science, Oxford.

Betts, M. and Wood-Harper, T. (1994) Reengineering construction: a new management research agenda. *Construction Management and Economics*, **12**, 551–6.

Carty, G. (1995) Construction. *Journal of Construction Engineering and Management*, **121**(3), 319–28.

Churchill, N.C. and Lewis, V.L. (1983) The five stages of small business growth. *Harvard Business Review*, May/June, 30–50.

Construction Industry Council and Department of Environment (1996) *A New Way of Working: The Future of Construction*, conference, London, 15–16 January.

Department of the Environment, Transport and the Regions (DETR) (1998) *Rethinking Construction*, DETR, London.

Department of the Environment, Transport and the Regions (DETR) (2000) *Construction Statistics Annual: 2000 Edition*, DETR, London.

Dodgson, M. and Rothwell, R. (1991) Technology strategies in small firms. *Journal of General Management*, **17**(1), 45–55.

Egbu, C.O., Henry, J., Kaye, G.R., Quintas, P., Schumacher, T.R. and Young, B.A. (1998) Managing organizational innovations in construction, in *Proceedings of the Association of Researchers in Construction Management Fourteenth Annual Conference*, University of Reading: 9–11 September.

Gann, D.M. (2000), *Building Innovation: Complex Constructs in a Changing World*, Thomas Telford, London.

Gann, D.M. and Salter, A.J. (2000) Innovation in project-based, service-enhanced firms: the construction of complex products and systems. *Research Policy*, **29**(7,8), 955–72.

Glaser, B.G. and Strauss, A.L. (1967) *The Discovery of Grounded Theory*, Aldine, Chicago.

Halpin, D. and Woodhead, R. (1998) *Construction Management*, 2nd edition, Wiley, New York.

Hansen, R. and Sjøholt, O. (1989) *Quality Management: A Challenge for The Building Industry*, Norwegian Building Research Institute, Norway.

Kimberly, J.R. (1981) Managerial innovation, in Nystrom, P.C. and Starbuck, W.H. (eds), *Handbook of Organizational Design – Volume 1: Adapting Organizations to their Environments*, Oxford University Press, New York, pp. 84–104.

Latham, M. (1994) *Constructing the Team*, HMSO, London.

Lawler, E.E. (1973) *Motivation in Work Organizations*, Brooks/Cole, Monterey, CA.

Loecher, U. (2000) Small and medium-sized enterprises – delimitation and the European definition in the area of industrial business. *European Business Review*, **12**(5), 261–4.

Maister, D.H. (1993) *Managing the Professional Service Firm*, Free Press, New York.

Mansfield, E., Rapoport, J., Schnee, J., Wagner, S. and Hamburger, M. (1971) *Research and Innovation in the Modern Corporation*, Norton, New York.

Monk, P. (1989) *Technological Change in the Information Economy*, Pinter, London.

Nooteboom, B. (1994) Innovation and diffusion in small firms: theory and evidence. *Small Business Economics*, **6**, 327–47.

Porter, M.E. (1991) Know your place. *Inc. Magazine*, September, 90–3.

Rothwell, R. (1989) Small firms, innovation and industrial change. *Small Business Economics*, **1**, 51–64.

Rothwell, R. and Dodgson, M. (1994) Innovation and firm size, in Dodgson, M. and Rothwell, R. (eds), *The Handbook of Industrial Innovation*, Edward Elgar, Aldershot, pp. 310–24.

Sexton, M.G. and Barrett, P.S. (2003) A literature synthesis of innovation in small construction firms: insights, ambiguities and questions. *Construction Management and Economics*, **21**(6), 613–22.

Storey, D.J. (1986) The economics of small businesses: some implications for regional economic development, in Amin, A. and Goddard, R. (eds) *Technological Change, Industrial Restructuring and Regional Development*, Allen & Unwins, London, pp. 86–102.

Susman, G.I. (1983) Action research: a sociotechnical systems perspective, in Morgan, G. (ed.) *Beyond Method: Strategies for Social Science Research*, Sage Publications, London, pp. 95–113.

Tatum, C.B. (1986) Organising to increase innovation in construction firms. *Journal of Construction Engineering and Management*, **115**(4), 602–17.

Thompson, V.A. (1965) Bureaucracy and innovation. *Administrative Science Quarterly*, **5**, 1–120.

Treacy, M. and Wiersema, F. (1995) *The Discipline of Market Leaders*, Harper Collins, London.

Vennix, J.A.M. (1996) *Group Model Building: Facilitating Team Learning Using System Dynamics*, Wiley, Chichester.

Zaltman, J., Duncan, R. and Holbek, J. (1973) *Innovations and Organizations*, Wiley, New York.