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Innovation in small construction knowledge-intensive professional service firms: a case study of an architectural practice

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Small construction knowledge-intensive professional service firms (SCKIPSFs) are becoming increasingly important agents of innovation within the construction industry. The nature and process of innovation in SCKIPSFs, however, is generally considered through the constraining prism of research results generated from significantly different contexts, such as from manufacturing sectors or non-project based firms. A theory of innovation for SCKIPSFs is developed from a longitudinal 22-month case study of a small architectural practice. Two forms of knowledge-based innovation were discerned from the empirical work: exploitative innovation and explorative innovation. 'Explorative innovation' was found to be located in immediate 'new' project domains, and entailed search, variation, experimentation, activity to solve project-specific problems; while 'exploitative innovation' concentrated on developing generic organisational infrastructure to 'refine' and 'improve the efficiency' of the firm operations to nurture capability for future activity. The key challenge for SCKIPSFs is to develop and manage an appropriate balance between explorative and exploitative innovation over time in order to generate sustainable competitive advantage.

Keywords: Knowledge-intensive, professional service firms, innovation, small enterprises

Introduction

Knowledge and knowledge workers are increasingly being regarded as the key source of wealth for individual organisations and nations (e.g. Dougherty, 1999; European Commission, 2004; Porter, 1990; Raich, 2002). This shift to the 'knowledge economy' (Drucker, 1993) is evident in the United Kingdom (UK) construction industry. CIC and DTI (2003, p. 9), for example, indicate a rise in the number of UK construction knowledge-intensive professional service firms (KIPSFs) from 19,000 in 1996 to 23,500 in 2003. The majority of construction knowledge-intensive professional services are provided by small firms. CIC and DTI (2003, p. 10, Table 3.1), for instance, state that 97% of UK construction KIPSFs employ fewer than 50 people.¹ As a consequence, small construction KIPSFs (SCKIPSFs) form a core part of the construction industry and, therefore, are an

important actor in any endeavour to enhance overall construction industry performance. KIPSFs are characterised by firms whose service offerings are client specific and have, at their core, the generation and application of new knowledge (Alvesson, 2001), and which are co-produced by the professional and the client (Løwendahl, 2000). There is significant agreement that the principal means by which this growing body of KIPSFs create value is through the successful creation and management of knowledge. Robertson *et al.* (2001, p. 334), for example, stress 'managing knowledge is a value-creating process in most organisations and is particularly important in knowledge-intensive firms'. The 'value-creating' performance of the construction industry, however, has often been questioned by its clients (DETR, 1998). The common perception of the construction industry is that of an industry which delivers products and services that are often of inappropriate quality, and that fail to meet client demands for price certainty and guaranteed delivery. The Egan report on the UK construction industry, for example, laments that 'too many of the

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industry's clients are dissatisfied with its overall performance' (DETR, 1998, p. 1); while the Department of Trade and Industry (DTI) in the UK has identified the need for significant performance improvement as an urgent issue (DTI, 2002).

Innovation has been described as being the key means to bring about this improvement in construction industry performance (e.g. DTI, 2002). There have been a number of reports which provide guidelines to help practitioners to enhance their business performance through better innovation (e.g. DTI, 2003). Reports of this nature have provided recommendations for practices and procedures to be adopted by the construction industry and its main stakeholders to realise step improvements in both large and small construction firms. These industry guidelines, however, generally inadequately address project-based, professional service orientated construction enterprises (Gann and Salter, 2000; van Giessel and Baekholt, 2005). Further, the relevance and accessibility of many of these initiatives for small construction firms is debatable (Miozzo and Ivory, 1998; Sexton and Barrett, 2005).

To reiterate, SCKIPSFs have unique characteristics (when compared to other types of firms in the construction industry; for example, large contractors or labour-only subcontractors), and these characteristics have a significant impact on the focus and nature of innovation activity. This lack of explicit focus on innovation within SCKIPSFs results in their unique characteristics not being adequately recognised and understood, creating the risk of inappropriate policy and corporate prescription being formulated on the basis of incorrect assumptions. The aim of this paper is to contribute to this underdeveloped area of innovation in small knowledge-intensive professional services within the construction industry. This is done through the development of an empirically based definition of appropriate innovation for SCKIPSFs and, within this context, an investigation of the key managerial challenges to bring about such innovation. This paper is presented as follows. First, key issues from the innovation literature in construction are discussed. Second, the aims and methodology of a 22-month case study which investigated innovation in a small architectural practice are described. Third, key findings from the case study are reported. Finally, conclusions are drawn.

Key issues from the innovation literature

Knowledge-based view of innovation

There is a diverse range of definitions of innovation in the literature, but a recurring theme across the definitional debate is that 'new ideas' are taken to be

the starting point for innovation (e.g. Sexton and Barrett, 2003a). In the general literature, Rogers (1983), for example, defines innovation as 'a product or service that is perceived as *new* by the members of the social system', and that 'it matters little whether the idea is "objectively" *new* as measured by the lapse of time since its first use or discovery' (Rogers, 1983, p. 11, emphasis added). The emphasis on newness is prominent in the construction literature with the Civil Engineering Research Foundation (CERF), for instance, defining innovation as 'the act of introducing and using *new* ideas, technologies, products and/or processes aimed at solving problems, viewing things differently, improving efficiency and effectiveness, or enhancing standards of living' (CERF, 2000, p. 3, emphasis added). The pertinent issue for SCKIPSFs is that the 'new ideas' are intrinsically 'knowledge-laden' and are principally the outcome of the co-production between the knowledge worker and the client. The proposition here is that the development of the optimal dynamic capabilities which bring these actors together to co-produce innovation is the principal source of sustainable competitive advantage for the SCKIPSF. Innovation for SCKIPSFs should, therefore, be considered synonymous with a 'knowledge-based' view of innovation which consists of knowledge-based resources and capabilities, labelled here as 'knowledge capital'. This 'knowledge capital' is presented as the 'dynamic innovation capability' which generates innovation and sustainable competitive advantage within SCKIPSFs. The following sections concentrate on what kinds of knowledge-based resources and capabilities are required to create, manage and exploit innovation within a SCKIPSF context.

Knowledge-based resources for innovation

The identification of different types of knowledge created within organisations is the first step to understanding how successful knowledge-based innovation is brought about. Knowledge has been traditionally grouped into two complementary types: tacit and explicit (Polanyi, 1962, 1967). The tacit and explicit distinction has evolved into knowledge as a 'noun', i.e. an 'asset' which can be neutrally articulated, stored and traded (explicit knowledge); and, knowledge as a 'verb', i.e. the context-specific 'process' of knowledge creation and use (tacit knowledge). De Long and Fahey (2000) synthesise fruitfully the 'asset' and 'process' dimensions, and identify three distinct, but interactive, types of knowledge:

- (1) Human knowledge (HK) constitutes what individuals know or know how to do, and is manifest in experience, knowledge and skills. HK is tacit knowledge.

- (2) Relationship/social knowledge (RK) exists in relationships among individuals and groups which add value to activities. RK is largely tacit, composed of cultural norms that exist as a result of working together. RK is reflected by an ability to create and maintain effective collaboration.
- (3) Structure knowledge (SK) is embedded in organisational systems, processes, tools, rules and routines. SK is largely explicit and rule based and can exist independently of staff.

These three types of knowledge are critical to understanding innovation in SCKIPSFs. The argument here is that the appropriate generation of, and conversion between, HK, RK and SK, is essential to successful knowledge creation and thus (particularly in SCKIPSFs) successful innovation. It is proposed that HK, RK and SK are embedded in human capital (HC), relationship capital (RC) and structure capital (SC), and these resources make up knowledge capital (KC). (The definition for each resource is detailed in the 'Knowledge-based innovation concept model' section below.) The rationale for this proposition is discussed as follows. First, it is argued that RC plays a particularly important role in innovation (Ibarra, 1993). Clients and their networks, as well as professional networks, are important resources for KIPSFs (Løwendahl, 2000). Second, appropriate HC is the essential factor to bundle different resources and capabilities to form KC to bring about appropriate innovation in services and service delivery (Maister, 1993). Baumard (2002), for example, argues that the generation and stimulus for 'new ideas' requires the motivation and in-depth knowledge and experience of knowledge workers. Further, the concentration of knowledge in a few staff renders small firms especially vulnerable to key people leaving the firm (Barrett, 1993). Finally, a key aspect of the management of knowledge in organisations is the development of an appropriate organisational structure to perform knowledge-based work (Shapero, 1985, p. 57). Where knowledge is formalised and embedded in SC, it becomes easier (from an asset perspective) to store and to distribute to the organisation (such as by developing standardised processes or good practices). Structure capital, therefore, is an important conduit by which outcomes of individuals' interactions can be captured, amplified and shared across different projects and across the organisation. The rationale for the capabilities required by SCKIPSFs to produce KC is explored below.

Organisational capabilities for innovation

The organisational capability for innovation is defined, for example, as 'the comprehensive set of

characteristics of an organization that facilitate and support innovation strategies' (Burgelman *et al.*, 1996, p. 8). It has been argued that the acquisition of 'organisational capability' occurs through 'organisational learning' processes (Chaston *et al.*, 1999) and that 'organisational learning' leads to innovation (Argyris and Schön, 1996), particularly in small and medium-sized enterprises (Chaston *et al.*, 1999). A key challenge for companies is when to innovate and when not to innovate. The work of March (1991, p. 65) provides theoretical guidance on this challenge through the distinction between exploitative and explorative routines, and the need for appropriate balance between them. They are adapted and defined as follows:

- (1) Exploitative capabilities are those resources utilised to improve organisational *efficiency* to generate *short-term* competitive advantage.
- (2) Explorative capabilities create and use new resources and capabilities to improve organisational *effectiveness* to generate *sustainable* competitive advantage.

The concepts of exploitative and explorative capabilities are a useful way of understanding, connecting and managing knowledge-based resources for successful innovation. This proposition leads to the concept of successful knowledge-based innovation (see 'Knowledge-based innovation concept model' section below). The next section will address the key managerial challenges facing SCKIPSFs in developing and using these knowledge-based capabilities.

Key managerial challenges for innovation

To reiterate, the co-production of professional services demands a high degree of interaction between knowledge workers and clients. Knowledge sharing and creation is thus significantly based on HC held by knowledge workers within KIPSFs (e.g. Sverlinger, 2000). Knowledge workers' knowledge about customers tends to be personal and anecdotal, and situationally prescribed (Clippinger, 1995, p. 28). This 'person specific' knowledge held by knowledge workers is labelled as 'individual knowledge' (Simon, 1957). The accrued or cumulative learning and knowledge of individuals has been referred to as 'individual knowledge capital' (Neilson, 1997, p. 1). The challenge within SCKIPSFs is to combine various individual knowledge domains to form dynamic 'organisational knowledge' in new configurations which feed back into, and enrich, individual knowledge (Bhatt, 2002). Knowledge within the organisational level forms organisational KC. The proposition made here is that organisational KC within

SCKIPSFs arises from a dynamic spiralling process wherein RC, SC and HC are converted into RK, SK and HK through their exploitative and explorative capabilities. Hence, these constant 'interaction activities' form an individual-organisational-individual (I-O-I) KC spiral. Through this spiral, individual KC is converted into fresh organisational KC and allows other individuals to access the organisational KC base. As a consequence, KC is dynamic (explorative capability), but must be capable of being accessed and used at any given time (exploitative capability).

Nonaka *et al.* (2001) further indicate that these 'interaction activities' take place in the 'ba' which is a place, space or facility where individuals interact to exchange ideas, share knowledge, conceptualise and create new knowledge. Davenport and Prusak (1998, p. 137) argue that the 'ba' should be focused on the 'knowledge' environment. 'Ba' is thus labelled 'knowledge ba'. For SCKIPSFs, the 'knowledge ba' is predominantly located within the interaction between individual knowledge workers and their clients. This individual level of the 'ba' can be viewed as 'individual knowledge ba'. There is a need, therefore, for a shared context for knowledge creation and conversion to take place from the 'individual level' to 'organisational level', and then back to the 'individual level' (Nonaka and Takeuchi, 1995). The organisational level of the shared context can be viewed as 'organisational knowledge ba'.

Insights into the nature and process of the interaction between individual and organisational knowledge ba can be gleaned from the adoption of the knowledge spiral model presented by Nonaka and Takeuchi (1995, p. 73). Figure 1 shows different phases of knowledge interactions between clients and the SCKIPSF,

including individual, group and organisational interactions. First, knowledge interactions start at the individual level. This is shown in Figure 1 in the left-hand side of the bottom rectangle. Knowledge interactions at the individual level occur in the 'individual knowledge ba'. Second, knowledge dialogue expands beyond individual knowledge worker-client interactions. At this stage, there is collaborative interaction as individuals share their diverse interests and issues within a team context. As the knowledge work tends to be project-based and extends to the broader organisation and beyond, the knowledge interaction occurs across 'individual' and 'organisational' knowledge ba. Organisational knowledge ba thus presents an influential factor facilitating the I-O-I knowledge creation and conversion spiral within SCKIPSFs. This spiral, which continuously nurtures the interaction and development of individual and organisational knowledge ba, is taken to be the core dynamic innovation capability for SCKIPSFs. This argument leads to the concept of KC (see 'Knowledge-based innovation concept model' section below). From this discussion, the following managerial challenges appear significant:

- (1) How do SCKIPSFs appropriately develop and manage knowledge interaction activities within individual-organisational-individual knowledge ba spirals, and how do these arrangements affect innovation performance?
- (2) How do SCKIPSFs appropriately manage and motivate their knowledge workers to create and engage in this development of, and alignment between, individual-organisational-individual knowledge ba spirals?

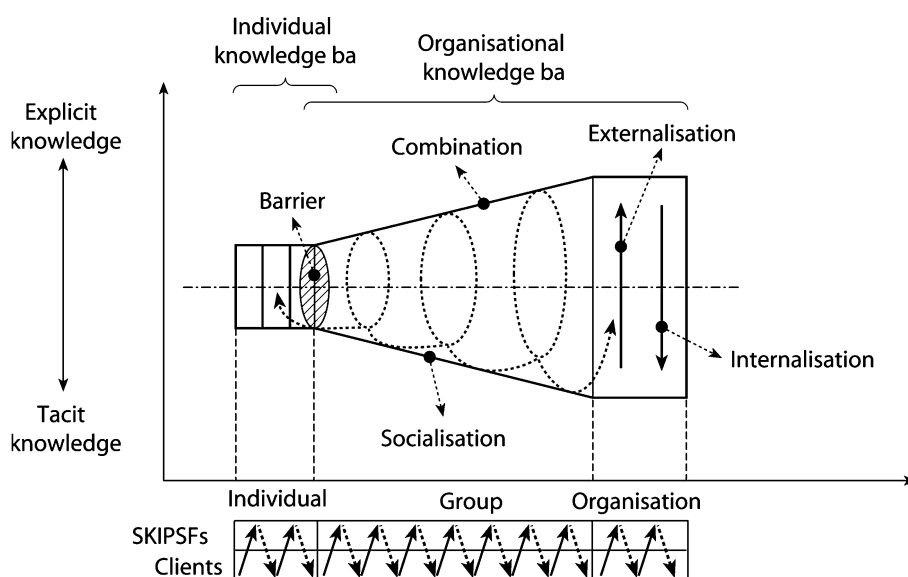


Figure 1 Spiral of organisational knowledge capital creation

Research aims and methodology

The aim of this research was to develop an appropriate definition of innovation for SCKIPSFs and, within this context, to investigate the key managerial challenges identified at the end of the previous section. Finally, from this understanding, to produce a definition of a successful knowledge-based innovating firm. Empirical data came from a 22-month single case study. This approach was adopted to gain an in-depth, rich understanding of the phenomenon being investigated (Yin, 1994, pp. 38–40). Generalisation is bounded by the argument set out by Yin (2003, p. 39) that the results are generalised to theory (which is analogous to the way in which scientists generalise from experiments to theory) rather than to the wider population of SCKIPSFs. A small architectural practice was chosen for the case study for two reasons: the practice was of an appropriate ‘small’ size, having 40 staff;² and the practice was of the ‘archetype’ of a professional service firm (Day and Barksdale, 1992; Wilson, 1997). The case study firm is a recent start-up with three equity directors within a limited liability partnership structure. The firm has grown from an initial turnover of £0.3 million in 1999 to £2 million in 2004. In the same period, the firm has increased its staff numbers from 12 to 40. The firm is at an early stage in its development and, drawing from Churchill and Lewis (1983) stage theory, is very much at the take-off and success phase. It is anticipated that the research results reported here would vary if the case study firm was at a different phase, as the approach to innovation management evolves in unison with the developmental stage of the firm (Sexton and Barrett, 2003b).

There were four main research phases: research focus, exploratory phase, action research phase and write up. Each phase provided progressive focus for the next. First, the research focus phase was carried out to develop a knowledge-based innovation concept model of key variables for successful innovation identified within the literature. Second, the exploratory phase tested these variables by investigating four successful and three unsuccessful innovations within the case study company. Five semi-structured face-to-face interviews were conducted—this sample constituted 12.5% of the firm’s staff. The sample represented all three levels of professional staff within KIPSFs: juniors, managers and seniors (Maister, 1993, pp. 4–5). Table 1 summarises the level, age and experience of each of the interviewees. Each interview was appropriate two hours in length. The interview data were captured by note-taking and tape recording (Hussey and Hussey, 1997) and then was transcribed verbatim. The transcripts were sent to each participant to check for accuracy

before analysis. In addition to the interviews, further data were obtained through the analysis of relevant company documents. The transcripts were analysed using content analysis and cognitive mapping data analysis techniques (Allard-Poesi *et al.*, 2001). First, the content analysis technique enabled the identification of *key issues* from the large volume of interview transcripts (Weber, 1985). Second, the cognitive mapping technique was used to help the researcher to see the *relationships between* the key issues emerging from the content analysis (Eden, 1992). The data analysis used two software packages—‘QSR NUD*IST Vivo’, a content analysis tool (www.qsrinternational.com); and ‘Decision Explorer’, a cognitive mapping tool (www.banxia.com). From this process, a company ‘general finding’ report was co-authored by the researcher and the company senior management. This report provided the foundation for the action research phase.

Third, the action research phase was carried out to further test and develop the concept model, to provide a narrative of ‘real time’ innovation within a company setting, and to bring about a successful innovation in the case study firm. The action researcher was embedded within the case study firm full time for 10 months. The action research phase began with a company workshop. The purpose of the workshop was to discuss and evaluate the key findings from the exploratory phase and, based on this, to identify an action research intervention (or innovation) to be developed and implemented. The senior manager identified the need of an interim project review process (IPRP) innovation. This new process was considered an integrated part of the ongoing preparation by the case study firm for ISO 9001 accreditation. Based on this, an IPRP handbook (including IPRP policy, guidelines and checklists) was jointly developed by the action researcher and the organisation members. This handbook was then assessed and signed off by the company senior management and integrated into the company’s quality systems. Finally, the completed results were written up, with the report validated by the case study firm.

Key research results

This section presents the key results from the case study. This section is organised as follows. First, the definition of an appropriate successful knowledge-based innovation and a concept model of knowledge-based innovation are described. Second, two types of knowledge-based innovation are introduced. Third, a definition of a successful knowledge-based innovating

Table 1 Profile of interviewees

Respondent	Classifi- cation	Age	Formal qualification (graduate & fully qualified members of professional institutions)	No. of years with this company & role/activity	Previous employer			
					Firm & number of years with it	Main products/services	Type	Size
A	Senior	34	<ul style="list-style-type: none"> Architecture Diploma Royal Institute of British Architects (RIBA) 	2/Associate director	3/Architect	Architectural practice	Private	Medium
					4/Architect	Architectural practice	Private	Micro
					2/Architect	Architectural practice	Private	Small
B	Junior	26	<ul style="list-style-type: none"> Trained to HNC (Higher National Certificate) or HND (Higher National Diploma) in Architecture 	2/Architectural technician	5.5/ Technical drawing	Architectural practice: design scheme for the building, achieve partnering information, and help the team building	Private	Micro
C	Manager	28	<ul style="list-style-type: none"> Architecture Diploma 	3.5/Architect	5/Managing contracts on site	Building company	Private	Small
D	Manager	31	<ul style="list-style-type: none"> RIBA Architecture Diploma 	3/ Project architect and team leader	2/Architect	Architectural practice	Private	Small
					3/Training architects	Architectural practice	Private	Medium
E	Senior	26	<ul style="list-style-type: none"> Architecture Diploma MBA in the marketing 	5/ Development manager and architectural assistant	5/Estate agent	Selling house	Private	Small
					1/Copy typist	Preparing documents for Court	Public	Large
					5/Selling shoes	Shoe shop: children's shoes	Private	Large

firm is given. Finally, key innovation management challenges are set out.

Knowledge-based innovation concept model

The research findings defined appropriate knowledge-based innovation as:

The effective generation and implementation of a new idea which enhances overall organisational performance, through appropriate exploitative and explorative knowledge capital which develops and integrates relationship capital, structure capital and human capital.

This definition formed the basis for the knowledge-based innovation concept model (Figure 2). These variables are discussed as follows:

- (1) Interaction environment is that part of the business environment which firms can interact with, and influence, including the 'task environment' (the environment where this client interaction occurs) and the 'competitive environment' (the environment where firms compete for customers and scarce resources). The interaction environment and the firm are separated by a permeable organisational boundary.
- (2) Relationship capital (RC) is the network resources of a firm. It results from interactions between individual, organisation, and external supply chain partners.
- (3) Human capital (HC) is defined as the capabilities and motivation of individuals within the SCKIPSF, client systems and external supply chain partners to perform productive, professional work in a wide variety of situations.
- (4) Structure capital (SC) is made up of systems and processes (such as company strategies, computers, tools, work routines and administrative systems) for codifying and storing knowledge from individual, organisation and external supply chain partners.
- (5) Knowledge capital (KC) is the dynamic synthesis of both the 'context' and 'process' of knowledge creation and conversion within individual-organisational-individual knowledge ba spirals, and the 'content' of RC, SC and HC.

The concept model highlights the need for senior management to strategically and systemically build, connect and energise appropriate RC, HC and SC to form KC, from which successful organisation and project innovation will flow.

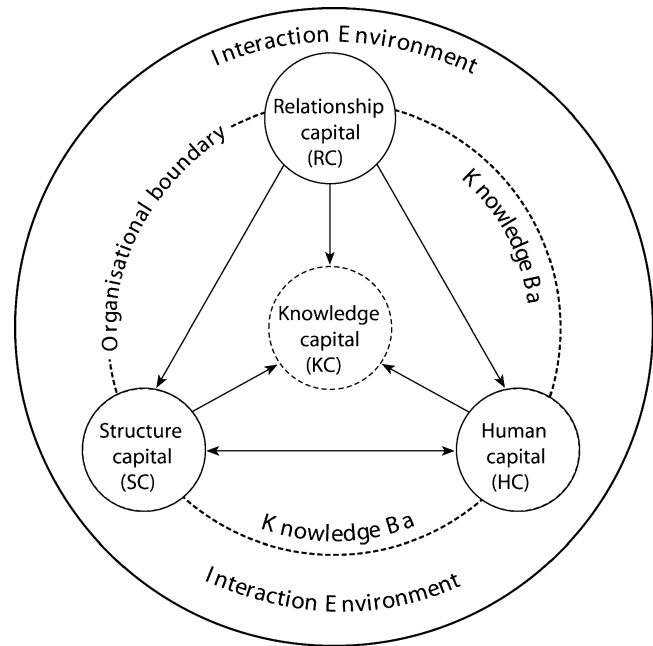


Figure 2 Knowledge-based innovation concept model for SCKIPSFs

Two forms of knowledge-based innovation

Two types of knowledge-based innovation were distinguished: explorative innovation and exploitative innovation (Figure 3). 'Explorative innovation' focused on client facing, project-specific problem solving. Explorative innovation activity heavily relied on the capacity, ability and motivation of staff at an 'operational level' to solve client problems to generate short-term competitive advantage (i.e. project specific). Its outcome focused on effective and efficient delivery of services to satisfy prevailing fee-earning project needs, but these were often not embedded in the organisational SC due to scarce management attention and company resources being constantly focused on other current or near future project-specific demands. The use of new materials in the case study firm, for example, was explorative in nature, being project-specific and individually driven. This was illustrated by an architect noting that the use of new materials '... is done more on an individual [project] basis ... ideas ... might come from me ... might come from a client's suggestion ...'.

In contrast, 'exploitative innovation' focused predominantly on internal organisation and general client development activity (non-project-specific, fee-earning activity). Exploitative innovation activity heavily relied on the capacity, ability and motivation of senior management at a 'social' level to improve organisational effectiveness and efficiency to generate sustainable competitive advantage. The distinctive feature of

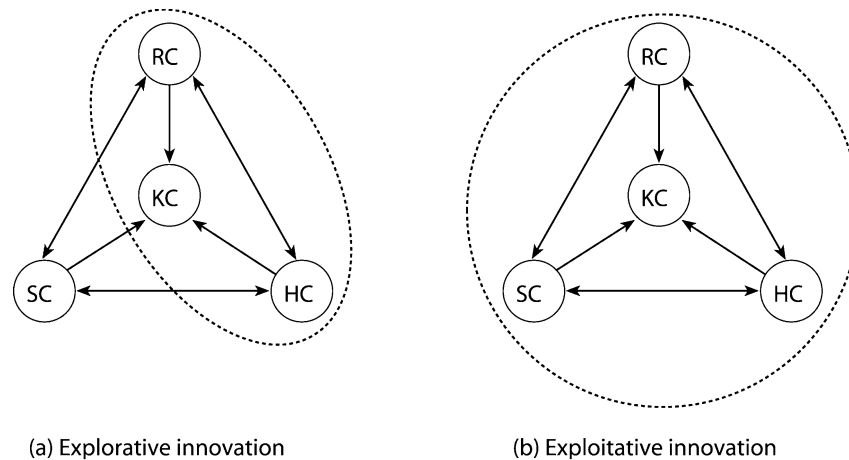


Figure 3 Types of knowledge-based innovation

exploitative innovation (compared to explorative innovation) was that new phenomena, systems or structures were securely embedded in the SC of the firm. The motivation for a new mission statement for the case study firm, for example, came from senior management, who saw it as a way of instilling an integrating vision for its portfolio of activities. One partner in the firm captured this rationale by confiding that ‘the company was very much ... directionless ... we didn’t know where we were going ...’.

Key generic and distinctive variables around these two types of innovation are summarised in Table 2. The Table shows that the key distinction between successful and unsuccessful innovation was the ‘social’ or ‘operational’ knowledge being applied to a specific innovation. ‘Operational knowledge’ was generated and created in ‘operational level’ interactions where the focus was on solving project-specific issues/problems. These projects were either ‘external’ fee-earning projects, or ‘internal’, but specific client-driven, projects. ‘Social knowledge’ was generated through ‘social level’ interactions where the focus was on generating non-project-specific innovation which built up general organisational capability, and forged and replenished deeper client relationships over the medium to long term. Moreover, social knowledge was found to have a significant effect on feeding operational knowledge at a specific project level at a future date.

Definition of a successful knowledge-based innovating firm

The research findings reveal that successful explorative innovation did not necessarily need integrated SC. It was evident in the case study firm that there was too much emphasis on individual learning on the project level (explorative innovation) to the detriment of the

organisational level learning (exploitative innovation). This emphasis of explorative KC over exploitative KC is not sustainable as the limitation of SC will become increasingly evident as a significant restraining force for the effective integration of explorative and exploitative KCs. There was thus not an appropriate balance between explorative and exploitative innovation over time. The case study firm needed to create and continue a balance between explorative and exploitative KC barriers which would allow the flow of KC between operational and social levels. The following definition of a successful knowledge-based innovating firm is therefore offered to accommodate the time dimension:

The effective generation and implementation of a *flow of* new ideas which enhance overall organisational performance *over time*, through appropriate exploitative and explorative knowledge capital which develops and integrates relationship capital, structure capital and human capital.

The time variable brings into focus the development phases of firms as they move from start-up to mature organisations. The focus and process of innovation activity will correspondingly change during the transition. It can be speculated that at the early stages of firms’ development, the emphasis is on explorative innovation, but, as firms mature, there is an increasing need to explicitly invest in exploitative innovation. This need was certainly evident in the case study firm.

Key innovation management challenges

The aim of this research is to provide insight into the nature and process of innovation for SCKIPSFs. It was achieved by answering the two research questions set out in the ‘Key managerial challenges for innovation’ section above. The answer to the first question, ‘How do SCKIPSFs appropriately develop and manage

Table 2 Key generic and distinctive variables for explorative and exploitative innovations

Types of innovation	Variables	Generic variables	Distinctive variables for successful innovation	Distinctive variables for unsuccessful innovation
Explorative innovation	Human capital (HC)	<ul style="list-style-type: none"> • The capacity, ability and motivation of staff 	<ul style="list-style-type: none"> • Social or operational knowledge being applied to meet project needs 	<ul style="list-style-type: none"> • Social knowledge not being applied to meet project needs
	Structure capital (SC)	<ul style="list-style-type: none"> • Team structure • Teamwork 	<ul style="list-style-type: none"> • Team-based ideas • Teamwork • Senior management involvement through teamwork 	<ul style="list-style-type: none"> • Individual-based ideas • Individual-based work • Senior management not involved in teamwork • Limitation of relevant and updated information within the structure
	Relationship capital (RC)	<ul style="list-style-type: none"> • Operational RC: within internal, client and supplier interactions • Social RC: within internal, client and supplier interactions 	<ul style="list-style-type: none"> • A combination of operational and social RCs being applied to meet project needs 	<ul style="list-style-type: none"> • Social RC not being applied to meet project needs
	Knowledge capital (KC)	<ul style="list-style-type: none"> • Social context¹: company environments (office, meeting room) • Technical context²: e-mails, the internet 	<ul style="list-style-type: none"> • A combination of social context and technical context being applied to meet project needs 	<ul style="list-style-type: none"> • Technical context
	Outcome	<ul style="list-style-type: none"> • Effective and efficient delivery of services to satisfy current and/or future project needs 	<ul style="list-style-type: none"> • Project performance improvement 	<ul style="list-style-type: none"> • Individual performance improvement

Table 2. Continued.

Types of innovation	Variables	Generic variables	Distinctive variables for successful innovation	Distinctive variables for unsuccessful innovation
Exploitative innovation	Human capital (HC)	<ul style="list-style-type: none"> • The capacity, ability and motivation of senior management • Employee participation 	<ul style="list-style-type: none"> • Top management support • Senior management implementation • Employees buy into the need for innovation through training 	<ul style="list-style-type: none"> • Top management not supportive • Senior management not driving the implementation • Lack of time • Employees not buy into the need for innovation (inappropriate encouragement and not related to an individual job)
	Structure capital (SC)	<ul style="list-style-type: none"> • The administrative system • Team structure • Computer systems 	<ul style="list-style-type: none"> • Formalised structures and documentation systems • Senior management implementation through the team structure • A combination of operational and social RCs being applied to meet project needs 	<ul style="list-style-type: none"> • No formalised structures and documentation systems • Senior management not driving the implementation through the team structure • Social RC not being applied to meet project needs
	Relationship capital (RC)	<ul style="list-style-type: none"> • Operational RC: within business adviser, internal, client and supplier interactions • Social RC: within internal interactions 	<ul style="list-style-type: none"> • A combination of operational and social RCs being applied to meet project needs 	<ul style="list-style-type: none"> • Social RC not being applied to meet project needs
	Knowledge capital (KC)	<ul style="list-style-type: none"> • Social context¹: company environments (office, open family culture) • Technical context²: e-mails, the internet 	<ul style="list-style-type: none"> • A combination of social context and technical context being applied to meet project needs 	<ul style="list-style-type: none"> • A combination of social context and technical context not being applied to meet project needs
	Outcome	<ul style="list-style-type: none"> • Organisational effectiveness and efficiency 	<ul style="list-style-type: none"> • Organisational performance improvement 	<ul style="list-style-type: none"> • Individual performance improvement

Notes: 1. A 'social' context was used to stimulate interaction and collective 'process orientated' knowledge creation and conversion. 2. A 'technical' context was used to support the search for external knowledge and sharing of 'asset orientated' knowledge.

knowledge interaction activities within individual-organisational-individual (I-O-I) knowledge ba spirals, and how do these arrangements affect innovation performance?', is that successful innovation in SCKIPSFs is principally characterised by 'project pull' and 'project push' I-O-I knowledge ba spirals which create dynamic project-specific and/or client-driven KC. Figure 4(a) depicts specific project requirements (either external fee-producing or internal client-driven projects) 'pulling', combining and converting 'organisational knowledge' and 'individual knowledge' from the social level to form specific 'project individual knowledge' at an operational level. Project individual knowledge is integrated and leveraged to create 'project team knowledge' which is appropriately applied to create successful innovation within the operational domain. The feedback I-O-I knowledge ba spiral is complemented by a feedback or 'project push' knowledge ba spiral where new specific 'project team knowledge' feeds back to develop 'project individual knowledge' (both at an operational level), which, in turn, further enhances 'individual knowledge' and 'organisational knowledge' in the social sphere. The tacit, experiential knowledge accumulation and learning is the basis for subsequent cycles of project-based innovation. In contrast, unsuccessful innovation in SCKIPSFs is principally characterised by 'organisation push' of disjointed, unfocused 'social'

non-project-specific and/or non-client-driven KC being 'rejected' by day-to-day project priorities and activities. Without a project-specific focus, innovation fails because the I-O-I knowledge ba spiral does not happen. Figure 4(b) depicts that there is no specific project needs 'pulling' 'individual knowledge' and 'organisational knowledge' together. Rather, generic 'organisational knowledge' is 'pushed' into a project team setting without appropriate filtering and adaptation to meet specific project needs. Further, the 'organisational knowledge' does not benefit from individual knowledge worker championing and tacit understanding. In combination, the 'organisational knowledge' is 'rejected' by day-to-day projects. As a consequence, the feedback loop through individual knowledge, project knowledge and organisational knowledge does not happen.

The answer to the second question, 'How do SCKIPSFs appropriately manage and motivate their knowledge workers to create and engage in this development of, and alignment between, individual-organisational-individual knowledge ba spirals?', is that successful innovation in SCKIPSFs is principally focused on specific project needs (either external fee-producing or internal client-driven projects). The interaction and co-production between the knowledge worker and the client within a 'project setting' was found to be the principal vehicle for managing and motivating knowledge workers. Knowledge workers are

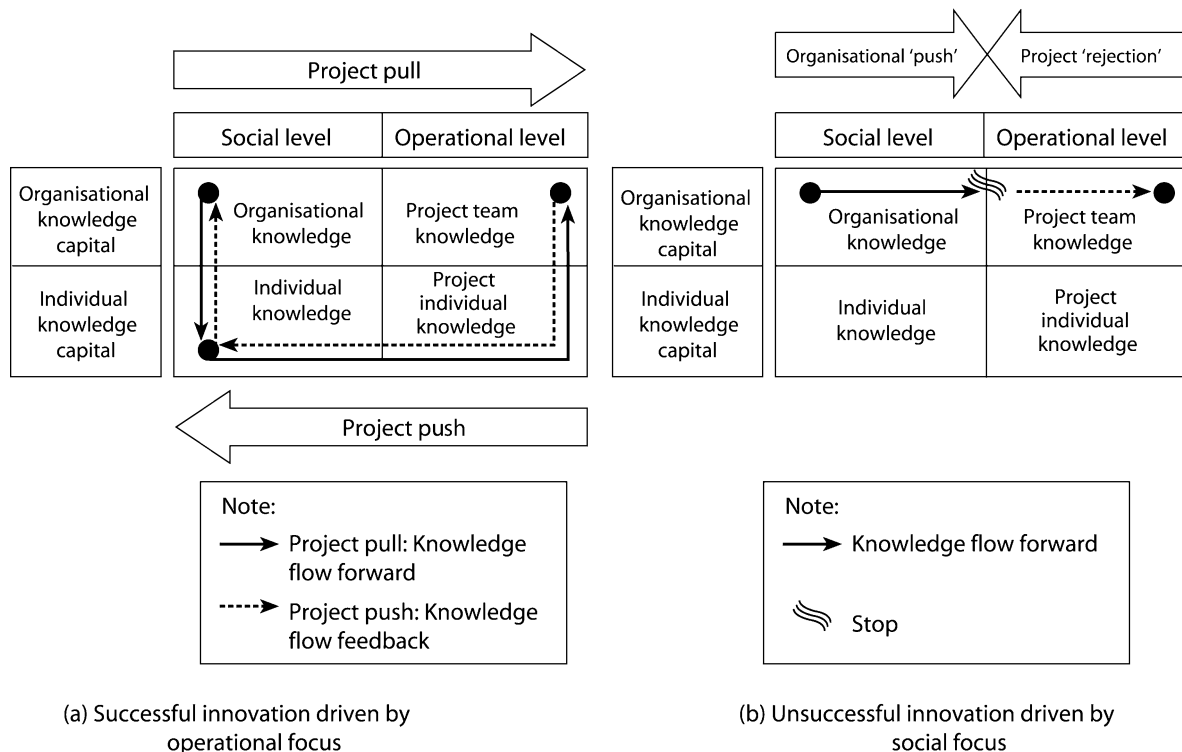


Figure 4 The difference in focus of successful and unsuccessful innovation

intrinsically motivated to undertake interesting knowledge-intensive work in their chosen field. 'Senior management commitment' was found to be the key for SCKIPSFs to manage and motivate their knowledge workers to create and engage I-O-I knowledge ba spirals. Senior management commitment to appropriate 'leadership' is necessary to generate an inclusive, galvanising strategic vision which balances and progresses both individual and organisational needs within a project-based setting; and which empowers knowledge workers to meaningful 'participation' in the innovation process and to delegate appropriate 'ownership' and 'accountability' of the innovation to encourage its enduring relevance and success.

Conclusions

Key limitations and future research

Before discussing the theoretical and practical implications for innovation in SCKIPSFs from the research findings, key limitations and associated future research directions are identified. First, a 22-month single case study was used to produce the research findings. The results are thus limited by the degree of representativeness and generalisability of the chosen case study. These limitations have been addressed by a careful sampling strategy to select a representative SCKIPSF based on the size and type of firm. Consequently, we believe that the results can be generalised, with a significant degree of confidence, to the theoretical understanding of innovation within SCKIPSFs. Nevertheless, future research would broaden, or appropriately limit, the generalisability of this research by undertaking multiple case studies with a large sample of architectural SCKIPSFs and other discipline SCKIPSFs (for example, building surveying and quantity surveying practices).

Second, moving on from the limitation above, the focus and process of the innovation process is contingent on its developmental phase: from start-up through to maturity and decline. The case study firm was relatively young. It would therefore be useful if future research would investigate the proposed innovation model and types of innovation by using a longitudinal design over many years in a single case study firm and/or to undertake case study research in different firms at different stages of development. This would provide a richer picture of the innovation process through the developmental life cycle of firms.

Finally, there is an emerging literature which is articulating the moderating effects of professional service firm governance structures on organisational

priorities and, thus, innovation activity. Empson and Chapman (2006), for example, argue that a shift from an unlimited partnership arrangement to a limited liability partnership results in a corresponding adjustment of strategic priorities from long-term client and professional discipline development to more short-term profit maximisation. The case study firm was a limited liability partnership, which is the dominant governance structure of SCKIPSFs in the UK. It would be of interest, however, for future research to apply and evaluate this paper's research findings within a variety of construction professional service firm governance contexts. This strand of enquiry could usefully be extended to consider the impact of new interorganisational governance arrangements on professional service firm innovation activity; for example, partnering and alliance configurations.

Theoretical and practical implications

Despite these limitations, our findings may have several interesting theoretical and practical implications. First, the findings have contributed to our understanding of the distinctive nature of innovation in SCKIPSFs by offering an empirically based definition of, and model for, successful innovation. The need for a strategic and systemic investment in, and management of, relationship capital, human capital and structure capital to produce dynamic knowledge capitals which bring about an appropriate balance of explorative and exploitative innovation is emphasised. Second, when compared to innovation in small construction firms (Sexton and Barrett, 2003b), there is a significant difference in emphasis on the:

- pivotal role of the knowledge worker in leading the co-production of innovation with clients, compared to non-knowledge-intensive professional service firms where the owner-managers are the principal innovation champion; and,
- creation of enabling social and structural environments to encourage and capture learning from individual knowledge worker-client interactions so that they can be shared and amplified within an organisational context.

Third, the concept of explorative and exploitative routines has been modified to accommodate the unique characteristics of SCKIPSFs. March (1991) notes that explorative routines are focused on search, variation, experimentation, flexibility and discovery to create new opportunities and resources to generate sustainable competitive advantage. In contrast, exploitative routines were characterised by new refinement and efficiency activities to ensure competitive advantage. The first part of this concept resonates with the

research findings, with explorative innovation being found to be located at immediate 'new' project domains, and entailed 'search, variation, experimentation, flexibility and discovery' explorative activity to solve project-specific problems. However, the project-specific innovation focus was to generate short-term competitive advantage, i.e. a successful project. For sustainable competitive advantage, which departs from March (1991), exploitative innovation was found to be the principal source, with its focus on the design and implementation of generic organisational infrastructure to 'refine' and 'improve the efficiency' of the firm; to 'embed' project-specific knowledge and learning in the structure; and to accumulate, transfer and apply learning within and through projects.

Policy implications

The key implications for government and institution policy are twofold. First, as innovation activity is explorative and exploitative in nature, there is a need for policy makers to guide and support the development of new frameworks and tools which emphasise the overtly social nature of innovation in SCKIPSFs: it is not a mechanistic, linear process; rather, it is a fluid process where knowledge-based innovation flows from context-specific 'one-off' encounters between knowledge workers and clients at the project level of resolution. The challenge for policy makers, in particular, is to design interventions which encourage these idiosyncratic human-centred flows within the structure of firms and supply chains. Interventions should move away from the current heavy emphasis on codification strategies (such as information technology based knowledge management systems) which are more attuned to the needs of large construction firms, to a more balanced approach which promotes personalisation strategies to encourage context-specific interaction (such as guidance for the creation and nurturing of communities of practice). Second, within this context, the critical role of senior management in successful innovation within SCKIPSFs needs to be better recognised, and this should explicitly shape research priorities and resourcing. A contribution to a remedy for this, for example, is policy to support the education and training of senior managers in innovation management within a SCKIPSF context.

Notes

1. International and national bodies define micro companies as having fewer than 10 staff; small as having fewer than 50 staff; medium as having between 50 and 250 staff;

and, large as having more than 250 staff (e.g. European Commission, 2003, p. 39; SBS, 2003).

2. See note 1.

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