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Knowledge within small and medium-sized firms: A systematic review of the evidence

Luke Pittaway, Richard Thorpe, Robin Holt and Allan Macpherson

Institute for Entrepreneurship and Enterprise Deve
Lancaster University Management School
Lancaster LA1 4YX
UK

KNOWLEDGE WITHIN SMALL AND MEDIUM-SIZED FIRMS: A SYSTEMATIC REVIEW OF THE EVIDENCE

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From:

Richard Thorpe
Leeds University Business School
Maurice Keysworth Building
Leeds, LS2 9JT
rt@lubs.leeds.ac.uk

Robin Holt
Manchester Metropolitan Business School
Aytoun Street
Manchester
M1 3GH
r.holt@mmu.ac.uk

Luke Pittaway
Adjunct Senior Lecturer (LUMS)
The University of Sheffield Management School
9 Mappin Street
Sheffield
S1 4DT
luke.pittaway@shef.ac.uk

Allan Macpherson
Manchester Metropolitan Business School
Aytoun Street
Manchester
M1 3GH
a.macpherson@mmu.ac.uk

ABSTRACT

This paper provides a systematic review of the literature on how SMEs use and acquire knowledge. The review was undertaken as part of the Economic and Social Research Council's Evolution of Business Knowledge Programme. The paper describes the systematic review protocol and provides a detailed explanation of the methods used. From the review it is evident that SME knowledge research primarily concentrates on the acquisition and use of knowledge, treating it as an asset that is transferred by routines. The findings suggest that research is focused in three main areas. First, focusing on the influence and abilities of the entrepreneur to extract, use and develop knowledge resources. Secondly, research that explores the firm-wide systems and human capital that facilitate knowledge exploration and exploitation. Thirdly, study that examines the institutional context and which is primarily focused on the effectiveness of Government policy. There are also a handful of studies reviewed that reflect a concern with the socially constructed nature of knowledge. From a practical perspective, the review concludes that regeneration policies need to be more flexible and sensitive to the often complex contexts within which knowledge is constructed. From a research perspective, and given the flexible, opportunity-oriented and often novel nature of SMEs identified in these studies, there is a need to consider the relational and embedded qualities of knowledge by which these characteristics are framed; qualities that resist conceptualisation as some form of separable, material asset.

INTRODUCTION

The systematic review reported in this paper was guided by a desire to understand how small and medium enterprises (SMEs) acquire and use knowledge. The review was led by a panel including the authors and was funded within the Economic and Social Research Council's (ESRC) Evolution of Business Knowledge Programme (EBK). The paper will explain how the systematic review was conducted with reference to previous approaches in management research (Tranfield, Denyer and Smart, 2003; Denyer and Neely, 2004; Leseure et al. 2004; Pittaway et al. 2004) and it will highlight the results of the review.

The main focus of the review was informed by the title of the EBK Research project: 'The Evolution of Knowledge in SMEs'. The specific aims of this project were to:

(1) Show how knowledge is acquired, generated, shared, absorbed, and challenged within and between SMEs.

(2) Investigate the enablers and constraints that influence the effective use of knowledge in SMEs within a regional context and taking into account: social; historical; economic; and, sectoral factors.

(3) Understand how studies have conceptualised knowledge and the influence this has had on findings, with specific reference to activity theory.

(4) Extract and synthesise literature providing an overview of the research conducted and explore its implications.

The systematic review was undertaken to understand the research 'landscape' and situate the study in the concerns and insights of previous research. The specific project aims meant there was a natural division of the systematic review into three parts: studies looking at uses of activity theory; theoretical and empirical studies developing new conceptions of knowledge; and finally studies looking at knowledge use in SMEs. It was in this third part of the review that much of the evidence-based research was located. We begin our discussion by explaining the methodology used, following which we focus on the findings from the third part of the review. The paper will, therefore, explore research conducted with SMEs, exmining the ways in which entrepreneurs and SME managers have: transformed their knowledge; used and stored knowledge; and, communicated knowledge to others.[1]

METHODOLOGY

Systematic reviews emerged from an identified need for better evidence-based research amongst the UK medical profession. In the early nineties the UK Government identified a research-practitioner gap, arguing that academics were driving a research agenda of little perceived use (Tranfield, Denyer and Smart, 2003). To close the gap the UK Government advised the profession to establish evidence networks with a remit to populate and update databases of research via systematic techniques. The idea was to promote

evidence-based policy making and allow researchers to have a thorough appreciation of what had been achieved already by previous researchers. The basic principles of systematic reviews have spread across many sciences and social sciences in the UK and they have begun to enter management research (Tranfield et al. 2003; Denyer and Neely, 2004). The basic principles behind adopting such systematic and explicit methods are:

(1) Transparency – each search of the available research studies is recorded. This includes making explicit the criteria of relevance against which retrieved lists of studies are judged for inclusion. By describing each search string and the rationale behind its selection the review can be repeated to test its rigour and update its findings (Denyer and Neely, 2004).

(2) Clarity – a clear, stepped series of searches is presented, allowing any reader a full 'audit trail' of how the review arrived at a final list of studies on whose evidence it reports (Tranfield et al., 2003)

(3) Focus – the review ensures there a close and persisting relationship between a clearly formulated question and the identification of primary evidence that informs such a question (Pittaway et al., 2004).

(4) Unifies research and practitioner communities – by broadening the scope of dissemination, emphasising evidence and the form of the evidence, the review methodology is designed to promote a policy and practitioner perspective (Leseure et al, 2004).

(5) Equality – the review makes no distinction in principle between the type and nature of journals and other publication outlets. Studies are reviewed on their own merits, and the inductive, iterative methodology means reviewer bias is avoided where possible (Pittaway et al., 2004).

(6) Accessibility - the reviews are made available outside of the specialist, academic community in the form of reports and searchable databases.

(7) Broad coverage - the use of systematic strings and protocols within increasingly sophisticated electronic databases allows reviewers to cover the plethora of places and forms of publication.

In following these principles a systematic review is designed to help engender a sense of collective endeavour, relevance and openness amongst research and practitioner communities (Tranfield et al, 2003), while at the same time improving the methods used to collect and synthesise previous empirical evidence. In the next part we outline how the systematic review methodology was operationalised in this study.

Systematic Review Strategy

This systematic review followed the stages and phases as outlined by Tranfield, Denyer and Smart (2003). In this respect it had three stages: planning the review; conducting the review and reporting and dissemination, within which there were discrete phases of activity[2]. The review panel was formed and was used to monitor the progress of the review. The use of the panel was especially helpful for providing a narrative check on the methodology ensuring the identification of gaps. These gaps appeared in some instances because the database of articles started after the date of publication, in other instances because the citation lacked key information, there were differences in spelling or because of genuine oversight. It was concluded from this that systematic reviews do require the involvement of review panels who can provide 'narrative expertise' and who can cross-check the quality of the review process.

The review was limited to published journal articles (peer reviewed); both practitioner and academic[3]. A number of key bibliographical databases[4] were searched using the root search string 'learn* AND know*'. The databases found to have the greatest coverage

coupled to functionality and full article access were ABI Proquest; Web of Science and Ingenta (incorporating Science Direct)[5]. . In the next stage the review developed a series of keywords and search strings (Appendix 1) based on the root concepts learning, knowledge and SME. Other keywords identified were used selectively within search strings to further refine the classification of relevant studies. The following steps were applied to the review process during the assessment of citation databases.

(1) The search strings were developed according to the criteria for the study (Appendix 2).

(2) Search strings were used within title, abstract and keyword searches.

(3) If the search retrieved more than 600 studies, a second search string was added using the operators AND and/or NOT and the exclusion criteria (Appendix 3) were used when searching within the title, abstract and keywords.

(4) If the number of citations was between 100 and 400 from the 1st search string the scholars searched within the title of the articles only.

(5) If the number of studies was still between 100 and 400 the 2nd search string was set within the title only.

(6) Individual studies were reviewed when the search retrieved less than 150[6].

The scholars assessed citation retrievals according to their relevance to the review criteria (Appendix 1 and 2) once they had been downloaded from the citation databases. The citations were separated into A, B and C lists. 'A' was defined as studies that were definitely relevant. 'B' was defined as studies where the relevance was not clear *a priori.* 'C' was defined as studies that were less relevant or where the nature of the research work was unclear. The relevance assessment was undertaken in Procite the bibliographical software package. First, keyword searches were undertaken and secondly, the use of search strings was used within abstracts. Following the use of search strings and keyword searches in Procite the resulting list of abstracts were reviewed by the scholars. At this stage the review

undertook a relevance assessment using the abstracts alone (see Appendix 4). This approach has been recognised to have some weaknesses[7] but is also thought to be useful when a systematic review is faced with overwhelming list of citations to review in a short timeframe (Pittaway et al., 2004)[8]. It should be stressed that the relevance assessment was relative, to the extent that the judgements the authors formed were focused on aspects contained within the review scope. If an article, for example, developed a theory of organisational knowledge but within larger firms, or talked of small firm growth without explicit reference to knowledge, then irrespective of its quality it would not have been included in the review[9]. Following the development of an 'A' list of 209 articles, a descriptive and a thematic analysis was carried out. The descriptive analysis developed tables that were designed to contain the title, area of concern and possible implications of each study in the relevant list. The thematic analysis analysed the abstracts using a form of inductive content analysis, where the abstracts were coded within the Nvivo qualitative research software package (Pittaway et al., 2004), and further analysed within Procite. The full-text versions of all of the 209 articles found through this process were reviewed to build up a 'landscape' of emerging, current and past research activity covering studies relevant to the research objectives outlined earlier.

Results of the Systematic Review

[Insert Table 1]

The results are presented in four stages. Table 1 provides an overview of the results. In the first stage the scholars used search strings in the three identified databases this yielded over 5000 citations, of which 1744[10] were left after filtering according to the exclusion criteria (Appendix 3). In stage two the relevant citations were transferred into Procite[11], wherein nearly 400 citations were eliminated by further application of the inclusion and exclusion criteria (Appendix 2 and 3). In addition the software allowed the researchers to

identify and eliminate duplicate studies. At the end of this stage there were 941 relevant studies (see Table 2).

[Insert Table 2]

In stage 3 the remaining 941 citations were searched using the keyword and search string functions in Procite. The keywords were examined and those occurring as isolate or at minimal levels of citation were identified. These acted as 'flags' highlighting a need to explore the abstracts in more depth. For example, the search string economic* AND model* produced 14 documents in Procite of which 8 were eliminated. Likewise keywords that led to exclusions in Procite included, for example: benchmarking; commercialisation; computer programming and these also led to exclusions. The final number of studies left after this stage was 478. Of the excluded documents 157 were excluded using keywords and 313 were excluded using search strings.

In the final stage the assessment criteria (Appendix 4) were used to assess relevance. There were 111 less relevant articles, 142 partially relevant articles and 209 relevant articles. The remaining 209 articles were directly relevant to the research question and were reviewed using NVivo to realize thematic structures by which the evidence could be classified. The overall process of the review is summarised by Figure 1.

[Insert Figure 1]

In the next part of the paper the detailed conclusions from the review examining the use of knowledge in SMEs are explored.

STUDIES OF KNOWLEDGE USE IN SMES

Much of the literature on the use of knowledge in SMEs adopts a resource-based view of the firm. Performance is related to the ability to integrate knowledge assets (understanding of markets and technology) with the routines that govern everyday organisational activity. It is argued in this literature that the importance of knowledge resources vis-à-vis other assets is

high for SMEs (Yli-Renko et al., 2001; Wiklund and Shepherd, 2003). This conclusion is reached because:

(1) SMEs control fewer assets, and their lack of size and financial scope provides little opportunity for strategic market control (Wiklund and Shepherd, 2003).

(2) Consequently, there is higher reliance on what 'individuals' know, particularly the owner-managers (Wiklund and Shepherd, 2003).

(3) As these knowledge resources cannot be used to contain or channel market activities this skews SMEs toward a concern with, 'entrepreneurial orientation' (Wiklund and Shepherd, 2003)[12].

The implicit hypothesis in many studies, therefore, is that an SME that demonstrates a rich array of knowledge resources *and* entrepreneurial orientation will outperform other firms (Wiklund and Shepherd, 2003). Critical to this is what Yli-Renko et al (2001) identify as the SME's social capital or their ability to acquire and exploit knowledge arising from external relationships. It is argued that social capital enables owner-managers to:

(1) Access greater amounts of information.

(2) Recognise information that is pertinent to their strategic aims.

(3) Achieve absorption of the essentially incommunicable elements of others' skill through relationships of prolonged familiarity.

(4) Benefit from swifter knowledge transfer because of the need for contiguous expectations.

(5) Increase the potential for knowledge transformation where there is a preference for dynamic critique above repetitive imitation.

(6) Become exposed to multiple perspectives where there is a broadening of customer markets (Yli-Renko et al 2001).

Given that this literature conceptualises knowledge as an asset and explores how it is used, as well as exploring the role of social capital, the discussion that follows is organised into three parts. The first describes studies emphasising the identity, role and influence of the entrepreneur in this organisation of resources. The second part is confined to those studies isolating the SME and its network as the location of knowledge creation and use. The third part describes those studies where the focus is on knowledge resources held by SMEs, including their social capital, that are seen to be enhanced or hindered by environmental influences especially government policy. A summary of the themes emerging from Nvivo analaysis and upon which the discussion is based is given in Table 3

[Insert Table 3 here]

Knowledge, the managers and the entrepreneurs

Amongst many of the studies of knowledge use in SMEs there is a recognition that knowledge is gained through the tacit experiences of specific individuals. For example, Carson and Gilmore (2001) found decision taking to be heavilly reliant upon existing knowledge and personal judgement and communication skills each of which is experienced in what Wong and Radcliffe (2000) identify as processes of negotiation, revision and argument. These authors imply that tacitness of what is known resides with: judgement; estimating capacity; physical co-ordination; familiarity with techniques; image recognition; and, personability. To reveal these knowledge resources Wong and Radcliffe (2000) recommend the adoption of routines that:

(1) Minimize tacit components by highlighting the rationale behind the origin and use of designs.

(2) Share knowledge across management functions.

(3) Use structured decisional apparatus so that diagnostics or cataloguing can occur automatically.

Despite making such recommendations Wong and Radcliffe (2000) acknowledge, however, that much of what makes knowledge an important asset for SMEs is its non-replicability. Lofstedt (2001) also concludes that repetition of rotuines – in this case training – tended to focus attention on the development of generic skills for each employee rather than on the varied needs of the organisation as a whole.

Making the tacit explicit is viewed as problematic by a number of studies (Filion, 1996; Chaston et al., 2001; Honig, 2001). These authors associate a significant element of any SME's knowledge resource as being experiential and remaining so over time. For example, when examining intrapreneurs[13] and entrepreneurs in Sweden Honig (2001) found distinct differences in learning strategies. Intrapreneurs favoured consensus seeking strategies that favoured codified procedures, used internal networks and pre-existing knowledge. Entrepreneurs tended towards using unstructured flexible processes, used external networks and avoided established patterns of doing things. The contrast between knowledge configured as certainty on the one hand, and as discovery, on the other hand, was associated with individual characteristics and social influences that could not necessarily be taught. This was a difference also identified by Filion (1996) where the management systems of non-entrepreneurs were found to elicit or reflect activities of assigning, dividing, and adjusting, whereas the systems of entrepreneurs encouraged animating, designing and learning. Chaston et al's (2001) study also found that entrepreneurs more willing to invoke double-loop, or higher order learning styles than their non-entrepreneurial counterparts. In the study this willingness to embrace problem-solving activities was seen as a function of having to create and launch innovative products, as opposed to continuing to exploit existing knowledge under mature stable markets (Chaston et al., 2001). Chaston et al. (2001) only found a weak correlation between the development of such a style and the explicit enhancement of

managerial competencies, such as marketing or financial skills. The finding suggests that entrepreneurs are more alive to the need to adapt to contexts, to question practices, and to consult a wider range of information sources. They are willing to correct mismatches in experience by reflecting on their underlying values, as well as, on their technical solutions (Argyris, 2003). This may not necessarily lead to the development of heightened levels of internal managerial competence or skill; the understanding remains intuitive and linked to individual competence (Chaston et al, 2001).

Ward (2004) argues, however, that because codification is relatively unusual in SMEs there is a risk they loose 'an edge' over larger firms because these firms have the ability to integrate and exploit knowledge that is codified via economies of scale, range and continuity. This points to the need for balance by which SME managers use their 'entrepreneurial orientation' to use knowledge, retaining skills to exploit loosely configured networks of personal relations, rather than employ mechanistic formulas based on the codification of knowledge (McAdam and Reid 2001). This viewpoint is supported by Sadler-Smith (1995) who found that marketing, information management and human resource competence within SMEs was positively related to the explicit adoption of a relational approach to marketing, as opposed to a transactional one. Where effort was put into developing on-going relations and the identification of customer needs the SME management experienced a sense of 'learning' because they introduced the voice of others (mainly customers) into decision making (Sadler-Smith, 1995).

One way of intorducing this multi-voicedness, argue Choueke and Armstrong (1998), is to use action learning sets that focus on encouraging owner-managers to actively reflect on experience. Sullivan (2000) and Deakins and Freel (1998) take a similar tack when they argue for entrepreneurial 'mentors' to assist start-up ventures[14] (Sullivan, 2000). Here the collective approach is important, because a consequence of depending too heavily on solitary reflection is an unduly bounded rationality. For example, Petts et al. (1998) found that when asked about

their experience managers were overly optimistic, compared to their employees, when assessing their environmental performance. There was a perceived gap between the managers' attitudes and their actions. This illustrates the limitations of 'reflection' divorced from other actors' knowledge and context, as well as, demonstrating the weaknesses of 'knowledge' when conceptualised separately from 'action' or 'activity'. Likewise, Macri et al. (2001) found in their case study that despite being initially enthusiastic about adopting innovation the owner became quickly sceptical, realising how it made them dependent on an employee (the systems manager). Having failed to judge the innovation in multiple contexts of application, not least its potential impact upon leadership power and influence, the entrepreneur drew attention and resources away from the innovatory system, foreclosing on the potential benefits[15] (Macri et al. 2001).

The empirical evidence to this point, therefore, suggests that small firms have to engage in specific organising practices[16] from different perspectives in order to fit in with the prevailing conditions and routines of others (Korunka et al, 2003) and appreciate their personal constructs[17] (Wyer et al, 2000). For example, Keh et al (2002) found that even the 'illusion' of control influencing the evaluation of opportunities[18] was framed in socially embedded, subjective orientations picked up through experience; the ability to recognise opportunity, therefore, was not a psychological trait but a publicly framed skill. Shane (2000) provides further evidence for the point, identifying that opportunities are a function of the availability of knowledge within local contexts of operation and are linked to the related personal histories of the individual. Whilst knowledge tends to be within the influence of people who favour novel decision taking, and who are willing to trust their own judgement, this knowledge remains socially embedded (Keh et al, 2002; Shane and Venkataraman 2000). As knowledge is dispersed across different people and communities the role of the individual is to provide the nexus for relations and the development of 'new combinations' of knowledge (Dew et al., 2004). It is the entrepreneur's view that becomes critical in explaining which

routines are being used, but these routines have a conditioning influence on the entrepreneur whereby what constitutes an opportunity is configured by ordinary, everyday experience (Deakins and Freal, 1998; Gibb, 2000; Cope, 2003). Here the criteria for success relate not only to self-motivation and vision, but the entrepreneur's ability to adapt creatively to the influences of others (Gibb, 1997). For example, Floren (1996) identifies how owner-managers learn by exposing themselves to opinions from outside of the enterprise. In the study the opportunity to learn in this way was not always available because of the lack of peers and the presumed omniscience of the 'solitary' entrepreneur (Floren, 1996).

Understanding how entrepreneurs learn from others, and how others learn from entrepreneurs, has been examined in research exploring the cognitive framing of 'entrepreneurial knowledge structures'[19] by which opportunities are recognised, created and pursued (Korunka et al, 2003; Mitchell et al, 2002; Keh et al, 2002). Ward (2004), for example, analyses entrepreneurial ability as cognitive creativity. In the study entrepreneurs are able to move beyond the constraints of old knowledge and are able to recognise and create new products because of their cognitive creativity. A similar cognitive perspective is adopted in Minniti and Bygrave's (2001) entrepreneurial learning model. Rather than assume entrepreneurs 'always' learn they provide a more complicated model and highlight the tendency amongst entrepreneurs to become locked into previously successful patterns of activity (Minniti and Bygrave, 2001). This condition of 'myopic foresight' is governed partly by conditioning from previous experiences of success and failure, which create path dependencies. They show that entrepreneurial learning is informed by direct knowledge of existing market conditions and by the 'general' background knowledge of what it means to '*be'* an entrepreneur. For both Ward (2004) and Minniti and Bygrave (2001) entrepreneurial ability is not so much cognitively rooted as cognitively configured. As such, it is an aptitude for working within and at the edge of habitual patterns of *activity* rather than *thought.*

This move away from abstract rationalising is described by Saravathy's (2003) theoretical model as effectual entrepreneurial decision-making. Rather than choose optimally amongst a range of distinct alternatives, entrepreneurs demonstrate an effectual willingness to design alternatives influenced by:

(1) A tolerance for experiment governed by the logic of affordable loss, thereby minimising investment in failures.

(2) The adoption of stakeholders in an enterprise, thereby increasing the knowledge stock to avoid failures.

(3) The exploitation of absence, always working into blank spaces, thereby not repeating failures. (Sarasvathy, 2003).

From an effectual perspective, then, knowledge is not so much something 'gathered in'as experienced in a willingness to create opportunities. Creativity comes from skills, insight, technical knowledge and leadership strengths, but as Sarasvathy (2003)_and Hoffman et al., 1998) argue, these are not confined to personalities or psychological profiles. Isolating these as root causes of knowledge is itself too subjective and abstracted to be of much explanatory use, and result as much from a fixation on the 'heroic' values (Gibb, 2000) associated with entrepreneurs as they do on empirical analysis of phenomena. It would be far better, Hoffman et al (1998) argue, to hone in on what encourages and frustrates innovation itself; this means looking to the contexts in which entrepreneurial ideas are 'enacted'. In support of the view Corti and Storto (2000) observe that the two most significant influences on the generation of knowledge were related to cognitive factors of felt ambiguity and context uncertainty. Even at this overtly personal level they note how these were experiences mediated by the context of application. Similarly, Cope (2003) recognised that the often intimate link between business and personal success experienced by entrepreneurs was socially rather than psychologically constituted. Financial and emotional well-being was

intimately tied to the realisation of the business idea in terms of its being validated by members of a wider community.

These studies begin, at least implicitly, to move analysis away from a resource-based view. They regard the entrepreneur and their firm, less as a discrete bundle of characteristics or assets and more as an entity whose identity is relaint upon the social relations by which it is articulated, argued for and challenged. Rae and Carswell (2001) and Rae (2002) have analysed such socially configured experiences of entrepreneurship by looking at discourse. Narrative accounts were used to show how the creation of a business venture and developing practical theories of action were themselves articulations of each entrepreneur's personal life stories. The authors argue that what informs the self-confidence that entrepreneurs associate with achieving business success is their known experience and abilities, which are configured as personal theories[20]. Pitt (1998) also uses narrative analysis of conversations with entrepreneurs and their colleagues to understand the relational elements of the entrepreneur's venture including:

(1) How their basic world-views inform what they think it is to be an entrepreneur;

(2) The action templates that cover the entrepreneur's understanding of the possibilities for action (including contingent goals)

(3) Potential antagonisms;

(4) Metaphorical views of the entrepreneurial role.

In his analysis Pitt shows, how from similar entrepreneurial beginnings of founding a new venture in a spirit of independence, the realities of individuals diverge. Rather than explain this divergence as a distinction between different types of entrepreneur he argues that by tracking action templates over time researchers can better understand the influence of favoured dilemmas and roles on entrepreneurial activities.

[Insert Table 4]

From the analysis in this part of the paper, summarised in Table 4, it is possible to conclude:

(1) The knowledge developed and used by the entrepreneur is socially embedded and is a function of personal constructs (Wyer et al., 2000), experience (Honig, 2001), effectual reasoning (Sarasvathy, 2003) and wider social contexts (Rae and Carswell, 2001).

(2) Entrepreneurs can have different learning strategies from the population in general since they prefer unstructured, flexible processes that depend on external networks (Filion, 1996; Chaston et al., 2001; Argyris, 2003; Cope, 2003).

(3) Knowledge can be derived from learning via reflection (Deakins and Freel, 1998; Sullivan, 2000).

(4) Routine knowledge used within SMEs in some contexts requires external networks (mentors or learning sets) in order to be challenged to develop innovation (Petts et al., 1998).

(5) The lack of codification of knowledge in SMEs brings with it limitations based on a lack of economies of scale (Sadler-Smith, 1995; Ward, 2004).

In the following part of the paper we move away from studies that focus specifically on entrepreneurs or owner-managers and begin to explore those studies that focus on the 'firm'.

Knowledge and the firm

The previous part of the paper suggests that entrepreneurial knowledge is not only dependent on individual personality and cognitive capacity but is also 'situated'. For most studies, the overriding 'situation' is the institution of the firm and its immediate network. For example, Takur (1999) found that whilst management capability had a strong determining influence on venture growth, this influence was only manifest in the ability to organize; in this

case using resources to create space, or 'slack' needed by others to exploit opportunities. The creation of slack was enabled:

(1) By the entrepreneur's ability to stabilise the business venture by defining organisational structures and boundaries

(2) By their ability to create enlarged strategic spaces using a reflexive management of self as a form of empathetic leader (Thakur, 1999).

This concern with developing internal resources is also identified by Gray and Gonsalves' (2002) who found that investment in and integration of information and communication technology was positively correlated to expansive, growth-oriented business strategies. Whilst these technologies were useful in terms of wider dissemination, however, their indiscriminate use was cited as a risk, with too much or irrelevant information being transferred. The conclusion chimes with Lefebvre et al*'s* (1995) survey which illustrated the importance of technology resources for developing a wider market base (especially exporting) but found no link between these 'innovators' and financial performance, possibly because in the short run any gains in profitability were set against the cost of technology investment. These warnings suggest a need for the judicious orgaization of resources, presuming a level of what Bessant et al (2001) call 'agility', or the ability to continually re-configure problems, solutions and routines rather than rely upon a fixed set of previously identified solutions. Thet suggest this dynamic capability to marshal and re-organise a range of sources of knowledge from within the firm[21] and not to rely on habitual knowledge and experience is what distinguishes sustained innovation. By way of illustration, Soderquist et al (1997) and Irani et al (1997) identify the importance of integrating R&D activities into established routines, as well as, promoting the use of cross-functional teams when seeking to innovate.

In terms of what constitutes a knowledge base for innovative SMEs, a critical and overriding element of their intellectual capital seems to be those people they employ. Keogh (1999) finds in his study that owner-managers are aware of a need to develop a human

resource competence in nurturing and retaining their knowledge base. Without the people in place, these firms recognised that their competitive future would be very short. Key people were also important in Darby and Zucker's (2003) work and they identify the significance of maintaining close links with 'star' scientists. This was particularly relevant where technological advances were metamorphic rather than incremental and where new knowledge has not been developed or adapted by incumbents. New SMEs staffed by 'star' scientists can play a vital role in creating new industrial activity, but can only do this because of the direct influence of the scientists from whom the new knowledge originated (Darby and Zucker, 2003). Much of the scientists' knowledge remains tacit and firm success is closely tied to the ability to retain their services. Here Darby and Zucker (2003) show that where technology is characterised by experience, the ability of the owner-manager to create and sustain links with the science community is critical. Ravasi and Turati (2005) go further and argue that where technology is transferred into an SME rather than developed 'in-house', the conditions of ambiguity, asset scarcity and relational dependency are such that it is better for the entrepreneur themselves to stay involved with the requisite technological platforms. This intimacy with the knowledge base enables the entrepreneur to integrate tasks, to ensure continued loyalty and commitment of key actors and to have a far clearer idea of potential commercial applications (Ravasi and Turati, 2005).

This ability to integrate human and non-human resources is linked by Liao et al (2003) to 'absorptive capacity'[22]; the use of routines to gather, communicate and use knowledge from the wider environment in ways that blend with accumulated experience (Liao et al., 2003). What is known is both an issue of being exposed to new information and a willingness to act upon it. The assumption is that the better the absorptive capacity of an SME, the more able it is to recognise opportunities in proactive rather than reactive ways. The authors find that high levels of responsiveness (acting upon knowledge acquired) are associated with:

(1) A capacity for external knowledge acquisition and internal knowledge dissemination;

(2) A pro-active strategy of new opportunity exploration as opposed to exploiting existing ones.

(3) An ability to focus inwardly.

Each of these findings is relational, suggesting growth-oriented SMEs maintain a lucid and extensive awareness of their environment (customers, suppliers, regulators, professions). This is emphasized by Meeus et al (2001) who argue that because SMEs are too small to grow through acquisition their absorptive capacity remains skewed to relational integration within supply chains rather than internal focus. They found this to be especially the case where the pressures to innovate are strong, in markets where heterogeneous skills[23] can become obsolete, and where the typical market response was to increase the rate of innovation. SMEs absorptive capacity, therefore, is not so much a unit-based competency as that of a social network (Meeus et al., 2001). It is argued that by developing external links (or social capital) an SME can excel at developing resources and enhancing entrepreneurial skills (Meeus et al., 2001; Liao et al. 2003).

Dallago (2000) continues this line of thought from a theoretical perspective by arguing that SMEs can obviate transaction costs by using relational rather than formal contracts as by fostering trust through frequency of contact and flexibility they are less likely to experience costly opportunism or enforcement. Costello (1996) also recommends that SMEs build their social captial as a matter of enhancing knowledge routines. Within the study 'innovative ' SMEs were found to continually re-interpret routines, as what was known was institutionalised as a routine, it remained under rapid notice to quit because of a recognition of shifting and complex path dependencies (Costello, 1996).

As to which elements of social capital have the strongest influence, most studies emphasize the importance of customers and/or suppliers. Hoffman et al (1998) found high-

levels of interaction, especially with customers, assisting access to new knowledge, technological competency, innovativeness and competitiveness. Lipparini and Sobrero (1994) also support this view and in their study firms that were innovative and competitive were run by owner-managers who demonstrated strong relational competence. Notably they tended to enlist suppliers and customers in order to benefit from cross-fertilization of ideas, particularly during product design. Perez and Sanchez's (2002) study also agreed and argued that finding networking solutions to production problems enabled 'real' product requirements to emerge from interaction (Panizzolo, 1998). Simmie's (2001) study explores links with customers and suppliers and it was customers and their international distributors that exposed SMEs to the novelty by which they might challenge existing routines. The supply-side, conversely, was the source of embedded knowledge, with local networks providing the knowledge spillovers through which uncertainties were resolved (Simmie, 2001). The implication is of a virtuous cycle, albeit limited; between creating and using knowledge and exposure to a wider customer base (Simmie, 2001).

Minguzzi and Passaro (2001) demonstrate the influence of these virtual cycles in terms of their contribution to the development of entrepreneurial spirit. They were able to distinguish between 'learning entrepreneurs' and 'bounded entrepreneurs'. Proximity to final customers provided 'learning entrepreneurs' with a stimulus for change, while 'bounded entrepreneurs' tended to avoid and resist change in favour of focussing on the production of existing commodities (Minguzzi and Passaro, 2001). Rather than accept the identification of entrepreneurial spirit with a willingness to adapt and undergo renewal, Minguzzi and Passaro (2001) identified, how the availability of regular, orthodox and mutually re-enforcing knowledge in demographically knit market conditions encouraged entrepreneurs to resist innovation and discontinuity. Where the final market is changeable entrepreneurs were increasingly flexible but in other markets entrepreneurs preferred existing distributions of knowledge and the comfort of using familiar solutions. The closer to the final consumer and

the more direct the relations (the fewer the intermediaries) the more open and successful is the entrepreneurial activity (Minguzzi and Passaro, 2001).

Yli-Renko et al's (2001) exhaustive study, however, was less conclusive. They investigate the importance of social capital to the acquisition and use of knowledge from the perspective of the key customer relationships of young high-tech SMEs. Here, they propose that acquisition and use is dependent upon:

(1) The availability of knowledge;

(2) The ability of the firms to recognise and use knowledge;

(3) The intensity and continuity of the relationship between the firms.

They found that where social interaction[24] and wider network ties[25] are related to knowledge acquisition, the quality of those relations[26] are negative. This suggests that whilst social capital is vital SMEs must be wary of how closely they associate within one relationship because such embededness may limit 'entrepreneurial orientation'. Trust may smooth transaction costs, therefore, but at the expense of exposure to new knowledge (Yli-Renko et al., 2001). A similar 'mixed-message' is found by Beecham and Cordey-Hayes's (1998) when they found that SMEs working closely with much larger organisations through supply chains did not often get the technological collaboration they hoped for. SMEs were obstructed, not by the inability to develop innovative technical knowledge, but by a failure to recognise the managerial difficulties of collaboration. Beecham and Cordey-Hayes (1998) identified that 'islands' of collaboration through the supply chain yielded knowledge benefits but that their lifespan was dependent on the ability of each partner to keep abreast of rapidly changing technologies. This included the capacity to divest themselves of already established routines and aims when necessary.

Another influential aspect of social capital highlighted by the literature, and related to the influence of customers and suppliers, is internationalization. This was identified by Simmie (2002) who recognised that significant encouragement to innovate stemmed from the

internationalised nature of the SMEs client networks. Bell et al (2004), Kim et al (1993) and Khan and Manopichetwattana (1989) also all found that product and process innovations of innovative firms were linked to a broadening of markets and internationalisation. This is confirmed by Burpitt and Rondinelli (2000) who found that even where the financial incentives to widen customer exposure through exporting were unclear; many firms still pursued the policy spurred on by an enthusiasm for new knowledge. Exposure to international customer pressure becomes a good, or competence, in itself (Burpitt and Roninelli, 2000; Bell et al., 2004).

In addition to increased proximity to markets or integration within supply chains, another way smaller firms can develop knowledge resources through social capital is through relations with larger firms (Rothwell, 1991). The association of smaller firms, larger firms and innovation is in fact a frequent one in the empirical evidence (Pittaway et al., 2004). From a theoretical perspective, Nooteboom (1994, 1999) argues that interactive relationships between large firms and small firms should support innovation. Put simply, Nooteboom (1994) argues that larger firms tend to be more effective at basic inventions, while smaller firms have diversity, independence, personality and flexibility, which enable them to be adroit at exploiting basic knowledge. Their complimentarity[27] enables them to produce novel combinations and isolate 'mistaken forms of novelty'. What SMEs may be less good at, is in delivering the scales of economy, production systems integration and specialisation of tasks necessary to exploit the dominant innovations fully (Nooteboom, 1999). In terms of empirical support for such a view King et al (2003) identify how smaller firms are less likely to be dissuaded by uncertain growth prospects or pursuing untried technologies because they:

(1) Have the benefit of entrepreneurial commitment to an idea

(2) Have less structured routines that allow for the adoption of new technologies.

(3) Have greater exposure to these new technologies because of their mobility and proximity to spillovers from universities and other industries.

King et al (2003) argue that these specific knowledge characteristics compliment the financial soundness, technological breadth and the marketing and sales resources of larger firms; warranting the use of equity-based alliances (King et al., 2003). These enable the small firm to benefit from robust resourcing to exploit their knowledge and from a formalised common-destiny. The larger firm benefits from an avoidance of its often bureaucratic decision-making structures and exposure to the development of new products, services and even new industries.

Another related strategy identified by Sapienza et al (2004) is for the larger firm to create smaller 'spin-offs' to innovate. They identified the most successful relationships to be those in which there was sufficient overlap to ensure knowledge absorption and strategically targeted activity but enough distance to explore 'novel knowledge combinations' (Sapienza et al., 2004). The smaller firms benefited from sufficient flexibility to exploit innovations and their parental 'history' kept the businesses stable. These observations echo previous studies by Eden et al (1997) and Juliene et al (1996). The former cite the benefits to innovation of an inherent flexibility and a willingness to act unconventionally. It is precisely where smaller firms are weak, in terms of size and the cost of capital, that larger firms can step in and so reduce the costs of technology production and transfer. It is this inability to source cost-effective short-term capital that Juliene et al (1996) cite as the main barrier to SME technological innovation.

A study of innovative SMEs by Rothwell (1991) identified how to overcome the knowledge economies of scale in terms of R&D investment. Smaller firms had to be assiduous in developing 'dense networks' with other firms, universities and private sector research institutes. The lack of in-house expertise was not an insurmountable barrier to innovation but had to be overcome by working with others. Rather than being a barrier, the lack of in-house expertise might actually be a boon (Rothwell, 1991). For example, Jarillo's (1989) study found links between growth in sales and profit margins and the willingness to

use external resources. Jarillo's (1989) study suggests that smaller firms benefit from retaining flexibility, using the resources of others such as venture capital or buying in experts rather than growing by owning them 'in house'; an empirical expression of Sarasvathy's (2003) model of 'effectuation'. The more entrepreneurial systems tend to be the ones that demonstrate an ability to decompose structurally, whereby elements remain detachable rather than becoming wholly integrated. Such flexible systems allow for the re-working of the network in response to change (Sarasvathy, 2003). System flexibility, however, erodes during the accumulation of generic resources, or what Jarillo (1989) calls experiencing the second entrepreneurial dilemma (where the first is locating knowledge). This viewpoint is supported in part by Almeida et al (2003) who identify an offsetting influence. As firms grow so does their exposure to sources of external knowledge but the concomitant increases in task-centred formality and geographical fixity mean that their willingness to learn from informal, social sources of knowledge is reduced (Almeida et al., 2003). It appears that these routine interactions manifest themselves in the growth of internal information control systems that weakens an organisation's ability to renew itself (Floyd and Woolridge, 1999).

Perhaps the most frequently attested way that SMEs are able to use social capital to develop knowledge is in building ties with one another, typically in geographically knit clusters. The orthodox view is that by forming tight knit geographic clusters SMEs within a similar industry can explore and exploit rapidly flowing knowledge. Lissoni's (2001) study, however, upsets this view by identifying highly codified, distinct and almost idiosyncratic 'epistemic communities' centred around specific mechanical engineers and other technicians rather than on any specific organisation or cluster. The intimacy of the personal 'know-who' amongst such engineers can contribute to knowledge stickiness[28]. Similarly, Capello (1999) finds in her study that innovative firms were characterised by stability and a close cultural identification with their workforce (Capello, 1999). The emerging picture is far more complex than one of simply identifying a geographical region of sector-specific SMEs.

Capello (1999) finds that firms set within a regional milieu who did engage in collective learning tended to be smaller firms innovating in new products (Capello, 1999). Where firms innovated in processes, the emphasis was on the development of internal routines, and hence growth occurred via improvements in efficiency and effectiveness (Capello, 1999). The results of Capello's study (1999) suggest that SMEs network in clusters for commercial reasons rather than learning. This viewpoint is also highlighted in Hanna and Walsh's (2002) review of previous SME networking studies. They identify a preponderance of 'clusters' that are vertically integrated, designed to improve their competitive position within supply chains. Rather than horizontally integrated 'clusters' designed to promote collaboration amongst peers in the pursuit of new products (Hanna and Walsh, 2002).

[Insert Table 4]

By drawing together the findings (see Table 4) from this part of the review it is possible to conclude the following:

(1) The creation of 'space' within new ventures can enable entrepreneurs and employees to be more agile than larger organisations, enabling them to configure new problems and solutions in flexible ways (Thakur, 1999; Bessant et al. 2001).

(2) More innovative SMEs tend also to be growth-orientated but the relationship between growth motives and innovation is not a simplistic one (Lefebvre et al., 1995; Gray and Gonsalves, 2002).

(3) Internal consistency (teams and people employed) within SMEs plays an important role in knowledge construction and consequently innovation. The management of teams by entrepreneurs emerges as a key finding for the effective use of knowledge (Irani et al., 1997; Soderquist et al., 1997; Keogh, 1999; Darby and Zucker, 2003).

(4) The absorptive capacity of individual firms, which is based on their social networks, plays a role in their ability to act on opportunities (Meeus et al., 2001; Liao et al., 2003).

(5) The flexibility that SMEs have enables them to reduce transaction costs through relational contracts and trust thereby building knowledge symmetry (Gartner et al. 1992; Costello, 1996; Dallago, 2000).

(6) The ability of firms to build social capital is, therefore, important because it allows for the transfer of knowledge (Lipparini and Sobrero, 1994; Yli-Renko et al., 2001).

(7) Likewise the ability of firms to actively manage knowledge and networks is viewed as important in their competitive 'success' (Khan and Manopichetwattana, 1989; Kim et al., 1993; Bell et al., 2004).

(8) Proximity to other firms and relationships with larger firms are important in some SME contexts but not all and the relationship is a complex one (Jarillo, 1989; Rothwell, 1991; Juliene et al., 1996; Eden et al., 1997; King et al., 2003; Sapienza et al., 2004).

In the next part of the paper we begin to explore the relationship between the firm and its environment, exploring how knowledge is diffused. The section has a particular focus on empirical studies exploring policy interventions.

Knowledge and the wider SME environment

The importance of configuring knowledge at firm and then network level extends empirical concern to the wider institutional environment. It is the latter 'space' that concerns Cooke and Wills' (1999) survey of knowledge use and innovation. They examined the institutional role of governments in facilitating the growth of networks through the European Union's 'framework programmes'. The firms in the survey experienced considerable benefits

to innovation as a result of having developed links with other firms and stakeholders from outside their national economies. They show that SMEs come to value different forms of social network as a method to advance know-how and exploit commercial opportunities (Cooke and Wills, 1999).

Morrison and Bergin-Seers (2002) identified[29] a policy need to attend to the creation of a 'learning architecture' to better engage SMEs. Specifically, they argue that policy needs to be sensitive to the experiential and practical ways in which owner-manager's learn, requiring:

(1) Work-based rather than off-site learning to emphasise relevance.

(2) Maintaining an onus on owner-managers to direct their own learning.

(3) The use of mentors as advisors intimate with business problems;

(4) The encouragement of peer networks.

As to of what such an architecture consists, Mehra and Dhawan's (2003) study identified components which included:

(1) A base line of organisational financial 'health'.

(2) A willingness to pursue innovation.

(3) An ability to interact with others and so build networks.

(4) An acceptance of risk.

(5) An ability to change direction should circumstances demand.

As Morrison and Bergin-Seers (2002) suspect, none of these require explicit, generic, formal, off-the-peg advice. Rather the focus is on encouraging entrepreneurs to ensure both they and others are provided with challenges, are exposed to a variety of tasks, used team-based activity and are empowered to make decisions.

In contradiction to the need for 'learning architecture' Sikka (1999) argued that it was not so much an entrepreneurial policy culture that was lacking, as a persistent gap between SME activity and new technological innovation. The study suggests the use of government policy to assist in brokering relationships is valid when seeking to create technological

innovation. As Platt and Wilson (1999) point out, it is not merely having the 'learning architecture' in place but having the capability to use it. This capability varies across socio-cultural contexts and local development of technologies is required to institutionalise the innovation as a set of local routines (Platt and Wilson, 1999). It is the demographic aspects of these different knowledge environments that concern Van Horn and Harvey (1998) who argue that due to low set up and running costs, the availability of grants and advances in telecommunications, rural entrepreneurship is viable, but would be significantly enhanced if it also had:

(1) Expertise (finance, marketing; legal);

(2) Shared resources to reduce idle assets;

(3) Economies of scale to reduce the cost of supply;

(4) Institutionalised benefits of continuity and consistency.

In developing a model of an entrepreneurial 'virtual mega-firm', Van Horn and Harvey (1998) suggest that much can be done by a collection of rural entrepreneurs held in a virtual assembly by common goals. It is argued that given the right policy environment, and by developing network and relationship skills, and adopting a learning outlook, entrepreneurs would be able to form such a firm (Van Horn and Harvey, 1998).

The use of government policy to promote knowledge use, however, can be a somewhat clumsy tool if it is applied across time to all conditions. In their study, Lagace and Bourgault (2003) found indiscriminate public sponsorship for a raft of world-class manufacturing practices meant that some of the sample firms ended up resenting rather than welcoming public assistance. The authors argue that for competitiveness policies to work, account has to be taken of each individual firm's growth aspirations and its ability to grow. Similar findings come from the earlier study of high-tech SMEs by Oakey and Cooper (1991). They found the variance between technologies, notably in R&D lead times, to be so great as to produce different rates of growth and different managerial conditions. One recommendation was that,

rather than assume the adoption of high technology will encourage rapid growth whatever its nature, policy communities need a better scientific understanding of how different technologies have different gestation periods. One way of ensuring policy remains less generic to the economic conditions it aims to configure is indirectly via professional associations as opposed to direct government intervention. For example, Swan and Newell (1995) found the professional development advice and training offered by the association responsible for product inventory and control had a positive effect upon disseminating technology innovation. Due to a lack of resources and size the links between smaller firms and the professional association were somewhat limited. This may suggest that targeted investment in the development of professional bodies to promote SME exposure to technology developments may be problematic because not all professional associations have deep and widespread links with SMEs.

Another direction for governments to take is to accept the role of other intermediaries. As Cook and Wills (1999) point out, what SMEs valued least about their participation in EU programmes was the presumption of knowledge on the part of public bodies. It was found to be far more productive to spend public resources on encouraging meetings between knowledgeable SMEs, who act as agents for interaction and encourage the better exchange of tacit knowledge.

In much of the policy literature explored in this part of the paper there is an implicit link between innovation and growth. It should be noted that the assumption linking innovation to growth in SMEs is a strong but not undisputed one. On the one hand, we have Yli-Renko et al (2001) who found that where knowledge acquisition was strong amongst high-tech SMEs it was positively related to knowledge exploitation, improving innovation, efficiency, technical capability and reducing costs. On the other hand, Bagchi-Sen's (2001) study of innovating SMEs linked the ability to recognise and pursue new knowledge to stronger sales growth but did not see any link with profitability. Similarly, Freel's (2000) contrasted innovating with

non-innovating firms and identified links between levels of product and service innovation and turnover growth. Yet, positive correlations with productivity, profitability and internationalisation were not found in the study. Sadler-Smith et al's (2001) also had conflicting findings, with a positive correlation between manufacturing SME growth and the adoption of generative learning[30] but no similar relationship for SMEs in the service sector[31]. This suggests that though influential in terms of growth, the edict of 'innovate or die' is itself a contentious one for the policy community to take up given that the links to profitable outcomes are unclear (Freel, 2000; Sadler-Smith et al., 2001).

[Insert Table 6]

From this part of the review (see Table 6) it is possible to conclude the following:

(1) SMEs come to value social networks as they grow as a means to advance know-how and exploit commercial opportunities (Cook and Wills, 1999).

(2) Policy designed to build 'learning architectures' for SMEs that enable them to learn experientially is viewed as a useful role for Government but that this works best when done indirectly through intermediaries (Swan and Newell, 1995; Morrison and Bergin-Seers, 2002; Mehra and Dhawan, 2003; Pittaway et al., 2004).

(3) Such policies need to be developed locally to encourage knowledge flow and institutionalise innovation routines (Van Horn and Harvey, 1998; Platt and Wilson, 1999; Sikka, 1999).

In the concluding part of this paper we bring together all the findings from this review, making some conclusions about knowledge in SMEs, explaining the current state of research on the subject and highlighting the implications for future research and policy.

CONCLUSIONS

Research of knowledge within an SME context can be broken down into three distinct fields:

(1) The knowledgeable SME manager or entrepreneur;

(2) The knowledge systems and routines embedded within the context of the firm and their immediate networks;

(3) The institutional and policy framework that is intended to support knowledge production within SMEs.

These fields are not discrete and inevitably overlap but they provide a useful heuristic through which research can be examined. In addition, it is noteworthy that, apart from a handful of studies which address entrepreneurial knowledge construction through narrative analysis, knowledge is considered to exist as a configurable resource.

In the first of the knowledge fields, findings suggest that it is the use of flexible, unstructured and socially-embedded experiences and relations that exemplify the knowledgeable and knowledge-creating entrepreneur. The researchers reviewed have typically concluded that these configurations should remain informal and flexible, since too much structure creates a focus on knowledge exploitation rather than exploration, and reduces entrepreneurs' learning capacity (Filion, 1996; Chaston et al., 2001; Honig, 2001). When structure becomes too rigid, it is suggested that opportunities for reflection are required (Choueke and Armstrong, 1998). Access to alternative knowledge resources via networks, may provide the social capital necessary for entrepreneurs to leverage resources and re-conceptualise activities (Yli-Renko et al., 2001). There is a note of caution suggested by some studies as it is this very informality that reduces the capacity to capitalise on economies of scale (Macri et al., 2001).

In the second of the fields, it is recognised that while the entrepreneur's knowledge activities and identities are important for the firm, so are the systems and routines of wider organisational activity, including the attraction and retention of human capital (Gray and Gonsalves, 2002). These include: creating 'space' for activity that enables problem solving;

the capacity for knowledge acquisition (via external knowledge networks); and the capacity for internal knowledge dissemination and sharing. The absorptive capacity of the firm, therefore, is dependent on the routines of organising embedded in the firm by the entrepreneur and how he or she encourages teams within the organisation to use knowledge effectively and innovatively (Darby and Zucker, 2003). Consequently, social capital is not only dependent on the entrepreneur but it is dependent on the management team and the system of interactions and networks inside and outside the firm (Ravasi and Turati, 2005). Social capital allows the transfer of knowledge and, as a result, the ability to manage networks may be a key factor in SME success (Liao et al., 2003). The network relationship to knowledge flow is complex but paradoxically, strong (and therefore fewer) relational ties may encourage knowledge flow, while limiting the sources of that knowledge (Meeus et al., 2001). Alternatively, weaker and more diverse networks may provide access to a wider range of knowledge, encouraging reflection on and change to existing routines (Minguzzi and Passaro, 2001).

In the third of the knowledge fields, the SME environment, it is evident that policy interventions have been targeted at building 'learning architectures'. Government agencies, however, were not necessarily seen by SME managers as providing relevant or credible advice (Mehra and Dhawan, 2003). Rather than get involved in this role directly, the research suggests that Governments should encourage peer to peer networks and professional networks (Oakey and Cooper, 1991; Lagace and Bourgault, 2003). These policies, it is suggested, must be local and sensitive to context (Cook and Wills, 1999). These elements of the review suggest that generic solutions are not effective in encouraging the development of knowledge resources within SMEs.

In terms of policy, the study conducted suggests that, in order to encourage the development of SME knowledge resources, a flexible approach is required. This approach needs to be sensitive to the entrepreneur's capabilities, experience and identity, and also to the specific context and activity in which the SME is embedded and engaged. Understanding the

aims, objectives and motivations of SME managers or entrepreneurs is important since they have a significant influence on the firm's activities. In such policy interventions entrepreneurs would need to be engaged in the design of a 'learning architecture' and the ability to help build social capital seems significant within such architecture. It would also require the development of networking and team-building competencies, which assist the development of skills linked to accessing resources and leveraging human capital. The role of Government intervention, therefore, would be to support networking activity and the general architecture but not to be involved directly in its delivery, as is currently the case (Pittaway et al., 2004).

This study shows that the situated nature of entrepreneurial learning has a substantial influence on the development and use of knowledge within SMEs. The studies reviewed include statistical analyses using large samples and case studies and these have typically focused on knowledge as a resource. It is, therefore, recommended that more studies examining SMEs need to be conducted that conceptualise knowledge differently, which focus on knowledge configuration, rather than knowledge creation. Such work should seek to explore the way in which owner-managers and entrepreneurs make sense of their individual and situated realities. Studying SMEs from this perspective may provide a useful way of understanding how entrepreneurs develop, apply and negotiate their personal theories within their firms. As such, this type of research would provide a richer picture allowing researchers to have a more sophisticated understanding of knowledge use and ensuring that this understanding sees knowledge as embedded in its social context.

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TABLE 1

OVERVIEW OF THE SYSTEMATIC LITERATURE REVIEW RESULTS

Databases searched	3
Key words used in search strings	42
Number of searches	48
Documents retrieved	5050
Studies after being filtered by exclusion criteria (Stage One)	1744
Studies after being filtered by title analysis (Stage Two)	941
Studies after being filtered by keyword and search string analysis in Pro-cite (Stage Three)	462
Studies after being filtered by quality and relevance analysis of abstracts into three lists (Stage Four)	Relevant: 209 Partially relevant: 142 Less relevant: 111

TABLE 2

TITLE ANALYSIS (STAGE TWO)

		Excluded documents	Total relevant documents
			1744
Duplicates		373	1363
Anonymous authors		12	1351
Book reviews/chapters/forms		14	1337
Exclusion criteria:	(education; neural; technology; planning; engineering; technical systems/operations; environment; psychoanalysis; public relations; library; applied economics; game theory)	396	**941**

TABLE 3

EMERGING THEMES FROM SME STUDIES' EVIDENCE BASE

Unit of analysis	Variant on unit of analysis
Entrepreneur & SME managers	1. Compared with intrapreneurs. 2. Characteristics & abilities. 3. Social context of activity. 4. World-views of. 5. Learning & competence development 6. Intuition (tacit) and routines (explicit) 7. Critical self-reflection
Firm & social capital	1. Compared with larger firms 2. Clusters 3. Internationalization 4. Innovation (key personnel, slack etc.) 5. Absorptive capacity 6. Relations with suppliers, customers & other stakeholders 7. Institutional forms
Wider institutional context	1. Economic conditions 2. Government & regulatory policies 3. Use of intermediary bodies 4. Demographics

FIGURE 1

A SUMMARY OF THE SYSTEMATIC REVIEW PROCESS AND RESULTS

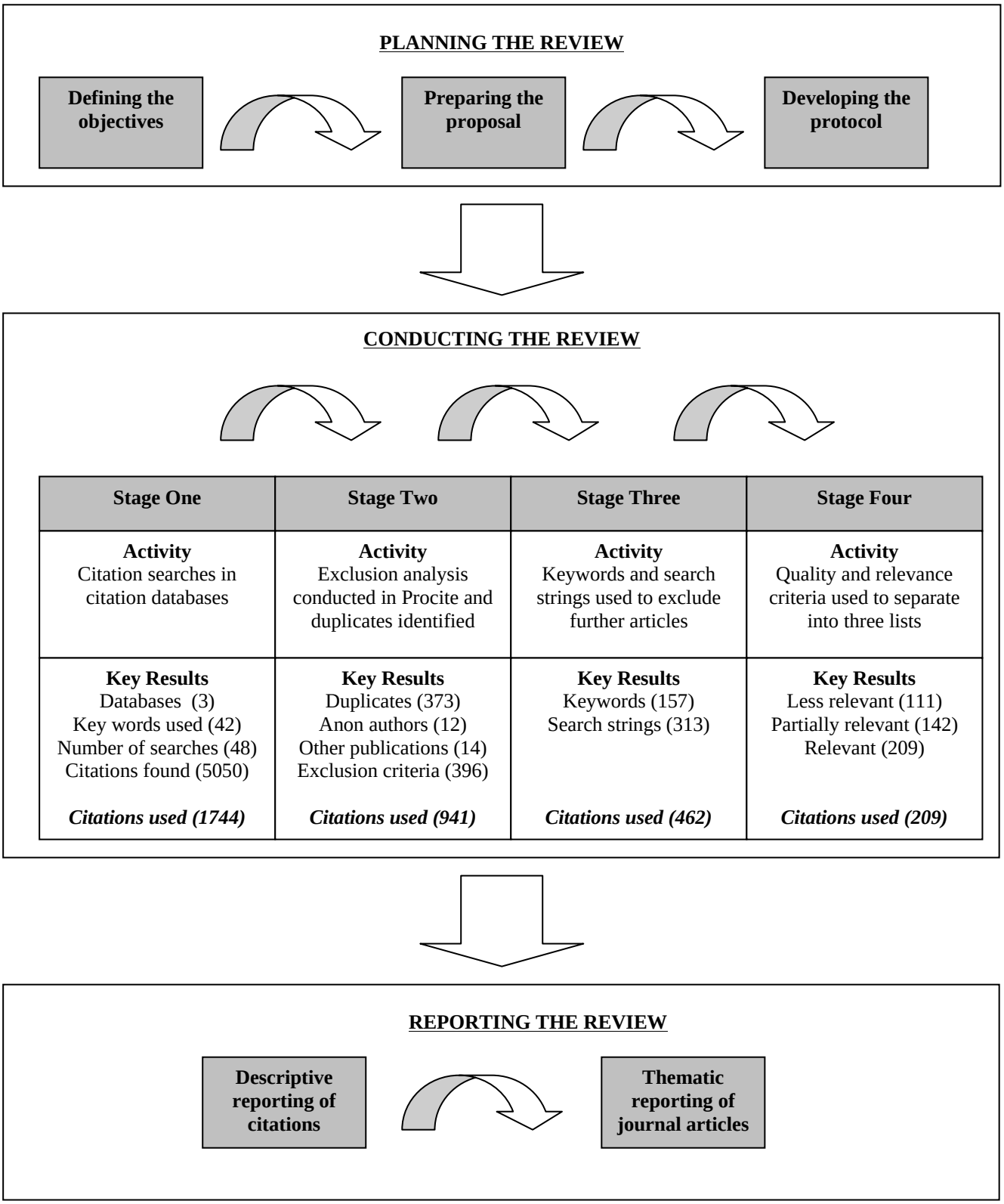

TABLE 4

EVIDENCE-BASED STUDIES FOCUSSING ON ENTREPRENEUR AND SME MANAGER

Studies	Key findings	Method & scope	Journal	Country
Carson, D. and Gilmore, A. (2000) 'SME marketing management competencies'	Using marketing activities as an exemplar, the authors demonstrate how owner-managers rely on existing knowledge, experience and intuitive judgement rather than formal systems	Field study of 60 UK SMEs (qual)	*International Business Review*	UK
Chaston, I., Badger, B. and Sadler-Smith, E. (2001) 'Organizational Learning: an Empirical Assessment of Process in Small UK Manufacturing Firms'	Found strong links between entrepreneurial firms and double-loop learning; but only partial significance in hypothesized links between entrepreneurs and development of managerial competence	Survey of UK SME manufacturing firms (quan)	*Journal of Small Business Management*	UK
Choueke, R. and Armstrong, R. (1998) 'The learning organisation in small and medium-sized enterprises A destination or a journey?'	Argues that action research allows for the active interpretation of experiences – rather than the absorption and imitation of pre-created knowledge – and ensures the continued relevance of devolving power through the greater involvement of others.	Narrative discussion of previous action research studies	*International Journal of Entrepreneurial Behaviour & Research*	UK
Cope, J (2003) 'Entrepreneurial Learning and Critical Reflection: Discontinuous Events as Triggers for 'Higher-level' Learning'	Identifies 'lower' order gradual accumulation of experience and 'higher' order awareness of personal identity . Argues the latter is only realized through critical-self reflection	Case study analysis of UK owner-managers (qual)	*Management Learning*	UK
Deakins, C and Freel, M (1998) 'Entrepreneurial learning and the growth process in SMEs'	Argue for learning theories that reflect the creative destruction, intuitive and non-adaptive experiences of decision taking within SMEs	Case studies of UK SMEs	*The Learning Organization*	UK
Filion, L.J. (1996) 'Differences in Managerial Systems of Owner-Managers - Small Business Entrepreneurs and Small Business Operators'	Distinguishes between entrepreneurs' vision of their activities (designing, animating, learning, monitoring) and those of the operators (selecting, allocating, assigning, monitoring).	Survey of 116 SMEs – 74 SMEs and 42 'operators' (quan)	*Canadian Journal of Administrative Sciences*	Canada
Floren, H. (1996) 'Collaborative approaches to management learning in small firms'	Identifies how owner-managers learn by exposing themselves to others' opinions from the periphery of their enterprize. Such a perspective was not typically afforded them because of the lack of peers and the presumed omniscience of the 'solitary' entrepreneur	Case study analysis of 4 UK SMEs	*The Journal of Workplace Learning*	UK
Honig, B (2001) 'Learning strategies and resources for entrepreneurs and intrapreneurs'	Intrapreneurs favoured consensus seeking learning strategies (teams, codified procedures, use of internal networks and pre-existing knowledge). Entrepreneurs preferred un-structured, flexible processes, were willing to explore external networks, and eschewed established patterns of doing things	Longitudinal survey of nascent entrepreneurs and nascent intrapreneurs with 283 used responses (quan)	*Entrepreneurship: Theory and Practice*	Sweeden

Keh, H, Foo, M, Lim, B (2002) 'Opportunity Evaluation under Risky Conditions: The Cognitive Processes of Entrepreneurs'	From independent variables (illusion of control, belief in law of small numbers, planning fallacy and over-confidence) the first two are found to have significant influence over the recognition of opportunities – though only the latter of these to the pursuit of a venture.	Survey of Singapore's SME 500 (quan)	*Entrepreneurship: Theory and Practice*	Singapore
Korunka, C., Frank, H., Lueger, M., and Mugler, J. (2003). The entrepreneurial personality in the context of resources, environment and the start-up process'	Linked start-up to heterogenous contexts (resource availability, market pressures and demographic influences such as role models) and the presence of different personality traits (high need for achievement, strong locus of control, medium risk taking propensity)	Sample of 1169 start-ups	*Entrepreneurship: Theory and Practice*	Austria/ Germany
Macri, D., Tagliaventi, M. and Bertolotti, F. (2001) 'Sociometric location and innovation: how the social network intervenes between the structural position of early adopters and changes in the power map'	Using network influence modelling, shows how entrepreneurial owner, fearing growing influence of IT managers, resists further implementation of his own information system initiative	Ethnographic & participant observation study of Italian staircase manufacturer	*Technovation*	Italy
Petts, J., Herd, A. and O'Heocha, M. (1998) 'Environmental Responsiveness, Individuals and Organizational Learning: SME Experience'	1)managers were over-optimistic about knowledge of environmental performance vis-à-vis employees' perceptions 2) saw potential 'knowledge' benefit in formal training but lacked resources 3) market was primary source of information & motivation	Triangulated: postal survey (3090 SMEs, 393 response); survey of 500 employees & 47 interviews in 12 SMEs; 6 focus groups	*Journal of Environmental Planning and Management*	UK
Pitt, M. (1998) 'A Tale of Two Gladiators: 'reading' Entrepreneurs as Texts'	Investigates 'personal story' of venture creation as 'myth', linked to the entrepreneur's basic assumptions about actions (desired future states or goals, causal relations etc.); perceptions of constraint and obstacles; and self-understanding – found less imaginative appreciation of 'myth' linked to lower growth	Analysis of semi-structured conversations with 2 entrepreneurs and colleagues	*Organization Studies*	UK
Rae, D. (2002) 'Entrepreneurial emergence: A narrative study of entrepreneurial learning in independently owned media businesses'	Reflects on learning as a social practice (guides for practical action) for business owners in culture-media industry. Finds participant stories to show strong links between the development of personal identity and the growth of the venture.	Longitudinal study of 4 SMEs using shared narrative/ discourse analysis (qual)	*The International Journal of Entrepreneurship and Innovation*	UK
Rae, D. and Carswell, M. (2001) 'Towards a conceptual understanding of entrepreneurial learning'	Develop model connecting realization of goals to: strong personal values of persistence; learning relations with others; known experience and abilities configured as personal theories.	Narrative analysis of in-depth interviews with 13 entrepreneurs (qual)	*Journal of Small Business and Enterprise Development*	UK
Ravasi, D. and Turati, C. (2005) 'Exploring entrepreneurial learning: a comparative study of technology development projects'	Recommends entrepreneur's create and preserve a deep familiarity with requisite technological platforms as it allows them to: remain centre-stage; forecast likely risks and returns of the venture; retain control; alleviate personal anxiety and capture newly created knowledge.	Comparative case-study of two projects in Italian lighting manufacture	*Journal of Business Venturing*	Italy

Shane, S (2000) 'Prior knowledge and the discovery of entrepreneurial opportunities'	Shows entrepreneurs recognize opportunities 'almost by accident' (rather than search) & are influenced in such by idiosyncrasies of prior knowledge – each cases used same technology in different applications, & markets, for different customers.	Embedded case study of 8 MIT new ventures exploiting the same new technology (qual)	*Organization Science*	US
Sullivan, R. (2000) 'Entrepreneurial learning and mentoring'	Argues that entrepreneurial learning is experiential, and so would benefit from 'just-in-time' support on request (primarilly through mentors) rather than the delivery of externally conceived pro-formas.	Longitudinal study of new start-ups in Paisley	*International Journal of Entrepreneurial Behaviour & Research*	UK
Thakur, S (1999) 'Size of investment, opportunity choice and human resources in new venture growth',	Isolates access to resources and the human resource capabilities associated with using entrepreneurial teams – including the effective exploitation (involvement) of the entrepreneur's own knowledge – as critical to firm growth.	Formal model testing through 50 case study interviews subject to	*Journal of Business Venturing*,	India
Wyer, P. Mason, J., Theodorakopoulos, N. (2000) 'Small business development and the "learning organisation"'	Using personal construct theory argue that the 'anticipatory' actions of the owner manager are modified and extended when expectations are confounded - identifying need for strategies that eschew fixed ends for preferred ones – the vision is an idea, not a target.	Tentative model based on survey of authors' previous research (qual)	*International Journal of Entrepreneurial Behaviour & Research*	UK

TABLE 5

EVIDENCE-BASED STUDIES FOCUSING ON FIRM AND ITS SOCIAL CAPITAL

Studies	Key findings	Method & scope	Journal	Country
Almeida, P., Dokko, G. and Rosenkopf, L. (2003) 'Startup Size and the Mechanisms of External Learning: Increasing Opportunity and Decreasing Ability?'	Find that the technological opportunities recognized by SMEs through external relations are not equally realized – or exploited – a factor linked to firm size.	Sample of 86 semi-conductor start-ups mainly within US	*Research Policy*	US
Anderson, V. and Boocock, G. (2002) 'Small firms and internationalisation: Learning to manage and managing to learn'	Identifies informal SME learning culture and so argues adoption of standard human resource development routines inappropriate	Case study of 6 SMEs and postal survey of 3000 SMEs with 252 responses	*Human Resource Management Journal*	UK/US
Archibugi, D., Cesaratto, S. and Sirilli, G. (1991) 'Sources of innovative activities and industrial organization in Italy'	Contrasted relatively low level use of R&D with high levels of innovation	Survey of 24,000 business units (quan)	*Research Policy*	Italy
Bagchi-Sen, S (2001) Product innovation and competitive advantage in an area of industrial decline: The Niagara region of Canada	Finds strong links between innovation, sales growth and a preference for: expanding R&D, pursuing incremental process change, new product development, and finding new export markets.	Survey (quan)	*Technovation*	Canada
Beecham, M. and Cordey-Hayes, M. (1998) 'Partnering and Knowledge Transfer in the Uk Motor Industry'	Knowledge use constrained by relational and managerial rather than technical ignorance. Successful knowledge integration between partners was considered a function both of product 'clockspeed' and ability of managers to unlearn	Interview based field study of 27 SME automotive suppliers (qual)	*Technovation*	UK
Bell, J., Crick, D. and Young, S. (2004) 'Small Firm Internationalization and Business Strategy: An Exploratory Study of `Knowledge-Intensive' and `Traditional' Manufacturing Firms in the UK'	Found product and process innovation a drive for international expansion, but the differences in business strategy between the advice based and manufacturing firms meant the latter were more commodity driven – exploiting rather than exploring	Interviews with 15 knowledge-intensive and 15 manufacturing SMEs (qual)	*International Small Business Journal*	UK
Bessant, J, Francis, D, Meredith, S, Kaplinsky, R and Brown, S (2001) 'Developing manufacturing agility in SMEs'	Isolates the development of dynamic capabilities (articulating and codifying knowledge) as critical to SME competitiveness. Evidence suggests it is less the resources you have (technology transfer, R&D) than how you use them.	Case study of UK manufacturing SMEs (qual)	*International Journal of Technology Management*	UK
Burpitt, W.J. and Rondinelli, D.A. (2000) 'Small Firms' Motivations for Exporting: to Earn and Learn'	Concludes that many SMEs continue to export, despite inability to guarantee financial returns, because they value the learning experience that contributes to longer-term sustainability and enhancement of work experience	Survey of exporting SMEs, 138 responses (quan)	*Journal of Small Business Management*	US
Capello, R. (1999) 'Spatial transfer of knowledge in high technology Milieux: Learning versus collective learning processes'	Found that collective learning is linked more with smaller firms focussed on product innovation. Process innovation, on the contrary, is linked to development of internal competencies, with technological proximity to supply chain.	Survey of 63 high tech SMEs in three industrial milieux in NE Milan (quan)	*Regional Studies*	Italy

Corso, M., Martini, A., Pellegrini, L. and Paolucci, E. (2003) 'Technological and Organizational Tools for Knowledge Management: in Search of Configurations'	Links use of information and communication technology (ICT) tools and higher levels of product innovation to an ability to employ ICT administratively as well as in production	Survey of 123 SMEs (quan)	*Small Business Economics*	Italy
Corti, E. and Storto, C. (2000) 'Knowledge Creation in Small Manufacturing Firms During Product Innovation: An Empirical Analysis of Cause-effect Relationships Among its Determinants'	Highlight impact of ambiguity and context uncertainty upon the quality and range of knowledge creation.	Exploratory survey - path analysis of 91 cases of tech. problem solving in 35 SMEs	*Enterprize and Innovation Management Studies*	Italy
Darby, M. and Zucker, L. (2003) 'Metamorphic Learning', *Economic Inquiry*, 41 (1): 1-19	With breakthrough technology new entrepreneurial start-ups upend incumbents, but to survive have to create and maintain strong ties with path-breaking scientists (knowledge is tacit), debunking the idea that it is cheaper to imitate than create.	Survey of previous studies in US and Japanese bio and nano tech industries (quan)	*Economic Enquiry*	US/Japan
Freel, M (2000) 'Do small innovating firms outperform non-innovators'	Found 'innovators' more likely to experience growth than non-innovators, but that the contribution of innovation to exports, productivity and profitability is less clear because of high performance variation across sample.	Survey of 228 small manufacturing firms (quan)	*Small Business Economics*	UK
Gray, C. and Gonsalves, E. (2002) 'Organizational learning and entrepreneurial strategy'	Makes positive link between contribution of information & communication technologies, networking and commitment to learning to SME growth.	Survey supplemented by longitudinal survey data from (quan)	*The International Journal of Entrepreneurship and Innovation*	UK
Hanna, V. and Walsh, K. (2002) 'Small firm networks: A successful approach to innovation?'	Review of inter-firm co-operation shows performance to be erratic, even most successful regions show some clusters to be better than others. Questions use of networking to gain the expert competence SMEs require to pursue radical innovation fully. Argues most SMEs network because of competitive pressures rather than aspirations to innovate.	Review of studies on SME networks; interviews with 2 Danish and 1 Irish networking facilitators (qual)	*R&D Management*	Denmark/Eire
Jarillo, J.C. (1989) 'Entrepreneurship and growth: the strategic use of external resources'	Identifies a strong correlation between growth in sales and profit margins and the adoption of a strategy preferring to use external resources rather than one of increasing the integration of resources through asset ownership.	Survey of 1902 US firms' publicly listed results (quan)	*Journal of Business Venturing*	US
Khan, A.M. and Manopichetwattana, V. (1989) 'Innovative And Non-innovative Small Firms: Types And Character'	Was able to distinguish between innovatory and non-innovatory groups, and found strong relationship between innovation and 'scanning', itself linked to an environmental dynamism, abundant resources and heterogeneity. Hostile markets induced withdrawal.	Survey using correctional analysis of 5 groups of SME manufacturers from Texas (quan)	*Management Science*	US
Keogh, W. (1999) 'Understanding processes and adding value within innovative small firms'	Identifies difficulties SMEs have in retaining skilled staff in face of uncertain project outcomes and commercial pressures to exploit. Identified weakness in customer management.	In-depth interviews with directors in 19 SMEs (qual)	*Knowledge and Process Management*	UK
Kim, Y., Song, K. and Lee, J. (1993) 'Determinants of technological innovation in the small firms'	Variables of distinction between innovative and non-innovative firms were: managerial capacity for risk taking; environmental heterogeneity; professional divisions of labour and scanning strategies.	Survey of 49 small firms using multiple discriminant analysis	*R&D Management*	Korea

Liao, J.W., Welsch, H. and Stoica, M. (2003) 'Organizational Absorptive Capacity and Responsiveness: an Empirical Investigation of Growth-Oriented SMEs'	Mature external knowledge acquisition & internal knowledge dissemination; 'prospector' strategies and turbulent environment were equated with responsiveness in growth-oriented SMEs.	Random survey of 1000 US SMEs with 242 useable responses (quan)	*Entrepreneurship: Theory and Practice*	US
Lofstedt, U. (2001) 'Competence Development and Learning Organizations: a Critical Analysis of Practical Guidelines and Methods'	Creativity and participation within SMEs would be enhanced by adoption of bespoke rather than generic systems of competence development.	Review of 8 studies	*Systems Research and Behavioural Science*	Sweeden
Lefebvre, E., Lefebvre, L.A. and Roy, M.J. (1995) 'Technological Penetration and Organizational Learning in Smes - the Cumulative Effect'	Technological penetration in both administrative & production contributes significantly to the ability of SMEs to broaden their markets	Telephone survey of 151 manufacturing SMEs with 86 responses (quan)	*Technovation*	Canada
Lipparini, A. and Sobrero, M. (1994) 'The Glue and the Pieces - Entrepreneurship and Innovation in Small-Firm Networks'	Focussing on relations with suppliers, found technical entrepreneurs (highly product focussed, inward) obsolete in terms of innovation and competitiveness. Highlighted importance of relational competence, notably in joint-design	Postal survey of 240 SMEs in two business sectors with 103 responses (quan)	*Journal of Business Venturing*	Italy
Lissoni, F. (2001) 'Knowledge Codification and the Geography of Innovation: the Case of Brescia Mechanical Cluster'	Focusing on SME clusters in Lombardy, identifies engineer-centred, cross-organizational epistemic communities of highly codified, restricted knowledge. These upset the orthodox view that clusters are beneficial to creation and diffusion of innovation due to rapid spread of knowledge.	Interviews with managers and survey of 200 senior mechanical-engineers (quan informed by qual background)	*Research Policy*	Italy
McAdam, R. and Reid, R. (2001) 'SME and large organisation perceptions of knowledge management: Comparisons and contrasts'	Found SMEs prone to 'mechanistic' conceptions of knowledge where larger firms were more reliant on people-based modes of embodied knowledge and transfer (discussion groups, meetings). Both sizes emphasized knowledge management as source of cost efficiencies.	Survey of 296 Smes and large firms, 95 responses (quan and qual)	*Journal of Knowledge Management*	UK
Mehra, K. and Dhawan, S.K. (2003) 'Study of the process of organisational learning in software firms in India'	Found variations in learning perspectives to be influenced by five significant organizational factors (organisational health; opportunities to learn; flexibility/risk taking; innovativeness; and interaction) and four significant group factors (challenge, variety at work, team activity and empowerment).	Survey of employees, using factor analysis, from 7 software SMEs	*Technovation*	India
Minguzzi, A. and Passaro, R. (2001) 'The Network of Relationships Between the Economic Environment and the Entrepreneurial Culture in Small Firms'	Identify social homogeneity (same cultural, educational and business experiences) leads to a distrust of innovation and discontinuous change. Found this to be prevalent amongst commodity entrepreneurs, and less so amongst those for whom the customer is a significant stakeholder	Statistical testing (component and cluster analysis) of theoretical model	*Journal of Business Venturing*	Italy
Oakey, R. and Cooper, S. (1991) 'The Relationship Between Product Technology and Innovation Performance in High Technology Small Firms'	Questions assumption that R&D investment necessarily creates fast growth high tech firms; specifically, contrasting SME experiences from different sectors to explain how the technological characteristics constrain opportunities for entrepreneurial manoeuvre	Comparative survey of 174 biotech and electronic instruments' firms in UK and US (quan)	*Technovation*	UK

Panizzolo, R. (1998) 'Managing innovation in SMEs: A multiple case analysis of the adoption and implementation of product and process design technologies'	Develops typology of influences on the motivation to use advanced production technologies: perceptions; internal constraints, environmental conditions. Found the relationships with customers, buyers and suppliers to be most significant	Multiple case-study analysis of machine-tool SMEs (qual)	*Small Business Economics*	Italy
Pentland, B.T. (1995) 'Information systems and organizational learning: The social epistemology of organizational knowledge systems'	Shows how adoption of new information system by engineering consultants not only assisted with better retrieval, storing and transfer of information, but actually changed the nature of what was seen as knowledge and the criteria for its construction.	Case study of SME	*Accounting, Management and Information Technologies*	US
Perez, M. and Sanchez, A. (2002) 'Lean production and technology networks in the Spanish automotive supplier industry'	Links productivity and quality (arising from better in-house training and team working) to the creation and use of dense supplier networks. Argue that job flexibility and multi-tasking are integral to effective networking because of the pressures under lean supply to continually improve.	Hypothesis testing using 28 structured interviews of automotive suppliers in Basque region (quan)	*Management International Review*	Spain
Powell, W.W., Koput, K.W. and Smith-Doerr, L. (1996) Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly* 41 (1):116	Demonstrates need for robust, flexible and durable routines that enable biotech and pharmaceutical firms to build relations whereby knowledge is exchanged swiftly, and appropriately. Argues that the network (rather than the individual, or firm) is the locus for innovation	Hypothesis testing on sample of bio-tech firms (1990-1994) (quan)	*Administrative Science Quarterly*	US
Rothwell, R. (1991) 'External networking and innovation in small and medium-sized manufacturing firms in Europe'	Discusses how SMEs can gain access to external sources of technological expertise, recognising that the knowledge needs differ between sectors. Shows how SMEs use dense networks with educational institutions and peers to overcome these shortfalls, especially in R&D collaboration.	Survey of 400 firms, 103 responses, and sub-sample of 20 (quan)	*Technovation*	UK
Sadler-Smith, E., Spicer, D. and Chaston, I. (2001) 'Learning Orientations and Growth in Smaller Firms'	Investigates active learning (challenging routines – equating to generative, integrative or double-loop learning) traits present in faster growing small firms. Found correlation between risk-taking, free flow of information and challenging of routines and faster growth in manufacturing firms, but no such correlation in business-support firms	Sample of 1000 UK SMEs with 300 response rate (quan)	*Long Range Planning*	UK
Sapienza, H.J., Parhankangas, A. and Autio, E. (2004) ' Knowledge relatedness and post-spin-off growth'	Confirms that growth is fostered when the knowledge base of spin-off and parent partially overlap – this fosters good communication, knowledge absorption and common expectations without nullifying pursuit of novelty	Hypothesis testing using sample of 54 industrial spin-offs (quan)	*Journal of Business Venturing*	Finland
Simmie, J. (2002) 'Knowledge Spillovers and Reasons for the Concentration of Innovative Smes'	The author suggests cities rich in supplier (embedded support) and customer (innovation stimulus) connexions foster the creation and growth of innovative SMEs	Sample of 310 innovation award winning SMEs in SE England – 128 responses (quan)	*Urban Studies*	UK

Soderquist, K., Chanoron, J., and Motwani, J (1997) 'Managing innovation in French small and medium sized enterprizes'	Identifies use of cross-functional teams, investment in R&D, the propinquity of customers, and developing closer working relationships with preferred customers, as influential sources of innovation	Survey of French SMEs in Rhone valley – 84 responses (60% small; 40% medium sized) (quan)	*Benchmarking for Quality Management and Technology*	France
Tsui-Auch, L. (2003) 'Learning Strategies of Small and Medium-Sized Chinese Family Firms: A Comparative Study of Two Suppliers in Singapore'	Found irrespective of financial position, size and industry both firms' have adopted technology and management control routines because of their position in international supply chains; but only the larger firm has adopted a professional management system.	Comparative case-study analysis of two family firms	*Management Learning*	Singapore
Wiklund, J. and Shepherd, D. (2003) 'Knowledge-Based Resources, Entrepreneurial Orientation, and the Performance of Small and Medium-Sized Businesses'	Found entrepreneurial orientation (risk-taking, pro-activity etc.) moderates relations between bundle of knowledge resources and performance – the more intense the entrepreneurial orientation – the better the firm's results.	Stratified sample of 384 firms (quan)	*Strategic Management Journal*	Sweeden
Wong, W. and Radcliffe, D. (2000) 'The tacit nature of design knowledge'	Argue SMEs can improve design by: minimising unspoken elements; sharing design elements through greater articulation; using automation and codification to systematize processes diagnostics, or cataloguing. The helps ameliorate loss of knowledge through the departure of key employees in which knowledge is embodied.	Case study (3 years) using narrative analysis of documents, participant observations & interviews (qual)	*Technology Analysis & Strategic Management*	Australia
Yli-Renko, H., Erkko, A. and Sapienza, H. (2001) 'Social Capital, Knowledge Acquisition, and Knowledge Exploitation in Young Technology-Based Firms'	Investigates relationship between external relational ties (social capital) and knowledge acquisition and exploitation (manifest in new product development; sales cost efficiency and technological distinctiveness) between young high-tech firm and its significant customer.	Sample of 180 entrepreneur high-tech ventures (quan)	*Strategic Management Journal*	UK

TABLE 6

EVIDENCE-BASED STUDIES FOCUSSING ON WIDER ENVIRONMENT

Studies	**Key findings**	**Method & scope**	**Journal**	**Country**
Cooke, P. and Wills, D. (1999) 'Small firms, social capital and the enhancement of business performance through innovation programmes'	Analysis of social capital, innovation & competitiveness. Found Irish and to a lesser degree Danish SMEs to have benefited from social capital in the form of external linkages with foreign 'partners', and for Welsh SMEs to have favoured the more insular form of domestic integration.	Survey of SMEs from European Union's framework programmes': 56 in Eire; 54 in Denmark; 43 in Wales (quan)	*Small Business Economics*	Denmark/ Eire/ Wales

Garud, R. and Karnoe, P. (2003) 'Bricolage Versus Breakthrough: Distributed and Embedded Agency in Technology Entrepreneurship'	Analyzes entrepreneurial learning from two perspectives – the US influenced 'breakthrough method' characterized by isolation, and Danish 'bricolage' emphasising collaboration between entrepreneurs and institutional support	Case study analysis of wind turbine innovation in Denmark and US (qual)	*Research Policy*	Denmark/US
Julien, P.A., Stpierre, J. and Beaudoin, R. (1996) 'Innovation in Small Business, New Technologies and Their Financing - an Overview of Recent Research'	Argues that where SMEs really suffer with respect to resources is in the area of short-term financing to enable them to absorb high-risks associated with innovation. Suggests gov't and financial institutions focus on enhancing this specific provision.	Review article of SME studies in Canada	*Canadian Journal of Administrative Sciences*	Canada
Lagace, D. and Bourgault, M. (2003) 'Linking manufacturing improvement programs to the competitive priorities of Canadian SMEs'	Assessed impact of gov't policy to promote use of technology innovation in SME. Found indiscriminate recommendations (assuminl SMEs shared common competitive positions & aspirations) damaged gov't reputation and hindered firm development.	Survey of 229 SMEs (quan)	*Technovation*	Canada
Morrison, A and Bergin-Seers, S (2002) 'Pro-growth small businesses: Learning "architecture"'	Despite open-management styles and a willingness to network amongst peers, found managers distrusted publicly sponsored innovation initiatives. Argue for a gov't policy more sensitive to practical and experiential concerns of owner-managers.	Survey of 3740, yielding sample of 409 (quan)	*The Journal of Management Development*	Australia
Sikka, P. (1999) 'Technological innovations by SMEs in India'	Identitifes need to promote links between SMEs and universities and R&D laboratories in order to exploit under-used entrepreneurial capacity and a latent potential in India for ancillarization sub-contracting	Survey of SME and national research institutes	*Technovation*	India
Swan, J. and Newell, S. (1995) 'The role of professional associations in technology diffusion'	Found professional associations were capable in disseminating knowledge of new technologies – including the provision of associated professional development skills. Found small size of association to be a limiting factor.	Survey of members (quan and qual)	*Organization Studies*	Canada
Van Horn, R. and Harvey, M. (1998) 'The Rural Entrepreneurial Venture: Creating The Virtual Megafirm'	Suggest rural entrepreneurs can experience benefits of acting within 'megafirm' structures by creating a virtual firm informed by principles of networking (establishing mutual benefits from knowledge sharing) and dynamic learning (encouraging challenge).	Narrative review and theory testing	*Journal of Business Venturing*	US

APPENDICES

APPENDIX 1

learn*AND know*	innovat* AND learn* OR know*	learn*AND activity theory OR activity system*
know* AND activity theory OR activity system*	entrepreneur* AND learn* OR know*	learn* AND language OR grammar OR author* OR disc* OR rhetoric*
know* AND language OR grammar OR author* OR disc* OR convers*	know* OR learn* AND communit* OR practi* OR situate*	know* OR learn* AND construc*
leader* AND learn* OR know*	learn* AND know* AND organize* OR organise*	activity theory OR activity system*
recipe* AND organi* OR manag* OR industr*	manag* AND learn* OR know*	learn* OR know* AND Mode II OR practice*
SMEs OR SME OR small firms AND learn* OR know* OR innovate*	activity theory OR activity system AND method*	learn* OR know* AND autopoesis
Other key words identified for search strings based on keyword citations in articles in Proquest: practic, rule*, cognit*,pragmat* (w) development; social (w) capital; habitus; landscap*; praxis; poetic*; pattern (w) matching; creativ*; problem (w) solving; grow*;*		

APPENDIX 2

Inclusion Criteria

No.	Criteria	Reason for inclusion
1	Theoretical papers – internal/ external validity	Provide the working assumptions to be used in the report
2	All sectors	Examine how knowledge is used within and across industry sectors
3	All ages	Cross-reference organizations of differing stages of development/demise
4	All SMEs	Examine how knowledge is used within and across SMEs
5	Quantitative and qualitative empirical studies	Capture all empirical evidence
6	Business organizations	Focus on uses of knowledge in and between business organisations

APPENDIX 3

Exclusion Criteria

No.	Criteria	Reason for exclusion
1	Pre-1980 articles	The majority of databases do not contain earlier papers. Moreover, with a few significant exceptions contributions to learning and knowledge in organizations were published after 1980.
2	Neural learning	This does not refer directly to managerial, or organizational knowledge
3	Education (students, teachers, pupils, schools, child, adults)	This does not refer directly to managerial, or organizational knowledge
4	Medical (including sensory)	This does not refer directly to managerial, or organizational knowledge
5	Artificial Intelligence (AI) (motor; computer)	Exclude articles on constructing and discussing AI
6	Natural science	Exclude articles on 'learning' amongst non-sentient entities
7	Foreign Language	Exclude articles not written in English on grounds of its being in a non-native tongue

APPENDIX 4
Relevance Assessment Criteria

Element	**Level**				
	0- Absence	**1- Low**	**2 – Medium**	**3 – High**	**Not applicable**
1. Theory robustness	The article does not provide enough information to assess this criterion	Weak development of theoretical insights and limited awareness of prevailing literature.	Basic development of theory & use of concepts garnered from existing literature	Good use of theory, including the novel & provocative development of concepts.	This element is not relevant to the study
2. Implication for practice	The article does not provide enough information to assess this criterion	Hard to use the concepts and ideas in pragmatic problem solving	The studies findings and observations have potential utility for businesses and policy makers	The utility for practitioners is clear	This element is not relevant to the study
3. Methodology. Data supporting arguments.	The article does not provide enough information to assess this criterion	Data incomplete and not related to theory coupled to weak research design.	Data broadly related to the arguments, and conveyed through a clear research design	Data strongly supports arguments. Robust research design	This element is not relevant to the study
4. Relevance of three areas: - findings; - theories; - methods	The article does not provide enough information to assess this criterion	Only tangentially relevant; provocative but linked to 'line of flight'	Broadly relevant – perhaps in one of the areas, or applied in different disciplinary field	High level of relevance across findings, methods and theoretical constructs/concepts	This element is not relevant to the study
5. Contribution	The article does not provide enough information	Does not make an important contribution. It is not clear the advances it makes	Although using other's ideas, builds upon the existing theory	Further develops existing knowledge, expanding issues	This element is not relevant to the study

[1] This review forms part of a wider set of reviews informed by two of the ESRC's strategic aims under the EBK programme, namely: 'To understand the ways in which knowledge is created within and meditated by existing infrastructures, practices and locations' and 'To understand the ways in which knowledge is consolidated, stored and managed over time'.
[2] Planning the review included: identification for the need for a review; preparation of a proposal for a review; development of the review protocol. Conducting the review included: identification of the research; selection of studies; study quality assessment; data extraction and monitoring progress; data synthesis. Reporting and dissemination included: the report and recommendations; getting evidence into practice.
[3] It was felt that looking beyond these sources would be more of a narrative rather than systematic process because of a lack of any access to searchable bibliographical databases covering reports, book chapters and the like.
[4] ABI Proquest; Business Source Premier; Science Direct; Web of Science; PsycINFO Cambridge Scientific Abstracts; Emerald; Ingenta (inc. Science Direct).
[5] To some extent this coverage was a function of institutional subscription levels as well as the generic characteristics of each database.
[6] This criterion was used in a flexible way; for example, where the search retrieves 156 the whole list was read.
[7] For example, where the abstract is too thin or unclear to make a judgement
[8] For example, reviewing in full the 462 articles sourced by the database searches would have been impractical in the time available for the study.
[9] Without this strict interpretation of the review criteria there would have been too many papers to review for the study to remain practical.
[10] ABI Proquest 1715 and 597 relevant; Web of Science 1898 and 1141 relevant; Ingenta 1437 and 603 relevant.
[11] It is of particular import to include keywords and abstracts in the download at this stage.
[12] Defined as the pro-active identification of trends, niches, contradictions and omissions that provide opportunities for creative and flexible activity.
[13] Defined as entrepreneurs within organisations
[14] People whose experience and success in creating a venture, and their entrepreneurial values, enable them to act as a sounding board for the new entrant, allowing would-be entrepreneurs the space to critically reflect on their experiences – to 'stand back' and take stock of their knowledge gaps and emerging competencies
[15] For example, buying new incompatible software, enlisting support from other managers.
[16] Such as business planning, marketing or limiting liability.
[17] Such as employees, advisors, regulators, suppliers or customers, and for whose knowledge the managers have to make provision in terms of participation, consultation and reward.
[18] Knowledge of desirable and feasible future states of affairs.
[19] Which veer toward cognitive biases, heuristic tools and opportunity evaluation.
[20]Such as: balancing vision and planning; being close to the market; managing through people and balancing control and letting go.
[21] Such as research and development and technology transfer.
[22] Ability to acquire, assimilate, transfer and exploit new ideas manifest in communal interactions.
[23] Customer demands, market changes, new technology, competitor pressures.
[24] Repeated, intensive relations.
[25] Extension of customer base facilitated through introductions.
[26] Trust, reciprocity and goodwill
[27] Different experiences coupled to mutual trust
[28] The technological knowledge cannot be used without their active contribution
[29] At least around Melbourne, Australia
[30] Risk taking, rapid and open information channels and encouragement of open-critique.
[31] Business support