

Inter-Organizational Learning and Strategic Renewal in SMEs

Extending the 4I Framework

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This article explores how mature SMEs which lack internal resources access external knowledge to facilitate strategic renewal. Organizational learning, in contrast to entrepreneurial learning, recognizes that owner-managers must distribute knowledge throughout the firm to achieve competitive benefits. Three case studies demonstrate how external 'knowledge providers' (customers, suppliers and educational institutions) help institutionalize 'new' knowledge. Initially, learning from inter-organizational relationships requires owner-managers to be proactive in accessing and extending appropriate inter-organizational relationships. Second, external organizations can play an active role by 'intertwining' knowledge to support the development of processes, systems and routines that distribute and institutionalize learning throughout the organization. The three cases have practical implications for owner-managers and add to academic knowledge via the extension of Crossan et al's 4I model of organizational learning.

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Introduction: challenges for SMEs

Senior managers' perceptions of environmental conditions have a significant influence on the exploitation of opportunities. Researchers must identify the influences on those key individuals responsible for decision-making if they are to understand the way in which organizations acquire and utilise new knowledge.¹ This is particularly important in SMEs where owner-manager (OM) influence is pervasive and will directly affect the ability of their organization to learn.² Limited managerial resources in smaller firms means that they are often dependent on knowledge from external sources, including feedback from customers and suppliers.³ However, organizational learning based on the systematic incorporation of new knowledge depends on the owner-manager's ability and willingness to encourage knowledge-sharing. Many SMEs operating in mature sectors lack the skills and knowledge to adopt modern management techniques and new technologies. If their firms are to survive in the long-term, owner-managers must develop mechanisms for identifying, acquiring and exploiting new knowledge.⁴

In this article we consider the following question: *how do mature SMEs acquire and institutionalize external knowledge?* We find that OMs attempting to promote strategic renewal must first acknowledge that their organization is actually facing a crisis. Crises may include declining sales or demands by customers and suppliers for new ways of working. Because most SMEs lack internal skills and resources, opening-up to external organizations is a crucial element in accessing knowledge. We also suggest that this may involve the OM ceding some control to enable customers, suppliers or other knowledge providers to help institutionalize learning mechanisms within the firm. Furthermore, delegating real responsibility to other managers and employees helps the shift from individual (owner-manager) learning to genuine organizational learning.

The article begins with a discussion of literature associated with the distinction between individual and organizational learning. We then utilise the work of Crossan *et al* as a basis for framing the institutionalization of learning in SMEs.⁵ Following a discussion of our methodology, we present data on three cases which illustrate key concepts and activities that illuminate the process of learning and change in mature SMEs. We then discuss our findings and make proposals related to strategic renewal in SMEs, and consider the implications for academic researchers and owner-managers.

Individual to organizational learning

While the topic of learning in SMEs has attracted considerable attention in recent years, much of this work focuses on learning associated with the entrepreneur or owner-manager.⁶ We actually know very little about the internal processes associated with organizational learning and strategic renewal in smaller firms.⁷ Crossan *et al.* posit that, while learning may start with individuals, for organizational learning to occur new knowledge must be interpreted, distributed and institutionalized in organizational routines. While human capital is important, strategic renewal requires that knowledge be embedded in routines, systems and structures so that it can be distributed throughout the organization.⁸ Consequently, to understand the processes of organizational renewal, managers must consider how to transfer individual knowledge to the collective level.⁹ Learning at an organizational level depends both on developing personal knowledge and skills (human capital), and on having effective systems for knowledge sharing (social capital).

Existing systems that support the application and exploitation of knowledge focus on the '*refinement, routinization, production and elaboration of existing experience*'.¹⁰ Strategic renewal, on the other hand, means that firms must break out of these path dependencies and shift from knowledge exploitation to knowledge exploration.¹¹ This requires routines and processes that support the recognition and assimilation of new knowledge.¹² Such systems can also provide the opportunity to encourage organizational adaptability and change. A quantitative study of SMEs by Sadler-Smith *et al*, for example, suggests that when existing routines encourage inter- and intra-firm information flow and experimentation they correlate with higher growth.¹³ A study of growth-orientated SMEs indicates that systems of knowledge acquisition and dissemination are more important for strategic renewal than the firm's strategic orientation or environmental turbulence.¹⁴ Mechanisms associated with the distribution and institutionalization of knowledge distinguish organizational learning from individual and group learning.¹⁵ While strategic renewal may begin with individual learning it is the organizational ability to assimilate and distribute knowledge at the collective level that is of primary importance.¹⁶

... systems of knowledge acquisition and dissemination are more important for strategic renewal than strategic orientation or environmental turbulence

The problem for many SMEs, well-established in the literature, is that they are generally dominated by an owner-manager who relies on direct authority and high levels of informality.¹⁷ While informality is often considered a key source of competitive advantage in smaller firms, the lack of formal systems and procedures make it difficult to distribute and institutionalise new knowledge. Such firms also find it difficult to attract high-quality employees because of lower pay rates and fewer benefits such as holidays, sick pay and trade union membership.¹⁸ SMEs are also less likely to engage in training which further hinders the distribution and development of human and social capital throughout the firm.¹⁹ Consequently, SMEs lack the organizational routines, diagnostic systems, rules and procedures that support the acquisition, distribution and institutionalization of new knowledge. In the following section we utilise the work of Crossan *et al* to explore the way in which organizational learning is conceptualized.

Institutionalizing learning

One of the most widely quoted attempts to give greater theoretical coherence to the field of organizational learning (OL) is Crossan *et al*'s 4I framework. OL is viewed as a process incorporating thought and action shaped by the institutional mechanisms that are the basis of every established organisation. Crossan *et al* define the four social and psychological micro-processes which link learning at individual, group and organisational levels in the following manner:

Intuiting is the pre-conscious recognition of the pattern and/or possibilities inherent in a personal stream of experience. The process can affect the intuitive individual's behaviour, but it only affects others as they attempt to (inter)act with that individual.

Interpreting is the explaining of an insight or idea, to oneself or others. This process goes from pre-verbal to verbal, and requires the development of language.

Integrating is the process of developing shared understanding and coordinated action through mutual adjustment. Dialogue and joint action are crucial to the development of shared understanding. This process will initially be *ad hoc* and informal, but if the action is recurring and significant it will be institutionalized.

Institutionalising is the process of ensuring that actions become routinized. Tasks are defined, action specified and organizational mechanisms established to ensure that certain actions occur. Institutionalising is the process of embedding individual and group learning into the organisation's systems, structures, procedures and strategy.

The process of OL is illustrated in Figure 1, which also distinguishes between stocks (knowledge retained at individual, group and organizational levels) and flows (knowledge shared between the various levels) of learning. *Intuiting* and *interpreting* occur at the individual level; *interpreting* and *integrating* occur at the group level; *integrating* and *institutionalising* take place at the organizational level. At the individual level, as F W Taylor has pointed out, employees constantly seek ways of decreasing their effort by improving the efficiency with which they perform their work-tasks.²⁰ *Feed-forward learning* takes place when such individual gains are shared with other employees and with managers (*interpreting* and *integrating*) so improvements can become *institutionalized* into the firm's operating procedures, allowing efficiency gains made by individual employees to become an organizational asset via cost reductions or quality improvements. A key managerial role is the creation of a climate in which employees share their tacit knowledge.²¹ *Feedback flows* occur as a result of tacit knowledge being codified so that it can be disseminated throughout the organization. In the 4I model, the institutionalisation of learning promotes further insights as employees exploit new knowledge through feedback flows from the organizational level *via* groups back to the individual level.

Zietsma *et al* add two new concepts to the original framework.²² '*Attending*' captures a more active process of information seeking than the original, passive term *intuiting*, while '*experimenting*' is described as a parallel activity carried out by individuals and groups that adds substance to the

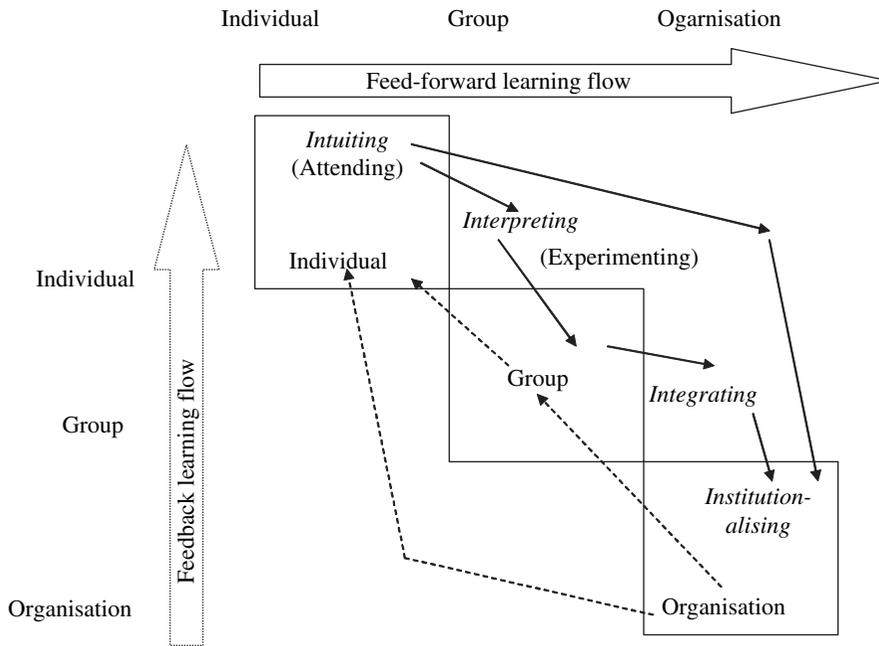


Figure 1. The 4I Learning Framework

process of interpreting (Figure 1). Although the processes of interpreting and attending appear to extend the internal process of intuiting to include some level of external awareness, both sets of authors see organisational learning as taking place largely isolated from external influences. In SMEs this is problematic, since it is well established that scarce human and financial resources, time pressures, path dependencies and short-term goals hinder organizational development. Consequently, most SMEs are heavily reliant on external sources, including customers and suppliers, for the generation of new knowledge. It is important to develop a better understanding of the process by which new knowledge is acquired from such sources and how it becomes institutionalized in SMEs.

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Research methods and data collection

Our primary objective is to demonstrate how SMEs institutionalise knowledge acquired from external sources. We adopt a similar approach to Crossan *et al* to demonstrate the process of strategic renewal through the institutionalization of knowledge from external sources, drawing on three cases undertaken as part of other research projects. We suggest that this approach is appropriate because it is important to understand better the processes of learning and organizational renewal in smaller firms. SMEs, particularly those with less than fifty employees, are generally dominated by the entrepreneur (owner-manager) and the characteristics of such ventures generally closely reflect the founder's motivations. First, there are strong links between organizational growth and entrepreneurial style and consequently small, owner-managed firms vary as they reflect differences between individual entrepreneurs.²³ Second, such firms are also typified by their lack of structure, systems and rules with an emphasis on high levels of informality. Third, as the majority of external contacts are established through the owner-manager, new knowledge tends to be channelled through him or

her. Given the pervasive influence of owner-managers, we consider it essential to understand how they themselves conceptualize the influences and responses to change. Thus regular in-depth interviews with each owner-manager were the main sources of data for this article. Other data were acquired from observation during frequent visits to the companies, formal and informal interviews with other managers as well as documents (such as BRW's in-house audit of managerial systems). Research on all three companies took place over at least two years.

The companies were selected from a database of contacts established *via* a range of earlier projects. Our primary selection criteria were that the companies should be independent (owner-managed) SMEs, well-established, and operating in mature manufacturing sectors, and BRW, RSL and DMF fit these criteria (see Table 1). These three firms had different managerial styles and faced very different competitive environments, which were reflected in their approaches to knowledge acquisition. In BRW's case, its main customer played an active role in helping the owner-manager adopt the standards expected in the aerospace industry through development of formal quality and continuous improvement procedures; a process we describe as '*normative learning*'. In the case of RSL, discussions with an academic advisor and a KTP (Knowledge Transfer Partnership) associate meant the OM was actively involved in choosing from a range of options that worked in other organizations; this fits with the idea of *mimetic learning*. At DMF, learning was much more *coercive*, as their main customer threatened to take their business elsewhere unless the OM instigated changes to managerial systems and workplace organization.

In summary, the owner-manager's authority and vision combined with flexible structures mean that many small firms obtain competitive advantage from their ability to respond quickly to customer requests and market changes. The disadvantage of this informality is that SMEs lack the structures by which knowledge can be shared and retained at an organizational level. Our argument is that external links are central to the promotion of organizational learning within SMEs. Interactions with suppliers, customers and knowledge providers offer OMs access to knowledge which can improve organizational performance. As discussed below, the acquisition, distribution and institutionalization of that knowledge depends on the relationship between the SME and provider.

Table 1. Company Details

Background	Company		
	BRW	RSL	DMF
OWNERSHIP	Private (Owner-Managed)	Private (Owner-Managed)	Private (Owner-Managed)
ANNUAL TURNOVER	£2 Million	£2.5–£3.0 Million	Approx £6.0 Million
COMPANY AGE	31 yrs	45 yrs	50 yrs
MANAGEMENT STRUCTURE	OM + 2 Managers and 2 Shift Supervisors	OM + 2 Directors & 2 Managers	OM, 2 Directors, 4 Senior Managers + Shop-floor Supervisors
NUMBER OF EMPLOYEES	35	70	200
PRODUCTS	Precision Machined Components	Cardboard Files + Metal Racking	Machined Components to Telephony
BUSINESS SECTOR	Aerospace, Water Treatment	Office Filing Equipment	Engineering to Electronics
NUMBER OF CUSTOMERS	1 Major Customer (Now reduced to 60% of Sales)	10 Main Customer + Direct Sales	2 Main Customers
TYPE OF LEARNING	<i>NORMATIVE</i>	<i>MIMETIC</i>	<i>COERCIVE</i>

The process of change in SMEs

As discussed above, the empirical data are based on three SMEs from different manufacturing sectors. We describe key elements of the change process in each firm to demonstrate how SMEs can respond positively to serious environmental threats. Critically, this positive response depends primarily on the willingness of owner-managers to initiate radical organizational change.

Case 1: BRW (normative learning)

Towards the end of the 1990s Roger Watson, OM of the aerospace component manufacturer BRW, became aware of a shift in relationships with his customers. Lucas Aerospace, his main customer at that time, set up a strategic sourcing initiative that removed decisions from local buyers. In order to win business, suppliers had to meet stringent performance criteria and evidence-based performance improvements were stipulated in all new contracts. Although Watson knew he was making savings and improving quality he could not provide evidence to his customer.

They were looking for good business strategy you know. What are you doing to cut costs? How much scrap do you produce? I knew we'd made cost savings but I couldn't produce evidence... I knew I wasn't performing well in these audits.

It was clear to Watson that if he was going to retain his major customer he needed to provide competitive year-on-year improvements. It was also evident that his company's internal management systems were inadequate and lacked the professionalism that had become the industry norm. However, he did not have the expertise or knowledge to implement the appropriate changes:

It was very frightening because I didn't really know what to do. I knew I wasn't giving my customer what they wanted. I knew these strategic sourcing people weren't going to pick BRW and I also knew we were in danger of losing the work.

He was fortunate that Lucas Aerospace, concerned by the number of failed supply audits, set-up a supplier development programme delivered by a Further Education (FE) College. Initially sceptical, he started to 'open up' and consider whether the information provided by both his customer and the college might be useful to his company.

Well there's this college and they're telling me that all big companies use these tools and techniques and I thought, they can't all be wrong, you know. It was a realization that these must work for them to be so popular and I started to cherry-pick and listen to what could work in BRW.

As a result of attending the course, Watson was able to codify tacit knowledge within the firm by establishing internal procedures based on ISO systems for quality management and continuous improvement. Internal systems were improved as a result of a process which involved the interpretation and integration of new knowledge.

Management training made me realize that I had to delegate. It gave me the ideas to do all of the improvements and the processes that I did make. It showed me how to do it to a certain extent. It showed me how to communicate that to the workforce. I started doing graphs, putting them on the wall and showing the workforce exactly what was going on... You started tackling the problem. Plus I think the fact that we started to record things meant that every issue was being tackled, and your employees were involved more in discussions... it was discussions that solved the problem together.

Encouraging shop-floor employees to access the appropriate information enabled them to eliminate the causes of faults (double-loop learning) rather than simply rectifying problems (single-loop

learning). To support the changes, Watson created a quality function and appointed a quality manager to help institutionalize the new systems.

But the move to continuous improvement techniques was a radical departure from previous informal work practices. The OM and his team lacked experience in formal production reviews and employees were reluctant to forgo their informal work practices. Given the changing customer-supplier relationship, Watson was convinced that if the company were to survive, continuous improvement techniques had to be embedded throughout the firm as a holistic production system. In order to communicate the need for change the OM again enlisted the help of Lucas Aerospace. He took his workforce on an away-day delivered by Lucas to set the change programme in a wider business context.

Successful institutionalization of knowledge enabled [the firm] to demonstrate professional management techniques, [and] both retain existing customers and win new business.

Watson also engaged a consultant to train his workforce in continuous improvement techniques, as well as recruiting a production manager with large-firm and continuous-improvement experience to provide a formal focus for production improvement. Production systems were formalized with set-up procedures and manufacturing methods for every job stored on computer. Information from these formal systems was used to optimize workflow and enable seamless handovers between shifts, as well as being available as a management aid to control quality, cost and production problems. Successful institutionalization of quality and continuous improvement knowledge enabled BRW to demonstrate professional manufacturing management techniques, allowing them to both retain existing customers and win new business.

Potential customers can look at our procedures and know instantly how BRW is run and customers demand that now; they don't want companies that are doing everything on the hoof and 'on the back of a fag packet'. I can demonstrate to them that I do monitor my deliveries, I do monitor my quality performance and I know where all my costs go... I can show them what I've done and what I am doing because my continuous improvement plan provides evidence for them.

In summary, the failed audits put pressure on the OM, beginning the process of intuiting and attending to his firm's informal work practices and structures. By experimenting with the techniques taught at the FE College he was able to interpret and integrate them within his own firm. Supplementing his own experience by obtaining knowledge and enlisting support from a variety of sources (from Lucas Aerospace, an F.E. College, and a consultant and his new production manager) enabled Watson to engage his employees in the integration process. This support encouraged the employees to participate in change and helped to institutionalize new management systems. Continuous improvement has become a norm in the firm as well as conforming to norms expected in the manufacturing community. The institutionalization of new formal processes has contributed to the firm's development and growth, and demonstrates to potential customers the level of professionalism expected from a precision engineering company (Table 2).

Case 2: RSL (mimetic learning)

In the late 1990s the office equipment manufacturer RSL was acquired by a family trust fund and three brothers were appointed directors. The brothers were all in their early to mid-thirties and all had managerial experience in large organizations. Two non-family members completed the management team: the finance manager was recruited from a similar position in a large manufacturing company and the works manager was a long-serving employee. It quickly became apparent to the

Table 2. Learning in BRW

Organizational Routine	Organizational Activity	Learning Outcome	Knowledge Source
PERFORMANCE MEASUREMENT METRICS	OM introduced performance measurement activities and graphs and modified for use in BRW.	Record of activity for focus of problem solving and provided initial evidence stimulating need for change and improvement.	FE College through supply chain development programme.
STAFF INVOLVEMENT	OM encouraged staff to consider how problems could be solved.	Provided access to ideas and experience (human capital) of workforce	Harnessing internal (tacit) knowledge
CUSTOMER INVOLVEMENT	Took staff to presentation of business case by the customer.	Helped to set change processes in wider business context encouraging support for change.	Lucas Aerospace (key customer) strategic sourcing management team.
SET-UP REDUCTION ACTIVITY	Consultant brought in to train staff in work efficiency procedures.	Staff started taking the lead in suggesting cost saving activities. Institutionalization of continuous improvement.	Consultant
INTRODUCTION OF MANAGEMENT STRUCTURE	Set up of ISO quality management and continuous improvement processes. Import of experienced management skills and decentralization of responsibilities.	Formal focus for quality & continuous improvement systems. Conformance with industry norms and evidence of improvement.	Recruitment of production manager and quality manager
COMPUTERIZATION OF JOB SCHEDULING	Details of set-up procedures and job requirements stored on computer to provide a record of, and template for, activity.	More efficient job set-up & optimization of workflow. Transfer of knowledge between shifts.	Expertise of skilled machine operators (tacit knowledge)

senior director, William White, that the existing portfolio lacked customer appeal and survival depended on improving current products and developing more attractive new products. The OM contacted a local Business School to investigate the possibility of setting-up a Knowledge Transfer Partnership (KTP) to improve innovation in the company. KTPs are jointly financed by government and participating firms whose joint contributions are paid as a grant to a university. These funds support the employment of one or more young graduates (known as KTP associates) who promote the transfer of technology from university to SME. The advantage of KTPs are that associate(s) and their supervisors help identify *‘information which can add value to a business’* and integrate *‘new knowledge into a company’s existing store of accumulated knowledge’*.²⁴

Initially, the Associate concentrated on redesigning two existing products. Changes to the *Rotanote* (a small business-card filing system) halved manufacturing costs and improved customer appeal. The *Platfile* (a large filing rack) was changed to a ‘modular’ design which reduced transportation and storage costs. At the end of year one, the redesigned products contributed £310,000 to sales and by the end of the second year this had increased to more than £600,000 (turnover at the outset was £2.5 million).

Following his success in redesigning the *Rotanote* and *Platfile*, the Associate concentrated on introducing mechanisms to help all employees contribute to the innovation of new products and processes with the objective of institutionalizing mechanisms that would ensure RSL continued to innovate when the programme ended (see Table 3).

Wider-ranging changes included the emergence of an innovatory culture [and] commitment to develop new products [and improved] customers' perception of the company as innovative and forward-thinking.

The KTP was managed via regular local management committee (LMC) meetings, at which academic and industrial supervisors and the KTP consultant evaluated 'progress against objectives' and set 'deliverables for the next three months'. These seven quarterly LMCs were key learning mechanisms by which new knowledge was absorbed into the organization. The KTP consultant, who had many years of engineering experience, stressed the importance of good product design, while the academic supervisor concentrated on the importance of a structured approach to improving existing products and the evaluation of new ideas. At the second meeting it was agreed to establish a New Product Development Committee (NPDC) to evaluate ideas and allocate resources to their development. Membership included the three directors, the works manager, the sales representative and the KTP Associate, meeting monthly for approximately two hours. The Associate identified staff in 'boundary spanning roles' (sales representatives and service engineers) as a key source of new ideas, and introduced an Idea Capture Form (ICF) that was distributed to all employees to help promote their involvement. This proved important for translating tacit knowledge possessed by employees and managers into codified knowledge. The drive to institutionalize information processing was successful and, after screening by the Associate, 30 ideas were evaluated at the first NPDC meeting. Overall, wider-ranging changes included the emergence of an innovatory culture as employees and managers combined their day-to-day responsibilities with a commitment to develop new products. Equally important were changes in major customers' perception of RSL, as they began to regard the company as innovative and forward-thinking rather than in decline.

Table 3. Learning in RSL

Organizational Routine	Organizational Activity	Learning Outcome	Knowledge Source
Local Management Committee (LMC)	Industrial & academic supervisors, KTP consultant and associate meet to discuss progress	Key forum for knowledge sharing (intra and inter-organizational)	Industrial and academic supervisors + KTP consultant
New Product Development Committee	Monthly meetings of senior manager and staff to formally evaluate new product ideas and to report on progress of those 'in the system'.	Linked innovation to strategy and helped disseminate ideas and information	Senior management team
Idea Capture Form	Encouraged all staff to contribute new ideas as well as suggesting improvements to existing products	Translated wide range of tacit knowledge into codified knowledge	Shop-floor and administrative staff (tacit knowledge)
Fortnightly meetings (OM, Associate, academic)	Open discussions (1 to 2 hours) in which three main participants evaluated progress	Ensured that operational (practical) issues were given full attention	Owner- manager and academic supervisor
Weekly meetings (Associate & academic)	Meetings provided the opportunity for academic input into company activities	Identification of core competences + structured approach to NPD	Academic supervisor

The ability of RSL's management team to develop new products was limited by both resources and know-how. The KTP provided access to new knowledge from the University Business School and the KTP consultant. Intuiting began with the Associate's attempts to make sense of current activities within the company. Interpreting and integrating occurred during conversations with the OM and other staff as the Associate focused on improving the design of two existing products. The NPDC and the ICF helped institutionalize learning by both capturing new ideas and disseminating knowledge. What distinguished this case from a straight-forward example of intra-organizational learning was the interaction of academic supervisor, KTP Associate and OM. From the outset, the academic stressed the importance of taking a strategic view of innovation as well as building mechanisms which helped capture and disseminate external knowledge. These strong linkages between RSL and the University Business School helped institutionalize new practices via the NPDC and the ICF. Institutionalization was also facilitated by the fact that the change process began with a relatively simple project (redesigning existing products) which had an immediate impact on turnover. The OM, senior managers and shop-floor staff saw outcomes from the programme which could, if sustained, help ensure RSL's long-term survival; thus the introduction of new ideas (to the company) from academia helped institutionalize structural changes. These ideas also stimulated new ways of thinking throughout the organization as employees at all levels began to consider new ideas and new ways of working.

Case 3: DMF (coercive learning)

DMF, a medium-sized manufacturing company, was founded in 1950 to supply casting and machined components to the Ministry of Defence. The period of study coincided with the company making the transition from batch production of engineering components to mass production of domestic telephones which required a period of intensive organizational learning. Conventional batch production methods continued to be used and a range of factors contributed to shop-floor inefficiency including an ancient material requirement planning system which made it difficult to track material flows through the factory. Mass production exacerbated this problem, with operator 'waiting time' increasing as a result of material shortages and store-keepers and material controllers spending considerable amounts of time searching for missing components.

Initially, BT was the main customer for the company's new product line of domestic telephones but a contract was subsequently gained with LCL, a rapidly growing telecommunications company. LCL managed their supply chain actively, and informed DMF owner Martin Francis that the firm had to become more professional if it wanted to retain their business. Because existing managers lacked mass-production experience Francis recruited a new production manager, Gareth Williams, with experience of high-volume manufacturing. He recommended the purchase of an IT system incorporating MRPII software to improve material flow and eliminate WIP (work in progress). To ensure the new system was fully integrated into existing activities, Williams created a forum in which junior staff affected by the IT system were involved in discussions about its implementation. These meetings led to the creation of 'module champions' responsible for ensuring the views of every department were incorporated into the system design. Information about selection, purchase and implementation of the new system was passed on *via* regular meetings over a 12 month period. As a result, there were considerable changes to communication structures with particular emphasis on autonomy and delegation:

We've gone in at the shopfloor level and said these are the objectives. We have to improve the response time to customers, improve the service we provide and we need to do it in a number of ways. Getting the shopfloor to give us their thoughts, getting them to come back with answers means they are driving it forward. By doing that they have more responsibility and they know they are thought about as people rather than numbers. (Materials Director)

As production manager, Williams also had regular interactions with LCL representatives, which led to a number of suggestions, including greater use of assembly flow-lines and incorporation of

quality procedures into operator job descriptions (rather than being the responsibility of quality control). Instead of simply implementing these new approaches, Williams engaged supervisors, stores personnel and the quality manager in discussions about their appropriateness. These changes to shop-floor layout and associated investments in new equipment would not have occurred without pressure from the company's main customer.

We've had problems with LCL who've got very clearly defined objectives - they want to grow at a massive rate and they want us to come with them. The next problem will be to start enforcing what we said that we would do. LCL said that they will come in and check, we can't just say that we are going to do things, we have to do them, it's a clause in the contract. (Production Manager)

Institutionalizing the changes proved difficult, with shop-floor employees constantly reverting to their conventional forms of work organization. Francis again utilised LCL representatives to explain directly to supervisors and operators the importance of professionalizing their manufacturing activities. Francis also used LCL's threats as a 'lever' to minimise resistance amongst first-line supervisors and operators to the required changes in traditional working practices:

Everyone's realized that they've got to change from the top to the bottom and the hard bit was to keep the momentum going. I think that the success of winning the LCL business showed that they could see that we were committed as a team. We haven't taken their threats lightly, we needed to change.

Francis encouraged Williams to take advantage of a Regional Development Agency (RDA) programme to improve manufacturing practices in small firms. The RDA project, which emphasised the importance of Kanban and shopfloor teams, in combination with the new layout, helped DMF shift towards the principles of lean manufacturing. The project involved a consultant from the RDA helping managers and supervisors understand how modern manufacturing ideas and practices could resolve their production problems. The RDA consultant then helped Francis and his management team introduce and embed these working practices with shop-floor workers.

Table 4. Learning in DMF

Organizational Routine	Organizational Activity	Learning Outcome	Knowledge Source
Recruit new production manager	Catalyst for introduction of modern manufacturing techniques.	Initiated switch from batch to mass production techniques.	Work experience of new production manager
Creation of module champions	Weekly meetings between representatives of all departments affected by introduction of MRPII.	Inter-departmental knowledge sharing (buying, scheduling, labour productivity etc).	Internal (tacit) knowledge
Regular meeting with LCL (main customer)	Help identify main weaknesses in existing management processes and manufacturing activities.	Awareness of 'modern' manufacturing techniques amongst senior managers.	LCL technical staff (main customer)
Overt pressure for organizational change from LCL	Provided Francis/Williams with 'power' to enact change within DMF.	Aided the institutionalization of new working procedures.	LCL senior managers (main customer)
Employ consultants from RDA (regional development agency)	Provided 'lean-production know-how' to supervisors and shop-floor workers.	Improved knowledge of modern manufacturing techniques at operational level.	RDA Consultants

Although the RDA's assistance was important the company was still heavily reliant on LCL's advice to sustain improvements in performance.

Changes to shop-floor layout and investments in new equipment would not have occurred without pressure from the company's main customer.

Discussion: intertwining knowledge in SMEs

This article focuses on the processes by which mature SMEs acquire, absorb and institutionalize new knowledge. We suggest that the way in which change was managed in each of the three SMEs followed a broadly similar process:

1. a critical incident prompted managerial action;
2. owner-manager recognized the need to access external knowledge and 'opened-up' to sources of new knowledge (customers, suppliers, knowledge providers);
3. internal systems and structures were created to share knowledge (from individual to organizational learning)
4. systems and structures were institutionalized with the assistance of external organizations (customers, suppliers, knowledge providers).

First, all three firms responded to 'critical incidents' which endangered their long-term survival. BRW's position as a component supplier to the aerospace industry was under threat after their main customer introduced strategic sourcing and the firm failed a supplier audit. At RSL, William White was prompted to action because of a rapid decline in sales of the company's ageing products. DMF's critical incident was an overt threat from their main customer to take their business elsewhere if Martin Francis did not instigate more professional managerial practices and improve product quality. The subsequent stages were influenced by variations in the nature of these critical incidents.

At the second stage, each owner-manager 'opened-up' their firms to external sources of knowledge. BRW's Watson acquired knowledge from his main customer, a FE college, a consultant and a new production manager. At RSL, involvement with a KTP programme was the first stage in White's opening-up, and provided external knowledge from both academic and KTP associate. In the case of DMF, Francis had fewer options as he was under direct pressure from his main customer to introduce a wide range of changes. As a result, Francis employed an experienced manager to help introduce mass-production techniques into DMF, who became the catalyst for much closer working relationships with LCL, as well as accessing knowledge from other sources including the RDA. Opening up, then, is not just the recognition of a crisis, but involves the owner-manager proactively seeking external help. Companies, including SMEs, operating in mature sectors, generally emphasize the exploitation of existing knowledge rather than exploration for new knowledge. Strategic renewal involves firms moving from exploitation to exploration rather than the more usual transition from exploration to exploitation as firms move into maturity.

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The third and fourth stages of strategic renewal in these case studies highlight the influence of external organizations in the distribution of knowledge and the institutionalization of learning. At BRW, Lucas Aerospace, the FE College, a consultant and a new production manager played supportive roles in helping Watson overcome resistance to change, enabling him to implement the principles of quality management and continuous improvement and obtain relevant ISO accreditation. '*Normative learning*' occurs as a result of the influence of bodies such as ISO (International Organization for Standardization), or the CIPD (Chartered Institute of Personnel and Development) in the case of human resource issues. The professionalization of production management was central to Watson retaining the business of Lucas Aerospace, and also made BRW more credible to other potential customers. At RSL, participating in a KTP provided White with an Associate who was able to undertake a range of tasks designed to renew the company's unpopular products. The Associate also introduced established practices used by effective innovators such as formalized new product development procedures, an idea capture form and a strategic approach to innovation. This suggests a process of '*mimetic learning*' by copying 'best-practice' from other organizations. At DMF, new knowledge came from a variety of sources, including senior employees of LCL who gave advice on shop-floor organization and managerial responsibilities/structures, an RDA consultant who introduced the principles of lean production as well as a new production manager with experience of high-volume production. Systems were introduced to support knowledge dissemination, such as team working and module champions. However, the implementation of Kanban and just-in-time production techniques owed much to the overt pressure for organizational change applied by LCL. In this case, '*coercive learning*' occurred as a result of direct pressure from an external organization for the adoption of new knowledge.

Even when owner-managers overcome hurdles associated with the identification and acquisition of knowledge there can still be formidable barriers within the firm. The assimilation, transformation and exploitation of external knowledge demand the creation of structures, systems and routines to broaden the scope of learning from individual (owner-manager) to organizational levels. In these cases, all three owner-managers introduced new systems and procedures for sharing knowledge with and between their employees (see Table 5). Such communication structures are central to both feedback and feed-forward learning flows (as illustrated in Figure 1). Our core argument is that external organizations have a significant role to play in institutionalizing the feedback processes by which new knowledge and procedures become embedded within the firm. This embedding, we suggest, is the key to strategic renewal in SMEs: external knowledge must be effectively institutionalized if learning is to occur at the organizational level. The knowledge which all three companies accessed was well-established and readily available from a number of sources. In our cases, absorbing and implementing new knowledge required fundamental changes to the case firms' operating activities. Because all three companies initially lacked the systems, structures and routines associated with larger firms, the roles of the respective knowledge 'suppliers' were central to the institutionalization of that knowledge.

Theoretical implications

In the context of a theoretical understanding of OL, our objective is to extend the 4I framework by incorporating an external dimension to the institutionalization of knowledge in SMEs. That inter-organizational learning, both formal and informal, takes place is widely established in a range of literatures.²⁵ Our approach differs in two ways: first we focus specifically on the problems of learning in mature SMEs, and second, we highlight the importance of external actors (customers, suppliers and knowledge providers) in helping to embed learning at the organizational level. Learning from other organisations can be formalised in strategic alliances or joint ventures²⁶ or may be informal via 'invisible colleges' or communities of practice.²⁷ In our extension to the 4I, we identify

Table 5. The Institutionalization of Knowledge

Background	Company		
	BRW	RSL	DMF
LEARNING CATALYST	Failed customer audit	Decline of sales	Threatened loss of customer
KNOWLEDGE SOURCE	Industry best practice	Knowledge transfer prog	Main customer + new manager
TRANSFER MECHANISM	OM, consultant and new manager	OM + KTP Associate	OM + new manager
NATURE OF KNOWLEDGE	Quality management and continuous improvement techniques	Innovation of new products	Work organization (JIT & Kanban)
KNOWLEDGE-SHARING STRUCTURES (INTERNAL)	Shop-floor training; formalisation of internal procedures	KTP local management committee; NPD committee	Module champions; team-work training
TIME PERIOD	2 years	2 years	3 years
INSTITUTIONALIZING MECHANISM	New organizational systems and culture	New organizational routines	New work practices + communication
INSTITUTION FORCE	Customer and wider industry expectations	Target setting	Loss of business
TYPE OF LEARNING	Normative (adopting industry standards)	Mimetic (adopting & adapting proven practice)	Coercive (enforced learning)
INTERTWINING ACTIVITY	Customer, FE college and consultant	MD, KTP associate, academic, consultant	Regular monitoring Visits from customer

the crucial role of external organizations in helping institutionalize knowledge within SMEs (Figure 2).

We adopt Holmqvist’s term ‘intertwining’ because it indicates active engagement between the firm and its external knowledge network. The concept of ‘intertwining’ indicates that learning mechanisms are at the interstices between organisations and not just within organisational boundaries (Figure 2). Emphasis on integrated supply chains means that small firms are increasingly encouraged to share learning (feed-forward) with customers and suppliers.²⁸ Although feed-forward is important for building competitive advantage we focus on how external organizations promote the institutionalization of new knowledge in SMEs. Intertwining promotes a feedback learning flow within the recipient company. The institutionalization of external knowledge leads to a cycle of integrating, interpreting and intuiting as employees learn from operating new procedures. Typical examples in SMEs might include adoption of formal quality procedures (ISO 9000:2000) or a structured process for evaluating new ideas. A number of writers confirm the importance of institutionalizing new knowledge if real organizational learning is to take place.²⁹ Beer *et al* argue that senior managers must recognize a gap between aspirations and achievements; be willing to confront their own weakness; and promote a participative culture that values others as partners in implementing strategic change.³⁰

Our extension to the work of Crossan *et al* suggests some of the more obvious mechanisms for mutually beneficial learning partnerships (Table 6). For smaller firms, links with customers and suppliers are the most accessible sources of learning. These links may be based on customer requests for improvements in products and services, or supplier suggestions for cost reductions by

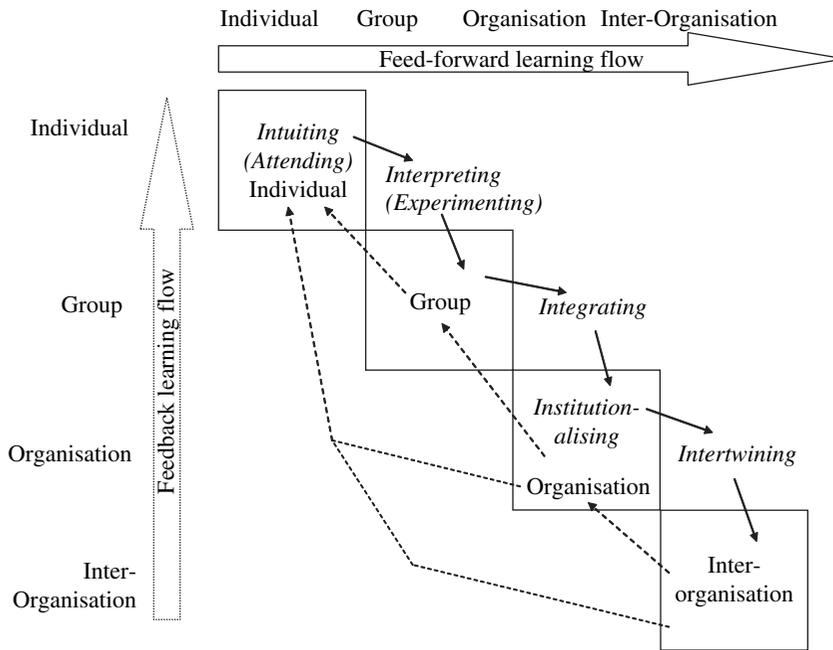


Figure 2. The 5I Learning Framework

streamlining joint processes using EDI (electronic data interchange). Engagement with the regulatory environment, particularly concerning financial accounts or taxation, may also lead to learning by the adoption of activity-based costing, for example. Learning also occurs as a result of formal programmes which link SMEs to external knowledge providers. In terms of accessing knowledge from academic sources, the most successful UK initiative is the Knowledge Transfer Partnership (previously known as the Teaching Company Scheme). Rather than being based on one-off transactions, in most small firms, such relationships are likely to be influential in the nature and direction of organisational learning as part of on-going network relationships in which knowledge sharing benefits both parties.³¹

Crossan and her colleagues use an early version of the framework to discuss inter-organizational learning.³² As the authors point out '*learning involves institutionalizing: the processes of incorporating new knowledge and skills into the systems, structures and procedures of the organization*'. This view presupposes the existence of structures and procedures which is often not the case in small firms. For new knowledge to become embedded within the 'memory' of such firms requires external organizations which can provide both motivation (by precipitating crisis) and guidance (exemplar, specific assistance, experience) to the SME. Our work also differs from von Hippel's concept of 'lead users' which describes the role of customers in the innovation process as providing companies with feedback on the performance of their innovatory products or services.³³ Lead users (or early adopters) are important to innovating companies but they do not take the kind of active role in institutionalizing knowledge that we suggest here.

Managerial implications

This paper has implications for those responsible for managing small firms. We know from the limited research on organizational learning in SMEs that owner-managers (OMs) can be both the main means of accessing new knowledge *and* the barrier to dissemination of that knowledge. This paradox is related to the way in which OMs exercise proprietary rights which means they are often

Table 6. Organizational Learning and Renewal

LEVEL	PROCESS	INPUTS/OUTCOMES	
INDIVIDUAL	<i>INTUITING</i>	Experiences Images Metaphors	
GROUP	<i>INTERPRETING</i>	Language Cognitive map Conversation/dialogue	ORIGINAL MODEL
ORGANISATION	<i>INTEGRATING</i>	Shared understanding Mutual adjustment Interactive systems	
	<i>INSTITUTIONALISING</i>	Routines Diagnostic systems Rule & procedures	
INTER-ORGANISATION	<i>INTERTWINING</i>	Customer requirements Supplier suggestions After-sales service Regulatory environment Knowledge providers	EXTENSION TO ORIGINAL MODEL

the sole authority within the firm. Effective and proactive OMs recognize the risk of organizational failure associated with a critical incident (for example, customer complaints). To initiate strategic renewal, OMs ‘open-up’ their companies to external knowledge sources by first realizing that their firm needs new knowledge inputs, and then actively engaging with other organizations. In most cases, opening-up means making better use of existing links with customers, suppliers and professional advisors such as accountants or bank managers. As pointed out by Baden-Fuller and Stopford, maturity is a managerial state of mind, and in firms which adopt entrepreneurial thinking there is a belief in the potential of new strategies and new ways of working.³⁴ For example, in the cases discussed here, all three OMs responded to early signals of organizational failure by seeking external assistance. Reacting to such signals before the situation becomes critical allows OMs more scope for retaining some measure of control, for example, being able to exercise greater choice of potential partners than they might in times of real crisis. This is important because, as we demonstrate, institutionalizing external knowledge means that OMs must accept some outside influence on the nature and structure of organizational activities. In all three cases discussed above, external agents helped create the internal mechanisms by which organizational learning took place.

In all three cases, external agents helped create the internal mechanisms by which organizational learning took place.

There is also an internal dimension to opening-up which involves the OM giving authority to other managers. Delegating real responsibility allows the OM to concentrate on strategic issues rather than day-to-day operational tasks. Crucially, appropriate internal mechanisms must support

the dissemination and sharing of knowledge throughout the organization. Delegation must be accompanied by knowledge-sharing that underpins the switch from individual to organizational learning; this process is demonstrated in each case study (Table 5). Such opening-up and delegation requires OMs to cede significant levels of power, which may entail involving external agents in helping to institutionalize new practices in order to retain knowledge and learning capacity. The advantage of relinquishing some measure of control is that it helps create 'entrepreneurial space' and promotes wider organizational learning. Accessing external knowledge and distributing authority can act as resource multipliers by providing time (delegation of tasks and responsibilities) and expertise (knowledge resources) that are generally in short supply in SMEs. We do not suggest that creating genuine organizational learning in small firms is easy to achieve. Ceding control is likely to be a fundamental challenge to the OM's desire for autonomy, which may have been a significant influence in establishing the business. Moreover, the organizational benefits of these actions may not be immediately apparent. In the cases presented here, it took time for learning to become institutionalized into an accepted part of everyday practices.

In our cases institutionalization mechanisms reflected three different categories of learning (Table 5), but all required the respective OMs to relinquish some operational control and direct their attention strategically to encourage renewal. Institutionalizing learning means establishing systems, procedures and routines by which external knowledge is disseminated to all employees. Lucas Aerospace played a supportive role in helping BRW implement formal ISO standards so that the company could provide evidence of quality management and continual improvement. RSL's participation in a two-year KTP scheme provided long-term expertise and advice from both academic supervisor and KTP consultant. Initially, DMF's new customer LCL enforced changes to the firm's working practices, but gradually a more effective working partnership was established. Each company created different *knowledge-sharing structures* (Table 5) but in each case these mechanisms helped promote genuine organizational learning.

... genuine organizational learning is central to the strategic renewal of mature SMEs.

To restate the most important issue in this paper: genuine organizational learning is central to the strategic renewal of mature SMEs. Furthermore, as demonstrated in the three cases, inter-organizational relationships are key to actually embedding learning within the firm thereby ensuring that the effect of acquiring new knowledge is not transitory. This process is illustrated in Tables 2, 3 and 4, in which we indicate the 'knowledge source' for each learning outcome in our three case studies. It is also important that OMs recognize that different types of learning (normative, mimetic and coercive) are likely to reflect their response to relationships with customers and suppliers and the particular industry context in which they operate. Normative learning involves the acquisition of knowledge from institutional bodies such as ISO or the adoption of practices regarded as 'industry standard'. Mimetic learning involves the copying of particular skills from other organizations and is often based on 'benchmarking'. Coercive learning has the most negative connotations because it suggests an unwillingness to learn within the focus organization. Pressure from DMF's main customer was the catalyst for far-reaching organizational change as managers and shop-floor employees gradually acquired the skills and knowledge required to adapt to a mass-production environment. It is, however, important to acknowledge that, even in our three cases, there were 'overlaps' between the learning categories. For example, in BRW, although the relationship with Lucas Aerospace was positive, there was certainly implicit coercion in the institutionalization of appropriate quality and continuous improvement procedures. It will be important for owner-managers to reflect critically on their available networks and how they might extend that network in order to select potential partners. In all of these cases the OMs chose (or had chosen for them) partners from outside of their traditional contacts. It is necessary for OMs to consider industry and customer

Table 7. Managerial Implications

RENEWAL ACTIVITY	MANAGERIAL ACTIONS/DECISIONS
Open-up	Early recognition and analysis of problem/threat Evaluate limits to knowledge exploitation Review levels of skills and expertise of staff Create strategic or entrepreneurial space by delegating responsibility to staff/managers
Explore knowledge environment	Proactively seek external assistance (extend network, search for possible sources of help/information) Identify potential knowledge standards and expectations (benchmarking, industry and customer expectations) Implement and develop knowledge-sharing systems to review performance (continuous improvement and customer feedback) Consider recruitment of new expertise, or training of existing staff Encourage feed-forward learning by involving staff, seeking their ideas/input
Integrate and institutionalize knowledge	Review and implement relevant organizational structures Engage staff in the process of change Encourage direct involvement of external knowledge provider(s) and cede some control
Maintain/develop inter-organizational relations	Regular interaction with key partners/stakeholders 'Outward-facing' culture (exploration) of technology and industry developments Constant environmental scanning for threats and opportunities

standards and whether they are meeting them (normative/coercive learning); what they can learn from other industries, organizations or institutions through benchmarking and copying (normative/mimetic learning); and the likely implications for their business if they do not address the concerns of key suppliers and customers (coercive learning). Addressing each of these considerations will provide a heightened awareness of expectations and/or sources of external knowledge. Table 7 summarizes the main learning outcomes for those involved in the management of SMEs.

In all three companies, learning did not stop once the initial crisis was averted. The experience and process of opening-up encouraged the owner-managers to engage in further learning activities. Roger Watson, the OM of BRW negotiated with a local University to set up a KTP in order to renew and extend their continuous improvement processes. William White, OM of RSL judged the KTP to have been a 'tremendous success' for his company and demonstrated his faith by investing in a 'follow-on' programme. Prior to the changes discussed in this paper, DMF had been in steady decline for approximately ten years as OM Martin Francis struggled to respond to the loss of MoD business. Increased confidence in the company's future encouraged Francis to invest in the acquisition of a small firm which produced highly specialized electric motors. As a result, all staff underwent a further period of intense learning as the company developed a new range of skills and competences.

Conclusions

This article extends the original 4I framework by identifying the significance of external organizations to learning in SMEs. As a means of demonstrating the utility of our model we introduce three cases of learning in small, independent firms, who each renewed their activities by tapping into knowledge and expertise from external organizations. This activity was clearly part of the feed-forward process, as inter-organizational links helped resolve intractable problems in BRW, RSL and DMF. Further, in all three firms, external pressure helped institutionalize new knowledge by encouraging the adoption of more professional managerial practices. Because knowledge was

embedded within organizational processes and systems (rather than in the head of owner-managers) learning was fed-back to groups and individuals via the micro-processes of integration, interpretation and intuiting.

We extend the 4I model by incorporating ideas related to inter-organizational learning. Learning in SMEs tends to occur in reaction to some crisis or critical incident rather than as a result of a careful strategy to acquire new knowledge. Effective organizational learning requires owner-managers to relinquish some proprietary control so other actors have involvement in the acquisition, dissemination and application of that knowledge. We suggest that our conceptualization provides the opportunity for a more rigorous focus on the mechanisms by which small firms acquire new knowledge as a basis for organizational renewal. Not least of all because the need to compete in an increasingly globalized economy means that service firms as well as manufacturing firms can only remain competitive in the longer-term by becoming knowledge-based organizations.

Effective organizational learning requires owner-managers to relinquish some proprietary control so other actors are involved in the acquisition, dissemination and application of knowledge.

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References

1. J. Child, Strategic Choice in the Analysis of Action, Structure, Organization and Environment: Retrospective and Prospective, *Organization Studies* **18**(1), 43–76 (1997).
2. M. Stanworth and J. Curran, Growth and the Small Firm: An Alternative View, *Journal of Management Studies* **13**(2), 95–110 (1976); P. Wyer, J. Mason and N. Theorakopoulos, Small Business Development and the “Learning Organization”, *International Journal of Entrepreneurial Behaviour and Research* **6**(4), 239–259 (2000).
3. L. Pittaway, M. Robertson, K. Munir, D. Denyer and A. Neely, Networking and Innovation; A Systematic Review of the Evidence, *International Journal of Management Reviews* **5/6**(3/4), 137–168 (2004).
4. G. Chandler and S. H. Hanks, An Examination of the Substitutability of Founders Human and Financial Capital in Emerging Business Ventures, *Journal of Business Venturing* **13**(5), 353–370 (1998).
5. M. Crossan, H. Lane and R. White, An Organizational Learning Framework: From Intuition to Institution, *Academy of Management Review* **24**(3), 522–537 (1999); M. Crossan and I. Berdrow, Organizational Learning and Strategic Renewal, *Strategic Management Journal* **24**, 1087–1105 (2003).
6. A. Macpherson, Learning How to Grow: Resolving the Crisis of Knowing, *Technovation* **25**(2), 1129–1141 (2005); J. Cope and G. Watts, Learning by Doing: An Exploration of Experience, Critical Incidents and Reflection in Entrepreneurial Learning, *International Journal of Entrepreneurial Behaviour and Research* **6**(3), 104–124 (2000).
7. E. Sadler-Smith, D. Spicer and I. Chaston, Learning Orientation and Growth in Smaller Firms, *Long Range Planning* **34**(2), 139–158 (2001).
8. G. Huber, Organizational Learning: The Contributing Processes and the Literatures, *Organization Science* **2**(1), 88–115 (1991).

9. P. Pawlowsky, The Treatment of Organizational Learning in Management Science, in M. Dierkes, A. Berthoin Antal, J. Child and I. Nonaka (eds.), *Handbook of Organizational Learning & Knowledge*, Oxford University Press, Oxford, 61–88 (2001).
10. M. Holmqvist, A Dynamic Model of Intra- and Interorganizational Learning, *Organization Studies* **24**(1), 95–124 (2003).
11. J. March, Exploration and Exploitation in Organizational Learning, *Organization Science* **2**(1), 71–87 (1991); D. Vera and M. Crossan, Strategic Leadership and Organizational Learning, *Academy of Management Review* **29**(2), 222–240 (2004).
12. M. Feldman and A. Rafaeli, Organizational Routines as Sources of Connections and Understandings, *Journal of Management Studies* **39**(3), 309–331 (2002); D. Leonard-Barton, Core Capabilities and Core Rigidities: A Paradox in Managing New Product Development, *Strategic Management Journal* **13**, 111–125 (1994).
13. E. Sadler-Smith, D. Spicer and I. Chaston (Op Cit at Ref 7).
14. J. Liao, H. Welsch and M. Stoica, Organizational Absorptive Capacity and Responsiveness: An Empirical Investigation of Growth-Oriented SMEs, *Entrepreneurship, Theory and Practice* **28**(1), 63–85 (2003).
15. C. Armistead and M. Meakins, A Framework for Practising Knowledge Management, *Long Range Planning* **35**(1), 49–71 (2002); M. Crossan, H. Lane and R. White (Op Cit at Ref 5) 525.
16. W. M. Cohen and D. A. Levinthal, Absorptive Capacity: A New Perspective on Learning and Innovation, *Administrative Science Quarterly* **35**, 128–152 (1990); S. A. Zahra and G. George, Absorptive Capacity: A Review, Reconceptualization and Extension, *Academy of Management Review* **27**(2), 185–203 (2002).
17. R. Rothwell, Successful Innovation: Critical Factors for the 1990s, *R&D Management* **22**(3), 221–240 (1992); R. W. Vossen, Relative Strengths and Weaknesses of Small Firms in Innovation, *International Small Business Journal* **16**(3), 88–94 (1998).
18. R. Scase, Employment Relations in Small Firms, in P. Edwards (ed.), *Industrial Relations: Theory and Practice in Britain*, Blackwell, Oxford (1995).
19. O. Jones, The Persistence of Autocratic Management in Small Firms: TCS and Organizational Change, *International Journal of Entrepreneurial Behaviour and Research* **9**(6), 245–267 (2003).
20. F. W. Taylor, *Scientific Management*, Harper Row, New York (1947); O. Jones, Scientific Management, Culture and Control: A First-Hand Account of Taylorism in Practice, *Human Relations* **53**(5), 631–653 (2000).
21. O. Boiral, Tacit Knowledge and Environmental Management, *Long Range Planning* **35**(3), 291–317 (2002); A. Ortenblad, The Learning Organization: Towards an Integrated Model, *The Learning Organization* **11**(2), 129–144 (2004).
22. C. Zeitsma, M. Winn, O. Branzei and I. Vertinsky, The War of the Woods: Facilitators and Impediments of Organizational Learning Processes, *British Journal of Management* **13**(SI), S61–S74 (2002).
23. E. Sadler-Smith, Y. Hampson, I. Chaston and B. Badger, Managerial Behaviour, Entrepreneurial Style and Small Firm Performance, *Journal of Small Business Management* **41**(1), 47–67 (2003).
24. P. Senker and J. Senker, Transferring Technology and Expertise from Universities to Industries: Britain's Teaching Company Scheme, New Technology, *Work and Employment* **9**(2) (1994).
25. D. Ancona and D. Caldwell, Bridging the Boundary: External Activity and Performance in Organizational Teams, *Administrative Science Quarterly* **37**(4), 634–665 (1992); P. Käser and R. Miles, Understanding Knowledge Activists' Success and Failures, *Long Range Planning* **35**(1), 9–28 (2002); M. Tushman and T. Scanlan, Boundary Spanning Individuals: Their Role in Information Transfer and Their Antecedents, *Academy of Management Journal* **24**(2), 289–305 (1981); A. Zaheer, B. McEvily and V. Perrone, Does Trust Matter? Exploring the Effects of Interorganizational and Interpersonal Trust on Performance, *Organizational Science* **9**, 1–20 (1998).
26. A. C. Inkpen and M. Crossan, Believing is Seeing: Joint Ventures and Organizational Learning, *Journal of Management Studies* **35**, 595–618 (1995); P. Kale, H. Singh and H. Perlmutter, Learning and Protection of Proprietary Assets in Strategic Alliances: Building Relational Capital, *Strategic Management Journal* **21**, 217–237 (2000).
27. J. Brown and P. Duguid, Organizational Learning and Community-of-Practice: Toward a Unified View of Working, Learning, and Innovation, *Organization Science* **2**(1), 40–57 (1991); D. Price-DeSolla and D. Beaver, Collaboration in an Invisible College, *American Psychologist* **21**, 1011–1018 (1966). C. Yeh-Yun Lin and J. Zhang, Changing Structures of SME Networks: Lessons from the Publishing Industry in Taiwan, *Long Range Planning* **38**, 145–162 (2005).
28. A. Macpherson and A. Wilson, Supply Chain Management in SMEs; Improving Competitive Advantage, in O. Jones and F. Tilley (eds.), *Competitive Advantage in SMEs: Organizing for Innovation and Change*, Wiley, Chichester (2003).

29. P. Baumard and W. H. Starbuck, Learning from Failures: Why it may not Happen, *Long Range Planning* **38**, 281–298 (2005); M. D. Cannon and A. C. Edmonson, Failing to Learn and Learning to Fail (Intelligently): How Great Organizations Put Failure to Work to Innovate and Improve, *Long Range Planning* **38**, 299–319 (2005).
30. M. Beer, S. C. Voepel, M. Leibold and E. B. Tekie, Strategic Management as Organizational Learning: Developing Fit and Alignment Through a Disciplined Process, *Long Range Planning* **38**, 445–465 (2005).
31. D. Taylor and K. Pandza, Networking Capability: The Competitive Advantage of Small Firms, in O. Jones and F. Tilley (eds.), *Competitive Advantage in SMEs: Organising for Innovation and Change*, Wiley, Chichester (2003).
32. I. Tiesessen, H. Lane, M. Crossan and A. Inkpen, Knowledge Management in International Joint Ventures, in P. W. Beamish and P. Killing (eds.), *Cooperative Strategies: North American Perspectives*, Jossey Bass Wiley, San Francisco, (1997) p384.
33. E. von Hippel, *The Sources of Innovation*, Oxford University Press, Oxford (1998).
34. C. Baden-Fuller and Stopford, *Rejuvenating the Mature Business: The Competitive Challenge*, Routledge, New York (1994).

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