An Ecosystem Approach to Knowledge Management: Case Studies of Two Australian SMEs

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Abstract

This study is centred on the premise that knowledge is personalised information which can be enriched through the process of learning, then shared and applied to practical situations to attain value. To highlight the complex nature of knowledge management (KM) as a set of practices aimed to enhance collaboration, the concept of a Collaborative Learning Ecosystem (CLES) is presented as holistic approach toward improving practical learning environments. In view of the pressing need for better KM in small-to-medium-sized (SME) enterprises, the CLES framework is used to examine the KM positions of two Australian SMEs. Viewing each case as an 'organisational ecosystem', the holistic assessment of each SME exposes certain KM inefficiencies unique to the firm, which are addressed through a set of actionable KM strategies for improving the relationships among the components interacting within each organisational ecosystem.

Keywords:

Learning Ecosystem, Knowledge Management, SMEs, Collaborative Learning

INTRODUCTION

Widespread recognition of knowledge as a key organisational resource and a driver of sustained competitive advantage have brought about several perspectives on knowledge. One perspective is that of knowledge as a complex form of data and information; a state of mind; an object; a process; a condition or a capability (Alavi & Leidner 2001). The perspective that knowledge is the result of cognitive processing implies that learning brings about a change in the state of knowledge which could result in a change in understanding, a decision or an action (Gourova et al. 2001).

Organisational knowledge is valuable information retained in the organisational system regardless of the comings and goings of individuals (Deloitte & Touche LLP 2005). Individuals continually develop new knowledge, but organisations play a critical role in articulating and amplifying that knowledge (Nonaka 1994). Organisational knowledge arises through a continuous dialogue between explicit and tacit knowledge where organisational knowledge is developed through "unique patterns of interaction between technologies, techniques and people" (Bhatt 2000). In this regard, the successful codification of individuals' tacit knowledge to permanently retain as organisational knowledge relies on the effective implementation of knowledge management.

While there has been considerable development in the areas of knowledge, knowledge management (KM), communities of practice and organisational learning, much of the KM research has been accomplished without substantial impact on the way organisations operate (Grover & Davenport 2001). With a view to bridge the gap between theory and practice, this study draws on Brown's (1999) proposition that "an organisation is a knowledge ecology" comprise of interacting components. The research advances Chang & Guetl's (2007) ecosystem-based framework by drawing on the relationship between KM and collaborative organisational learning, and highlights three key categories of contributors to the dynamics of collaborative learning environments; these being the learning or knowledge management utilities, the learning stakeholders and the internal and external influences that could impact the learning environment (Chang & Guetl 2007). The Collaborative Learning Ecosystem (CLES) serves as a valuable framework for examining and improving the *KM* positions of organisations. The framework is used as a practical analysis tool for holistically assessing the *KM* positions of two small-to-medium-sized (SME) organisations.

KNOWLEDGE MANAGEMENT (KM) & COLLABORATIVE LEARNING

KM is aptly defined by Gurteen (1998) as "an emerging set of organisational design and operational principles, processes, organisational structures, applications and technologies that helps knowledge workers leverage their

creativity and ability to deliver business value". The definition captures the KM concept, with the inclusion of "*knowledge workers*" placing emphasis on *individuals* as possessors and transferors of knowledge. According to Hasanali (2002), a key objective of KM is to *create value* for the enterprise by facilitating the flow of information to the right person at the right time. KM goes beyond simply using technology and processes to improve the access to explicit information, but is the ability to render the tacit knowledge embodied in the minds of individuals "public, actionable, useful and explicit" (Papows 1998, p. 109).

Critical Success Factors of Knowledge Management

An investigation conducted by Wong and Aspinwall (2005) on SMEs identified "senior management leadership and support, a knowledge friendly culture, a clear strategy and the development of a technological infrastructure" as critical factors to KM success for SMEs. *Leadership* plays a vital role to ensure the success of any organisational initiative (Hasanali 2002). *Organisational culture* shapes the values and beliefs that encourage or impede knowledge creation, sharing and decision-making (Janz & Prasarnphanich 2003). Alavi, Kayworth and Leidner (2005) suggest that there exists a positive relationship between a 'good' knowledge culture (defined by *trust*, *collaboration* and *learning*) and a firm's ability to manage knowledge. *Strategy* is thought of the senior executive's role concerning the firm's position using information, knowledge and intelligence (Spender & Grant 1996). However, the link between the KM and business strategy is typically overlooked in practice. SME executives often face difficulty in articulating the relationship between the firm's competitive strategy and its intellectual resources. IT is an enabler of various facets of KM, from the capturing of tacit or explicit knowledge to its application (Sahasrabudhe 2001). KM tools assist in the development of KM systems involving a combination of people, technology and culture (Liebowitz 1999). Without a sound IT infrastructure, an organisation faces difficulty enabling its knowledge workers to collaborate effectively (Hasanali 2002).

As observed by McAdam and Reid (2001) and Janz and Prasarnphanich (2003), knowledge and learning are inextricably related. A learning organisation is one that effectively creates and shares new knowledge, recognise its ability to solve problems does not rely solely on technology-based initiatives (Grover & Davenport 2001) or in the individual expertise, but is a result of *interactions* among components within the organisational knowledge base (Dickinson 2002). This interactive process that occurs both intra- and inter-organisationally is facilitated by *collaborative organisational learning* where the state of knowledge is continually changed to enable its application to a problem or situation (Gourova et al. 2001). The key focus of KM is to encourage and simplify the collaborative learning process by taking into consideration a range of technological, cultural and social factors.

KM AND COLLABORATIVE LEARNING IN SMES

It has been established that knowledge is a valuable organisational and economic resource (eg. Alavi & Leidner 2001; Grover & Davenport 2001), hence many small business owners who witness the day-to-day failings of operational processes find KM intuitively appealing. However, the key challenge for many SMEs is in identifying the practical steps toward promoting organisational learning through effective creation, storage, retrieval, transfer and application of knowledge (Earl 2001; Grover & Davenport 2001).

SMEs in Australia are entities with less than 200 full time equivalent employees and/or less than $10 million turnover (ABS 2001). Accounting for over 90% of job generation (ABS 1998), Australia's 1.3 million SMEs are regarded as the lifeblood of the Australian economy. It is evident that SMEs are significant contributors to the Australian economy. Therefore, effective KM to encourage ongoing collaborative learning in SMEs is deemed to be especially crucial for the following reasons:

- SMEs need *to leverage up-to-date knowledge* to compete on a global scale (Nunes et al. 2006).
- A study undertaken by Chan, Au and Chao (2006) revealed that SMEs often do not have formalised processes to transfer organisational knowledge to individuals for use in their work, and the retrieval of relevant information is tedious as knowledge is often unfiltered, unsorted and recorded in disjointed documents.
- The loss of key employees could detrimentally affect the firm's competitive edge, as the knowledge acquired by and embodied in these employees is lost at the employee's departure (Nunes et al. 2006).

Some perceived barriers that cause SMEs to overlook the applicability of KM and hence fail to invest in KM initiatives include:

- *Long-Term Investment*: SMEs are typically more concerned with short-term survival as opposed to long term market share (Beekhuyzen, Hellens & Siedle n.d., Delahaye 2005).
- *Uncertain Return* on *Investment*: The inability to guarantee a fast return on a technology investment is an impediment to knowledge management in SMEs (Beekhuyzen, Hellens & Siedle n.d.).
- *Past ICT/ Knowledge Management System failures* cause apprehension to make IT investments.

According to Nunes et al. (2006), "KM advantages have to be clear and easily attainable; otherwise SMEs will continue to focus on the traditional way of working". Earl (2001) and Grover and Davenport (2001) assert that even if an organisation embraces the concept that well-managed knowledge could enhance performance, they often do not know how to plan and execute KM initiatives. Also, more evident in SMEs than in larger firms are the "structural, cultural and managerial barriers to KM" (Ward & Peppard 2005, p. 513). In addressing the KM challenge shared by SMEs in that the application of KM is problematic and the factors requiring consideration are often ambiguous, the Collaborative Learning Ecosystem (CLES) framework has been developed as a tool to holistically examine unique organisational learning environments.

THE COLLABORATIVE LEARNING ECOSYSTEM (CLES) FRAMEWORK

A vital aspect of this framework is the ability to capture the evolving nature of knowledge and hence the term 'ecosystem' was used. The term 'ecosystem' was originally defined by A.G. Tansley as "*a biotic community or assemblage and its associated physical environment in a specific place*" (Pickett & Cadenasso 2002). The definition implicitly highlights the existence of *interactions* among the biotic (living) and a-biotic (non-living) components, as well as intrinsically within various highly-complex elements. Pickett and Cadenasso's (2002) insights on the applicability of the ecosystem concept to "any system of *biotic* and *a-biotic* components *interacting* in a *particular spatial area*" led Chang and Guetl (2007) to apply the concept to the learning domain in developing an initial "Learning Ecosystem" (LES) framework.

Papows (1998, p. 115) notes that "effective KM systems enable tacit and explicit knowledge to feed off of one another in an iterative manner". It is through this collaboration among the ecosystem components that organisational knowledge is able to grow and be translated into increased value. With a view to highlight knowledge worker as both 'teacher' and 'learner' engaged in collaborative learning activities, the current research extends Chang & Guetl's (2007) framework to incorporate a focus on collaboration. The model is re-named a '*Collaborative* Learning Ecosystem' (CLES) to represent the framework's intended application focus.

Overview of the CLES Framework

The CLES framework (Figure 1) emphasises "a *holistic approach* that highlights the significance of each component, their *behaviour*, *relationship* and *interactions*, as well as the *environmental borders* in order to examine an existing system or form an effective and successful system" (Chang & Guetl 2007).
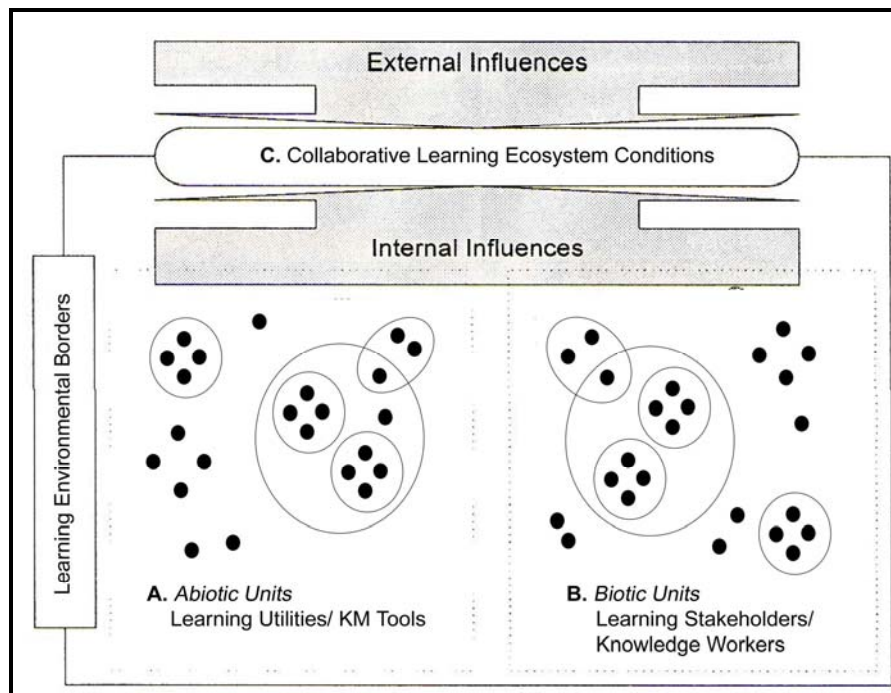

Figure 1: Representation of the Collaborative Learning Ecosystem (Adapted from Chang & Guetl 2007)

The CLES attempts to simultaneously highlight three key components of contributors (as described below) that "consists of the *stakeholders* incorporating the whole chain of the [collaborative] learning processes, the *learning utilities* and the *learning environment*, within specific boundaries, called environmental borders".

A: Learning Utilities or KM Tools

These are the static and dynamic media that contain and deliver the learning content, and are represented by individual and clusters of 'a-biotic units'. These typically (but not necessarily) technology-oriented utilities include all hardware, software and any other computerised platforms that carry the content to the learner.

B: Learning Stakeholders or Knowledge Workers

Learning Stakeholders comprise (i) the learning communities and (ii) other stakeholders who contribute to and/ or benefit from the ecosystem. Learning communities constitute individuals or workgroups (as denoted by clusters of 'biotic units') who can "interact and collaborate synchronously and asynchronously with one another" (Chang & Guetl 2007). Other stakeholders are those who provide the learning content, or support the learning processes through the provision of expertise and services.

C: Collaborative Learning Environment (Restricted CLES Conditions)

The learning environment is dynamic due to changes in a range of *internal* and *external influences*, and the impacts of these influences are dependent on the life-cycle of the examined system. External influences include economic dynamics, domain knowledge, competition and technology advancements (Nyhan et al. 2003). Cultural and sociological influences, funding, business strategies and management support are examples of internal influences (Chang & Guetl 2007).

Investigating the Specifics of the Learning Utilities or KM Tools (A)

It is crucial that both IT and non-IT mediums are considered when investigating the range of learning utilities employed by a firm. The ways in which learning utilities are used by stakeholders in carrying out tasks should be examined and where appropriate, represented using Alavi and Leidner's (2001) framework shown in Table 1.

Once the complete set of learning utilities have been identified, the relationships, usage and implementation effectiveness of each can be investigated. The nature of the interactions among individuals and these utilities is also an issue of interest when opearationalising the CLES framework.

Table 1. KM Processes and the Potential Role of ICT (Adapted from Alavi & Leidner 2001)

KM Processes	Knowledge Creation	Knowledge Storage/Retrieval	Knowledge Transfer	Knowledge Application
Supporting Information Technologies	- Data Mining tools - Learning Tools	- E-Bulletin Boards - Repositories - Databases - Search and Retrieval Tools	- E-Bulletin Boards - Discussion Forums - Knowledge Directories	- Expert Systems - Workflow Systems
Platform Technologies	*Groupware and Communication Technologies* - Instant Messaging, Email, Online Forums, Web 2.0 tools			
	Intranets/ Extranets			
	Internet			

Investigating the Specifics of the Learning Stakeholders (B)

Learning communities possess *learning attributes*, which include unique learning styles, strategies and preferences. The learner's demographics, experience, skills, IT competence, objectives, motivations and needs are also important characteristics. Of the range of learning attributes which could influence collaborative learning, a set of characteristics (see Table 2) considered to be central have been established based on existing literature.

Investigating the Internal and External Environmental Influences (C)

The application of CLES involves the investigation of the influences affecting a firm's internal and external operating environments. These influences and their impacts typically fluctuate across stages of the business life cycle; hence it is vital that the organisation is able to adapt to the conditions prevalent at a particular point in time and take action to facilitate the ongoing interaction among the stakeholders and utilities.

A range of existing frameworks can be employed in examining an organisation's internal and external environments. Examples of these frameworks include the SWOT analysis, internal value chain or network analysis (Michael Porter / Stabell & Fjeldstad), Porter's five forces competitive model and the Political, Economic, Social and Technological (PEST) model.

Table 2. Specifics of the Learning Stakeholders – Key Learning Attributes

1. Learning Styles and Preferences	Authors
• Preferred content delivery media (hard copy, digital) • Preferred content presentation format (text, graphics, audio, video) • Flexibility in selecting preferred learning styles	Bates 2005; Bhatt 2000
2. Background, Experiences and Perceptions of Personal Contribution	
• Extent to which background knowledge/ expertise is applicable • Extent to which background knowledge/ expertise is applied, and impacts • Extent of perceived personal contributions • Examine impact of reward and recognition (if any) on perceptions	Bhatt 2001; Grover & Davenport 2001; Janz & Prasarnphanich 2003; Lee & Ahn 2007; McDermott & O'Dell 2001
3. Expectations	
• Accessibility of useful information • Recognition of contributions • Leadership support and guidance • Assess if expectations are met, and impacts	McDermott & O'Dell 2001; Janz & Prasarnphanich 2003
4. Motivation to Learn	
• Perceived personal benefit • Personal interest in the topic • Perceived accuracy of existing information • Level of trust in information sources	Grover & Davenport 2001; Bhatt 2000
5. Motivation to Share Knowledge and Information	
• Perceived personal benefit of information sharing • Culture/ Cultural resistance • Leadership attitudes • Organisational ownership • Trust and Collaboration	Liebowitz 1999; McDermott & O'Dell 2001; Lee & Ahn 2007; Alavi, Kayworth & Leidner 2005; Papows 1998; Ward & Peppard 2005; Holsapple & Joshi 2000

Investigating the Internal Environmental Influences

Cultural influences, business strategies and management support are examples of internal influences of a firm's KM implementation success. Discussed previously were the top four critical success factors (CSF) of KM initiatives based on Wong and Aspinwall's (2005) study that ranked eleven CSFs of KM in SMEs. Hence, when applying CLES to smaller-sized organisations, the evaluation of the specifics and impacts of each of these internal factors is integral. Table 3 outlines the factors when evaluating the specifics of each internal influence.

Table 3. Internal Environmental Influences

Management Leadership and Support	Originating Sources
• Management understanding of knowledge management • Management commitment to knowledge management • Leadership behaviour as exemplars • Overall leadership support for enhancing collaborative learning/ KM	Hasanali, Holsapple & Joshi, Davenport, Ribiere & Sitar, Liebowitz
Existence of a Knowledge-Friendly Culture	**Originating Sources**
• Extent of a climate that is conducive to collaborative learning • Prominent cultural values or orientations (positive and negative) • Appreciation and implementation evidence of mission statement	Davenport, Skyrme & Amidon, , Janz & Prasarnphanich, Liebowitz, Hasanali, McDermott & O'Dell
Clear Knowledge Strategy	**Originating Sources**
• Existence of a clear knowledge strategy • Alignment of knowledge strategy to business objectives • Records Management practices or strategies • Components of the knowledge strategy	Skyrme & Amidon, Davenport, Liebowitz, Zack, Spender & Grant
Commitment Toward Developing an IT Infrastructure	**Originating Sources**
• Extent to which technology supports work processes • Focus on meeting users' needs in terms of content and usability • Training, support and ongoing maintenance of IT infrastructure • Document Management Systems • Security measures and access privileges (firewalls, authentication) • Business continuity management (backup and disaster recovery)	Skyrme & Amidon, Davenport, Liebowitz, Hasanali, Alavi & Leidner, Sahasrabudhe, Luftman

Investigating the External Environmental Influences

Organisations operate within a broad external environment characterised by a climate that is susceptible to radical change (Papows 1998). Chang & Guetl (2007) consider the industry job market, government policies, competition and technology life cycles to be important external environmental influences to a firm's collaborative learning environment. The standard PEST analysis could serve as an effective approach to strategically consider the external environment of an organisation.

Competition is a key external influence that has a significant impact on the learning environment of a firm. Porter's (1985) Five Competitive Forces model provides a detailed understanding of the competitive environment and relative position of the firm in its industry. The ways in which competitive forces affect a firm's KM and collaborative learning activities can be evaluated based on this analysis.

While the PEST and Porter's Five Forces models may not be necessary for every case study, each model provides a comprehensive structure for thoroughly evaluating the range of external factors impacting on an organisation's learning conditions. It is anticipated that the application of these frameworks will be particularly useful in longitudinal studies or action research.

Operationalising the CLES Framework

The CLES framework is believed to provide a holistic approach to facilitate the development of collaborative learning environments. The key to maintaining a positive environment is to "improve the ecosystem as a whole" (Chang & Guetl 2007), which in practice, refers to incorporating user-centric collaborative learning, technological innovation, content and learning design in line with the prevalent environmental conditions. These could result in the development of a range of knowledge management practices to help learners respond to uncertain conditions. It is vital that all the components that contribute to or interact within the CLES are appropriately integrated and that a balance in the utilisation of each component is achieved (Chang & Guetl 2007).

CASE ANALYSIS AND DISCUSSION

Using the CLES framework, detailed analysis was carried out on two Australian SMEs to examine the *relationships* and *interactions* that occur within the 'environmental borders' of each firm. The examination of each firm's KM effectiveness involved a description of its key business processes, followed by an examination of the learning utilities, learning stakeholders and the impacts various environmental influences have on the organisation's learning environment.

Focus was placed to investigate the range of KM tools and practices employed, and effectiveness of these to support key business processes and organisational value creation; and the impacts of environmental influences on staff interaction, KM initiatives and organisational learning. Each firm was evaluated on the criteria outlined in Tables 1, 2 and 3, and the overall recommendations summarised using a mixture of graphical and textual methods. Based on the performance gaps identified, as well as technological, environmental and sociological factors, a set of actionable enhancements to the firm's existing set of KM tools and practices was recommended. The CLES allowed a range of significant aspects to be considered in order to make suitable recommendations to facilitate a more conducive collaborative learning environment.

Insights on the range of business processes and staff perspectives were gained through interviews, observation of documents or reference materials and survey questionnaires. All key personnel at each firm were interviewed, and surveys distributed to all other employees.

SME 1

This SME specialises in the sales, service and hire of compressed-air equipment in the metropolitan areas as well as throughout state's mining-intensive regions. The firm has been in existence for 29 years, and currently employs 12 staff members, 6 of whom are technicians and the rest office staff. Figure 2 graphically illustrates SME 1 as a Collaborative Ecosystem.
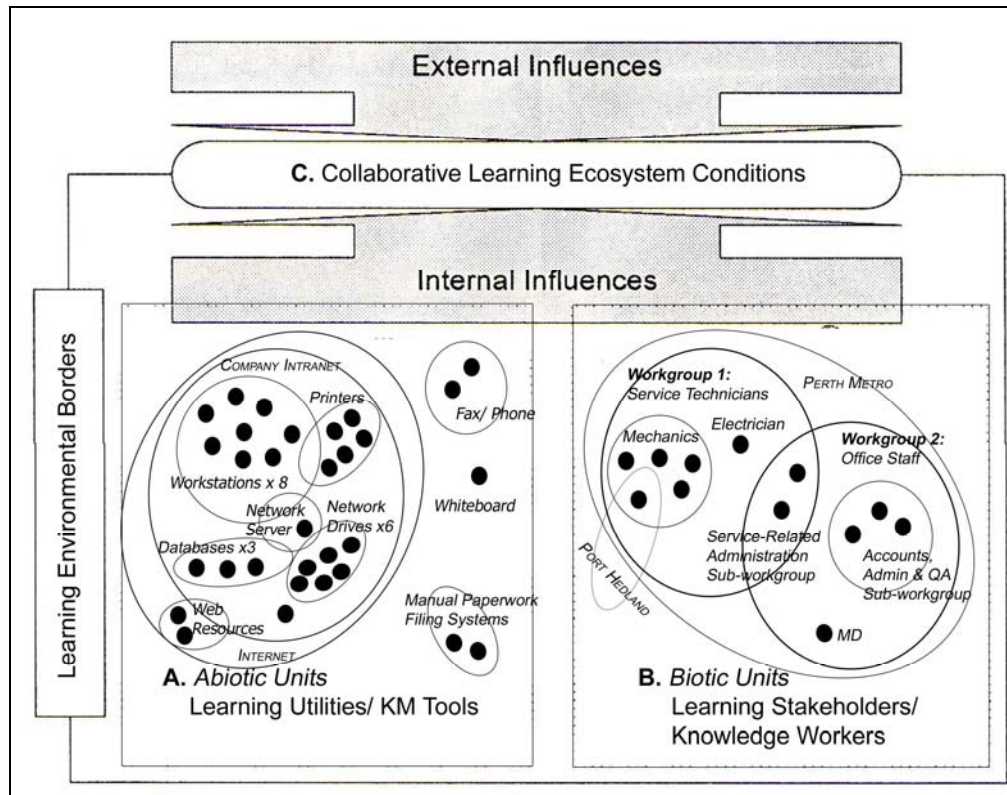
Figure 2: Representation of SME 1 as a Collaborative Learning Ecosystem

A detailed understanding of the firm's key business processes, key communication channels or learning utilities (A) and the individuals and groups of knowledge workers (B) was gained through interviews with the firm's leadership. Table 4 provides a high-level summary of these findings.

Table 4. SME 1 - Summary of Key Business Processes

Business Process	(A) IT and Non-IT Utilities or Comm. Channels	(B) Individuals or Groups Involved	Description of Process
Sales and Marketing	**IT:** Website, Email, Yellowpages/ Whitepages Listing; **Non-IT:** Word of Mouth, On-Site Visits, Signage on Vehicles, Phone, Newsletter;	**Internal:** MD, Office Staff; **External:** General Public, Target Market (mining/ manufacturing/ agricultural)	*Excluded from this article, but can be obtained from authors if desired.*
Sales and Service Quotations	**IT:** Email, CAMS Database, 2Clix Database v2, Microsoft Word; **Non-IT:** Fax, Phone, Post, Hard Copy	**Internal:** MD (New Equipment Sales), WC (Maintenance/ Repairs), SC (Service) **External:** Potential/Existing Clients	
Receiving/ Recording/ Processing Orders for Products/ Parts	**IT:** Email (preferred), 2Clix; **Non-IT:** Fax, Phone, Post, Hard Copy Documents	**Internal:** MD, Workshop Coord. (WC), Service Coord. (SC) **External:** Clients	
Booking Services and Recording Bookings	**IT:** Email, 2Clix; **Non-IT:** Fax, Phone, Hard Copy Docs	**Internal:** WC, SC **External:** Clients	
Scheduling Local Services and Allocating Jobs to Technicians	**IT:** 2Clix; **Non-IT:** White Board, Informal Face-to-Face Discussion (reminders)	**Internal:** SC, WC, Service Technicians	
Performing Compressed-Air Services	**IT:** Specialised Industry-Related Software **Non-IT:** Face-to-Face Interaction with Clients, Hard Copy Documents	**Internal:** Service Technicians	
Recording Details of Service Upon Completion	**IT:** 2Clix, Microsoft Excel Spreadsheets; **Non-IT:** Hard Copy Documents	**Internal:** Service Technicians, SC, Receptionist	
i. Purchase Parts Req'd ii. Match Part Orders to Jobs	**IT:** Email (to and from suppliers), 2Clix; **Non-IT**: Phone, Fax, Documents	**Internal:** WC, SC **External:** Suppliers	
Invoicing & Receiving/ Recording Payment	**IT:** Email, 2Clix, Online Banking Portals; **Non-IT**: Fax, Post, Hard Copy Documents	**Internal:** Office Manager (OM), Receptionist (R) **External:** Clients	
Payroll	**IT:** 2Clix, Online Banking Portals; **Non-IT:** Hard Copy Documents	**Internal:** R, OM	
Quality Assurance	**IT:** QA Management Information System	**Internal:** QAM	

Analysis was conducted on effectiveness of each learning utility (A), the learning attributes of the learning stakeholders (B) and the levels of interaction among these in carrying out work processes. The impacts of various internal and external influences were also examined, and based on the analysis, the key favourable and unfavourable aspects of the SME's KM practices were highlighted in Table 5.

Table 5. SME 1 - Favourable and Unfavourable Aspects of the Learning Environment

Favourable Aspects
1. **ICT utilities are well integrated with users needs** and effectively support workflow processes - good use of databases, network, document templates etc.
2. **High accessibility and accuracy of information** and records
3. **Efficient document retrieval** via Records Management System (Management System)
4. **Well established backup and disaster recovery strategies** - consistently implemented
5. **Strong commitment to developing of a stable IT infrastructure**
6. **Office staff are naturally driven** to carry out their work responsibilities to a high standard
7. **Office staff are keen on learning** for personal improvement
8. **Operates in a thriving (mining) industry** – ample opportunity for expansion
9. **Capable staff members** (both workshop and office staff) whose skills are valuable assets
Unfavourable Aspects
1. **Inadequate user authentication controls** – passwords are freely shared and used
2. **Inconsistent electronic filing and naming procedures** - documents are not always filed consistently; duplicates and outdated copies of the same document often exist
3. **Inadequate enforcement of knowledge strategy** –inconsistencies in QA policies and actual procedures – lack of cooperation/ acceptance due to underlying **resistance**
4. **Significant reliance on individuals' expertise** – ability to accomplish certain activities relies on individuals' 'head knowledge' which is sometimes not documented
5. **Lack of the provision of proper training** (both in work roles and IT systems) suited to learners' needs – good learning utilities but ease of use is not properly ensured
6. **Lack of leadership support and guidance** particularly in the following areas: a. inadequate demonstrated recognition or appreciation of staff contributions   b. lack of management intervention to investigate problems and make positive changes   c. lack of enforcement of accountability for allocated tasks or responsibilities   d. lack of an active input into promoting a healthy knowledge-sharing culture   e. lack of pro-activity in reviewing/ improving operational effectiveness and efficiency
7. **Inadequate face-to-face interaction platforms** – both formal and informal, in particular: a. insufficient formal meetings despite staff opinions that it is necessary   b. lack of opportunity or motivation to engage in informal chats
8. **Relatively low motivation to share knowledge** – generally do so only where there is a personal interest or benefit (for example, to avoid additional work due to others' errors)
9. **Selected, or low levels of mutual respect**
10. **Change-resistant attitudes** result in a **lack of pro-active cooperation/ collaboration**
11. **Relatively high level of clarification or re-confirmation required** - due to poor initial communication, poor communication of expectations or incomplete records
12. **Unarticulated values of individualism, power and knowledge hoarding** are apparent
13. **Unequal distribution of power/ authority** - evidence of unspoken **cliques or divisions**
14. **Avoidance of sensitive issues or problems** – failure/ reluctance to acknowledge and honestly address underlying issues and **no accountability** to do so
15. **Low levels of organisational ownership** – staff generally just want to 'get things done'
16. **Shortage of Skilled Labour** – puts technicians in a position of 'advantage' – they do not adequately respect the authority over them and often act out of convenience

The firm understanding gained through the holistic assessment of the firm led to a set of recommendations for promoting collaborative learning through better KM, each of which is also supported by actionable steps and activities. Some of the recommendations made are documented below:

1. *Management should more pro-actively provide support and guidance.* For example, the firm should *c*onsciously recognise and appreciate staff contributions and achievement.

2. *Recognise the existence of underlying issues and negative cultural values, then pro-actively address them.*

3. Create more platforms and opportunities for face-to-face interaction – currently a severely underleveraged collaborative learning channel. For example, having regular staff meetings.

4. *Enforce greater accountability for the performance of work responsibilities.*

5. *Implement mechanisms to capture employees' 'head knowledge'.* For example, encourage employees to pro-actively document, or implement formal procedures familiar to them but not necessarily to others

6. *Enforce more stringent information security and authentication controls.*

The recommendations are expected to facilitate the rectification of faulty KM practices and learning attitudes - in developing a more effective organisational learning environment.

SME 2

Functioning within the general engineering industry, this firm operates two distinct business functions of fabrication and machining. The organisation is in the early stages of its business, and provides specialised services throughout the state south-west region. It employs 7 staff members, two of whom are office staff.

Applying the CLES, SME 2 was examined in a consistent manner to SME 1, and based on the data collected, the organisation is represented as an ecosystem as shown in Figure 3.
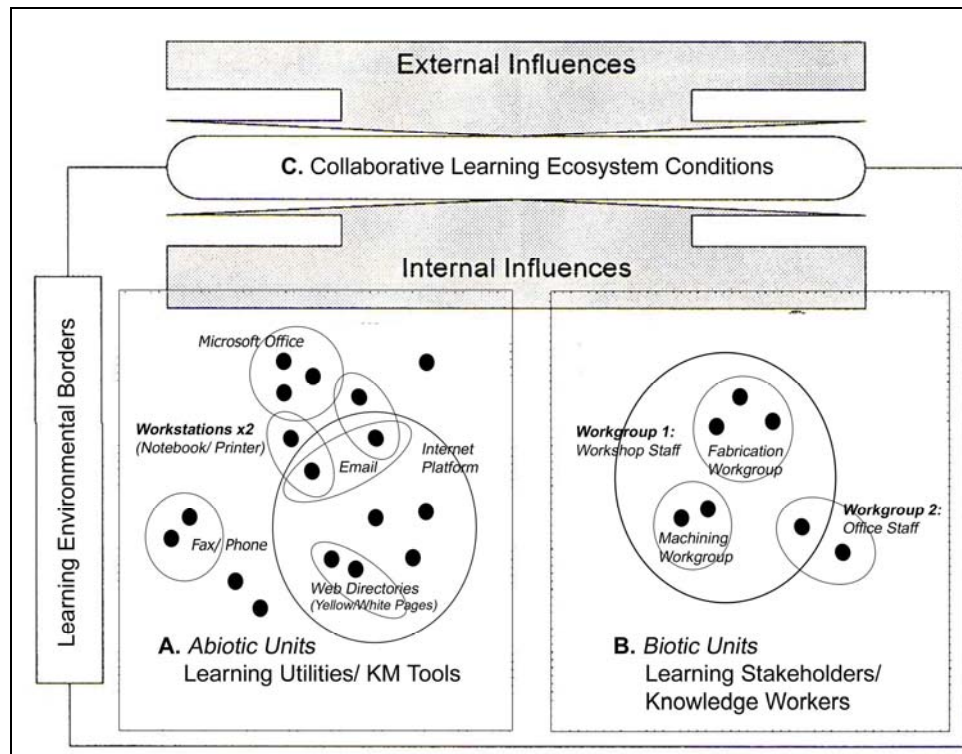

Figure 3: Representation of SME 2 as a Collaborative Learning Ecosystem

The learning utilities and knowledge workers operating within the SME's "environmental borders" were evaluated and documented and similarly to SME 1, a set of strategies to address the unfavourable aspects of the firm's collaborative learning environment was determined (see Table 6).

Table 6. SME 2 - Favourable and Unfavourable Aspects of the Learning Environment

Favourable Aspects
1. **Users willingly adapt to and make the most of technology-oriented utilities** despite the limitations of the current IT setup
2. **Information required is usually easily accessible** in a readily useable format and does not need to be deciphered
3. **Good use of document templates** by office staff to create consistent documents
4. **Frequent and effective use of formal face-to-face interaction platforms** to facilitate knowledge transfer and collaborative learning (eg. daily workshop meetings)

5. **Active leadership involvement in building the organisational structure and culture**
  a.   pro-actively promotes a positive knowledge-sharing culture
  b.   pro-actively improves operational and process efficiency (except fabrication area)
  c.   good communication of *expectations* in terms of work-roles and product-quality
  d.   places value on effective communication (human interaction) among employees

6. **Positive knowledge-friendly culture** that is conducive to collaborative learning
  a.   written goals are people or team-focused
  b.   evidence of written goals demonstrated in practice – trust, team environment
  c.   staff have a genuine interest in each others' lives

7. **Minimal barriers to knowledge sharing** – on both the social and work levels
  a.   atmosphere that values mutual trust, openness and collaboration
  b.   evidence of strong organisational ownership
  c.   staff have a relatively high motivation to share knowledge

8. **Staff have a relatively high motivation to learn** and **consider their working experience to be a constant learning process**   a.   staff have a keen interest in industry news
9. **Staff are given opportunities and the flexibility to leverage their backgrounds and experiences**
10. **Capable and motivated staff members** whose skills are valuable assets
11. **Thriving (mining) industry** and **shortage of engineers at rural areas**
Unfavourable Aspects

1. **IT utilities are inadequately attuned to users' information needs** – available capabilities are not fully leveraged for maximum efficiency and business benefit
  a.   lack of integration of IT utilities in the absence of a local area network
  b.   risk of human data-entry error due to minimal integrity constraints on spreadsheets
  c.   inefficient information sharing and transfer – due to physical separation of workstations and need to use multiple utilities (eg. usb thumbdrive)
  d.   limited ability to efficiently generate summary reports – manual calculations required
  e.   limited capacity of a single spreadsheet could limit the ability to maintain ongoing history in a single, consolidated location

2. **High volume of inaccurate or incomplete documents**
  a.   staff tend to require *additional clarification* (eg. job number on invoice or time sheets)
  b.   maintenance of *duplicate and redundant data* due to lack of integration – uncertainties to updated version

3. **Poor (practically non-existent) backup and disaster recovery strategies**
4. **Inadequate security controls** – only the standard windows account passwords. Critical documents are not password protected
5. **Complacent attitudes towards internet security** - belief that internet threats are unlikely (but acceptable internet security practices at current business life cycle stage)
6. **Significant reliance on individuals' expertise** – ability to accomplish certain activities relies on individuals' 'head knowledge' which is often *not documented*
7. **Substantial reliance (possibly over-reliance) on ad-hoc (verbal) communication** - insufficient enforcement of the use of documents and records for information transfer
8. **Staff are not entirely satisfied with information communication mediums used** – demands further investigation
9. **Weak records-management and filing procedures** – still in the developmental stage
10. **Inadequate pro-active use of learning utilities** by all staff for sharing explicit/ documented information (eg. failure of MD to indicate job numbers on job card, or failure of workshop staff to check job numbers on notice board, incomplete time sheets etc.)

11. **Inadequate fulfilment of certain expectations** – fabrication workshop only
  a.   perceived lack of leadership recognition of contributions or achievements
  b.   perceived lack of leadership support and guidance

In view of the apparent lack in technological integration in SME 2, the key recommendations included:

1. *Actively discover ways to better leverage IT capabilities to effectively cater to users' information needs*

2. *Proactively encourage or encourage the use of desired learning utilites to gather and accurately communicate work-related information*

3. *Implement formal disaster recovery and information security controls*

Summary of Findings and Recommendations

An analysis of the research findings has revealed certain notable trends and issues with regard to KM in SMEs. In line with the results of Wong and Aspinwall's study on the CSFs of KM, the findings of the current investigation further reinforces the pivotal role that leadership and support plays in shaping the organisational learning culture. A firm's management invariably sets the direction and strategies that drive the firm, and findings reveal that the priorities of each firms' Managing Director are both reflected in the documented organisational goals (company charter or mission statement), and manifested in the culture of the firm. For example, the MD of SME 1 perceives KM to be a technology-driven initiative, and there is clear evidence that the firm's strength is its ability to leverage IT capability to support workers to carry out their responsibilities. The organisational environment is task-focused, and due to a lack of leadership involvement in encouraging knowledge sharing on a personal level, the extents of human-interaction, mutual trust and collaboration is lacking. In contrast, the value the Managing Director of SME 2 places on communication and team-building could be seen as the source of the firm's positive knowledge-sharing culture. Leadership's active or passive involvement in shaping the firm's

knowledge culture is a crucial influencer of KM and collaborative learning effectiveness. The case study findings also exposed various KM inefficiencies shared by both SMEs, which are described below.

- *Lack of formal procedures for capturing employees' tacit knowledge*

  Despite the fact that substantial non-codified firm-specific knowledge is embodied in the minds of individuals both firms have a lack of enforced procedures to capture this.

- *Insufficient recognition of workers' contributions*

  There is a lack of leadership recognition for staff contribution or achievement. Without formal performance indicators, it appears that management typically overlooks employee achievements. Appropriate recognition of achievement is crucial to enhance workers' motivation to pro-actively contribute to the knowledge base.

- *Inadequate information security, user authentication and/or recovery planning*

  The prevalent attitude is that the threats of security breaches, information misuse or system failures is insignificant; SMEs tend to overlook the need to enforce stringent controls that minimises the risk of information loss in the event of a breach or failure.

- *Failure to provide adequate formal staff training*

  Insufficient value is placed on the need to provide proper training to staff which could hinder the motivation to learn or diminish the value-add of KM tools. Employees in both SMEs indicated areas of need in which formal training would be beneficial.

- *Disorganised storage of documents - data redundancy and inefficient retrieval*

  Evident in both case studies is the high volumes of duplicate or redundant information. This supports the observation made by Chan, Au and Chao (2006) that SMEs tend to lack formal procedures to manage documents; and as such information retrieval is hindered due to outdated, redundant and/or duplicate data.

- *Tendency to (over) rely on verbal communication channels*

  Workers in both firms prefer learning through face-to-face interactions to reading written documents. Although not a significant issue of concern in SME 1, there could be a tendency for staff in smaller firms that have a people-focused culture to rely on verbal communication and clarification of ambiguity; and hence fail to effectively use the proper channels to share information.

CONCLUSIONS AND FUTURE RESEARCH DIRECTION

This research demonstrates how the application of the CLES framework is valuable in facilitating a holistic understanding of an organisational learning environment. The examination of the interacting components within each SME's operating environment led not only to recommendations on strategies for improvement unique to the individual firms, but also highlighted areas in which SMEs in general face KM inefficiencies.

As evident from the findings, every component that exists within the organisational 'ecosystem' plays a significant role in shaping the collaborative learning environment. Not only is the nature and integration of the learning utilities important, but more critically, it is the knowledge workers' or learners' willingness and capability to leverage these utilities that facilitates effective collaborative learning. It is therefore through improving the relationships and interactions among the "ecosystem components" that ongoing collaborative learning is successfully achieved, elevating the state of knowledge within the firm.

It is anticipated that this research will continue to advance the theoretical framework and application domain of the CLES model. The empirical findings of this study serve as a platform to advance the investigations in future longitudinal studies involving action research. The recommendations in the current study are considered viable by the firms' managers and could be implemented in the respective SMEs. In future longitudinal studies, attention should be paid to the ways in which collaboration with external parties could be enhanced through the use of web and IT platforms. A deeper understanding of the offerings of Web 2.0 and Enterprise 2.0 collaborative tools should be pursued. Possibilities of merging the individual 'Collaborative Learning Ecosystems' (firms) into digital business ecosystems could be analysed, with a view to exploring the development of self-organising virtual communities of practice with clients or partner firms. Additionally, it could be worthwhile to conduct research into ubiquitous learning tools and the potential impacts of their implementation in firms whose services span large geographical locations to facilitate more efficient knowledge transfer. This research is expected to inspire the initiation of additional empirical investigations where the CLES framework is applied to firms of varying sizes and unique characteristics. It is anticipated that in addition to other small businesses, medium-sized firms and large organisations could be examined to holistically evaluate the effectiveness of their knowledge management practices.

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