

SMEs, CO-OPETITION AND KNOWLEDGE SHARING: THE IS ROLE

Margi Levy

Warwick Business School, University of Warwick, Coventry CV4 7AL, UK
Tel.: +44 (0)1203 524658
orsml@rapier.warwick.ac.uk

Claudia Loebbecke

University of Cologne, Koeln, Germany
Tel.: + 49 470 5364
Claudia.loebbecke@uni-koeln.de

Philip Powell

School of Management, University of Bath, Bath BA2 7AY, UK
Tel.: +44 (0)1225 323256
mnspp@bath.ac.uk

ABSTRACT

Co-opetition, simultaneous co-operation and competition, is a recent phenomenon. Co-opetition entails sharing knowledge that may be a key source of competitive advantage. Yet, the knowledge gained by co-operation may also be used for competition. There is little investigation of how this problem may be modeled and, hence, managed. A game-theoretic framework for analysing inter-organisational knowledge sharing under co-opetition and guidelines for the management of explicit knowledge, predicated on co-ordination and control theory has been proposed, but remains untested. This research empirically investigates these issues in the context of small and medium-sized enterprises (SMEs). SMEs provide an interesting setting as they are knowledge generators, but are poor at knowledge exploitation. The paper uses data from UK SMEs to investigate co-opetition, management of knowledge sharing and the role of IS.

1. INTRODUCTION

Knowledge is a source of competitive advantage. Co-opetition (Brandenburger and Nalebuff 1996), or simultaneous co-operation and competition, may aid competitiveness by knowledge sharing, but the exchanged knowledge may be used for competition. Firms have to manage 'knowledge sharing' under co-opetition. Skills in managing inter-organisational knowledge flows may be a source of competitive advantage (Dunning 1988) and managing co-operative relationships involves managing knowledge flows.

IS/IT play a paramount role in co-ordinating and controlling joint ventures and in learning from them and IS is an enabler of new organisational designs.

This paper analyses the role of IS/IT in the context of co-opetition using a game theoretic model to identify the effects of knowledge sharing under co-opetition. The opportunities for knowledge sharing are assessed by an analysis of IS use in small and medium sized enterprises (SMEs). This analysis demonstrates the opportunities for co-opetition. The paper first discusses SMEs and reviews their knowledge management. A description of co-opetition is given and the game-theoretic model presented. The use of IS by SMEs is discussed. The paper posits a relationship between knowledge sharing and SMEs' attitude to the use of IS and tests it through an analysis of UK SMEs. The paper focuses on explicit knowledge sharing through the use of IS in SMEs. Explicit knowledge is concepts, information and insights that are specifiable and can be formalised in rules and procedures, it is 'knowing about'.

2. SMES AND IS

A key inhibitor or enabler of IS use in SMEs is competitiveness. SMEs are driven primarily by customer needs and their competitive environment profoundly affects owners' perception of risk. Market uncertainty is strong as SMEs tend to have small market shares, few major customers and are unable to influence price. For SMEs, customer numbers and customer power tend to be inversely proportional: small numbers of customers dominate SMEs. Innovation and competitive position are correlated in SMEs (Lefebvre and Lefebvre 1993). IS are a mechanism by which SMEs can respond effectively to the market. IS enable response to customer requirements by enabling information to be transmitted directly.

3. KNOWLEDGE MANAGEMENT IN SMES

Knowledge management research focuses on large firms, yet SMEs are likely to be knowledge generators. Non-bureaucratic organisations excel at knowledge generation (Spender 1996), though only firms able to protect knowledge have incentives to innovate, and a major problem is knowing what knowledge is valuable. While the organic structure and culture of SMEs fosters knowledge innovation, many structural features suggest they are unable to obtain sustainable competitive advantage from innovation.

SMEs present a curious position with regard to knowledge management. SMEs face world markets and the need for quality, fast delivery and partnerships, just as their larger counterparts. Collaboration among SMEs and with large firms is common. The ability to share resources is important to SMEs that are unable alone to participate globally. Alliances encourage innovation, expand product portfolios, and forge new supplier relationships (Maynard 1996). However, scarce entrepreneurial resources restrict SMEs' activities (Dyer 1996). SMEs interactions with large firms may range from simply selling to full alliances, and the literature recognises a variety of strategic alliances as mechanisms for knowledge transfer (Mowery et al 1996). None of the SMEs considered here is in a formal alliance, though some have long-term relationships. Yet, even alliances will not necessarily protect SMEs as firms 'must learn how to better utilize strategic alliances as vehicles for learning new technologies and skills from their alliance partners while simultaneously protecting themselves from being deskilled and hollowed out' (Lei and Slocum 1992).

Many SMEs wish to share knowledge, as they see co-operation with customers as a route to survival. For example, SMEs are frequently involved in product design for larger customers. Design involves innovation and understanding customer needs; yet this knowledge is seldom integrated into a wider strategic perspective, due to SME preoccupation with day-to-day viability. SMEs are in co-opetition with other SMEs and with larger firms. Knowledge-intensive SMEs are often employed as constituents of larger project teams. Even non-knowledge intensive SMEs may compete on knowledge - often explicit knowledge of a local market or product. SMEs can gain from knowledge sharing (by collaborative design, cost reductions strategies, and guaranteed orders) but they have much to lose.

4. CO-OPETITION

Co-opetition recognises that firms may benefit from working together. Complementors, those firms whose products add value to a second firm's products, are likely to share knowledge informally. Competitors may come together to leverage advantage through a temporary partnership by agreeing to share knowledge. Under co-opetition, *what to share, with whom, when, and under what conditions* is paramount. For SMEs this is unexplored, but a game theoretic approach may offer insights.

5. GAME-THEORETIC APPROACH

Loebbecke and van Fenema (1998) extend van Hippel's (1988) analysis of the exchange of knowledge by introducing three additional dimensions:

- (1) *Synergy (S)* - extent co-operation yields additional value beyond the sum of the parties' individual knowledge. Synergistic value only exists if both players exchange knowledge.
- (2) *Leverage (L)* - potential of the 'knowledge receiver' to increase its value by exploiting the shared knowledge individually beyond the co-operation.
- (3) Use of 'received' knowledge may have a '*negative reverse-impact*' (NRI) on the 'sending' party. NRI is the extent to which a receiver's use of the knowledge lowers the sender's original value. The exchanged knowledge may be used by competitors and thus weaker its value to the original owner.

Loebbecke et al explore the effects of synergy and leverage on knowledge sharing under co-opetition and the effect of NRI on knowledge transfer (Table 1).

		Leveragibility by Receiving Party	
		Weak	Strong
Synergy	Weak	Ambiguous Attitude toward knowledge sharing Effect of NRI: Negative attitude towards Knowledge Sharing	Negative Attitude toward Knowledge Sharing Effect of NRI: Reinforced Negative attitude towards Knowledge Sharing
	Strong	Positive Attitude towards Knowledge Sharing Effect of NRI: Ambiguous Attitude towards Knowledge Sharing	Ambiguous Attitude toward Knowledge Sharing Effect of NRI: Negative attitude towards Knowledge Sharing

Table 1: Synergy, Leverage and Negative Reverse Impact and Knowledge (Loebbecke et al 1998)

Under conditions of weak leverage and synergy, from the sender's perspective there is little to gain or lose from knowledge sharing. Where there is weak synergy but a strong the receiving side may leverage the knowledge, propensity to share knowledge is low. Strong synergy and weak leverage describes a situation in which a firm would be eager to share knowledge in a 'co-opetitive' environment since there is more to gain from synergy than the other party might derive from leverage. However, with strong synergy and strong leverage, the expected synergy may be offset by the expectation that the other party may gain additional value. From a sender's perspective, strong NRI lowers interest in sharing knowledge.

If *both* parties can translate the knowledge into adjacent business capabilities, they can exploit opportunities beyond the co-operation. This suggests partially diverging interests, typical of co-opetition, and the derivation of competitive advantage requires careful management of knowledge sharing. While these theoretical positions are intuitively appealing, there is little work that investigates empirically how co-opetition operates. This paper illustrates the three forces in action. It uses the outcomes from 43 cases to assess management actions that influence how co-opetition may operate for SMEs, and how knowledge sharing may be managed. This exploratory work seeks to address four research questions:

- is co-opetition an issue for SMEs, and for what types?
- what is the role of IS in managing knowledge in SMEs?

- how are the three co-opetition forces, synergy, leverage, and NRI manifest in SMEs?
- how may SMEs attempt to manage the knowledge sharing process?

The next section reviews the use of IS in managing knowledge.

6. MANAGING KNOWLEDGE IN SMES: THE ROLE OF IS

SMEs use knowledge to manage day-to-day operations. It may be explicit and held on IS, or tacit and held by management. IS adopted by SMEs tend to be simple. Most SMEs view IS as a cost, and are reluctant to invest after start-up. However, some SMEs recognise the potential of IS to change their business - primarily those seeking growth.

Levy et al (1998) develop a framework, the 'focus-dominance' model, to investigate the potential for SMEs to get value from IS capabilities (Table 2). The framework has two dimensions: strategic focus for IS/IT adoption and customer dominance. The first reflects the two main purposes of IS/IT adoption: cost reduction or adding value. Cost reduction represents the traditional use of IS/IT, based on their incremental and reactive adoption. The value-adding focuses on the adoption of IS/IT for competitiveness - a possible source of success differentiation. The second dimension, customer dominance, is a key issue. SMEs are dependent upon their customers in two instances. First, when they are starting up, and second if the SME is a first tier supplier to a major customer it will have few customers. Yet, as SMEs grow market share, their customer base increases and individual customers have less power. The two dimensions create four competitive scenarios for SMEs - efficiency, co-ordination, collaboration and innovation (Table 2). The key characteristics of each quadrant are defined below.

		Strategic Focus	
		Cost	Value Added
Customer Dominance	Weak	Co-ordination	Innovation
	Strong	Efficiency	Collaboration

Table 2: Focus-Dominance Model

The focus of IS use in the *efficiency* quadrant is on control, primarily financial control. There is no integration with business strategy. IS are concerned with improving efficiency of internal processes and are, consequently, viewed as a cost. Knowledge is used to manage day-to-day operations.

In addition to the systems used for cost control, in the *co-ordination* quadrant the main use of IS is to improve customer care due to the larger customer base. Databases manage customers across departments. Inter-department communication is a role for IS. The objective of the IS is to improve the effectiveness of processes but the focus remains internal. There is limited integration of IS with business strategy. Again, the primary use of knowledge is to manage internal operations.

The third grouping is the *collaboration* quadrant. Here, there is an increase in technological sophistication. SMEs need to communicate and exchange information with customers in a cost efficient manner by using systems such as e-mail and EDI. The use of IS is integrated with business strategy, particularly when dealing with major customers. Often, customers are the driving force behind the introduction of new IS. Knowledge transfer and sharing is seen in this quadrant, while much of it is related to operations, exchange of performance management information provides some value.

The final quadrant is *innovation* - the integration of IS with business strategy. Here IS are an integral and tightly woven part of the business strategy. Therefore, IS influences the direction of business strategy as well as react to it. The role of information changes to how the firm may grow and learn rather than maintaining current direction. The need is for systems to support a performance-focused management style. Knowledge is critical in enabling the owner to manage business growth. Table 3 maps the types of information used in

the quadrants. This provides a background to identify when SMEs may find knowledge sharing and co-opetition pertinent.

		Strategic Focus	
		Cost	Value Added
Customer Dominance	Weak	Co-ordination Formal, operational, shared, internal use only through use of internal databases	Innovation Internet provides access to external information To support business strategy. Introduction of knowledge management systems is to improve effectiveness and competitiveness
	Strong	Accounting systems provide basic formal information. Owner's implicit knowledge of business is vital for survival.	MRP, EDI enable exchange of operational information with customers. Performance measurement systems share information with customers
		Efficiency	Collaboration

Table 3: Information Use in SMEs

Co-opetition is unlikely to be an issue for SMEs with a cost-focus strategy. Their systems are primarily internally focused. Levy et al (2001) show that the primary growth path for SMEs is from *Efficiency* to *Co-ordination*. Information is used to manage the business. In the *Efficiency* quadrant the tendency is to provide sufficient information to satisfy basic record-keeping only. *Co-ordination* is an extension of this, with firm size making it necessary to develop databases to provide information access. In contrast, the value-added focus suggests co-opetition may benefit SMEs that are either required to share information with customers (*collaboration* quadrant) or that use IS as a means of changing and developing the business. Information exchange may become core to business strategy (*innovation* quadrant). To explore the potential of SMEs for knowledge sharing under co-opetition, the game-theoretic and the focus-dominance model are integrated, first, to shed light on whether co-opetition an issue for SMEs and for what types of SME. Second, to identify how the three co-opetition forces might be manifest in SMEs.

7. CO-OPETITION FORCES IN SMES

Table 4 suggests that SMEs may be poor at reaping *synergies*, but in some circumstances large firms may do this for them by engaging them in co-operative design. Some SMEs are forced to become inter-dependent, particularly where a condition of being a supplier to a major firm is installation of EDI. SMEs are typically poor at *leverage* - they have limited resources and their main focus is survival. This manifests itself as 'fire-fighting' operational matters. Large customers encourage SMEs to focus on a narrow product range, to hone their skills and reduce costs progressively. SMEs are encouraged to enter open-book arrangements where both parties have access to product data; but this usually end up as a form of control not exchange. SMEs possess weak leverage due to their poor ability to manage both the knowledge exchange process and outcome, while larger firms are more able to lever the knowledge. This suggests that SMEs have a negative attitude to knowledge sharing, but they may have strong potential for synergy. However, *negative reverse impact* makes synergy potential less exciting. There is a strong probability of NRI as SMEs will, indirectly, give useful knowledge to competitors and customers.

		Strategic Focus	
		Cost	Value Added
Customer Dominance	Weak	Co-ordination Little co-opetition	Innovation Synergy – Strong Leverage – Strong Negative Reverse Impact – Weak
	Strong	Little co-opetition	Synergy – Strong Leverage – Weak Negative Reverse Impact – Strong
		Efficiency	Collaboration

Table 4: Co-opetition in SMEs

Synergy, leverage and NRI may operate simultaneously and may operate with a strong or weak effect. That is, synergy may be complete as in the case of co-design of a new product, or leverage may be weak as in the case of a completed good simply delivered to a customer. This paper characterises each force as being either weak or strong based on case evidence. Integrating the co-opetition forces into the focus-dominance model allows investigation of SMEs as knowledge receivers (Table 4).

The main use of information in the efficiency and co-ordination quadrants is to support internal operations. There is little likelihood of co-opetition as the only information shared between SMEs and their customers is order details and invoices. However, it is likely that co-opetition is an issue for firms that take a more strategic view of IS. SMEs in the collaboration quadrant have a few key customers that expect information on product and process quality. This exchange is critical to the relationship, hence synergy is strong. Few SMEs use information to exploit knowledge on their own - leverage is weak. However, SMEs do use knowledge to reduce customer power. Hence, NRI is strong. The innovation quadrant contains dynamic SMEs that recognise the value of information and knowledge as a strategic resource to enable change. The businesses often concern information exchange, and there is an expectation of strong synergy. SMEs use information to improve, grow and attract other customers, indicating strong leverage. However, it is unlikely that SMEs' use of knowledge will lower the sender's original value, hence NRI is weak.

8. RESEARCH METHOD

This paper uses data from 43 UK SMEs - part of a larger research programme investigating SMEs use of IS. Analysis is based on Levy and Powell's (2000) method for organisational information strategies for SMEs. This identifies the business context and the business processes that may need redefining to ensure strategic use of information. Each case was conducted over a week during which the owner, senior management team and other employees took part in a number of semi-structured interviews of 1-2 hours. History, background, market material and interview outcomes are analysed. IS models are used to demonstrate the role of IS in each SME. For example, the IS strategic grid identifies the way systems are used. The purpose for which IS/IT is used is analysed. Porter's 5 forces is applied to investigate strategic possibilities from IS/IT. Additionally, organisational maps are drawn to identify whether IS contributed to efficiency and effectiveness. Soft Systems Methodology (SSM) provides a framework for investigating information flow and business process issue. The interviews identify the history of IS development and also the future potential for IS adoption. Pertinent issues are reported back to participants to provoke discussion and to refine findings.

<i>Strategic Focus</i>							
Cost Focus				Value Added			
	S	L	NRI		S	L	NRI
Co-ordination				Innovation			
Warwick Training Brokerage	S	S	W	Radio mast Surveyors	S	S	S
Coventry Training Co	N	S	W				
Biotechnology products	S						
Chemical Resin Co	N	S	W				
IT Education Charity	S						
Birmingham solicitors	N	S	W				
Efficiency				Collaboration			
Precision Tool Manufacturers	S	W	W	Birmingham Clutches	S	S	S
Coventry Designs	S			Stratford Signage	S	S	W
Garden Health Care	S		W	Heath Springs	S	S	S
Tree House Health Care	S		W	Solihull Lighting Co.	S	S	W
Chemical Analysis Co	N		W	Car Paint Co.	S	S	W
Heating Engineers	N	W					
Sea Cable manufacturer	S						
Perforated Tubes	S		W				
Burring Engineers	N	W	W				

Table 5: Opetition Criteria by SMEs

Data analysis particularly considered the management and customer support IS. SSM also highlights issues of relationships between the SMEs and their customers. Based on this, 22 case firms do not exhibit any of the three co-opetition forces. In the remaining 21 firms the forces are categorised into weak (W) or strong (S) dependent upon the influence of customers and suppliers ('N' indicates the force is not apparent) (Table 5). The perspective taken is that of SME as knowledge receiver to determine possible benefits in these relationships.

9. ANALYSIS

The analysis reviews each of the strategic foci of the focus-dominance model, testing the research questions and identifying divergent results and their implications. The relationship between the three co-opetition forces is considered.

9.1. Cost-Focus Strategy

There is little co-opetition in cost-focused SMEs. Nevertheless, these firms provide a background to the analysis of value-added focus firms and the potential for co-opetition is highlighted. The lack of opportunity for co-opetition may determine why they remain in the efficiency and co-ordination quadrants.

Synergy Perspective. Most firms following a cost-focus strategy for IS have weak synergy with customers. They provide a clearly defined service. There is little interest in expanding to other services or products. None use management information to support growth. The value of customer information is not considered in monitoring or managing the business. However, several SMEs have potential for synergy. For example, Warwick Training has a close relationship with a university to manage overseas applications. Garden Health Care works with a health authority to identify future requirements and manage costs. Perforated Tubes is a preferred supplier for some motor manufacturers. While there is evidence of strong synergy, the SMEs do not have the capacity or the inclination to exploit the knowledge effectively. Table 6 reviews the firms' systems by sector, and assesses the impact on synergy.

All firms except the health-care providers have strong synergy in their production systems as they need to work closely with customers to develop products. However, the SMEs do not extend this exchange beyond the technical. Knowledge that could assist in improving internal management processes or improved service does not exist. Only the IT education charity has strong synergy in customer support since government is involved in determining the direction of projects and information dissemination. However, even here management information is not used to drive change in relationships. Systems for management support are limited. These SMEs focus on internal efficiency and effectiveness. The health-care firms differ. They have to work with health authorities to manage provision for elderly people. The focus is on managing costs and exchanged knowledge is about cost and capacity; no strategic information is formally exchanged. Thus, limited synergy occurs in cost-focused SMEs that have close customer relationships. There is scope, but the SMEs require IS targeted on management and customer support.

Leverage Perspective. There are no circumstances here of leverage but not synergy. Thus, the only cost-focused SMEs that have potential for leverage are those outlined in Table 6. Leverage is weak in those SMEs in the efficiency quadrant that have strong synergy. They depend on existing customers and would find it difficult to break these relationships. Their limited management information and customer IS render it unlikely they can use existing knowledge to diversify. However, leverage is strong for SMEs in the co-ordination quadrant with strong synergy. These are less dependent on existing customers and can use the knowledge they gain to expand and diversify. For example, Training Brokerage uses course information to identify opportunities to become an independent training provider. Biotechnology Products uses knowledge about developments in biotechnology to introduce new products and markets.

NRI Perspective. In all cost-focus cases NRI is weak. No SMEs can use shared knowledge to refocus the business to challenge the knowledge suppliers. There are three causes. First, owners are primarily concerned

with core daily operations. Second, they have insufficient resources. Third, they do not have IS to identify areas where they could challenge customers that supply the shared knowledge.

Synergy	Production Systems	Management Systems	Customer Support Systems
Training Providers			
Coventry training Co.	Trainee recording Claim system Time reporting	Accounting Environmental monitoring e-mail	
	Strong synergy – info on students, courses, costs exchanged with council	Weak synergy – information primarily for internal use	Weak Synergy - no systems to support customers
Training Brokers			
	Customer database		
	Strong synergy – info on students, courses exchanged with university	Weak synergy - no systems to support management	Weak Synergy - no systems to support customers
IT Education Provider	Project planning IT information services database	E-Mail Sales System Finance System	Contact database Events database
	Strong Synergy – research database depends on government project priorities	Weak Synergy – information primarily used internally	Strong Synergy – government/ other agencies share info
Health Care Providers			
Garden Health Care	Catering Budget Personnel Reporting	Accounting Invoicing Budget Monitoring	
	Weak Synergy as systems are primarily internal	Strong Synergy, info exchanged with health authority to plan care	Weak Synergy - no systems to support customers
Tree House Health Care	Nurse Call	Accounting	
	Weak Synergy as system is Internal	Strong Synergy info exchanged with health authority to plan future care	Weak Synergy - no systems to support customers
Manufacturing			
Perforated Tube Co	Labelling system CAD	Accounting	
	Strong Synergy - Design info exchanged with customers	Weak synergy – info not part of customer exchange	Weak Synergy - no systems to support customers
Precision Tool Co	CAD System MRP system	Accounting System	
	Strong Synergy - Design info exchanged with customers	Weak synergy – info not part of customer exchange	Weak Synergy – no systems to support customers
Sea Cable Manufacturer	CAD, Production, purchasing and inventory management (not used)	Sales order processing, order book analysis, (unused) accounting system	
	Strong Synergy - design info exchanged with customers	Weak synergy – info not part of customer exchange	Weak Synergy – no systems to support customers
Business Services			
Coventry Designs	CAD	Accounting	
	Strong Synergy - close relationship with customers to develop marketing strategies	Weak Synergy - limited use of info from previous client contacts	Weak Synergy - no systems to support customers
HiTech			
Biotechnology Products	Price codes Software development tools	Order records Accounting	Customer records
	Strong synergy - close relationship with customers to develop software	Weak Synergy – info not used to identify growth opportunities	Weak Synergy - no systems to support customers

Table 6: Cost-Focused SMEs

Thus, most SMEs that view IS as a cost do not consider co-opetition. However, a minority has opportunities, particularly where there is a close customer relationship. The ability to leverage knowledge depends on customer dominance. SME owners in the efficiency quadrant are only interested in limited growth and their experience of IS as a repository for knowledge is restricted. SMEs in the co-ordination quadrant are more likely to be interested in leveraging knowledge. They are already managing growth and may be persuaded that a value adding focus for IS is important to growth.

9.2. Value-Added Focus Strategy

Synergy Perspective. SMEs here have close relationships with 3-5 customers with whom they do 80% of their business. They mainly manufacture, although Stratford Signage provides livery. Radio Mast Surveyors identifies sites for mobile phone masts. Synergy is strong due to involvement in design as a preferred supplier, often to the motor industry. However, Solihull Lighting has strong synergy because of production systems integration. Table 7 identifies the systems and the synergy effects. As with cost-focused SMEs, most synergy is in production systems. However, performance measurement is essential to be a preferred supplier, leading to strong synergy in management information. Customer care and relationship management is critical and synergy is strong in customer support. Car Paint Co. differs as they have an operative on the client's premises, relying on a personal touch rather than systems.

Leverage Perspective. Leverage is weak in all SMEs in the collaboration quadrant as they are locked into production of one product and cannot use customer knowledge to migrate. Only in product design may leverage be possible, but there is no evidence of a desire to alter direction radically. The innovation quadrant SME is run by an entrepreneur seeking the next growth area in mobile communications. He uses customer-derived knowledge to plan and develop applications for radio masts and identify opportunities overseas and growth areas such as WAP phones.

Synergy	Production Systems	Management Systems	Customer Support Systems
Manufacturing			
Birmingham Clutches	MRP CAD	Accounting Performance measurement	EDI
	Strong Synergy – Design info exchanged	Strong Synergy – info on performance exchanged	Strong synergy – exchange of info to provide JIT service
Heath Springs	MRP CAD	Accounting Performance measurement	EDI
	Strong Synergy – Design info exchanged with customers	Strong Synergy – info on performance exchanged	Strong synergy – exchange of info to provide JIT service
Solihull Lighting Co	MRP (sales and production)	Accounting	EDI
	Strong Synergy – mainly order processing	Weak Synergy – info only used internally	Strong Synergy – info exchanged to enable forecasts of product reqs
Car Paint Co	MRP	Accounting Sales Forecasts	
	Strong Synergy with customers designing paint requirements	Weak synergy – paint tested visually	Strong Synergy – not systems based, operatives based at manufacturer
Stratford Signage	CAD/CAM Signflow	Accounting	External e-mail
	Strong Synergy - design info exchanged with customers	Weak Synergy – info only used internally	Strong Synergy – mainly used for discussion on operations
Business Services			
Radio Mast Surveyors	CAD for plans Photo manipulation software	Accounting Work progress Monitoring	Lotus Notes e-mail
	Strong Synergy – plans exchanged with customers	Weak Synergy – info only used internally	Strong Synergy – building up knowledge base with customers

Table 7: Value Added Focus SMEs with Strong Synergy by Industry Sector

NRI Perspective. *NRI in these SMEs varies. SMEs with performance measurement systems use them to support discussions with customers to reduce pressure for price reductions. At Heath Springs, presentation of current efforts to reduce costs prevented further price reductions. In all other manufacturers, NRI is weak, as for cost-focused SMEs. The key difference is that here the synergistic relationship is stronger, and any attempt to challenge the customer might be seen as a threat.*

Thus, co-opetition is relevant to SMEs for whom IS is a means of adding value. All have close customer relationships and work jointly on design and manufacture. Their IS are fairly advanced. Knowledge leverage is difficult due to symbiotic SMEs-customer relationships. However, NRI exists when performance measurement is part of doing business, suggesting some support for more openness in collaborative arrangements leading to knowledge exchange.

10. MANAGING KNOWLEDGE TRANSFERS

This paper focuses on explicit knowledge sharing through the use of IS in SMEs. It now addresses how SMEs may manage explicit knowledge exchange either to exploit or to mitigate the co-opetition forces. Managing explicit knowledge sharing requires; contractually defined quid pro quo knowledge exchange contents and procedure, and inter-organisational co-ordination, and planning and control procedures. Explicit knowledge can be readily assembled and exploited, yet the stickiness of tacit knowledge engenders synergy, leverage and NRI impacts less likely. Yet, for many SMEs, theirs is explicit knowledge of markets and customers, and the problem is guarding easily transferable information since small incremental knowledge can distinguish a firm (Cohen 1998).

SMEs are typically in a poor power position vis-à-vis their larger counterparts. Thus, in terms of explicit knowledge, SMEs are poor at recognising the value of their knowledge but are often forced to 'exchange' it. Further, their lack of strategic or external focus, coupled with poor IS, makes them poor at monitoring large firms' or competitors' performance. SMEs are poor at the contractual aspects of knowledge exchange. They are resource poor, so cannot retain adequate legal advice, and large firms are disinclined to negotiate. The primary mechanisms by which firms may manage co-operative knowledge exchanges include *co-ordination by mutual adjustment*, and *planning and control procedures*. Explicit knowledge allows comprehensive contracts to be developed that specify the contents and procedures for knowledge transfer.

Successful SMEs cultivate their customers to maintain loyalty. In the automotive sector customer influence extends to ensuring the SME can demonstrate quality of process and product by formal, computer-based performance monitoring systems. SMEs try to gain leverage by using performance information to limit price reductions, but the cases suggest success is limited. Information on operations and design are expected electronically, which may bring collaborative advantage. Operationally, firms need to screen their partner's performance and adjust accordingly. Formal planning is uncommon in SMEs leading to outdated management practices and autocratic management that may limit the ability to take advantage of knowledge from customers. SMEs' management structures are flatter and less bureaucratic than in large firms encouraging team and cross-functional orientation and efficient and informal communications. However, this may militate against formal planning and control procedures. Tables 8-11 demonstrate the contractually defined information flows, the processes by which information is exchanged and the nature of inter-organisational co-ordination, and planning and control procedures employed by the case SMEs. The tables are arranged by focus-dominance quadrant.

Efficiency Quadrant. The cases (Table 8) have strong synergy, weak leverage and weak NRI. Knowledge exchange is formal, though often there are no planning and control procedures. Firms have close customer relationships, but these are usually formal and limited to information supporting contracts. The game-theoretic model suggests that SMEs would benefit from knowledge sharing although owners might be concerned about its implications. The formality argues for more structured systems to assist SMEs in managing knowledge exchange more effectively. Perhaps unsurprisingly, Coventry Designs stands out as having more informal relationships as it is in a sector where creativity is important. Sea-Cable lacks planning and control procedures as it is young, and systems are being developed.

SME	Contract Defined Information	Process for Exchange	Inter organisational Co-ordination	Planning & Control Procedures
Precision Tool Manufacturers	- Design - Orders	Manual formal	Formal between design staff	Defined by customer
Coventry Designs	- Design Information - Costs	Meetings with clients	Informal meetings	None
Garden Health Care	- Patient cases - Budgets/Account - Medical	Formal process with Social Services	Formal process for exchange	Tight, clear structure for delivery of info
Tree House Health Care	- Patient cases - Budgets/Account - Medical	Formal process with Social Services	Formal process for exchange	Tight, clear structure for delivery of info
Sea Cable manufacturer	- Designs	Formal meeting	Limited	None
Perforated Tubes	- Design - Perf. Measure - Orders - Accounts - Invoices	Manual Formal	Formal process	Defined by customer

Table 8: Explicit Knowledge Transfer - Efficiency Quadrant

Co-ordination Quadrant. The SMEs (Table 9) all have strong synergy, strong leverage and weak NRI. The main difference between this group and those in the efficiency quadrant is that the latter lack formal planning and control procedures. The game-theoretic model suggests these firms might not be sure of the benefits of knowledge sharing. Therefore owners might want to explore business possibilities beyond the limitation of current customer relationships.

SME	Contract Defined Information	Process for Exchange	Inter organisational co-ordination	Planning & Control Procedures
Warwick Training Brokerage	- Student details - Course details	Formal process with University	Formal process for exchange	None
Coventry Training Co	- Course details - Student details - Costs	Formal process with council	Formal meetings	Clear structure
IT Education Charity	- Research	Formal meetings	Formal meetings	None
Biotechnology products	- Software - Design	Send software Meetings	Informal	None

Table 9: Explicit Knowledge Transfer - Co-ordination Quadrant

SME	Contract Defined Information	Process for Exchange	Inter organisational co-ordination	Planning & Control Procedures
Warwick Training Brokerage	- Student details - Course details	Formal process with University	Formal process for exchange	None
Coventry Training Co	- Course details - Student details - Costs	Formal process with council	Formal meetings	Clear structure
IT Education Charity	- Research	Formal meetings	Formal meetings	None
Biotechnology products	- Software - Design	Send software Meetings	Informal	None

Table 10: Explicit Knowledge Transfer - Collaboration Quadrant

Collaboration Quadrant. The SMEs in Table 10 have strong synergy and weak leverage primarily as they are preferred suppliers. This is the first grouping to use IS, usually EDI, for knowledge exchange. Use of

electronic systems forces exchanges to be formal and structured. This confirms the contention that these firms will have a positive attitude to knowledge sharing, though there might be concern that the knowledge provided might be used negatively. Customers define what is exchanged, but there are examples of SMEs refusing knowledge sharing requests - a key difference between manufacturing SMEs in the efficiency quadrant and those in collaboration.

Innovation. Radio Mast surveyors has strong synergy, strong leverage and strong NRI. Yet, information exchanges are fairly formal. There are no planning and control procedures that enable greater freedom for growth, as in the co-ordination quadrant. Additionally, there is significant use of IS to manage and disseminate knowledge. The attitude and knowledge of the owner determines the approach. The game-theoretic model suggests that firms with these characteristics may have an ambiguous attitude to knowledge sharing. However, this is not evident here, the owner positively encourages it.

SME	Contract Defined Information	Process for Exchange	Inter organisational Co-ordination	Planning & Control Procedures
Radio Mast Surveyors	- Site Information - Planning Information	Report delivery Formal process	Due date Formal	None

Table 11: *Explicit Knowledge Transfer - Innovation Quadrant*

The main message is that SMEs have greater freedom to plan and develop their own growth and leverage the use of information when there are limited planning and control systems. IS are important in managing customer relationships when SMEs take a value-added view of IS investment.

11. CONCLUSIONS AND IMPLICATIONS

This exploratory research sought to understand the context of co-opetition in SMEs, the role of IS in managing knowledge, how the three co-opetition forces, synergy, leverage, and negative reverse impact, manifest themselves, and how SMEs may attempt to manage the knowledge sharing process. The outcomes demonstrate that co-opetition is an issue for value-added focused SMEs and may become so for others. Co-opetition forces do impact on SMEs, though the context is significant. Some SMEs employ tactics to mitigate and exploit these forces through knowledge sharing management, though their efforts are largely unsuccessful. IS plays a part in these tactics.

Managing inter-organisational knowledge processes play a prominent role in sustainable competitive advantage. The game theoretic analysis provides a structure for modelling knowledge sharing under co-opetition. The model investigates how SMEs will fare. SMEs need to consider how to make themselves receptive to exchanged knowledge and flexible and responsive enough to gain competitive advantage if this is ephemeral. It may be that knowledge is bundled with other physical assets and that there are pre-requisites for using the knowledge fully. SMEs are knowledge creators, but are poor at knowledge retention. Part of the resolution of this lies in the SMEs' own hands. They need to be proactive in knowledge sharing agreements, to recognise knowledge has value and the value added derived from knowledge exchange. While some SMEs here expect new technology to open up global markets, their collaborations are essentially local. SMEs will be more vulnerable as inter-organisational IS spread and the world gets more information exchange intensive. At minimum, SMEs need to recognise that these forces exist. Recognition is the first step in management, though often the SMEs cannot mitigate the forces, especially from major customers. They may however, be able to gain more value internally from the knowledge they are forced to share. As with many issues in SMEs, the owner-manager attitude is paramount. That most of the knowledge shared by SMEs is explicit, suggests that some management of the sharing process is within the hands of the SMEs.

REFERENCES

Brandenburger, A. and B. Nalebuff (1996). *Co-opetition*. Doubleday, New York.

- Cohen, D. (1998). Towards a Knowledge Context. *California Management Review*, 40 (3), 22-39.
- Dyer, J. and H. Singh (1998). Relational View. *Academy of Management Review*, 23 (4), 660-679.
- Levy, M. and P. Powell (2000). IS Strategies for SMEs: an organisational perspective. *Journal of Strategic Information Systems* 9, 1, 63-84
- Levy, M., P. Powell and R. Galliers (1999). Assessment of IS Strategy Development Frameworks. *Information and Management*, 36, 247-261.
- Levy, M, Powell, P and Yetton, P (2001): Critical Issues for Growing IS Capabilities in SMEs, *Small Business Economics forthcoming*.
- Lefebvre, L. and E. Lefebvre (1993). Competitive Positioning. *Small Business Economics*, 5, 297-305.
- Loebbecke, C. and P. van Fenema (1998). Towards a Theory of Inter-organizational Knowledge Sharing during Co-opetition, *Proceedings of European Conference on IS*, Aix-en-Provence.
- Maynard, R (1996). Striking the right match. *Nation's Business*, 84 (5), 18-20.
- Mowery D., Oxley J and Silverman B., (1996), Strategic Alliances and Inter-firm Knowledge Transfer, *Strategic Management Journal* 17, pp.77-91.
- Reid, G. and C. Jacobsen (1988). *The Small Entrepreneurial Firm*. Aberdeen Press.
- Spender, J. (1996). Making Knowledge the Basis of a Dynamic Theory of the Firm, *Strategic Management Journal*, 17, 45-62.
- Van Hippel, E. (1994). 'Sticky Information' *Management Science*, 40(4), 429-439.