

SME Flexibility and the Role of Information Systems*

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ABSTRACT. Small and medium-size enterprises (SMEs) are a major component of all economies and are generally considered to be flexible, adaptive organisations. Although lagging behind their larger counterparts, SMEs are beginning to invest in information systems. Using data derived from a set of manufacturing SMEs located in the U.K., this paper investigates whether SMEs really do exhibit flexibility and if their use of information technology enhances or inhibits such flexibility.

1. Introduction

Small and medium-size enterprises (SMEs) are a volatile, yet vibrant part of the business environment throughout Europe. Indeed, in the U.K., after a number of years of relative decline in the 1960s and 1970s, the importance of manufacturing SMEs is increasing (Storey, 1994). Storey shows that firms with fewer than 200 employees constitute 31.8% of the manufacturing sector. Further, it is contended that the SME sector will increase in importance due to a shift in the strategic policy of many major organisations – the movement towards the ‘hollow’ factory where most assembly work is sub-contracted rather than done in-house. SMEs are the major beneficiaries of this policy.

However, most SMEs tend to produce one or two standard products for a narrow range of customers. They are critically dependent upon these customers for their existence and have relatively little power to raise prices. Storey and Cressy (1995) characterise small businesses as exhibiting many of the attributes of firms in perfect competition. They have little power to influence market

price by altering output quantities, small shares of the market and are unable to erect barriers to entry to the industry to other firms.

SMEs are often depicted as flexible enterprises, while information systems (IS) and information technology (IT) are held to be keys to the future flexible organisation. Ives and Mason (1990) argue that ‘information technology offers exciting opportunities to revitalise customer service by moving a company and its product offerings closer to the customer, thereby recapturing the conditions of intimacy and flexibility that characterised earlier eras’ (p. 67). Thus, on the face of it, since both SMEs and information systems are providers of flexibility, and as computing costs decline so SMEs invest more in technology, the expectation might be that IS would enhance the flexibility of SMEs. Indeed, Storey and Cressy, suggest that SMEs’ ‘speed of adoption of new technology (e.g. new software system) is often greater . . . [than that] . . . required in large firms’.

This paper investigates whether SMEs are, in fact, the flexible beasts as portrayed, whether information systems are universal providers of flexibility and if the development of IS capabilities in SMEs inhibits or enhances flexibility. This discussion is illustrated by the experiences of a number of firms from the manufacturing sector in the West Midlands of the U.K.

2. Issues of flexibility

Flexibility is a much-discussed issue (Genus and Dickson, 1995). Eardley et al. (1997) suggest that flexibility is the ability to change direction rapidly or deviate from a predetermined course of action

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– or as Evans (1991) puts it, the ‘ability to do something other than that which was originally intended’. Indeed, as he states, strategic flexibility is a critical success factor when most elements of an organisation’s environment and systems are in a state of continuous flux. Eppink (1978) characterises flexibility as a strategic response to the unseen. Volberda (1996) points out the inherent paradox in the concept of flexibility – that it must be combined with stability. On the one hand, organisations need to be able to adapt quickly, while on the other, they can only obtain efficiency from stable processes.

Volberda maintains that under the ‘hypercompetition’ which characterises the present environment, firms will thrive only if they have adaptive capabilities. More specifically, according to Eardley et al., organisations desire flexibility since it offers three major advantages (Avison et al., 1995). First, if the environment is turbulent, the ability to respond flexibly to forced change may be necessary for basic survival. Second, flexibility may allow the organisation to achieve superior levels of internal efficiency through such activities as business process re-engineering (Hammer, 1990), though the truly flexible organisation would not seem to require process re-engineering. Third, flexibility of response may give competitive advantage through its ability to develop new performance-enhancing features and to exploit first-mover advantages (Porter and Millar, 1985; Van de Ven, 1986). To these can be added the issue of slack resources which are a key issue in promoting innovation. In small firms with little slack innovation may be stifled. Genus (1995) points to the lack of clarity as to the meaning of flexibility, though its essence can be derived from synonyms such as robustness, which refers to a system’s ability to absorb or withstand the impacts of unpredicted events (Rosenhead et al., 1986) and versatility, the capability to respond to a range of future events or to modify behaviour quickly (Bonder, 1976).

There are two frameworks which might be used to demonstrate the actual or potential flexibility in SMEs. The more recent (Volberda, 1996), identifies four types of flexibility – steady-state, operational, structural and strategic and then maps these onto three organisational forms, rigid, planned and flexible. However, here, the concern

is more with the process of flexibility attainment, especially via IS, and thus the framework devised by Evans (1991) and discussed in an information systems context by Eardley et al. (1997) is used. This identifies two aspects of strategic flexibility; temporal and intentional. The temporal aspect may be *ex ante* – preparing in advance for an unpredictable future change – or *ex post* – making adjustments after an event has occurred. Likewise, the intentional aspect may be offensive or defensive. Evans uses these to develop a framework of four manoeuvres, termed as pre-emptive, protective, corrective and exploitive.

As Eardley et al. (1997) identify, a pre-emptive manoeuvre allows a firm to take advantage of possible future events and is most useful where the future is unpredictable and where the exploitation of innovation is a tool of competition. Heidegger (1977) describes the actions of firms which create a domain into which new products, distribution channels or business methods can be introduced as ‘enframing’, implying that an options framework is set up, from which a future choice can be made. A robust strategy is one which creates and leaves open options, that is, it has the maximum number of reachable outcomes and will absorb changing circumstances and cater for objectives not being fully formulated. According to Eardley et al., pre-emptive manoeuvres imply some future tactical actions. Conversely, whereas pre-emptive tactics are put into effect before an unforeseen trigger, exploitive tactics are deployed after the event. Exploitive manoeuvres capitalise on the opportunities created by chance or pre-emptive tactics. A firm’s ability to use IS or IT to exploit these depends on its ability to identify situations appropriate to its IT skills and to develop the right IS quickly.

Protective manoeuvres applied before unpredictable events are contingencies which attempt to limit the damage caused by an unknown future. Insurance against an unsuccessful strategy is obtained by having a choice of options available. Evans includes the installation of buffers, such as large inventories, in this category. It is significant that applications of IT, such as just-in-time (JIT) systems aim to supplant these by improved use of information. A further protection is barriers to entry. There are numerous, mostly unsuccessful, examples of the use of IT and IS as a barrier to

deter potential rivals from entering a market (for instance, ASAP from American Hospital Supply and CMA from Merrill Lynch). Due to the nature of technology, these barriers are usually temporary. As Cragg and Finlay (1991) identify, the major problem with using IT for competitive advantage is that it is easily transferable. Lastly, corrective manoeuvres, such as survival manoeuvres to prevent more damage, are used when other tactics fail.

The flexibility opportunities can be modelled against the criteria identified by Eardley et al. and Evans as shown in Figure 1.

This suggests that organisations take pre-emptive action to gain competitive advantage or use business process re-design for internal process alignment, which makes them more flexible and able to respond to opportunities in the market. Exploitive actions are linked to competitive advantage since they are about seizing opportunities as they are identified. Protective actions are taken to survive in a changing market and may also be used as a means of improving effectiveness within the organisation. Corrective actions are associated with survival. The contention is that information systems can be used to give flexibility in large companies using the four manoeuvres but their applicability in small and medium-sized enterprises remains unexplored. This paper begins that exploration, based on analysis of a set of U.K. manufacturing SMEs.

2.1. SMEs and flexibility

One of the main characteristics attributed to SMEs is flexibility (Storey, 1994; McKiernan and Morris, 1994; Gupta and Cawthorn, 1996). Indeed, their survival is often ascribed to their adaptability and speed of response to environmental change,

though environmental change is multi-faceted and responses to some aspects may be easier than to others. Small firms 'are perceived of as being significantly more "flexible" than large firms' (Storey and Cressy, 1995). In a similar vein, Julien et al. (1994) use the term 'dynamism' to describe SMEs' approaches to increasing productivity and market differentiation, finding that market type determines the need for dynamism in competing globally. They show that product differentiation is more critical than information systems in competitiveness.

SMEs have the reputation of being able to respond readily to customers' changing needs. Several reasons are cited for this form of flexibility. First, owners of SMEs have considerable knowledge about the firms' capabilities. Lefebvre and Lefebvre (1992) find that a CEO's personal characteristics, personality and decision making styles are positively correlated with innovativeness in small companies. They further argue (Lefebvre and Lefebvre, 1993) that the attitude of the CEO influences the effort put into research and development which is essential for innovation.

Second, SME management structures tend to be flat and there is an absence of bureaucracy since management teams are small and most SMEs managers work together closely on a day-to-day basis (Gupta and Cawthorn, 1996). Gupta and Cawthorn (1996) believe that flexible manufacturing provides a means of enabling SMEs to provide customers with new and innovative products, that is, to respond flexibly to market demands. They show, critically, that it is the organisational culture which is important for an SME to be seen as flexible, particularly a culture which encourages learning rather than control. This is supported by Carrie et al. (1994) who identify 13 types of industrial situation in which SMEs

Manoeuvres for flexibility	Advantages of flexibility		
	Survival	Internal process alignment	Competitive advantage
Pre-emptive		◆	◆
Exploitive			◆
Protective	◆	◆	
Corrective	◆		

Figure 1. Manoeuvres to gain advantage from flexibility.

operate. In a key example of the flexible firm, they indicate that it is people who provide flexibility rather than complex, advanced manufacturing systems. Third, due to close management involvement there is tight control over production processes. Tight control, though, is a double-edged sword. It might lead to rigidity when coupled with repetitive procedures in a command and control environment (Gupta and Cawthorn, 1996). Finally, SMEs can respond quickly to changes in demand as their production runs tend to be small.

2.2. *Planning for flexibility through IS*

Response to rapid change in the environment and in technology requires flexibility in strategic processes supported by flexible infrastructures (Evans, 1991). However, SMEs seldom have formal corporate plans or strategies and are even less likely to have IS or IT strategies (Hagmann and McCahon, 1993; McKiernan and Morris, 1994). They are not dissimilar to their larger counterparts in that Lederer and Mendelow (1986) identify the disparity between the desire for flexibility on the part of top management when implementing strategy and the requirement for a precise definition of future plans to be given to IS developers; 'top executives preferred flexibility. Written plans are more difficult to change'. As Eardley et al. (1997) suggest, this poses a problem for the IS planners as they are trying to develop systems to support manoeuvres and structures which may not even exist in any planned way. Hence, something of a paradox exists – top management develops strategies that are purposively undefined which change rapidly and unpredictably, while traditional IS developers require stability and predictability.

There is no doubt that the major organisations who are the dominant customers of most SMEs have felt the impact of IT on their business environment. Parsons (1985) concludes that, 'industries using IT in the competitive domain will continue to experience even more strategic consequences'. He continues 'although it may seem obvious that IT applications should be consistent with the business strategy, in too many firms there is a monumental lack of attention given to understanding how IT will influence the firm's competitive position in the industry, or how IT might

support a business strategy'. This is especially true of SMEs where there is a lack of strategic planning, limited investment in IT and hence very little regard for the interaction between them (Hagmann and McCahon, 1993).

Although flexibility is nearly always seen as beneficial, its costs are not well identified (Eardley et al.). Avison et al. (1995) suggest that the tangible costs involve hardware, software, training, reorganisation and on-going costs, and that the opportunity costs include the trade-off between the attributes necessary to support flexibility and other system characteristics – such as political realities, system complexity, effectiveness, and the need for standardisation. Eardley et al. take this further suggesting that 'this implies that strategic flexibility is a compromise; that optimal achievement of short-term goals should be sacrificed in order to keep open an optimally robust option set. While this makes empirical and pragmatic sense, a really flexible strategy would allow the optimal achievement of both short-term and long-term goals'.

One further route to flexibility might be via outsourcing. This is a popular route for large organisations, though SMEs have always relied on outside sources for much of their IS needs, and while there is evidence that some large organisations do gain from outsourcing, it is not necessarily the route to flexibility (Robertson and Powell, 1997).

3. **Information Systems and Technology in SMEs**

Lefebvre and Lefebvre (1992) argue that SMEs can be more innovative than large organisations because they are less bound by bureaucracy and cumbersome organisational systems. They suggest that innovation is driven by information, particularly about the external environment. Use of IT makes small production runs easier and, hence, SMEs will be able to be more competitive as they can introduce new manufacturing technologies quickly. These new technologies, it is argued, enable SMEs to be more flexible and able to respond to customer needs. Quality and variety of products is also seen as being improved by the introduction of new production technologies.

The work of Lefebvre and Lefebvre echoes that

of Tofler (1987). Eardley et al. (1997) suggest that past examples of IS built by large organisations were based on strategies in which the potential for manoeuvre was fixed in the long term and in which economies of scale were important, yet, the trend is towards what Tofler terms demassification. This is a reversal of the trend which large-scale inter-organisational systems (IOS) helped to create. Tofler suggest that production runs are getting shorter, the work units that produce them are getting smaller, and firms are becoming more geographically disbursed. This, argues Tofler, is a return to pre-industrial revolution customisation. As Eardley et al. point out, this view encompasses the 'adaptive corporation' – a company form which is able to 'restructure itself into more fluid and flexible forms' implying flexibility in strategy, infrastructure and vision. This view is also valid for SMEs particularly reflecting that the organisation structure (Gupta and Cawthorn, 1996) and the style of the owner (Carrie et al., 1994) is paramount in determining flexibility.

Abdullah and Chatwin (1994) suggest that IT is the key to flexibility in SMEs. They particularly highlight the importance of information as a resource in enabling SMEs to compete more effectively by integrating operational and management information systems. Naylor and Williams (1994) argue that SMEs are more advanced in their use of IS, they 'challenge the recent literature which suggest small firms restrict their use of IT to transactional processing'. They explain this as being due to reductions in the costs of technology and the increasing user-friendliness of software obviating the need for computing expertise. However, in a study on information systems planning in SMEs, Hagmann and McCahon (1993) find that very few consider the ability of their information systems to adapt or evolve to changing circumstances.

A reason for this might be that investment in both management information systems and advanced manufacturing techniques in SMEs is characterised by incrementalism (Hasmi and Cuddy, 1990). Hasmi and Cuddy find that SMEs move to automation by investing in a single area and then later expanding into another. This usually leads to the SME having a number of incompatible systems which are difficult to network. However, because of the high cost of investment

already made, the SMEs are unlikely to redevelop their systems. Generally, SMEs view investments in IS/IT in the same way as they view their production systems – they expect them to last for a considerable time. This supports the contention that SMEs are not particularly flexible as they see themselves continuing in their chosen market. An alternative view of lack of investment in IT might be that SMEs attempt to remain flexible by holding cash rather than becoming committed to a particular system.

The literature on SMEs, information systems and flexibility indicates that not all SMEs can have, or require a flexible response to their environment. As shown, people, organisation structure and the characteristics of the CEO may influence flexibility more than information systems (Blili and Raymond, 1993; Storey 1994, McKiernan and Morris 1994). Additionally, SMEs may not have the internal resources to develop flexible information systems. Here the opportunities for a flexible response may be more dependent upon these factors than those indicated earlier for large companies.

In summary, the literature suggests that flexibility in SMEs is enhanced by an organic organisation structure and a learning environment, managed by a visionary CEO with knowledge of IT.

4. Method

The research on which this paper is based is, by necessity, exploratory since there is little research into information systems for SMEs. Particularly, the contribution of IS in providing or enhancing flexibility is under researched. To understand the role of flexibility of information systems in SMEs, this research takes the perspective that it is necessary to 'understand the *context* of the information system and the *process* whereby the information system influences and is influenced by the context' (Walsham, 1993). Using an interpretive framework for the research the validity of the conclusions relies on the 'plausibility and cogency of the logical reasoning used in describing the results from the cases and drawing conclusions from them' (Walsham, 1993).

A number of exploratory investigations were undertaken in late 1994 to understand the attitudes and approaches to information systems in four

SMEs which had recently made a large investment in IT. They were identified through industrial contacts as interested and willing to discuss their experiences and, as such, are not a random selection. These are manufacturing companies in the West Midlands of the U.K., a region once the manufacturing heart of England which suffered greatly in the recession of the 1980s but is now more buoyant. The senior management team in each SME were interviewed in a series of meetings each lasting between one and two hours spaced over a number of months. The semi-structured discussions considered the roles and attitudes of senior managers to flexibility in general, and to information systems flexibility in particular.

5. Organisational characteristics

To establish the context for the explanations and examples discussed later a brief background of the SMEs follows and an overview is given in Table I. Detailed descriptions are provided in the Appendix, while observations on their attitude to information systems is provided below.

The main focus for the SMEs is survival in a competitive environment. This manifests itself as 'fire-fighting' to deal with operational matters. In all cases information systems were purchased in order to improve the quality of transaction processing, which reflects a deep concern with high levels of inventory. However, a low priority is accorded by all firms to the use of IS or IT for management information. While all adopted IT to aid day-to-day production and stock management, none has realised the potential of connecting this data to overall strategic and competitive analysis. For example, the companies are concerned to keep their existing customers but their response is at an operational level by fulfilling orders quickly, rather than asking themselves which customers they want.

Further, each company is aware that they will only stay in business through being seen by their customers to have both quality products and processes. However, the link between management information and measurement of quality is not well recognised.

The companies are all closely involved in

TABLE I
Characteristics of SMEs

Company	Product	Customers	Ownership	No. of Emp.	Turnover	Information technology
A	Assembly of light fittings	One major high street retailer, building relations with two more	Family owned	130	£5m	AS400 with MRP, networked terminals. Three EDI systems, one linked to MRP.
B	Manufacture of precision tools for automotive industry	Several major customer. A large number of small customers	Originally family owned now part of a European group	24	£1.6m	AS400 with MRP. Finance Director – standalone PC with spreadsheet. Marketing department – standalone PC. Standalone CAD/CAM.
C	Manufacture of springs for automotive industry	Two major customers. One operates a Kan-Ban system. Numerous small customers	Originally family owned now part of U.S. group	112	£4.5m	AS400 with MRP; MD has PC-based performance measurement system.
D	Manufacture of tube based products for automotive industry	Two major customers	Family owned	285	£12m	AS400 with MRP. EDI link to major customer also used for CAD transfer, not linked to MRP. Finance Director – stand-alone PC performance measurement system.

design of new items for their customers. Yet, they see this as an operational matter rather than being of strategic significance. For example, Company B was involved in close collaboration with an international car manufacturer to develop a new precision tool. This involved a high degree of innovation and understanding of the customer needs, yet this knowledge and information is only beginning to be integrated within the wider strategic perspective of the company. This typifies a general issue among SMEs: a preoccupation with day-to-day viability partly limits the time available to consider the strategic advantage inherent in production and customer interaction.

5.1. *Information systems in the SMEs*

All the SMEs studied have data processing systems which provided them with information about day-to-day operations. The systems were developed incrementally with MRP systems a recent purchase in all cases. Evidence here supports the findings of Blili and Raymond (1993) that SMEs are only in the Initiation stage of Nolan's Stages of Growth model. It is clear that investment had been made in automated production systems before considering information systems. As is common, the four SMEs have invested in basic systems such as word processing, accounting and stock control but these systems are not usually linked. Meredith and Hill (1987) develop a framework to analyse the impact of advanced manufacturing techniques on organisations. They show that the focus on standalone systems provides an emphasis on efficiency and tangible benefits. However, the impact of the systems is likely to be local, with minimal organisational-wide impact. The risk involved in implementing these systems is slight. They contrast this with integrated systems which emphasise effectiveness across the whole system, where intangible benefits are more important and there is likely to be considerable organisational impact. None of the companies have integrated their systems and are therefore unlikely to achieve the full benefits of those systems.

Material Requirements Planning (MRP) systems are seen as the primary approach to better management of operations by all four SMEs. The key reason given for purchasing an MRP system is to

reduce production costs. The process of purchasing these systems is generally taken over some months with considerable research being done by a senior manager as the purchase is regarded as a major investment for the long term. In Company B, the Finance Director visited a number of exhibitions and conferences to identify suitable MRP systems. Most of his criteria were satisfied (local maintenance, established product) but he found that there were few systems particularly directed to the SME market. He also wanted to purchase established hardware and therefore selected an AS400. The approach the company took was then to purchase some modules and grow the system incrementally as they increased their knowledge of it. The software provider continues to provide the company with information on the system's development, but Company B are very cautious about changing. They do not generally purchase new versions of software until the previous version is no longer supported.

In none of the SMEs were IS used to provide management information. When managers required summary data they tend to extract it from operational reports and re-enter it onto a spreadsheet. The CEO of Company C has developed his own spreadsheet applications to satisfy the quality conditions imposed by major customers. In the same company the MRP system is not being used to plan production, merely to manage stock. The operations director of Company A estimates that he spends three days a month manually extracting data about stock problems from a detailed operational report. Company D has also developed a spreadsheet system to report on performance to their major customers. The use of spreadsheets by SMEs to provide strategic financial information leads Naylor and Williams (1994) to suggest that information systems are used for 'more complex procedures than has previously been reported'. Their research suggests that once managers use the information available to consider strategic issues, benefits accrue and SMEs are more inclined to invest further in information systems.

The major interest for the SMEs is to manage their operations more effectively, to minimise wastage and improve stock control. In all the cases this was the reason given for the purchase of the MRP system. Planning for IS focuses on

improving the existing operation with which the senior management are familiar. Hagmann and McCahon (1993) find that, in companies where information systems planning occurred, the main focus is on tactical planning to meet operational requirements, competitiveness is not an issue considered by many SMEs. In none of the SMEs here is competitiveness cited as a reason for investing in information systems.

5.2. *IS organisation in SMEs*

Blili and Raymond (1993) suggest that the IS function in SMEs reports to the accounting function, in line with the experience of many large companies and those of public sector organisations. They also find that there are only limited IS management skills available to plan and organise information systems in the SMEs. This research supports the latter point as none of the SMEs studied have specialist managers with the skills to manage IS. The finance director of Company B has responsibility for selecting computer systems, but his major computer skills are in using spreadsheets, the information systems skills are provided by the software company from whom they purchased their system. In Company C the CEO passed the responsibility for information systems to the operations manager who had no experience of information systems but worked closely with an external consultant to develop appropriate skills.

Primarily, the SMEs recognise that they do not have the skills to plan and manage information systems. All use external companies to develop or purchase systems for them. Support is usually provided by the software company as required. In Company A and C support is provided by part-time independent consultants. In Company C the operations manager has developed an interest in IS and is developing programmes to interface with the MRP system they had purchased. Unfortunately his lack of formal training is evident in the information management area as the company had not instituted any security measures against loss of data. Company A has considerable dependency upon the bespoke system which they use which was developed by a one person company. They have recognised the risk, but are not yet in a position to change their systems, upon which

they have considerable dependency. This parallels work by Yap et al. (1992) who identify factors which contribute to information system success in SMEs. They highlight the dual needs of IS expertise and knowledge about small businesses, yet point to the lack of IS expertise in small business managers and the lack of small business expertise in most external software/hardware consultants.

5.3. *IS development in the SMEs*

Information systems in this study are typically developed by the technical methods which tend to be those of the structured school of systems analysis or the ad hoc approach of the self-taught. These systems are either produced for them by small software suppliers (Company A), bought off-the-shelf (Companies B, C and D), or are DIY systems developed within the firm (Company C). These structured methods are inadequate for modelling future requirements of a business system, and the models and specifications produced by such systems may be rendered obsolete by minor changes in business process (Eardley et al., 1997; Fitzgerald, 1990). The methods are therefore likely to produce systems lacking in flexibility to cope with future change. Requirement changes tend to be at the detailed operational level rather than aimed at meeting strategic objectives. Indeed, in the case of Company B, the computer software supplier regularly recommended changes in functionality. Because of the time for development due to the traditional methods used it is clear that the SMEs are reluctant to change the original system specification. There is little evidence of IS being linked to strategy and investment being made to support strategy.

The technical infrastructure in SMEs is third-generation. In particular, the software was designed using traditional methods which are weak at coping with changes to the application, and there are often difficulties in changing or adding functionality. This is typified by the prevalence of corrective maintenance which tries to modify software to cope with unforeseen changes in the business processes (Eardley et al., 1997). For example, company D employed a part-time programmer to make these changes. Further, SME

IS have the characteristic of being embedded in the inflexible technology of the 1970s and 1980s. The IT infrastructure which was available then are not well suited to producing systems which can cope with changes in business process and with IT innovation.

5.4. *Influence of customers on IS*

There are three key areas in which customers influence IS in SMEs. First, customers seek evidence of quality in both product and production process (Companies A, C and D). Second, order processing is done automatically (Companies A, C and D) and third, there is integration in design of new products (Companies B, C and D).

As discussed, all the companies have only one or two major customers. Customers place substantial emphasis on the need to show evidence of both quality processes and products. This evidence is expected to be provided from production data which has been analysed by the SME to show, for example, wastage rates, productivity, machine down time. The carrot held out to the SME for introducing these systems is one of more open book management and a mitigation of the price reductions demanded by the customer (Company C and D). The purpose is to maintain the preferred supplier status which the SME holds. Therefore, IS in SMEs need to be more than transaction processing systems, management information is critical to the survival of the SME.

Customers also expect SMEs to introduce electronic data interchange (EDI) systems, primarily for receipt of orders. However, in the case of Company A, it is also used as a means of supporting production forecasting as their major customer provides a schedule of estimated orders three months in advance. Problems can arise, for the SME, with EDI systems as every customer has a different system. The SME is faced with having to interface each EDI system with their production planning system. In the case of the light fitting manufacturer, while their major customer's EDI system is interfaced, those of two other large customers are not and data has to be re-entered manually into the production planning system. O'Callaghan et al. (1992) and Golden and Powell

(1996) find that EDI initiators, generally larger organisations, gain at the expense of followers.

It is interesting to note that despite pressure from a major motor manufacturer Company B does not think it worthwhile investing in EDI. This may be a reflection of the type of business. Orders tend to be large (for example, tooling up a new production line) and do not occur regularly. The life of a precision tool is about 10 years, unless damaged. The customer has not yet pushed the issue despite having the SME as a preferred supplier.

The final area where IS in SMEs is influenced by the customer is in the area of computer aided design (CAD). Large motor manufacturers now include SMEs in the design process for new vehicles. For example, engineers from Company D work with the motor manufacturer to design new parts which enhance the overall design. Designs for new clutch assembly parts are sent via communications links between Company D's CAD system and the customer's. Company A is considering the possibility of sending light fitting designs to one of their major customers to both improve the quality and speed of the design process.

What is clear is that SMEs are driven by the needs of their customers. The decision of customers to introduce the hollow factory concept has led them to outsource much of their production. SMEs have been the main beneficiaries of this. SMEs are the providers, in the main, of the components or sub-assemblies required by major manufacturers. JIT manufacturing is becoming the norm for major manufacturers. SMEs are now finding that they are becoming warehouses for their customers. Company A, for example, has built new warehouses to hold the stock required by its major customers until they required it to be sent to their stores. The industry value chain concept is of critical importance to SMEs. As Kanter (1994) argues, it is the concept of collaborative advantage that is important. This is driven through 'value chain partnerships' which depend upon openness, good communication and a willingness to share information. Company D has certainly benefited from this arrangement as they managed to convince their customer to accept prices higher than the customer initially requested as a result of sharing information about the

Company's efforts to reduce costs. While customers are driving the SMEs to produce quality goods at a minimal price, the decision to promote one or two SMEs has ensured that the relationship has to be two way. Essentially, there has been a reduction in the number of SMEs in the car manufacturing industry, for example, Company C has either acquired competitors or has seen them go out of business as they have achieved the contracts. In other words, the customer may not be able to find an alternative source quickly. It is in their interest to provide support for the SME. The usual form this takes is for SMEs to provide information to show that they are making efforts to improve efficiency and effectiveness. For their part, customers usually accept that the SME may not be able to reduce its prices as desired.

6. Flexibility: the SME response

The case studies indicate that the SMEs do not readily conform to the received wisdom that they are particularly flexible or adaptable. First, flexibility has been identified as the ability to change strategic direction relatively quickly. The evidence here is that all the companies have a specific skill in one main product or variants of that product. They believe that their expertise lies in that product and they are only competing in one market. In general, the companies have only one or two major customers, as reported by Storey and Cressy. There is considerable dependency upon maintaining those contracts, with all the concomitant dangers. For example, Company A was told by their one major customer that they were reducing their level of orders from about 80% of output to about 40%, having developed the company to manufacture light fittings to their standard. The manufacturer has since been successful in acquiring other customers, but the product lines are very similar.

Large motor manufacturers have taken a policy decision to move towards the 'hollow factory' concept where they buy in sub-assemblies. They are putting considerable pressure on the SMEs to conform to standards which they have set, both in terms of quality and price. Ford, for example, has developed a Quality Operating System which is used to evaluate its suppliers. Those SMEs who provide Ford with products have to offer evidence

that they conformed to the quality standard required. All the companies studied have achieved the U.K. quality standard BS5750 and are working to ISO9000. One conclusion which may be drawn is that it is not in the interests of customers for SMEs to be flexible. Customers demand a quality product and it may be in their interests to ensure that the SME hones this narrow expertise.

The second main definition of flexibility as a strategic response to the unseen also has limited validity in the context of this study. There was very scant evidence of strategic thinking in any of the SMEs. Survival is the key issue for all the companies. This is operationalised by focusing on developing efficient production processes rather than thinking about alternative strategies.

Efficient production tends to mean that companies try to maximise production runs regardless of whether orders exist. For example, Company B argues that the set-up time for each machine is so long, 16 hours, that the company then needs to make enough stock to minimise production costs. The outcome is a considerable amount of finished stock stored awaiting a customer order. In making this decision no attempt had been made to calculate the production costs of each unit and to decide whether this was best use of machines, labour or cash. In another example, Company C went further in maximising production: management spend four hours each week maximising production runs on machines. This often leads to orders being brought forward in order to maintain the same run, leaving other earlier orders unfilled until they became critical.

A further reason for limited flexibility in SMEs is their reliance on outdated machinery and under-investment for the future. The car spring manufacturer has many machines dating back to the Second World War and very little intention or capital set aside for re-investment. Storey and Cressy attribute this to the short-termism engendered by the need to ensure survival in the immediate future and the wish to avoid high fixed costs: 'they favour "flexible" over "fixed" investment and those with short rather than long term payoffs'.

In all the cases the CEO was not particularly knowledgeable about information systems and their potential as a strategic response. The main objective in all cases in purchasing IS is to

improve efficiency. The CEOs were also not focusing on innovation although they were aware of the market changes, for example, a move to ceramic springs will impact drastically on the spring manufacturer. The main objective appears to be one of maintaining current expertise.

Bolk and Van Manen (1990) note that SMEs are driven by a small dedicated group, thoroughly knowledgeable about the product range and the production processes being deployed. The management teams in this study support this contention. For example, frequent management team meetings are held by Company B. In the case of the spring manufacturer, management work co-operatively. Management are intimately aware of the potential of the product and are able to use this knowledge in attracting customers. However, their knowledge of the operation is very detailed and there is a tendency to become involved in the day-to-day operation to the detriment of forward planning (Lybereas et al., 1993), as shown above by the car spring manufacturer. Thus, while the organisations take advantage of the ability to communicate easily, the organisation structures are not particularly organic and responsive. This limitation may inhibit opportunities for flexibility, particularly for competitive advantage, which make it unlikely that SMEs will use pre-emptive or exploitive manoeuvres.

7. Discussion and conclusions

Analysis using Evans' framework suggests that SMEs cannot, or do not, use most of the range of tactics which might give flexibility. The companies focus on managing their current expertise more effectively and give very little thought to long term strategic planning. Certainly there is little evidence that their purchase of their MRP systems is any more than a tactical response. Only Company A has reviewed the organisational structure such that there is now a learning environment. However, even in this company, management information is not available from the IS. Thus, the two more pro-active advantages of flexibility, internal process redesign and competitive advantage, are not being sought by the companies. Hence, it makes it unlikely that the companies can take advantage of pre-emptive, exploitive or protective strategies for flexibility.

Survival is the central characteristic of the SMEs, and it could be argued that they have all taken advantage of corrective manoeuvres to ensure their continuing existence. However, it is not clear that their response, with regard to their investment in information systems, will enable them to respond flexibly to changing circumstances.

This, in turn, suggests that their global flexibility is low compared to organisations which can employ a variety of such tactics. Hence, it may be the SME sector rather than the individual firm that is flexible due to organisational birth and death. Alternatively, it is the whole value chain that has flexibility not any component part, or perhaps any value chain is more flexible at the top (customers) than at the bottom (sub-assemblers). Also, the evidence here is that IS does not provide flexibility for SMEs. The literature on computer integrated manufacturing (CIM) promotes it as a means of increasing flexibility and improving quality control (Ayres, 1991). However, there is very little evidence in the study of integration of design, production and management information systems which constitute CIM. This is largely due to the incrementalism which is a key feature of information systems in SMEs. This may all be encapsulated in the IT-flexibility paradox to which Lucas and Olson (1994) point – technology can contribute to organisational flexibility since IT is inherently more flexible than its predecessors, but since technology ages so rapidly and becomes hard to maintain flexibility is quickly lost.

This paper investigates the role of IS in promoting or inhibiting flexibility in small and medium sized enterprises. It shows that the firms all exhibit relative inflexibility in their general approach. Information systems do not seem to provide increased flexibility, but reinforce existing thinking. The key reasons are that SMEs view themselves as having a narrow product range which is used for the benefit of one or two customers. This leads them to consider the purchase of IS to improve the efficiency and effectiveness of current processes rather than considering the capacity of information technology to increase flexibility and improve competitiveness. The research method employed, a non-random sample using semi-structured interviews, is appropriate for the exploratory nature of this work. However, the

extent to which the findings can be generalised needs more investigation. Issues for further research which arise from this are the those relating to flexibility arising throughout the value chain, flexibility of the components of the value chain versus the whole chain and the alteration of flexibility relationships with increasing or differential use of information systems.

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Appendix

Company A

Company A was established in 1947 and specialises in the assembly of light fittings. Until recently, almost all of the firm's output was bought by a national chain of department stores. Apart from the commercial advantage of assured sales into a prestigious segment of the market, Company A also enjoyed the advantage of planning information. Every quarter, the major customer would share its predicted sales data with Company A enabling effective production planning. However, following a major strategic review, the national retailer informed them that they intend to foster greater competition among their suppliers and that Company A would, in future, receive a smaller proportion of their business. Thus, Company A has not only been faced with finding new outlets for its products, it has also had to set up systems for planning its production. Despite its success in obtaining orders from three other major retail chains, Company A is aware that too much stock or stock outs will not aid future viability.

In meeting the challenge of a more uncertain demand for its products, Company A adopted two prime strategies. First, it embarked on an internal culture change process to ensure that the workforce are involved in alterations to work practices, in particular, the increased importance of internal information recording and communication systems which is partially effected through its bespoke MRP system. Second, Company A has sought to develop IT links with all its major customers and now receives forecasts of orders from these through three separate EDI systems. The EDI system for their original customer is integrated with the MRP system. However, the data from other customers has to be entered manually into the operational data base to enable the company to plan its supplies and production systems. Firm orders are then received on a weekly basis from these customers.

However, Company A still faces problems. There is little management information which compares orders with forecasts and then with subsequent sales by the customer. This information would help them reduce its exposure on stock holding. They currently hold raw materials, work in progress and finished stock at fairly high levels.

Company B

Company B manufactures precision tools for the automotive industry which are considered to be durable items. A number of motor manufacturers are their main customers and they have numerous small customers. The company is privately owned and part of a large group regarded as a world leader. Company B sells as much as 30% of their goods to the parent company, although there is no guarantee that this level of sales will continue. It also sells into both U.K. and overseas markets.

The company went through lean times in the 1980s seeing its work-force reduce from 60 to 16 in 1984. There are currently 24 staff. The organisation is fairly traditional and reactive to customer requirements. The main concern is to manage capacity to fill orders. Production planning is done manually each week. Company B is concerned about rising stock levels both of inventory and finished goods. The philosophy is that once a machine is set up to manufacture a particular precision tool an optimum batch should be made.

Company B has recently purchased an MRP system to manage inventory, sales order processing, financial systems and, in time, production planning. This system complements existing information systems. The company is working at full capacity and operatives have to work overtime to complete orders. While formal monthly management meetings are held, most organisational systems are based on inter-personal meetings between managers.

Company C

Company C was founded in 1904 to manufacture shirt bands, but later expanded into manufacturing springs of all kinds. The company is owned by U.S.-based interests and is now a major supplier of coil springs to the automotive industry. It has three major customers and has an 'open book' partnership with one of them. This means that the companies share information pertinent to the contract so as to ensure the twin objectives of competitive pricing and reasonable profit margins.

Company C produces springs to order. Products are usually designed by the customer and Company C provide an estimate of material cost and time requirements. The company has purchased a number of its rivals which led to the introduction of computers for the first time to manage the accounts of the larger company. The value of computers has been recognised by the managing director and the company has recently purchased an MRP system to help manage a high level of inventory and finished stock. However, production planning is carried out manually with information subsequently fed into the system. Orders are filled on the basis of machine optimisation (i.e. making the best use of a particular set ups) rather than any priority of orders.

Company D

Company D has grown from a Victorian, family-run business in tube and wire bending. It is now a first tier supplier to two major motor manufacturers (i.e. they deal directly with these companies) and a second tier company to five others through wholesalers.

In the late 1980s the company recognised it was losing competitiveness through creeping inefficiencies and poor management information. The company was located in several sites in a city centre which made it difficult to run efficiently. The company took two major decisions as a result of an auditors' report. First, to bring in a finance director and production director, where previously the company had been managed by the owner, to improve efficiency and increase turnover. Second, the company relocated to the outskirts of the city, which has enabled them to have the whole company within the same building.

The auditors' report also highlighted the need for better management information, in particular, accounting information, which was only available months after events. The company also lacked an effective stock control system. Not only were there pressures to improve internal management information systems, but, as with the other firms, major motor manufacturers insist on the company having a quality information system which provides performance measures against which to assess production and process quality.

The company has introduced both accounting information systems and production systems. It has EDI links with one major manufacturer for both orders and CAD. However, the company has introduced these systems in a reactive manner to address individual situations. There was no attempt to develop an ISS to look at the integration of systems in the company. The quality information system is a spreadsheet-based system which is not integrated with production systems.

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