Assessing information systems strategy development frameworks in SMEs

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Received 6 October 1997; revised 20 July 1998; accepted 21 March 1999

Abstract

Information systems strategies (ISS) are generally believed to be of considerable benefit when planning information systems. The development of ISS is often performed in an ad hoc manner, though it may be undertaken with the support of frameworks. Some of these frameworks include the codification of existing practice, while others are the result of theory development. Some are tried and trusted, while other languish unused. This paper evaluates the usefulness of ISS frameworks in the context of small and medium-sized enterprises. The applicability of the frameworks to these organisations is assessed. The paper demonstrates that the assumptions upon which ISS development models are based may have limited applicability outside their original domain. Finally, a modified framework is proposed.

Keywords: Small and medium-sized enterprises (SMEs); Information systems strategy

1. Introduction

This paper is based on an investigation of information systems strategy (ISS) development in small and medium-sized businesses (SMEs). The research grew out of a widely held view \cite{1, 2} that strategic information systems planning (SISP) can play a critical part in helping organisations to increase efficiency, effectiveness and competitiveness \cite{3}. Further, ISS can provide the means to achieve truly innovative approaches to management and competitive challenges.

Most research in strategic information systems planning has been carried out in North America, where the focus is on large corporations \cite{4} and on the development of methods. European contributions, meanwhile, have tended to concentrate on developing frameworks that assist in identifying the position of SISP within the organisational environment \cite{5, 6}. To date, research interest in the role of ISS in SMEs in general, and manufacturing SMEs in particular, is surprisingly sparse and underdeveloped. Hagman and McCahon \cite{7} find that US SMEs value information systems planning as a means of obtaining greater efficiencies in their internal organisation, but that they are not used to increase competitiveness. However, there are indications among UK manufacturing SMEs that changing market structures are forcing managers to think innovatively and ISS may be both, a catalyst to, and guiding principle for, innovation.
Much of the current thinking in strategic information systems planning draws upon Earl [5]. This paper uses the vehicle of Earl’s ‘Framework of Frameworks’ to explore the applicability of ISS frameworks to SMEs. These are applied to four firms; all small to medium-sized UK manufacturers with between 24 and 285 employees and turnovers from US$ 2.6 million to US$ 20 million. All are family-owned businesses that have either been taken over by a larger group or where general managers have been introduced to widen the decision-making base. All have experience of information systems (IS), introduced to assist production.

2. Strategic information systems frameworks

Strategic information systems (SIS) encapsulate the notion that linking information systems to business strategy may yield significant competitive advantage, potentially transform the firm and perhaps the industry, and should be an active concern of top management.

Frameworks may be seen as outline models of how IS can potentially fit with firms’ objectives of gaining competitive advantage. SIS frameworks were developed to assist analysis of an organisation so that advantage could be taken of opportunities from IS [8]. Examples of these include Porter’s five forces, the value chain and information intensity matrix [9].

There are important caveats that need to be considered when using frameworks—especially in the context of SMEs. First, SIS frameworks are predominantly based on models of strategic behaviour of US business culture and their potential limitations in a European business context is under-researched. Second, the complex circumstances facing manufacturing SMEs may not be easily captured in the frameworks. For instance, the role of the SME as a strategic partner to a larger manufacturing corporation greatly complicates the concept of appropriate competitive behaviour. Authors offer very little detailed guidance on how to benefit from information systems or to avoid being marginalized by competitors’ actions despite promises of strategic and competitive advantage.

It might also be argued that frameworks codify commonsense and offer little of value to an organisation that knows its business. Doyle also argues that there is an assumption that frameworks exist outside time, which may render some frameworks irrelevant, particularly when addressing the impact of new technologies. For example, the Internet is radically changing the way firms do business and may make current frameworks seem parochial and dated.

This paper shows that, while SMEs are aware of the need to computerise, there is very little thought given to more than increasing operational efficiency. For the manager or SME owner, frameworks may also be viewed as an educational device to help increase sensitivity to IS and competitiveness, and as a planning tool. The frameworks do provide a means of indicating to SMEs that strategic opportunities exist and can be exploited using existing technologies but improved systems.

The range of frameworks on offer is bewildering to managers and some rationalisation is required. The value and limitations of frameworks is not always clear. Earl’s Framework of Frameworks provides a useful means by which to consider the relative value of each. According to Earl, individual frameworks may be classified under one of the following three headings: awareness, opportunity and positioning; this typology is used here. Table 1 summarises the key characteristics.

The frameworks Earl cites as exemplars are summarised in Table 2.

3. Awareness frameworks

Awareness frameworks indicate how IT can be used for strategic advantage. They provide insight at an industry level rather than at the firm level. They are intended to raise awareness and show the value of changing the way the business works. The purpose, therefore, is to encourage creative thinking and questioning. Awareness frameworks are primarily educational tools. Earl organises them into three subsets.

<table>
<thead>
<tr>
<th>Framework/Attribute</th>
<th>Awareness</th>
<th>Opportunity</th>
<th>Positioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>vision</td>
<td>ends</td>
<td>means</td>
</tr>
<tr>
<td>Scope</td>
<td>possibility</td>
<td>probability</td>
<td>capability</td>
</tr>
<tr>
<td>Use</td>
<td>education</td>
<td>analysis</td>
<td>implementation</td>
</tr>
</tbody>
</table>
### Table 2
Exemplar frameworks cited by Earl

<table>
<thead>
<tr>
<th>Awareness</th>
<th>Opportunity</th>
<th>Positioning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Refocusing frameworks:</strong> identification of potential to use IS/IT in the organisation</td>
<td>Systems analysis frameworks: identification of information flows within the business</td>
<td>Scaling frameworks: identification of scale of importance of IT to an organisation</td>
</tr>
<tr>
<td>Exemplar: Benjamin et al., strategic opportunities framework</td>
<td>Exemplar: Porter, value chain</td>
<td>Exemplar: McFarlan and McKenney, strategic grid</td>
</tr>
<tr>
<td><strong>Impact models:</strong> identification of impact which IS/IT could have on the organisation’s competitive position</td>
<td>Application search tools: identification of specific application areas within the business which might benefit from IT</td>
<td>Spatial frameworks: identification of information management implications for an organisation</td>
</tr>
<tr>
<td>Exemplar: Porter, generic strategies</td>
<td>Exemplar: Ives and Learmonth, customer resource life cycle</td>
<td>Exemplar: Earl, sector information management grid</td>
</tr>
<tr>
<td><strong>Scoping models:</strong> identification of strategic scope of IT in industry sectors</td>
<td>Technology fitting frameworks: identification of specific IT to achieve a business benefit to the organisation</td>
<td>Temporal frameworks: identification of IT suitable for the stage of IT development of organisation</td>
</tr>
<tr>
<td>Exemplar: Porter and Millar, information intensity matrix</td>
<td>Exemplar: industry dependent</td>
<td>Exemplar: stages of growth models</td>
</tr>
<tr>
<td><strong>Business strategy frameworks:</strong> identification of business strategy opportunities for IT</td>
<td>Exemplar: Porter, five-forces model</td>
<td></td>
</tr>
</tbody>
</table>

**Refocusing frameworks** aid identification of potential to use IS/IT in the organisation. The example used in this category is adapted from the strategic opportunities framework developed by Benjamin et al. This is used to identify support opportunities from IS/IT in three key business areas: production, management support and customer relations. **Impact models** consider the effect that IS/IT could have on the organisation’s competitive position, using Porter’s generic strategies model to identify the target of a firm’s strategy within the industry. The final subset is **scoping models** that address the strategic potential for using information in an industry. The information intensity matrix [9] is the preferred model here. It provides a useful means of identifying whether IS/IT should be focused on improving internal efficiencies and effectiveness or be more externally focused on competitiveness.

### 4. Opportunity frameworks

Opportunity frameworks are directed towards enabling the individual organisation to identify suitable strategic opportunities from the use of IS. This involves analysing the immediate competitive environment, the information flows required to carry out the business activities, and technology opportunities available. Earl identifies four opportunity subsets. **Systems analysis frameworks** consider the information flows within the business. A value chain may be used to identify information flows and gaps in value, adding primary and secondary activities. **Application search tools** help in the identification of specific application areas within the business that might benefit from IT. **Technology fitting frameworks** are used to indicate whether IT supports a business need, has potential to add value and, thus, derives its organizational impact. A number of industry-specific frameworks are suggested here. As all the cases here are manufacturers, Meredith and Hill’s [10] framework is deemed most appropriate, since it highlights differences in the attitude to automation in manufacturing. Finally, **business strategy frameworks** consider strategic opportunities for the organisation and the potential for competitive advantage from IT. Porter’s five forces model provides the exemplar as it is a well-established model for analysing strategic opportunities.

### 5. Positioning frameworks

Positioning frameworks consider the importance of existing IS to the business. The management of IS is
also considered in order to determine whether it enhances or inhibits the value of IS. The relationship of IS structures in the organisation is reviewed. Positioning frameworks are intended to help managers plan the future development of IS given a good understanding of the current situation. Three positioning subsets are presented. Scaling frameworks consider the importance of IT to an organisation and the management of its introduction or change. The McFarlan–McKenney strategic grid provides a means of considering the value of both, the existing and proposed systems to the firm’s strategic direction. The framework also aids managers’ understanding of the organizational changes likely to be required. Spatial frameworks address information management implications. The main issues here are the planning, organization, control and technology of the information resource, depending on the strategic context of the IS/IT. This may range from zero impact through operational support, to IS providing support for business strategies and, ultimately, IS changing the business. The final group are temporal frameworks that assist in identifying management issues at different stages of IS development. Stage models are used here to identify the current position of information management. These help identify issues that must be addressed before an organization can use information strategically.

6. Method

The research here is exploratory, since there is a paucity of research into ISS for SMEs. While aspects of the role of IT for production operations have been researched, there is little on the planning of IS to support management tasks. ISS frameworks have, however, been developed for large organisations and may be applicable to SMEs. The literature offers many methods but few coherent frameworks.

A number of exploratory case studies were undertaken to identify how ISS is carried out in SMEs which had recently made a large investment in IT. These cases are of manufacturing firms in the UK West Midlands. The Framework of Frameworks was used to develop questions that would help to determine the applicability of each of the models in the framework to ISS planning and practice. The senior management team in the SMEs was interviewed in a series of meetings lasting between one and two hours. The researchers then developed the models and the analysis presented back to senior management for response and refinement.

7. Case organisations

For the purpose of establishing the context for the explanations and examples, a brief background of the firms follows and an overview is given in Table 3.

7.1. Firm A

Until recently, a national chain of department stores bought almost the entire firm’s output. Apart from the commercial advantage of assured sales into a prestigious segment of the market, Firm A also enjoyed the advantage of planning information. Every quarter, the major customer would share its predicted sales data with Firm A, enabling effective production planning. However, following a major strategic review, the national retailer informed Firm A that they intend to foster greater competition among their suppliers and that Firm A would, in future, receive a smaller proportion of their business. Thus, Firm A has not only been faced with finding new outlets for its products, it has also had to review its production planning systems. Despite its success in obtaining orders from three other major retail chains, Firm A is aware of the need for better inventory control.

In meeting the challenge, Firm A adopted two prime strategies. First, it embarked on an internal cultural change process to make sure that the workforce was involved in modifications to work practices. In particular, this included the increased importance of internal information recording and communication systems; these are partially effected through its bespoke MRP system. Second, Firm A 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, data from other customers has to be entered manually into the operational database to enable the firm to plan its supplies and production systems.
Table 3
Characteristics of SMEs

<table>
<thead>
<tr>
<th>Firm</th>
<th>Product</th>
<th>Customers</th>
<th>Ownership</th>
<th>No. of employees</th>
<th>Turnover</th>
<th>Information technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>assembly of light fittings</td>
<td>one major high street retailer, building relations with two more</td>
<td>family owned</td>
<td>130</td>
<td>£5 million</td>
<td>AS400 with MRP, networked terminals. Three EDI systems, one linked to MRP</td>
</tr>
<tr>
<td>B</td>
<td>manufacture of precision tools for automotive industry</td>
<td>several major customers. A large number of small customers</td>
<td>originally family owned, now part of a group</td>
<td>24</td>
<td>£1.6 million</td>
<td>AS400 with MRP. Finance Director—standalone PC with spreadsheet. Marketing department—standalone PC. Standalone CAD/CAM</td>
</tr>
<tr>
<td>C</td>
<td>manufacture of springs for automotive industry</td>
<td>two major customers: one operates a Kan-Ban system. Numerous small customers</td>
<td>originally family owned, now part of US group</td>
<td>112</td>
<td>£4.5 million</td>
<td>AS400 with MRP; MD has PC-based performance measurement system</td>
</tr>
<tr>
<td>D</td>
<td>manufacture of tube based products for automotive industry</td>
<td>two major customers</td>
<td>family owned</td>
<td>285</td>
<td>£12 million</td>
<td>AS400 with MRP. EDI link to major customer also used for CAD transfer, not linked to MRP. Finance Director—standalone PC performance measurement system</td>
</tr>
</tbody>
</table>
Actual orders are received on a weekly basis from the customers.

Firm A, however, still faces problems. There is little management information that compares orders with forecasts and with subsequent sales by the customer. This information would help Firm A reduce its inventory exposure.

7.2. Firm B

Firm B manufactures precision tools for the automotive industry; these are considered to be durable items. Motor manufacturers are their major customers but they also have many small customers. The company is privately owned and part of a large group that is regarded as a world leader. It sells as much as 30% of its production to the parent company, although there is no guarantee that this level will continue. Firm B also sells in both UK and the overseas markets.

The firm went through lean times in the 1980s with its work-force being reduced from 60 to 16 in 1984: there are currently 24 employees. The organisation is hierarchical and reactive to customer requirements. Its main concern is to manage capacity to fill orders. Production planning is performed manually each week. Firm B is concerned about rising stock levels, both of inventory and finished goods. Its approach is that, once a machine is set up to manufacture a particular precision tool, an optimum batch should be made regardless of orders.

Firm B has recently purchased an MRP system to manage inventory, order processing, financial systems and, in the future, production planning. The MRP system complements existing IS. It 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 face-to-face meetings between managers.

7.3. Firm C

Firm C was founded in 1904 to manufacture shirt bands; it later expanded into the manufacture of springs of all kinds. The company is owned by US-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: the two firms share information pertinent to the contract to ensure the twin objectives of competitive pricing and reasonable profit margins.

It produces springs to order. The customer usually designs the products and the firm provides an estimate of material cost and time requirements. The firm has purchased a number of its rivals and this has led to the introduction of computers to manage the accounts of the larger company. The managing director 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 being fed into the system. Orders are filled on the basis of machine optimisation (i.e. making the best use of a particular setup) rather than order priority.

7.4. Firm D

Firm 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 them) and a second tier company to five others, through wholesalers.

In the late 1980s, the firm realized that it was losing competitiveness through creeping inefficiencies and poor management. They were located in several city centre sites, which made it difficult to run the firm efficiently. At this point the firm made two major decisions as a result of an audit report. First, it brought in a finance director and production director; where previously the owner had himself held these positions. Second, the firm moved to the city outskirts in order to operate at a single site.

The audit report also highlighted the need for better management information, in particular, accounting information, which had previously only been available months after the event. The firm also lacked an effective inventory control system. Not only were there pressures to improve internal MIS, but the major motor manufacturers insisted on a quality information system to provide performance measures that allowed them to assess production and process quality.

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

7.5. General observations

The main focus of these firms is survival in a highly competitive environment. This manifests itself as ‘fire-fighting’ to deal with day-to-day operational matters. In all cases, IS have been purchased in order to improve the quality of transaction processing and this decision reflects a deep concern with high levels of inventory. However, a low priority is accorded 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 firms wish to retain all their existing customers, but they operate by fulfilling orders quickly, rather than by asking themselves which customers they want.

Further, each firm is aware that they will only stay in business through being seen by their customers as having both, quality products and processes. However, the link between management information and measurement of quality is not well recognised by these firms. They are all closely involved in design of new items for their customers. However, they see this as operational rather than as being of strategic significance. For example, Firm B was involved in close collaboration with an international motor manufacturer to develop a new precision tool. This involved a high degree of innovation and understanding of customer needs, yet this knowledge and information is only beginning to be integrated within the wider strategic perspective of the firm. This typifies a general issue among many SMEs: a preoccupation with day-to-day viability limits the time available to consider the strategic advantage inherent in production and customer interaction.

8. Framework analysis

The paper does not describe our analysis in detail, but uses examples from each case to illustrate the applicability of the frameworks in identifying strategic opportunities for the use of IS in SMEs.

9. Awareness frameworks

Awareness frameworks are intended to help in the identification of suitable IS strategies in the context of particular industries. The application of these to SMEs may enable them to think more strategically and improve effectiveness through better use of management information. Thus, they may present opportunities for SMEs to compete through IS.

Refocusing frameworks raise awareness about the potential use of IT and IS in the organisation. The strategic opportunities framework was applied to Firm A to identify potential opportunities for IT from the perspectives of production, management support and customer relations (see Fig. 1). In production, the firm already has an effective MRP system. However, the competitive nature of a fast-moving industry suggests that the use of CAD to develop designs, that could be sent electronically to customers, could speed up analysis, design and production. Management support could be improved by modifying existing systems and providing exception reports. This would immediately free up management time. There is potential for the introduction of an executive IS to provide analysis of sales by product line and to monitor forecasting. While the firm already uses EDI to receive order information from customers, the provision of this could be extended to automate production planning for more of their customers. Apparently, management not only saw opportunities for new technologies, but they became aware that they could exploit existing technologies more effectively to improve operational management and provide strategic management information.

Impact models provide a means of considering whether IT can improve the competitive position of the organisation. The generic strategy of each firm in this study was not always clear. None are currently pursuing a cost leadership strategy. While they are being pushed by their customers to reduce prices, they all indicate that their main concern is to compete on quality and, thus, their strategy is one of differentiation. For example, Firm B has a very good reputation in the precision tools business. It has invested in production machinery which enables efficient production. Design capability, while reactive, also assists in differentiation. Time has been spent building relations with major customers. Prices are not determined
through a detailed analysis, and this makes a cost reduction strategy difficult. It is, however, recognised that efficiencies can be made and these are being addressed through the introduction of an activity-based costing system. Efforts are also being made to reduce inventory. While there is competition in the manufacture of precision tools, Firm B is convinced that it has the edge on quality.

At least one customer of Firm D, a major motor manufacturer, expects price reductions as a matter of course. This manufacturer works closely with Firm D to identify where savings can be made, recognising that price reductions may take several years. Open-book accounting provides a key tool for this collaborative approach. Information on the quality of both, the process and production, enable the firm to justify its proposals to customers. Firm C benefits in a similar way to Firm D from having information on the quality of both, the process and production.

Scoping models, such as the information intensity matrix, identify the strategic scope of IS/IT in different industries. As Fig. 2 shows, the value chain for a manufacturing company requires a high level of information to manage the process from raw material to finished product. However, the information necessary for the development of the product or service itself varies. There is very little information actually held in, what is essentially, an artefact. However, with a move into design, the information intensity of the product is high. There is much more scope here for the strategic use of IS/IT. Firm D already exploits this with a major motor manufacturer through electronic transfer of engineering drawings. While Firm C currently puts little emphasis on the design of springs, there is, however, a need to co-ordinate production with different automotive manufacturers, particularly when planning new lines.

10. Conclusions on the use of awareness frameworks

While the firms here are relatively simple organisations, the models are useful in indicating the potential of IS/IT. It is clear that the use of technology at the production/operational level is relatively advanced and is essential for survival in a highly competitive industry. In all cases, however, there is a paucity of the use of IS/IT for management information and, indeed, for strategic opportunity.

While Earl argues that awareness frameworks are more useful at an industry level they have highlighted issues specific to the firms. IS/IT is mainly being used to increase Firm A’s operational efficiency and effec-

<table>
<thead>
<tr>
<th>Firm A</th>
<th>Production</th>
<th>Management Support</th>
<th>Customer Relations</th>
</tr>
</thead>
<tbody>
<tr>
<td>traditional support</td>
<td>Systems specifically designed for A to allocate stock to jobs &amp; track work in progress. Essentially an MRP system</td>
<td>Transaction processing reports available from production support system; No summary or exception reporting and considerable analysis is required for use</td>
<td>EDI enables forecasts and orders to be sent. Invoicing also through EDI. Where EDI unavailable, FAX is used</td>
</tr>
<tr>
<td>New technologies and systems</td>
<td>Potential for CAD being addressed; seen as particularly opportune as design becomes central to competitive advantage which involves getting products to market faster than competitors</td>
<td>EIS could be of value in showing the progress of different lines and the accuracy of forecasts by customers</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1. Refocusing framework in Firm A: potential systems in italics and actual systems in Roman.
tiveness, but there is potential for its use in increasing competitiveness, particularly linking design of lights to customer requirements. However, to make this effective the business strategy needs to be clear. Strategic direction has not been addressed: the firm is primarily driven by operational imperatives, typically survival.

In Firm B, IS/IT is also used to provide operational support, but is not integrated into the production and scheduling process. Management information is limited, although the firm expects this will change with the move to the flexibility of a client-server system. There may be considerable potential for IS/IT to be used to support the changing strategic direction of the whole group, and in this context, it will be essential to have an effective network. Design of precision machine tools seems to be the direction in which the firm is heading. Use of interactive CAD/CAM linked to major customers could provide a means of locking in customers by providing them with a quality, proactive service.

Firm C has begun to make use of IT/IS. It can assist with the continued development of a cost leadership approach by improving efficiency and reducing wastage. Product differentiation does not provide a major opportunity. It would seem sensible for Firm C to focus on its main product and to look at designing and developing other springs. IS might provide the means to support a move to spring design and electronic exchange of these to its major customers.

Firm D has started to recognise that IS/IT is important in running an effective and efficient business. However, systems have been developed to solve individual situations rather than to develop a coherent plan that enables the greater exploitation of existing information. While Firm D has EDI links with its major customer, they have not taken the next step and integrated manufacturing processing and management information.

10.1. Opportunity frameworks

Opportunity frameworks focus more on a detailed analysis of the organisation. They provide an opportunity to consider in depth where IS and IT could provide leverage both, to improve efficiency and effectiveness and to enhance competitiveness. Application search tools and technology fitting frameworks cannot usefully be applied to SMEs. This reflects the relatively simple nature of the organisations and the cautious approach taken to purchasing IS. While relatively sophisticated systems, for example MRP, have been introduced, their exploitation in increasing efficiency and effectiveness is limited.

In contrast, analysis of the cases suggests that both, Porter’s value chain and the five-forces model are invaluable in analysing business processes and competitive drivers for SMEs. As an example, the value chain for Firm C is shown in Fig. 3.
The *Value Chain* provides an analysis of the value-adding activities that contribute directly to profitability and support activities. Information flows and constraints are also indicated in this model. All the SMEs cite the emphasis on quality processes and products. There is considerable pressure from major customers to demonstrate that quality is key. Hence the model has been adapted to highlight quality. The implication for SMEs is that better MIS are required to link to production systems and to provide customers’ reports. Currently, this is a time-consuming process with transaction processing data re-entered into spreadsheets to provide reports on quality.

A key operational focus for SMEs is on improving management information to reduce inventory, finished stock, and work in progress. The value chain also shows that, while the manual process ensures that machines are working to maximum capacity, SMEs should improve the availability of management information.

Porter’s *Five Forces* model provides insights into an organisation’s strategic drivers. It has merit as it directs SMEs to look outside their own operational boundaries. Here, while there is a general awareness of the competition, it is held informally and the attitude towards competitors is reactive (see Fig. 4).

The analysis confirms the need for the SMEs to develop or maintain customer links through the use of EDI. It is also clear that competitive advantage is more likely to be sustained if CAD is integrated along the industry value chain. The model also indicates where competitive advantage is likely to be inhibited by inefficiencies in the organisation.

### 10.2. Use of opportunity frameworks

The value chain and the five-forces model are invaluable in supporting an understanding of the potential of IS/IT to individual SMEs. They provided a means of highlighting key strategic areas where
SMEs can reap benefits through the use of IS/IT. The technology fit and application search frameworks are found to be less useful here as the size of the case firms means that IT opportunities are relatively self-evident as a result of using the business strategy and systems analysis frameworks.

### 11. Positioning frameworks

Positioning frameworks enable the organisation to review its current use of IS and determine whether their effectiveness. In addition, they assist in determining the nature of information management within the firm and the ability to respond to the introduction of new IS or IT.

<table>
<thead>
<tr>
<th>Competitive Force and IS Opportunities</th>
<th>Firm A</th>
<th>Firm B</th>
<th>Firm C</th>
<th>Firm D</th>
</tr>
</thead>
</table>
| **Threat of New Entrants**            | • EDI system linked to customers  
• Design of lights through CAD or Multi-media | • CAD used to design tools, library of designs available | • EDI ordering system linked to customers  
• Performance measurement systems in place | • EDI ordering system linked to customers  
• Performance measurement systems in place  
• CAD used |
| **Bargaining Power of Customers**     | • Improved design capability through CAD reduces customer power | • Design of precision tools integrated with manufacturer design process | • Design of springs integrated with manufacturer design process through CAD | |
| **Bargaining Power of Suppliers**     | • Better forecasting will enable planning of stock purchase | • Better inventory planning may enable reduction in stock holding | • Better inventory planning may enable reduction in stock holding | • Better forecasting will enable planning of stock purchase |
| **Threat of Substitute Products or Services** | • Use of CAD or multi-media catalogues to help gain edge in light design | • Introduce EDI and integrate CAD with manufacturer | • Primarily increase the use of CAD  
• Integration of CAD with manufacturing | |
| **The Industry: jockeying for position among rivals** | • Forecasting improved  
• Manage EDI links better  
• Better management information | • Better management information  
• Understand customer base better | • Quality performance information will exclude rivals  
• Highlight inefficiencies in production | • Improve forecasting  
• Quality performance information will exclude rivals |

Fig. 4. Application of Porter’s five-forces model.

Scaling frameworks consider the relative importance of IT for different business activities. The McFarlan–McKenney strategic grid (Fig. 5) shows that the SMEs focus on basic support systems, such as word processing and accounting. They also invest in factory systems to manage production; all the SMEs having purchased an MRP system. However, the MRP systems are not used to managing the whole cycle of production—from planning to finished product. For example, inventory is managed through the MRP system, but is not currently tied to production which leads to inaccuracies in stock maintenance. Production planning is carried out weekly and is done manually. There is little evidence of the SMEs thinking about the strategic use of systems. EDI is essential for Firms A, C and D to maintain their preferred supplier status,
yet they are not exploiting its full potential. It is primarily seen as a means of receiving orders and forecasts. However, Firm A is aware of the potential to provide customers with a ‘virtual catalogue’ which will enable more dynamic processing for the design of lighting assemblies.

For both, Firms C and D, performance measurement is seen as a means of maintaining current strategic position with respect to competitors.

Firm B has had enquiries regarding availability of EDI but it is not seen as a necessary investment currently. Ward and Griffiths [11] place EDI in the turnaround quadrant for manufacturing companies. It would appear here that EDI will be an essential part of the future competitive business, and Firm B should consider it carefully as customers are likely to make EDI a requirement for preferred suppliers: it is already a requirement from at least one of Firm A, C and D’s major customers. For these, EDI has been placed in the strategic quadrant rather than in the turnaround quadrant as suggested by Ward and Griffiths. Earl argues that IT is strategic if the business is ‘dependent or shaped by IT’; in A, C and D’s cases, major customer requirements have made EDI strategic.

Time may be a feature of the difference in positioning of both, MRP and EDI in different quadrants to those proposed for manufacturers by Ward and Griffiths. These technologies are not seen as an integral part of strategy. It is interesting that IS/IT plays little or no part in the strategic thinking of the firms. Only Firm A is thinking of moving into design using CAD as a strategic response to gain leverage over competitors. While Firm D is using CAD as part of its current strategy, it is only because customers have demanded it.

Spatial frameworks address management of the information resource in the organisation. They tend to be predicated upon large organisations with a separate IS department. Specialist IS staff are employed to develop organisational systems. There is also an assumption that IS planning is linked to business planning. Most IS literature also separates management from users of systems, particularly with respect to planning. Spatial frameworks offer little added value to the analysis, as most of the features in their definition are absent in SMEs.

IS introduction in SMEs is a reaction to a perceived need to improve efficiency and effectiveness. This leads to incremental introduction of IS as identified by Hashmi and Cuddy [12], rather than a response to business planning. SMEs are cautious in their purchase of IS/IT. It is a major investment that will be depreciated over a longer period of time than is generally expected. SMEs’ choices focus on hardware and software that can grow with them and they perceive the investment as long term: 10–15 years.
Implications for hardware providers are that they have to continue to support what they may consider to be obsolete technology.

In SMEs, management rely on being as close to operational systems as users, hence the need for separate consultation is far less than in a large organisation. The other critical issue is that the SMEs do not have staff whose core skill is IS. SMEs rarely have a fully developed IS department. There is considerable dependence on external consultants, for both purchase and implementation. This also highlights the limitation of temporal frameworks in analysing SMEs.

Temporal frameworks consider the development of IS over time. Nolan’s stages of growth model is probably the most commonly cited, although Galliers and Sutherland [13] identify others. Temporal models are predicated on the existence of an IS department within a functionally organised hierarchical structure. The models seem to imply an element of conflict in relationships between users and developers of IS. This attitude gradually changes as IS are recognised as having strategic potential. In the case of the SMEs, the starting point for most is control, but this is in response to a business need—not to contagion. The key difference between large corporations and SMEs is a concatenation of roles.

12. Towards A framework for ISS in SMEs

Applying the frameworks to the set of SMEs reveals that most have some merit and, as such, can be taken to be relevant for all business sectors. As Table 4 shows, many of the frameworks are found to be of value in identifying strategic opportunities for the use of IS in SMEs. The increase in depth of shading indicates the reduction in usefulness in analysis.

Positioning frameworks offer least assistance to SMEs. The only positioning frameworks found to be of value are scaling frameworks. The McFarlan–McKenney grid is useful in indicating the role of IS/IT and can provide a comparison with value-chain analysis. However, again, the focus of the spatial and temporal frameworks is predicated on the existence of separate IS departments which are usually found in larger organisations and cannot easily be applied to the SME situation.

The role of the IS department in SMEs is effectively carried out by an external software provider. There is, therefore, far less control over systems maintenance activities. It is likely that, once the initial IS planning has been done, any further development is reactive, driven by either software capability or a need from the business. This is unlikely

<table>
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<tr>
<th>Awareness</th>
<th>Opportunity</th>
<th>Positioning</th>
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<tr>
<td>Business Strategy Frameworks: Exemplar: five forces model (Porter)</td>
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Table 4
Useful frameworks for ISS for SMEs
to change. However, a more pro-active approach from the software provider could make the firm review its strategy and consider future IS/IT requirements. Another way would be to bring in a consultant to act as an intermediary between the firm and the software provider. Finally, Firm C now ensures that one person has the responsibility of reviewing IS needs and having discussions with the software provider. Senior management will need to be aware of the continuing need to provide input into the planning process.

Additionally, as customers insist on basic entry level IS/IT as a requirement for SMEs to remain preferred suppliers, it is important for SMEs to be aware of the externalities governing these relationships. The customer relationship is often seen as purely selling the product into the market. However, it is probably too much to expect strategic implications to be addressed by sales representatives. SMEs need to review their IS strategy in conjunction with the strategic direction of their customers. While it appears that the customers are extremely powerful, their dependence on preferred suppliers continues to grow. This suggests that inter-organisational systems planning will become more important in order to maintain the industry value chain.

Awareness frameworks are as essential to the development of ISS for an SME as for larger organisations. An understanding of the business environment is critical. This provides the means for SMEs to address wider business objectives and the potential for change that IS/IT can provide. However, this must encompass the views of major customers. As far as it affects SMEs, efforts need be made to ascertain the customer information requirements and the compatibility of systems. Impact models are of slightly less value to SMEs than larger organisations. This might be due to the lack of a clear business strategy, although it is more likely due to a need to compete on both quality and price conjointly.

Opportunity frameworks that focus on business strategy are most helpful. Application search tools and technology fitting frameworks have little relevance in the SME context, primarily because it is possible to gauge information requirements from the business strategy. Systems analysis and business strategy frameworks provide sufficient analysis to identify IS/IT opportunities for SMEs.

While the value chain is very useful, providing a view of current processes, it does not review the validity of the processes. There is a tendency for SMEs to focus purely on day-to-day issues without appreciating strategic management information requirements. Business modelling, including information flows, enables managers to see the progress of information through the organisation. A potential flaw of the Framework of Frameworks is that it does not consider the opportunities that exist to review the business activities to see whether they address the business requirements as is suggested by Galliers [14].

13. Conclusions

This paper has attempted to tackle two vital problems. One is the general need to validate ISS frameworks and the other is to assess the applicability of the frameworks in contexts other than those in which they were derived. The paper has demonstrated the strengths and weaknesses of the frameworks in the context of SMEs and has emphasised the significance of the assumptions upon which they rest. It has also outlined the basis of a method for ISS development in small and medium-sized enterprises.

Many of the lessons from large organisations are relevant to SMEs. However, there are a number of key differences that arise because of the dependence of SMEs upon external agencies. The paper has shown that awareness of IS potential for industry change is as important for SMEs as for their larger counterparts. Hence SME should consider IS as a matter of course in their strategic thinking. Also, there are opportunities for SMEs to use IS for strategic advantage, particularly in improving customer relationships and potentially in keeping out new entrants through IS. Strategic IS frameworks in these categories can, therefore, be seen as generic rather than only applicable to larger organisations.

The main failing for strategic IS frameworks is in the application of stages models for growth and the management of IS. As suggested, this may be due to the absence of IS departments in SMEs. Additionally, senior management are closely involved in the purchase of IS because there are no real departmental heads to make decisions. Hence, it is necessary to
question the general validity of the frameworks. Overall, it is likely that the IS frameworks indicated in Table 4 can provide SMEs with insights into the strategic use of IS. Indeed, further work with over 40 SMEs has shown that the frameworks identified in this paper provide the basis of ISS as they offer a clear means of describing strategic opportunities to owners.

References


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