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**An Exploration of the Role of Information
Systems in Developing Strategic Growth in
Small and Medium-sized Enterprises**

A dissertation submitted in fulfilment of the requirements for the degree of
Doctor of Philosophy to be awarded for the submission of published work.

Margaret Susan Levy

Warwick Business School

University of Warwick

Coventry UK

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10367 words from Summary and Contribution to Knowledge to Conclusions,
including figures and tables.

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Declaration and Collaborative Work

I declare that this work is not substantially the same as any that I have previously submitted or am currently submitting in any form or for any qualification at any university or other institution.

No parts of this work have previously been submitted for any similar qualification.

The papers included in this submission are all joint-authored. Statements from all collaborators are attached at Appendix 1. However, the author's contribution can be clearly identified and is substantial. This contribution has been primarily in understanding strategies for growth in small and medium sized enterprises and the role of management information systems in supporting that growth. The author led the initiative to study this area, developing the research approach and developing the database which forms the basis of the knowledge generated. Without this knowledge the papers would not exist.

My co-authors have played a number of roles in nurturing and developing my research output. Bob Galliers was an early mentor, encouraging me to develop my early research ideas and to apply for a university grant to achieve them. My relationship with Philip Powell has grown particularly from advisor to collaborator. Initially, as an inexperienced author, Philip helped me articulate my research. This led to us recognising that we enjoyed working together. The creativity generated by the relationship has generated more research ideas as well as extended the network of senior authors with whom we have also collaborated, such as Philip Yetton and Claudia Loebbecke.

Summary and Contribution to Knowledge

This submission demonstrates that the attached papers and book represent a significant contribution to knowledge in the field of information systems (IS) with a particular focus on small and medium sized enterprises. The theme throughout the publications is consistent: identifying strategic opportunities from information systems for small and medium sized enterprises (SMEs). This document presents the papers and evaluates their contribution. The papers and a copy of the book are included with this document.

The papers and book demonstrate the research contribution in four ways. The first contribution is to IS strategy knowledge, where the research has identified that IS analytical models that depend on IS department-business relationships are not useful in the SME context. Additionally, the research identifies those IS models that can be used in all organisational contexts to analyse strategic management information systems requirements.

Second, the research demonstrates IS concepts developed in the large firm context such as evaluation, flexibility and knowledge sharing may only have limited applicability in SMEs.

Third, the research contributes by developing a new model, the Focus-Dominance model that provides insights into analysing opportunities for strategic IS investment in SMEs. The final research contribution identifies issues that influence SME growth from internet adoption and e-business opportunities.

The papers represent development of the research theme over the last 13 years. The main themes of the papers are information systems strategy; exploring IS issues in the

SME context; strategic context of IS investment in SMEs and internet adoption and strategy in SMEs. The twelve papers and book represent a subset of the author's publications. These have been selected as they show the main contribution to knowledge. The book demonstrates a research led approach to understanding the information systems issues that can influence SME growth. It is the first book that has been written on this topic and provides a useful source for the growing number of researchers in the field.

The submission is organised as follows. A brief discussion is included on the reasons why SMEs behave differently from large firms and what this means for information systems. The next section presents the papers. These explore the validity of IS concepts in the SME context. Following on from this the submission considers the drivers and enablers of IS investment in SMEs. Finally the development of new theories in analysing strategic IS investment is discussed. Within the discussion the significance of the contribution, and the role played by co-authors is highlighted. The final section reflects upon the research contribution, methodology, research impact and current and future research.

Table 1 presents the list of papers for submission with a brief summary of their contribution. Appendix 1 includes the written statements by collaborators of joint papers. Appendix 2 presents the author's contribution to the submitted papers. Appendix 3 presents the known citations for papers included in the submission. Appendix 4 presents the author's full publication list.

No.	Reference	Topic	Contribution
1	Levy et al (1999)	Assessing the value of information systems strategy (ISS) frameworks in the SME context	Critique of IS contingency models in the SME context. Identifying those that are context independent and those that are not.
2	Levy and Powell (1997)	In depth case analysis investigating the development of an ISS for an SME	Demonstration of the value of an information systems strategy (ISS) to SMEs
3	Levy and Powell (2000)	Development of an organisational ISS framework for SMEs	Theory building to develop an ISS framework for SMEs taking an organisational perspective
4	Levy and Powell (1998)	Investigating the role of IS flexibility in and SME context	Critique of established theory by refuting concept that SMEs are flexible and demonstrating that their use of IS does not contribute to flexibility
5	Ballantine et al (1998)	Investigating evaluation approaches to IS investment in SMEs	Critique of IS evaluation theory and exploration of its concepts in the SME context
6	Levy et al (2001)	Modelling IS strategic investment in	Theory building to enable understanding of IS investment decisions taking account of SME

		SMEs	heterogeneity
7	Levy et al (2002)	Modelling strategic IS growth paths in SMEs	Theory building to enable understanding of the changing patterns in IS investment in SMEs as a result of business growth and strategic changes.
8	Levy et al (2003)	Investigating the IS role of knowledge and co-opetition in SMEs	Critique of a game theoretic framework for analysing inter-organisational knowledge sharing
9	Levy and Powell (2003)	Internet adoption in SMEs	Critique of stages models of internet adoption and development of a contingency approach for SMEs
10	Levy et al (2005)	Strategic enablers and inhibitors of Internet adoption in SMEs	Critique of existing knowledge on inhibitors and enablers of internet adoption. Demonstrates that strategic intent influences e-business adoption in SMEs
11	Beckinsale et al (2006)	Identifying internet adoption drivers for SMEs	Confirms existing knowledge of the SME owner as key driver of internet adoption. Shows the limited impact of government policies and competitor pressure
12	Levy and Powell (2005)	Brings together learning on the role of IS in SMEs	Provides a comprehensive analysis of IS adoption in SMEs

Table 1: Submitted Papers and their Contribution to knowledge

Background to the Research Topic

This section briefly introduces the key issues and rationale for studying information systems within the SME context. SMEs are defined and shown to vary in scale, scope and configuration. IS investment is shown to be problematic for many SMEs with the owner central to decision-making. This leads to research questions that consider whether and in what way it is possible to understand and inform SMEs decisions on IS adoption.

The importance of studying the role of IS in managing SMEs

The reasons for studying the role of IS in managing SMEs are described in the early chapters of **Levy and Powell (2005)**. The first three chapters explain the value of information as a strategic resource for firms, particularly in relation to improving competitiveness; collaboration and strategic partnerships, locally and globally. As is discussed in **Levy and Powell (2005)**, most of the research on identifying strategic opportunities from information systems is undertaken in large firms with limited research in SMEs. There is an increased need for research into opportunities from strategic IS in SMEs as more invest in management information systems due to customer demand. Increasing accessibility of information systems and technology also means that some SMEs invest in management information systems, particularly to support and manage growth (**Levy and Powell, 2005:43**).

Past research in IS and SMEs has demonstrated the problematic nature of IS investment for these firms (Hagmann and McCahon 1993, Thong 2001). Better understanding of the role of IS in SMEs may help to improve SMEs' capacity to make effective IS

investments to facilitate growth. The book and the papers demonstrate where existing knowledge in the IS field can be used in the SME context and where new models need to be developed.

Defining SMEs

There are several definitions of SMEs, but the one that is most useful in the context of management research is the number of employees. The reason for this is due to the increasing formality in management structure that develops as firms grow (Burns 2001, Storey 1994). This research defines micro-enterprises as fewer than 10 employees, small firms with between 10 and 49 employees, while medium sized firms have between 50 and 249 employees (SBS 2003).

SMEs vary in form and size. They are often seen as flexible and innovative organisations, able to respond quickly to customer demands. The owner/manager is often seen as the centre of a web, holding all the decision making power (Burns 2001).

However, the key issues that make SMEs different are, first, they lack control in the market as prices are usually determined by customers (Storey and Sykes 1996). SMEs are price takers. Second, SMEs attitude to risk and uncertainty may lead them to take a short term perspective on strategy, such that they behave tactically rather than strategically, mainly focusing on current operational activities. Third, they are often under-capitalised. Thus, SMEs are more prone to failure than large firms (Storey 1994, Bianchi 2002). SME growth is variable with some SMEs following high trajectory paths (gazelles) (Acs and Mueller 2008), but the majority are happy to have enough growth to enable them to retain control (Morrison et al 2003). There are also SMEs that

do not plan growth, where lifestyle opportunities provide the basis for the business (Gray 2002). In other words, SMEs are heterogeneous, with different drivers depending upon their strategic objectives. This heterogeneity is not taken into account in most SME research. The research discussed below demonstrates that IS adoption varies according to strategic objectives for growth.

IS Investment in SMEs

SMEs need business intelligence as much as large firms. Their attitude to investment in information systems is that they expect longevity, often preferring to repair existing systems rather than re-invest (Cragg and King 1992). Limited finances often inhibit new IS investment (Proudlock et al 1998). Information systems tend to be operational in nature, focusing on processing orders, invoicing and some limited financial analysis (Foong, 1999, Thong 2001). There is little investment in strategic IS that will provide the knowledge that can improve competitiveness (Blili and Raymond 1993).

Few SMEs employ their own IS staff, preferring to employ local consultants on a part-time basis to maintain business systems (Cragg and Zinatelli 1995). What is clear is that the SME owner is the key driver of IS investment. This is still true in medium sized firms where there may be some management delegation but never devolution: the owner is still the prime decision maker for capital investment (Thong 2001, Caldeira and Ward 2002). Where SME owners do invest in information systems, there is a tendency to purchase bespoke systems that can satisfy the immediate needs of the firm (Thong 2001).

Recognising the pivotal role played by SMEs who represent 95% of all firms with between 60-70% of all employees (OECD 2004), governments globally have invested in programmes to promote internet technologies as a means for improving competitiveness. Even with such programmes offering support and inexpensive internet access, SMEs are cautious about the value of e-business investment as they see limited benefits (Keindl 2000, Lawson et al 2003).

Research Themes

The above discussion leads to two research themes that are addressed by the collection of papers. First, the dynamic and heterogeneous nature of SMEs suggests it is important to understand whether differences in organisational structure and strategic direction require different IS adoption decisions. This leads to the proposition that there may be different criteria for adoption dependent upon the nature of the SME. Second, IS research has only had a limited interest in the study of SMEs. As such the utility of strategic IS models used to analyse IS opportunities has only been explored in the SME sector in a limited way. Similarly, there is little research in SMEs on IS concepts such as information systems flexibility, evaluation, knowledge sharing or internet adoption.

Presentation of the Papers

The papers in this submission demonstrate a chronology in research development and topic (see Figure 1). The early research undertaken focuses on the value of IS strategy models and their contribution to understanding IS strategy in SMEs. The outcomes of this research provide useful input into the second contribution which is to understand

two key IS issues, flexibility and evaluation, in the SME context. The research seeks to understand whether and, in what way, concepts developed in the context of large firms are relevant to SMEs. The third contribution is that of model development which seeks to contribute to explaining IS investment in SMEs and its role in supporting their growth. The final contribution is to identify and explore strategic opportunities from e-business for SMEs.

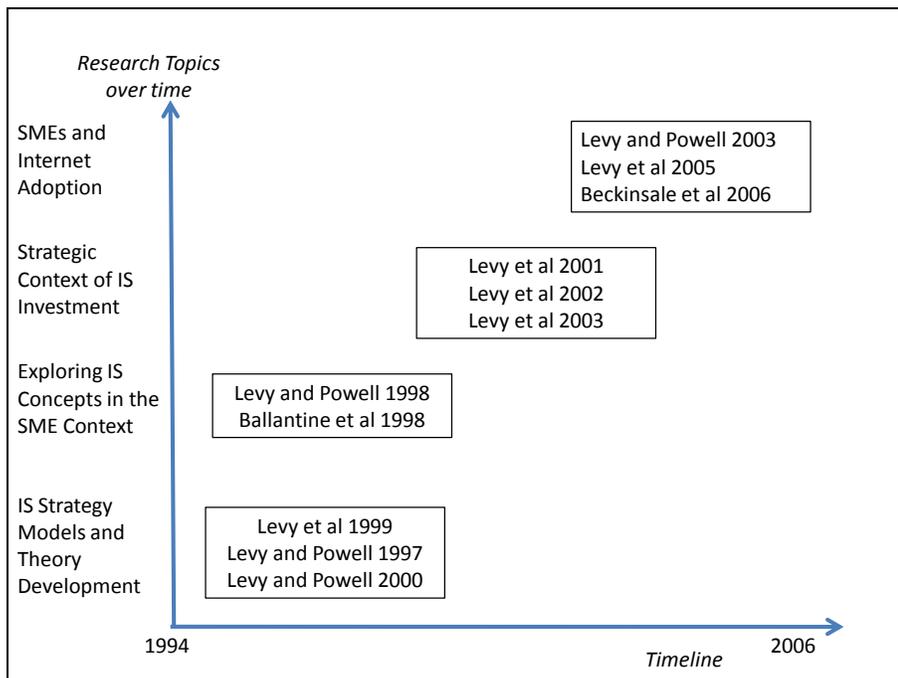


Figure 1: Research Topic Themes and Papers over Time

IS Strategy and SMEs

Information systems strategies (ISS) are a response to the need to plan and organise the IS requirements in firms (Galliers 1987). Unless this is done it is likely that management information systems will be developed in a piecemeal fashion, not contributing to business strategy nor enabling firms to respond flexibly to market changes (Avison et al 1998). The development of an ISS is an integral part of business

planning (Earl 1996). The initial research into this topic was funded by a small development grant from the University of Warwick awarded in 1994.

A review of the literature indicated that that Earl's (1989) framework of frameworks provided the clearest understanding of the role of IS analytical frameworks. The research undertaken was to identify which of these frameworks were applicable to SMEs. A case study approach was identified as appropriate to address this exploratory research.

The analysis identifies the strategic IS frameworks that are valid within the SME context. **Levy et al (1999)** demonstrate that strategic IS frameworks that raise awareness of IS opportunities are as valuable for SMEs as they are for larger firms. The paper concludes that SME owners can benefit from understanding IS trends as they apply to their industry. Also highlighted are the benefits of using Porter's (1980) five forces analysis and Porter and Millar's (1985) value chain analysis to identify opportunities for improving competitiveness as well as efficiency and effectiveness. **Levy et al (1999)** shows that customer pressure stands out as the dominant competitive force.

Levy et al (1999) also demonstrate that there are a number of IS models that are context dependent. These are primarily those that Earl (1989) defines as positioning models. The research finds that there is little evidence that stages of growth models and models that consider IS department management issues are valid in the SME context. Two factors are considered: the lack of an IS department and the owner being instrumental in IS purchasing decisions. The literature analysis, case interview design and analysis and conclusions are the author's sole work. Philip Powell helped the author reflect on the

arguments within the paper to ensure their coherence. Bob Galliers reviewed early drafts of the paper.

Detailed case analysis plus the findings from **Levy et al (1999)** provide the basis for **Levy and Powell (1997)**. This paper used a worked example of a medium-sized manufacturer of automotive springs to demonstrate that SMEs can gain benefits from strategic information systems planning. There are very few worked examples of how smaller firms might carry out ISS and the benefits that might accrue. The analytical tools used demonstrate the need to understand the strategic context of the firm compared to its existing business processes in order to determine the future strategic content. This paper identifies the operational focus of planning in SMEs and supports early research in the US by Hagmann and McCahon (1993). It highlights the need for business intelligence for more efficient and effective management of the firm. It demonstrates the need for SMEs to take a more strategic perspective on IS adoption if they are to remain competitive. The research was carried out solely by the author. Philip Powell reviewed the arguments in the paper to ensure their coherence and consistency.

These two papers provide the basis for **Levy and Powell (2000)**. This paper develops and tests an information systems strategy (ISS) framework directed at SMEs. The framework describes an iterative process that considers the business context (i.e. future direction) compares it with existing business processes to determine the strategic content (i.e. future strategic IS opportunities).

Walsham's (1993) interpretive approach to information systems strategy is instrumental in informing the framework. Walsham's approach recognises that vision for change

which is a key part of developing an ISS requires an understanding of the wider role played by the social context of the business as well the internal business processes. Hence, soft systems methodology (Checkland 1981, Galliers 1987) is used to capture this wider understanding. The analytical IS tools reported in **Levy et al (1999)** are used to identify strategic IS opportunities and model current use of IS.

The paper presents data from 44 cases: the larger data set supporting the earlier findings of the exploratory research on the value of analytical tools. The analysis also supports the literature which suggests that SMEs tend to have an operational focus to IS use and owners do not think of using it competitively. This is probably due to their limited knowledge about IS opportunities.

The contribution to knowledge can be seen in three main areas, value of strategic frameworks to SMEs, utility of strategic frameworks in contexts other than those in which they have been developed and the development of an approach to development of ISS specifically directed at SMEs. The author designed, developed the research approach, undertook the data analysis and developed the concepts in the paper. Philip Powell provided useful insights in refining the analysis and discussion in the paper.

Exploring IS Concepts in the SME Context

Since starting the research in 1994 a large database of SMEs and their response to IS issues has been developed, catalogued and analysed by the author using the models and frameworks outlined in **Levy and Powell (2000)**. This SME database provides a valuable resource to investigate other IS issues that might impact SMEs. As already noted, the majority of IS issues are studied within the context of large firms rather than

SMEs. In the early 1990s both flexibility (Evans, 1991; Eardley et al, 1997) and evaluation (Farbey et al, 1992; Farbey et al, 1993; Willcocks 1992) were issues that concerned researchers; neither of these issues had been studied in the SME context. Philip Powell had recently published on IS flexibility (Eardley et al (1997) and the author's research into SMEs' IS investment provided a rich seam of knowledge to investigate this topic. **Levy and Powell (1998)** was the first to explore whether IS enhances flexibility in SMEs.

Ballantine et al (1998) was the first to review IS evaluation issues in SMEs. SMEs investment decisions are often constrained by limited resources, particularly due to lack of capital. The three authors brought different strengths to the development of the paper. Philip Powell had previously published in the field of IS evaluation. Joan Ballantine was working on financing capital IS investments in large firms for her PhD. The author's knowledge and experience of SMEs and their decisions on IS investment provided the basis of the analysis.

Flexibility and SMEs: the IS role

The hypothesis underpinning **Levy and Powell (1998)** is that SMEs are flexible organisations (Storey and Cressy, 1995) and IS can enable flexibility (Eardley et al 1997) and therefore it might be expected that IS will improve flexibility within the SME. The paper utilises Evan's (1991) model to explore flexibility. Evan's (1991) model identifies four manoeuvres for strategic flexibility from technology: pre-emptive (innovative use of technology), exploitive (using existing technology more competitively), protective (utilising technology to improve effectiveness) and corrective

(learning from past mistakes). The benefits of flexibility are identified in the article as survival, business process alignment and competitive advantage. Modelling the advantages against the manoeuvres suggests that pre-emptive manoeuvres provide process alignment and competitive advantage, exploitive manoeuvres focus on gaining competitive advantage, protective manoeuvres are directed towards survival and internal alignment, while corrective manoeuvres only aid survival. These manoeuvres and the benefits of flexibility are explored in the context of SMEs and their use of IS.

Case study analysis demonstrates that SMEs' primary focus is survival in a highly competitive environment. This leaves little time for strategic thinking. Information systems investments primarily support transaction processing. Systems specifications are either technical or ad hoc, as systems are developed by external suppliers or self-taught personnel in the firm. This limits potential for flexibility, particularly as SMEs' finances are limited. SME owners are reluctant to make the ongoing commitment required for flexible systems. Flexibility is also limited by customer demand for quality in product and process which often includes specific guidelines for IS that SMEs must follow. Overall, the case analysis indicates that SMEs do not use many tactics that might generate flexibility, although it might be argued that their focus on survival has led them to take corrective manoeuvres. But there is no evidence of IS supporting flexibility in SMEs. This provides a dilemma in that SMEs are portrayed as flexible. **Levy and Powell (1998)** suggest that flexibility might occur at a sectoral level but not at an individual level. One reason for this might be that individual firms focus on a market niche, which is likely to limit their flexibility.

Evaluating IS in SMEs

Ballantine et al (1998) explores two main aspects of evaluation taken from extant theory as applied to large firms. These are approaches to evaluation and evaluation practice. The paper shows that the reasons for evaluation range from a means of justifying investments, to decide between projects, as a control mechanism and as a learning device. These reasons lead to different approaches to evaluation ranging from quantitative and objective to qualitative and subjective. Evaluation practice is shown to be problematic as full costs are not always articulated, intangible benefits are often ignored and risk is neglected.

Evaluation in SMEs only appears to be undertaken as a means of justifying investments. Investment decisions are primarily made using financial criteria as the techniques available reflect the factors that are critical to SME success, for example, short-term liquidity, profitability and cash flow. Limited access to capital means that SMEs are likely to limit the number of IS investments undertaken at any one time. Thus, it may be sufficient for SMEs to use evaluation tools that consider a single investment in isolation. The cases show a lack of planning and control, which may make it difficult for SMEs to identify whether anticipated benefits have been achieved or to provide information for control purposes. There is little evidence of evaluation being used as a learning tool for SMEs. There is no evidence of other factors being considered such as intangible benefits, quality or flexibility. Customer dominance, it is argued, may be a major reason for limited evaluation practice.

Thus evaluation approaches in the SMEs are primarily quantitative, calculating affordability and payback, recognising the need to recoup the original investment within

a period of time. For example, payback emphasises the importance of liquidity which is an important critical success factor for SMEs.

Strategic Context of IS Investment in SMEs

The third group of papers arise from discussions between Philip Powell, Philip Yetton and the author on whether more could be said about patterns of behaviour in strategic IS investment in SMEs and hence contribute to theory development. Working closely together a model of strategic IS investment was developed which was tested using the rich database developed by the author of SMEs' approach to IS investment. Both Yin (1994) and Eisenhardt (1989) recognise the benefits of multiple cases in identifying patterns and ensuring research is robust. The analysis led to the development of an analytical model, the focus-dominance model (**Levy et al 2001**) to describe strategic IS investment in SMEs. This model is the first to explain the heterogeneous nature of SMEs in strategic IS investment. **Levy et al (2001)** identify two dimensions to consider strategic IS investment in SMEs, strategic focus and customer dominance. Strategic focus is defined as either a low cost strategy or a value added strategy, while customer dominance is defined as either few or many customers. These two dimensions lead to the proposition of four scenarios for strategic IS investment in SMEs. They are efficiency (low cost and high customer dominance), co-ordination (low cost and low customer dominance), collaboration (value added and high customer dominance) and innovation (value added and low customer dominance) (See Figure 2).

<i>Customer</i>	Low	Co-ordination	Innovation
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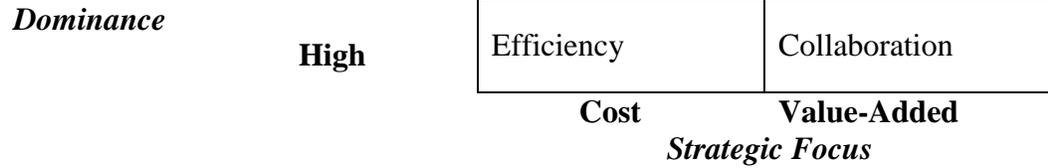


Figure 2: The Focus-Dominance Model (Levy et al 2001)

The efficiency scenario is seen when SMEs focus on IS for support and internal control of finances. The co-ordination scenario is based on improving internal effectiveness to maintain control in a growing SME, primarily managing customer information. Collaboration recognises the growing relationship with major customers who require effective exchange of information to process transactions and manage quality, IS becomes more sophisticated with SMEs recognising the value added potential. The final scenario, innovation, is seen in firms that recognise IS as integral to business strategy. Investment in IS influences business strategy direction in these firms. The literature analysis led to the development of the hypothesis that IS adoption in SMEs is a function of the strategic context as defined by the focus dominance model.

Testing the model was done in two ways, first assigning case firms to the scenarios based on its strategic context as understood through competitive forces analysis and Seven-S analysis, second through classifying the firms through their IS systems. The analysis was carried out by all the authors. The author wrote much of the literature review and the detailed case studies that form a key part of the paper.

The focus-dominance model provides a novel conceptual approach to understanding strategic IS investment in SMEs. The four scenarios indicate that, in general, SMEs' information systems align with their strategic direction. **Levy et al (2001)** shows that SMEs that take a cost focused view of strategy utilise basic IS systems such as

accounting and customer databases for managing the business, as identified in the literature. However, the paper also shows use of more complex IS for managing the business in those firms taking a value-added approach to strategy. **Levy et al (2001)** provides the first evidence that it is possible to differentiate SMEs' strategic IS investments.

As the propensity to grow is one of the main distinguishing features of SMEs, an implicit dynamic is likely to be embedded in the focus-dominance model. **Levy et al (2001)** suggest that firms approach to IS investment can take one of two paths. The first is a change in focus from efficiency to co-ordination to manage an increasing customer base. The second path is from efficiency towards a value added strategy to improve collaboration with major customers. **Levy et al (2002)** explore this contention. Additionally **Levy et al (2002)** consider two approaches to dynamics identified in the literature. The first is that SMEs adopt a 'stages of growth' model to investment, including IS, as part of planned growth (Churchill and Lewis, 1983). This approach is questioned by Storey (1994) who suggests that the approach to growth, and hence investment, is dependent more on the owner, industry sector and structural factors such as location.

The focus-dominance model is used in this paper to analyse 43 SMEs' strategic IS adoption in the past, currently and the future. The data is taken from the detailed database the author developed that mapped SMEs IS investment behaviour over time. The analysis enables the dynamics, if any to be seen. The analysis shows that in the long term the dominant paths are either moving from efficiency to co-ordination or from efficiency to collaboration. Two firms plan a move directly from efficiency to

innovation. In both cases the owners identified strategic opportunities from IS which they believe can change their market position. Storey's (1994) perspective is valid here: strategies for growth are a combination of the owner knowledge and experience, the firm's structure and organisation and the business strategy..

Seventeen of the case firms plan innovative use of IS in the longer term and here a "stages of growth" model may be observed as the owners recognise the need for structural change. However, this does not negate Storey's contention that the knowledge of the owner, the organisational structure and business strategy are important in planning growth. Thus, the focus-dominance model informed by Storey's analysis, appears to offer a useful means of considering dynamics in SMEs.

Knowledge Sharing and Co-opetition in SMEs – the IS role

The focus-dominance model suggested to us that there are different approaches to managing knowledge in SMEs and that this might impact on SMEs ability to work co-opetively with their customers and share knowledge. **Levy et al (2003)** grew from knowledge that Philip Powell had of work carried out by Claudia Loebbecke and Paul Fenema using a game-theoretic approach to investigate knowledge sharing particularly in those firms that work in co-opetition (Loebbecke and van Fenema 1998).

Co-opetition is defined as a dual relationship between firms that can simultaneously be co-operating and competing (Brandenburger and Nalebuff 1996). Firms may work together as complementors to improve product quality and safety with a supplier while competing in the same market. Exchange of knowledge between firms to satisfy the

requirements of this process may lead to benefits to the firms beyond the original intended use.

Levy et al (2003) explores explicit knowledge management in a new context, the SME. Four questions were posed in the paper. The first is whether co-opetition is an issue for SMEs. The second asks about the role of IS in managing knowledge in SMEs. The third question asks how co-opetition forces (synergy and leverage) manifest themselves in SMEs. The final question considers how SMEs may attempt to manage knowledge sharing.

Knowledge sharing is known to be essential for collaborative working (Kanter 1994). More than this, if partners expect to benefit from a relationship then they may well be in co-opetition, either collaborating or competing depending on the market circumstances. Knowledge sharing may benefit either or both partners positively or negatively. Loebbecke and Van Fenema's game theoretic model considers the influence of synergy and leverage on knowledge sharing. Synergy is defined as both firms gaining additional value from knowledge; while leverage is defined as when the partner receiving the knowledge gains more than the giver.

The focus-dominance model and the game-theoretic model are integrated to explore the potential of knowledge sharing under co-opetition in the four strategic IS investment scenarios for SMEs identified in **Levy et al (2001)**. The proposition of the model is that co-opetition is unlikely to be an issue for SMEs with a cost-focused strategy. However, those firms that take a value added approach, particularly those in the collaboration

scenario will find knowledge sharing of value. Firms in the repositioning¹ scenario may have an ambiguous attitude to knowledge sharing. This may be because their strategic positioning leads them to be protective of their knowledge, even though they value working co-operatively.

The method used in the paper is case analysis for two reasons. First, the research is exploratory and second multiple cases provide a useful means of identifying patterns. The case analysis was carried out by Philip Powell and the author separately and then reviewed together. Thirty-seven cases were taken from the extensive database of SMEs that developed by the author. The analysis focused on the use of the different management information systems found in the firms.

The research confirms that there is little or no interest in knowledge sharing in SMEs with an efficiency focus. Similar findings are seen in the co-ordination scenario, although four firms exhibit strong synergy and leverage which suggests an ambiguous attitude to knowledge sharing. Strong synergy may be due to the importance of knowledge sharing in product design, while strong leverage may be a function of firms using their knowledge to plan future growth.

In contrast value adding strategy firms, particularly in the collaboration scenario, do recognise the value of knowledge sharing. However, this is primarily in the area of production systems rather than in management or customer focused systems (as defined by Earl 1989). The final group of firms, in the repositioning scenario, value knowledge and utilise what they receive very effectively. However, there is some reluctance to

¹The innovation scenario discussed in **Levy et al (2001)** is renamed as the repositioning scenario as this more accurately describes the SMEs' actions i.e. repositioning themselves for future growth.

share knowledge if it is thought that it might affect their competitive position as both synergy and leverage are found to be strong.

To summarise, managing inter-organisational knowledge is important for sustaining competitive advantage. Co-opetition forces are seen to impact on SMEs, but only to a limited extent. Knowledge sharing primarily occurs in production systems in SMEs. SMEs do not seek to exploit their knowledge explicitly in either managing the firm or in providing customer support. The model development and analysis was primarily joint work with Philip Powell. Claudia Loebbecke confirmed the use of the game theoretic approach and contributed to ensuring the logic of the paper.

SMEs and Internet Adoption

In the late 1990s Internet technologies were becoming more widely available. Governments round the world identified SMEs as a high priority group that would benefit competitively from adopting internet technologies and e-business in particular. Government programmes to encourage adoption and to assist SMEs with such adoption multiplied. Internet adoption amongst SMEs was considered to be a critical issue by the UK government and considerable resources were made available to encourage uptake of internet technologies. There was very little research on the strategic value of Internet technologies for SMEs at this time. There was little appreciation in the literature of the different drivers for adoption by SMEs or acknowledgement of their heterogeneity. The author recognised the opportunity to identify whether internet technology adoption followed similar patterns to other IS investments in SMEs.

These papers reflect the outcome of three research projects the author was awarded from 1999 to 2002.

Levy and Powell (2003) questioned whether SMEs followed a Stages of Growth model of Internet adoption as posited in the IS literature (Costello and Tuchen, 1998; Willcocks and Sauer, 2000; Currie, 2000) or whether SME Internet adoption strategies are contingent on factors such as owners' attitude, business strategy, perceived benefits and customer influence in a similar fashion to their other IS investments. As the research was exploratory semi-structured interviews of between 1-2 hours were undertaken with 12 SME owners. The interviews reviewed business strategy, competitive influences and future internet potential as perceived by owners. Interview analysis was confirmed by the interviewees to validate the authors' understanding. The internet technologies in use in the case firms are used as a measure of the SMEs' recognition of the value of e-business. The research shows that SMEs do not follow a stages model, rather a segmentation strategy is seen based on whether business growth is planned or not and whether business value of the internet is high or low. There is little evidence that SMEs see e-business as a major change agent. The author developed and designed the research, undertook the case studies and the preliminary case analysis. Philip Powell and the author developed the segmentation strategy model jointly.

Following on from this research the author was asked by the West Midlands regional e-envoy to review and gain more detailed knowledge on the drivers for internet adoption among SMEs across the region in order to offer them better support. **Levy et al (2005)** investigate whether and in what way strategic intent affects SMEs attitude to e-business. The research approach used in this paper utilises the outcomes of a West Midlands wide survey. The value in using a survey is that it allows comparison between industries and

strategic intent across the region. The author developed the survey questions with Les Worrall.

Three research questions are posed in **Levy et al (2005)**. The first question focuses on whether strategic intent drives e-business adoption and whether it is a function of market position or product innovation. **Levy et al (2005)** show that SMEs remaining in their existing markets are the least likely to invest in e-business. The main finding, contrary to the literature at that time, is that product innovation rather than market penetration drives e-business. The second research question explored whether there is any difference between industry sectors. The research outcome is not clear. More research is needed to explore whether there is industry sector differentiation.

The final question is whether strategic intent is influenced by enablers and inhibitors of e-business adoption. The findings confirmed existing research that customer demand, increasing market share, avoiding loss of market share and improving on-line services are important enablers. This suggests that SMEs believe their strength lies in their market niches. The key outcome here is that firms whose strategic intent is product development perceive the need to improve online services as of lesser importance than reducing operating costs. Inhibitors of e-business adoption are confidentiality, fraud and cost. These findings concur with the literature. However, in contrast to the literature, limited IT skills and management unwillingness are not seen as inhibitors except in innovative firms following a diversification strategy.

The final paper in this group presents findings based on the author's European Regional Development Fund (ERDF) award of £315k over three years to evaluate internet adoption in Coventry and Warwickshire as part of a wider research project. **Beckinsale**

et al (2006) explores internet adoption influencers for SMEs. The author and Martin Beckinsale developed semi-structured interview questions to identify markets, customers, competitors and suppliers and institutional influencers (local internet adoption projects and government information) on SME internet adoption. Fifty SME owners whose firms participated in the ERDF project were interviewed. Interviews lasted between 1-2 hours and firms were visited at least twice over the duration of the three year research project. Interview reports were confirmed with the interviewees. The analysis identifies five different patterns or networks influencing behaviour on internet adoption amongst SMEs. The expert network tends to be hi-tech firms where staff and owners are highly knowledgeable about IS and the internet. Internet adoption is primarily influenced by customer requirements. The second group, the industry support network, introduces a further market influence, regulatory bodies, as well as customers. The next group, the customer-led network, is purely driven by customer demands. These three networks represent firms driven by market demands. The final two groups have no external pressures on them and are investigating opportunities rather than intending to invest. The first group, ICT support network, are firms that are looking to improve internal integration and the owner is investigating whether internet technologies can help. The final group, the Novice network, are not sure of the value of IS at all and are enquiring about possibilities.

The main outcome from the analysis is that competitors have no influence on internet adoption, it is only IS suppliers that have some influence. Local government funded internet projects are well supported and regulatory body support is instrumental, however, national government projects, such as UK online provide no influence. The

other finding from this research is that internet adoption is more likely when SMEs have a planned strategy. Martin Beckinsale and the author designed the research approach together and Martin Beckinsale undertook the data collection. The analysis and writing was done jointly. Philip Powell supported the final development of the paper.

Strategies for Growth in SMEs: the role of Information and Information Systems

The final inclusion in this submission is **Levy and Powell (2005)**. This book is the first authored book to study strategic IS in SMEs. It provides a valuable contribution to the study of IS in SMEs as it provides insights into IS theory from an SME perspective as well as providing new theories that help researchers understand strategic IS investment in SMEs. This book brings together the learning from the above papers and demonstrates their coherence as a theme: the strategic role of IS in managing SMEs. The strength of the book is that it describes the reasons in detail for studying both SMEs and IS. Case studies are used regularly to explore the main points in the discussion. The concepts from the papers are explored in greater detail in many cases by using an extended range of cases which increases the robustness of the research. The book not only develops theoretical ideas that have the antecedents in the papers described above, but also provides many case examples that enrich the theory.

The author used a sabbatical in 2003-4 to put the book together. Philip Powell and the author worked together on the structure and issues that the book contains. The author prepared the first draft. Philip Powell and the author worked together on developing and

polishing the finished product. There is no doubt that the author's sabbatical helped bring the project to fruition more quickly than it otherwise might have been.

Levy and Powell (2005) is organised in five sections. The first section defines and introduces the influences that affect SME growth. This includes the changing management structures that occur as SMEs grow. This discussion leads into issues of organising and managing SMEs including, briefly, the role of business systems. The first section of the book provides insights into the role of IS in managing firms and what this means for SMEs. It addresses issues of IS flexibility and IS evaluation in the light of this understanding. The second section introduces information systems strategy (ISS) demonstrating the dynamic relationship between ISS and competitiveness before discussing the value of strategic IS frameworks to understanding ISS in SMEs. Section two also shows the identification of relevant analytical IS tools towards the development of the organisational ISS approach for SMEs. It is completed by a detailed case study demonstrating the use of the approach. The third section introduces the concept of IS as a strategic resource in SMEs, in particular issues that may affect adoption and use of IS in SMEs. The issues raised in **Levy et al (2001) and Levy et al (2002)** are revisited and the arguments strengthened by utilising data from the 44 cases identified in section one of the book. Two further strategic IS issues are explored in this section: business transformation and strategic alignment. Business transformation as defined by Venkatraman (1994) is shown not to be followed by SMEs. SMEs are found to have limited strategic alignment as defined by Scott Morton (1991), although strategic alignment can be achieved by those SMEs for whom information systems are a strategic driver.

The fourth section in the book reflects on planning and managing knowledge including re-engineering in SMEs. Again these chapters provide some of the first empirical research that addresses these concepts. The co-opetition concepts described in **Levy et al (2003)** are reconsidered using an extended case analysis. The chapter considers the value of knowledge sharing for SMEs in building future partnerships, particularly with customers. The chapter on the role of core competencies in developing ISS, is based on Duhan et al (2001). This chapter explores whether the resource-based view (Miller and Shamsie 1996) provides a richer means of analysis for the development of information systems strategies in SMEs. The chapter shows that an understanding of core competences is useful when developing an SME information systems strategy. The final chapter in this section focuses on business process engineering (BPR). The chapter develops early research on the value of BPR to SMEs by Chang and Powell (1998). The chapter uses eight Taiwanese cases to explore Chang and Powell's framework. A revised model is developed that shows BPR success is dependent upon customer relations, IS investment and financial resources and empowered by innovation, employee empowerment, top management commitment and strategic direction.

The final section of the book looks towards the future. It investigates e-business opportunities for SMEs. The ideas from **Levy and Powell (2003)**, **Levy et al (2005)** and an earlier version of **Beckinsale et al (2006)** are included here. The final chapter reviews the learning from the book. It includes a revised focus-dominance model that acknowledges the role of internet technologies. The chapter reminds readers of the importance of the role of the owner in making IS investment decisions in SMEs. The role of customers in knowledge sharing and in development of partnerships is identified

as critical in IS investment. ISS is important for SMEs, particularly those planning growth. There is potential leverage from knowledge and information that can benefit SMEs.

Contribution Summary, Methodology and Impact

This section summarises the contribution to knowledge from this submission. Methodological approaches are reviewed and justified. The impact of the research is discussed briefly.

Contribution Summary

The published works provide a significant contribution to understanding the role and value of strategic information systems to an under-researched constituency: small and medium-sized enterprises. Significantly for the study of strategic information systems, the published works provide evidence of the value of IS analytical tools and techniques for analysing strategic information requirements in new contexts. The application of these analytical tools and techniques within SMEs provides good evidence for their inclusion as part of the general body of strategic IS knowledge.

The converse is also true. There are a number of IS tools and techniques that are not useful in analysing SMEs, primarily because their organisational structures tend to be less formal than larger organisations. Also, SMEs tend to have fewer systems and less complexity which makes some IS analytical tools difficult or impossible to use. Therefore, context is an issue when using analytical tools.

The submission provides significant insights into the value of developing information systems strategies for SMEs. It shows that SMEs can benefit from such strategies in a similar way to larger firms. While previous research suggests that SMEs primarily take an operational focus to ISS (Blili and Raymond 1993), this submission demonstrates that ISS can be used to improve business effectiveness. The submission also confirms

the limited role of information systems in promoting competitive advantage in SMEs found in previous research.

This research finds that in the field of strategic IS it is possible to differentiate SMEs by two key factors. These are the role and importance of customers and the strategic focus of the business. The focus-dominance model developed in **Levy et al (2001)** identifies four scenarios for SMEs. The significance of this research is that it is the first to identify the different strategic IS requirements of different groups of SMEs. The research also finds that business growth paths differ for SMEs depending upon the owners' strategic objectives and this leads to different strategic IS development paths.

This differentiation is also identified in e-business adoption which is seen to be driven by potential for business value from the internet and growth strategies in SMEs. What this research clearly identifies is that "stages of growth" models are of limited importance to SMEs due to their different strategic perspectives. The research also identifies the role of intermediaries in e-business adoption and provides further evidence for the need for trust.

Methodology

The description of the papers in this submission includes discussion of the methodology used. This section reflects on different research approaches available to the IS researcher and their relevance to the research in this submission. The reasons why several of these were not selected is discussed briefly and the rationale for adopting the case approach which is the predominant methodology is discussed.

Many approaches have been taken to studying IS and therefore it is useful to reflect at this point on whether or not other approaches might have been used in this research. One of the best known taxonomies is that of Galliers (1992) who discusses strengths and weaknesses of different research approaches in the study of IS. Table 1 presents an adaptation of Galliers' taxonomy applied to the research in this submission. It shows that laboratory experiments and, to some extent field experiments, depend upon having a small number of well defined variables (Benbasat et al 1987). Field experiments do not address context (Cavaye 1996), which was one of the main drivers for this research. In the research discussed here there are many ill-defined variables therefore neither field nor laboratory experiments are suitable approaches. Surveys are useful in looking at relationships at one particular time as was seen in **Levy et al (2005)**. In this paper variables are clearly defined and quantitative analysis is helpful in drawing out inferences. However, research issues in the other papers do not readily lend themselves to the survey methodology, particularly as the research seeks to understand causes and processes. Galliers (1992) indicates that surveys may be unable to address causes and processes. The research does not seek to model futures therefore forecasting and futures research is not suitable. Simulation is not possible as modelling the complexity of the real-life situation is one of the main purposes of the research. The subjective/argumentative approach is not appropriate as observation is thought to be important for this research rather than relying on the researchers' existing knowledge. Finally, action research is an approach that could be considered as practical assistance is given to the SMEs in the research but they were not involved in the learning process within the studies.

Research Approach	Key Features	Strengths	Weaknesses	Appropriateness for the author's research
Laboratory Experiments	Using analytical techniques to measure dependent variables while controlling independent variables in order to make generalisable statements about real life situations	Intensive study of a small number of variables in a controlled situation	Over-simplification of the experimental situation when compared to the real world	The research situation is to explore issues in the real life context. Variables are not clear nor are they limited. Analytical techniques could not be employed
Field Experiments	Extension of laboratory experiments into the organizational setting	Greater realism in the data collection	Difficult to find organizations to study in this way. Difficult to achieve sufficient control in the real world setting	While the real world setting is achieved, the issue of not knowing the limited number of variables makes this approach unsuitable
Surveys	Looking at relationships at a particular moment in time using questionnaires or interviews. Using quantitative analytical techniques to draw out inferences	Can study many variables. Can describe real world situations. Can make generalizations as outcomes derived from a large population	Limited insight into the causes/processes being studied. Possible bias in respondents, the researcher and the timing of the research	This approach has been used in Levy et al (2005) . The research sought to understand at a particular moment in time whether a particular set of issues influenced internet adoption in SMEs. In the other papers the relationships are not clearly known and quantitative analytical techniques are therefore not appropriate
Case Studies	An attempt to describe relationships which exist in reality in a single or multiple organizations	Able to capture the real world situation in greater detail and analysing more variables than is possible in the above approaches	Difficult to generalize, given problems of obtaining data from statistically meaningful number of cases. Lack of control of variables. Different interpretation of events by individual researchers.	Access to a wide range of SMEs was possible for the research discussed in this submission. The main control was size rather than other factors such as industry. Multiple sources of data including interviews, observation and documentation ensure robust analysis that describes relationships. Validity testing reduces researcher bias.
Forecasting, futures research	Deduction about future events or impacts using regression analysis, time series analysis or Delphi	Provides insights into potential future situations if the current relationships may not	Lack of real knowledge of future events. Scenarios are representations that are only as good as the past data and	This research seeks to look at current organizational relationships to understand the different drivers for IS adoption. It does not seek to model future events

		last. Attempts to deal with rapid changes in IS and its impact on society and organizations	the abilities of the researchers	
Simulation, game/role playing	An attempt to copy the behaviour of a system which might be difficult to solve analytically, by the introduction of random variables	Provides an opportunity to study situations that might be impossible to analyse	Similar to experimental research as it is difficult to devise a simulation that reflects the real world situation	This approach is again not suitable to this research as the complexity of the situation is not clearly understood nor are the variables identified
Subjective/argumentative (cf phenomenology, hermeneutics)	Creative research based more on opinion/speculation than observation, thereby placing greater emphasis on the role/perspective of the researcher.	Useful in building theory that can subsequently be tested. Creation of new insights and ideas. Recognition that the researcher will interpret what is being studied in a particular way. Contributes to cumulative knowledge	Unstructured, subjective nature of research process. Despite making the prejudice of the researcher known, this is likely to bias the interpretations	This research required observation and analysis of real life situations in order to build knowledge that could be used to test existing concepts in IS research and also to develop new ones. It was important to the research to avoid researcher bias. Thus this research approach is not appropriate
Action Research	Applied research where there is an attempt to both add to theoretical knowledge as well as provide practical assistance with a real life issue. Learning is gained by the researcher and the research subject. The researcher is an actor in the research process	Practical as well as theoretical outcomes that enable the organization to develop and grow. The researcher's biases are known.	Similar to case study research but places more responsibility on the researcher as they are part of the research process. The ethics of the researcher might be an issue	It could be argued that the case studies in this research were a form of action research as practical assistance was provided in the form of advice on strategic information systems that would improve efficiency, effectiveness and competitiveness. However, researchers were not embedded within the firms nor were the staff in the firms involved in the process, thus there was not transferred learning.

Table 1: Comparison of IS research Approaches (adapted from Galliers 1992:150-152)

The case study has been the predominant approach taken as the research objective is to understand relationships within organizations. As Galliers (1992) argues case research in the study of information systems is useful as it enables descriptions of organizational relationships to be made that reflect real life. Case studies provide a rich medium for understanding organizational issues and information flows (Walsham 1993, Eisenhardt 1989). SMEs organizational structures and processes, while simpler than large firms, tend to be more informal, hence a case approach provides a means of understanding relationships and information flows. Yin (1994) suggests that cases are particularly useful when investigating real life situations, especially when there is a need to appreciate the views of several sources of evidence. In this research submission the evidence is variously the views of managers and staff in the case firms, documentation such as business plans and accounts, as well as researcher observation of the business processes and systems.

In the submitted papers the research is seeking understanding and also eliciting meaning from behaviour within a social context (Cavaye 1996). Thus an interpretive case approach is used to understand a little known phenomenon: the role of IS in SMEs. Theory is used to guide the design of the research as suggested by Walsham (1995).

Apart from **Levy and Powell (1997)**, the other case-based papers use multiple case studies. Multiple case studies provide more compelling evidence and lead to the study being considered more robust (Yin 1994:45, Darke et al 1998). As has been discussed previously, SMEs are heterogeneous, thus multiple cases are necessary to identify whether similar or different patterns emerge that can explain their attitudes to IS. As Eisenhardt and Graebner (2007) argue, multiple cases are helpful in theory building as they enable research questions to be explored in more depth. The use of

multiple cases is considered to lead to more generalisable theory (Eisenhardt and Graebner, 2007). Patterns of behaviour are identified through researchers coding their observations and interview data. Data gathering and analysis continues until patterns emerge and confirm the research question (Glaser and Strauss 1965). **Ballantine et al (1998), Levy and Powell (1998) and Levy et al (1999)** use four detailed cases to explore existing IS tools and techniques. In these cases the detailed descriptions of the cases as well as the model analysis through use of data matrices provides sufficient understanding to draw out inferences about the research issues. The data matrices are discussed in detail in **Levy et al (1999)**. Whereas in later papers – **Levy and Powell (2000), Levy et al (2001), Levy et al (2002), Levy et al (2003), Levy and Powell (2003), Beckinsale et al (2006)** - exploration of patterns leading to the development of theory required more cases to be analysed. The data matrices are developed for all the cases by the author and reviewed by collaborators independently.

Overall, the case approach has been found to be the most useful in developing understanding and analysis of the use of strategic IS in SMEs.

Impact

The impact from these papers can be seen from the number of citations listed in Appendix 3. The papers provide researchers with both new ideas that contribute to the on-going development of the study of IS in SMEs, which is a rapidly growing field of research. The focus-dominance model (**Levy et al 2001**) is recognised as a useful way of understanding IS adoption in SMEs. **Ballantine et al (1998)** is also an influential paper that is cited widely as it demonstrates the role of evaluation in SMEs.

Levy and Powell (2005) is seen as a useful resource by researchers, judging by its steady sales.

Practically, the concepts in **Levy et al (1999)** and **Levy and Powell (2000)** contributed to the development of an MBA module on ISS that enabled students to work with SMEs in developing an ISS. Student learning benefitted from both practical experience and also the reflective process enabling them to appreciate the extant knowledge of information systems strategy. SMEs benefitted from the process through the delivery of a company based information systems strategy. MBA students have since used the concepts as a basis for their dissertations and to develop their own approaches to ISS that help them develop their consultancies.

Current and Future Research

This section reviews current research on strategic alignment of IS in SMEs which shows that SMEs follow different paths to strategic alignment contingent upon their position in the Focus-Dominance model. Future research into the role of innovative technologies in supporting competitiveness within SMEs is outlined.

Current Research

Levy et al (2001) and Levy et al (2002) led Philip Powell, Philip Yetton and the author to consider how strategic alignment could influence strategic IS adoption in SMEs. Strategic alignment of IS has long been an issue of concern to researchers seeking to understand the relationship between business strategy, technology adoption and organizational structure. It is believed that strategic alignment sustains competitive advantage (Avison et al 2004).

Alignment requires consistency between decisions taken in each domain to ensure fit with both internal and external environments (Yetton and Sauer 1997). Philip Yetton's knowledge and research on strategic alignment led to him, Philip Powell and the author to undertake research on alignment in SMEs.

This research considers the classic model of strategic alignment, the MIT90s (Scott Morton 1991). This model suggests a path to alignment or fit that considers strategy then structure followed by alignment of management processes, technology, roles and skills. Later research Yetton et al (1994) and Hsiao and Ormerod (1998) find different paths to alignment. This suggests that the choice of path may be context contingent. In the SME context this is supported by **Levy et al (2001)** which argues that choices about IS are a function of the location in the Focus-Dominance model. This suggested that SMEs may choose different paths through the MIT90s model

dependent upon their location in the Focus-Dominance model. The general question of the research is to investigate whether and if this is the case and what the different paths might be.

Future Research

Most SMEs have long been thought to be cautious in their adoption of new technologies, often not being able to identify business benefits. The Focus-Dominance model goes some way to explain the reasons for this. The model is revised in the final chapter of **Levy and Powell (2005)** to include Internet tools such as e-mail and web services. This suggests that SMEs follow a similar path to adoption with innovative technologies as with more traditional management information systems.

Future research could investigate whether this is the case by initially considering Radio Frequency Identification (RFID) technologies. These have been widely adopted over the last decade primarily to enhance supply chain efficiency (Loebbecke and Palmer, 2006). Two small grants from Advantage West Midlands and Warwick Business School with Stephen Roper are enabling the research to progress. The approach to investment by SMEs into other innovative technologies such as Web 2.0 and cloud computing should provide additional evidence on patterns of adoption.

Conclusions

The knowledge presented in this submission highlights the development of thirteen years of research into strategic IS investment in SMEs. This document identifies the reasons for considering such a study and demonstrates that it is possible to understand the different drivers for investment by SMEs. In particular, it is clear that the business objectives and strategies of SME owners as well as their market position as indicated by customer dominance are critical in decisions on strategic IS adoption.

The development of the research from exploring the value of strategic IS models and a new approach to information systems strategy in SMEs to identification of the different drivers strategic IS investment, leading to new model development, is discussed. The acknowledgement of SME heterogeneity in strategic IS investment led to further exploration of knowledge management and e-business. Strategic IS investment in e-business is a final theme that is explored in later papers, which both critique existing concepts and develops new models that are applicable to SMEs. The contribution to knowledge is discussed and the rationale for the methodology used. Current research on strategic alignment and future research on adoption of innovative technologies in SMEs is discussed in the context of the papers included here. The research is shown to have had impact on the research community as well as practical use in teaching.

These papers demonstrate that the first research theme that IS adoption may depend upon the nature of the SME has been addressed through the identification of the four scenarios of the Focus-Dominance model. This model has been shown to be a useful means of exploring SMEs' strategic adoption decisions. The second research theme investigating the value of IS concepts in the SME context shows that not all IS

concepts and models are transferable from the large firm environment in which they are developed nor are they context independent.

The document shows the author's development over time as well as the development of collaborative relationships that have enabled the growth of a clear body of knowledge that contributes to current research in the field strategic IS investment in SMEs as shown by the citations.

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Appendix 1: Written statements by collaborators

Appendix 2: Contribution to the submitted papers by the PhD candidate

	Papers	Co-Authors %ages							
		ML	PP	PY	CL	JB	MB	RDG	LW
1	Levy et al (1999)	80	15					5	
2	Levy and Powell (1997)	80	20						
3	Levy and Powell (2000)	80	20						
4	Levy and Powell (1998)	50	50						
5	Ballantine et al (1998)	40	30			30			
6	Levy et al (2001)	40	30	30					
7	Levy et al (2002)	40	30	30					
8	Levy et al (2003)	40	40		20				
9	Levy and Powell (2003)	80	20						
10	Levy et al (2005)	50	10						40
11	Beckinsale et al (2006)	40	20				40		
12	Levy and Powell (2005)	60	40						

CL: Claudia Loebekke
 JB: Joan Ballantine
 LW: Les Worrall
 MB: Martin Beckinsale
 ML: Margi Levy
 PP: Philip Powell
 PY: Philip Yetton
 RDG: Bob Galliers

My contribution to the published papers is the equivalent of 6.2 single authored papers. The book is not included in this summation

Appendix 3: Citations

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Appendix 4: Bibliography of all published work by Margi Levy

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