



Challenges facing W. Midlands ICT-oriented SMEs

Caroline Chibelushi and Pat Costello

*School of Computing and IT, University of Wolverhampton,
Wolverhampton, UK*

Abstract

Purpose – The purpose of this paper is to highlight the challenges faced by West Midlands (UK) information communications technology (ICT)-oriented small to medium-sized enterprises (SMEs) in adopting and coping with the speed of fast-changing technologies.

Design/methodology/approach – A total of 73 company managers (most of them are owners) were interviewed in various sub-regions of West Midlands. Among the companies, 81 per cent of SMEs opted for face-to-face interview, while 19 per cent opted for a telephone interview.

Findings – Several factors that affect the speed of adopting new technology were identified, ranging from SME owner or manager level of education, lack of strategy and perceived benefits in adopting new technologies, to ICT investment, involvement in research, innovation and research and development.

Research limitations/implications – The study focused on the ICT-oriented businesses in general. ICT is a wide area and so there is a need to test each type of ICT and see how other factors like geographical location affect the business. Also, it would have been interesting to have large number of medium-sized businesses involved in the survey.

Practical implications – The identified factors need to be addressed if sustainable ICT adoption within the ICT-oriented SMEs in the region is to be achieved. The research provides a basis for the establishment of future projects that will embed these factors.

Originality/value – This is the first study that uses a large data sample collected through face-to-face interviews to present the challenges faced by the ICT-oriented businesses in West Midlands in adopting new technologies. The study suggests means to achieve a successful and sustainable technology adoption for ICT-oriented SMEs in the region.

Keywords Communication technologies, Small to medium-sized enterprises, Problem solving, United Kingdom

Paper type Research paper

Introduction

The advancement in information communications technology (ICT) has had major influences on globalisation, rapid revolutions in information and knowledge (Kaynak *et al.*, 2005; Pavic *et al.*, 2007), business structural change (Booz Allen Hamilton, 2002) and the way small to medium-sized enterprises (SMEs) conduct their business activities (including their marketing strategies, service provision, working practices and management). A typical example is the internet, fibre optics, satellite which have launched an enormous technical revolution (Sprano and Zakak, 2000), coupled with increasing advancement in software languages such as the Microsoft.Net environment. For example, the Microsoft.Net development environment is proving to be popular because it allows firms to rapidly produce web-based software (Thompson, 2007).

The preparedness of each SME to respond to these ICT developments vary (Ritchie and Brindley, 2005) greatly because their structure and size make the obstacles they face unique (Ramsey *et al.*, 2004). In addition, changes in ICT with their impact on the



cost and skills of the workforce often cause major challenges for most organisations and these are mostly on human resources (Bee and Bee, 1994). Specifically, SMEs have major constraints that are related to their inability to make the necessary investment to adopt new technology and take advantage of the concepts provided by ICT (Maguire *et al.*, 2007). Recently, Holden *et al.* (2007) reported that there were approximately 2.3 million students (i.e. full- and part-time) in the UK. However, McLarty (2000) states that the skills associated with SMEs demands are significantly different from those offered by graduates, and that SMEs expect that the recruitment of graduates will bring into the firm “work-ready” recruits.

This problem could be associated with the problem reported by Lai (2008), who states that the usage of ICT such as e-mail and internet was common among the professional accounting students, but the same students had not mastered the application of accounting software.

Loukis and Sapounas (2008) reported that research concerning the relationship between ICT investment and business performance (e.g. business performance measures proposed by Brynjolfsson and Hitt (1996); Loukis and Sapounas (2004)) were mixed and inconclusive. Many questions concerning the business value generated by the significant investments that the company has made in ICT were fuzzy, and some researchers (such as Solow, 1984; Brynjolfsson and Hitt, 2000) referred to it as the “ICT productivity paradox”. On the other hand, Cragg *et al.*'s (2002) research claims that ICT investment can impact on SMEs performance and that aligning ICT to SMEs business plans can help to understand the relationship between ICT and business performance. Most SMEs recognise this and the opportunity it offers to SME global markets (Gunasekaran *et al.*, 1996). Consequently, ICT can be used as one of the strategic factors to help improve business processes and change the function of markets (Sprague and McNurlin, 1986; Earl, 1989; Peppard, 1993; Robson, 1997; Pollard and Hayne, 1998; Venkatraman and Henderson, 1999; Feeny, 2001; Taylor and Murphy, 2004; Yang *et al.*, 2007). However, Smallbone *et al.* (2001), Jutla *et al.* (2002), and Houghton and Winklhofer (2004) present the evidence showing a slow and limited response in the ICT adoption process by SMEs. Brady *et al.* (2008) consider efforts to gain efficiency and profitability from investing in ICT such as the internet (Deeter-Schmelz and Kennedy, 2004), sales force automation (Speier and Venkatesh, 2002; Geiger and Turley, 2005), electronic data interchange (EDI), marketing information systems (Li, 1995), databases (Desai *et al.*, 1998), or customer relationship management (Chen and Ching, 2004), not to have satisfied the initial expectations. In addition, over €130 billion of ICT projects have had to be abolished (McAfee, 2006). As a result, many SMEs are still uncertain to adopt new ICT, and do not believe that ICT should be considered as a strategic resource because of its commoditisation (Carr, 2003). Recently, Maguire *et al.* (2007) have also reported that SMEs are not using ICT fully. Their study suggests that the main reason could be the lack of resources and skills to do so. But ICT resources and skills can be imported to SMEs from their service or product providers (in this context – the ICT-oriented SMEs), and that SMEs do not necessarily need to have most ICT skills and resources in-house. Specifically, there are approximately 8,000[1] ICT-oriented businesses in the West Midlands region, employing up to 53,000 people. A total of 8,000 ICT SMEs can be considered to be enough ICT-oriented SMEs in the West Midlands, and should be able to provide the required ICT resources and skills. Since the nature of their business is in ICT sector, it can also be considered that

ICT-oriented SMEs are able to adopt new technologies and cope with the speed of technological change. Akhavan and Jafari (2008) consider ICT-oriented SMEs to be highly dependent on intellectual capital rather than physical assets. However, this has not been the case, as the ICT SMEs are facing challenges in adopting new technologies (Costello and Chibelushi, 2007). Since this is the existing situation, it can be inferred that the companies from other sectors will have less confidence in adopting new technologies. That is, companies from sectors other than ICT will not risk their businesses by adopting technologies in which they may not have technical support when they need it.

The ICT-oriented SMEs, the forgotten ICT adopters

SMEs are classified based on the number of employees they hire. Literature on the classification of SMEs varies greatly (for example, Atkins and Lowe, 1997; Wilkes and Dale, 1998; Martin and Matlay, 2001; O'Regan and Ghobadian, 2004). This paper classifies SMEs by three categories: micro (one to ten employees), small (11-50 employees), and medium (51-250 employees). In addition, this paper defines ICT as any product that will store, retrieve, manipulate, transmit or receive electronically in a digital form, which comprises the following fields shown in Figure 1.

Most governments around the world, including the UK, recognise the importance of working with businesses to improve competitiveness and productivity (Sheppard and Hooton, 2006) by uniting businesses, educators, and the government to a common goal, i.e. innovation, and research and development for competitive advantages. This goal can be achieved if companies invest and use new technologies. According to the report published by Adroit Economics Ltd (Sheppard and Hooton, 2006), it is estimated that the impact of ICT on West Midlands region productivity can provide 3-4 per cent GVA[2] uplift which may be approximately ranging between £1 billion and £5 billion. This is a significant figure for the regional economy, and hence there is a strong need to support ICT-oriented SMEs in adopting new technologies. The adopted technologies will then be used to support the non-ICT-oriented SMEs, innovate different aspects of business, and to allow different SMEs (ICT and non-ICT) to be involved in research and development.

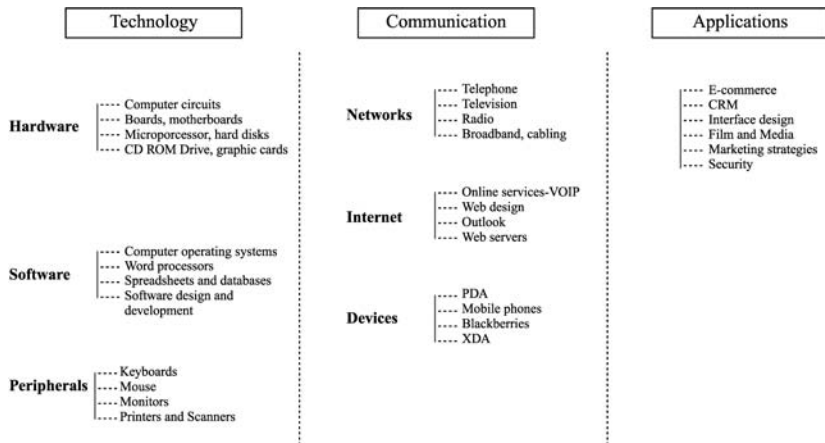


Figure 1. Area of ICT covered in this research

A speedy and a sustainable means of adopting new technologies is crucial to ICT SME businesses. However, while there is substantial research in the area of internet and e-business adoption, relatively little research has been done to express the issues of concern that are related to the process of adopting infrastructure technologies (Fink and Disterer, 2006). The first step to articulate these issues is to identify challenges that ICT-oriented SMEs face while conducting their business. IT infrastructure is generally defined as including hardware, software, development environments, shared databases, common applications, and human skills and expertise. Rai *et al.* (1997) broke down the ICT budget investigated for their research in SMEs into key areas: hardware, software, telecommunications and IS/IT staff. Here the latter definition is used and referred to.

This paper presents research conducted on ICT-oriented SMEs in the West Midlands, in which the majority of owner managers opted for a face-to-face interview. The research results show the barriers deterring ICT adoption in ICT-oriented SMEs. The primary purpose of the research is to examine the implications of these barriers with regard to the innovation and competitive advantage aspects of these businesses.

The research findings presented in this paper show that ICT-oriented SMEs need more and immediate support in adopting new technologies because this is the main determinant to their own business survival, and to the survival of SMEs that are not ICT-oriented.

SME ICT investments

Recently, Williams and Williams (2007) and Clark (2007) reported that most companies are investing heavily and are fundamentally dependent on their ICT infrastructure. However, these companies have struggled to find the best ways to successfully introduce ICT into their domain (Brady *et al.*, 2008). Consequently, it is often the case that these ICT-related investments do not deliver value or business objectives (Fitzgerald, 1998), especially when a company adopts ICT without clear understanding of the scope and implications of that adoption (Pires and Aisbett, 2003). This may often be because the new technology introduces new problems by replacing the old problems with the expectations that there will be some benefits out of it. ICT failure in organisations is not a new problem; it is a long-standing problem reflecting incapacity to deliver (Fincham, 2002). Gibson (2003) reports the reasons for underperformance in ICT being related to technology, i.e. expanding the project, unable to cope with the complexity of integrating different systems. Although companies face other challenges such as inability to develop new workflow processes, or adapt the structure of organisation or change from old to new cultural practices, this research realises that the potential of these SMEs could be maximised if there is some means to achieve a successful and sustainable adoption of ICT in their businesses. The importance of the need for SMEs to develop robust, responsive and more sustainable means to adopt ICT to support their business planning and control has been accepted (Irani, 2002; IAI, 2000) by many companies. As a consequence, ICT is not regarded as “just another option” but as a critical resource (Kohli and Devaraj, 2004) that determines SME growth and survival.

ICT-oriented SMEs, their challenges

SMEs (from all sectors) in the West Midlands region are facing similar challenges to those faced by most SMEs in UK and other countries such as Canada (Shutter, 2006), Australia (Shiels *et al.*, 2003), etc. These challenges emanate from external and internal sources and can be associated with social, legal, economic, political and technological (SLEPT) factors (ACCA, 2007; Johnson *et al.*, 2007). As a result, companies have found themselves in a most turbulent economic environment (Pavic *et al.*, 2007) with increased levels of uncertainty and risks (Ritchie and Brindley, 2005) in a so-called “e-economy” (Reis, 2006).

However, ICT-oriented businesses specifically are witnessing even more challenges that are exacerbated by social and technological factors. That is technology changes, customer behaviour and attitude aspects. For example, at the moment the internet is running out of address space which is caused by the multitude of mobile phone use, growing adoption of the internet in developing countries, widespread use of the radio frequency identification (RFID) tags, etc. There is a risk to the smooth running of the Internet until the next generation internet protocol version 6 (IPv6) is adopted (Bicknell, 2007). Although IPv6 may solve the address issue, businesses around the world have been slow in implementing it (Bicknell, 2007). Internet service providers and other ICT-oriented companies who provide services that are related to the internet are also not keen to implement IPv6 (Bicknell, 2007). The reason for this may be the changes that IPv6 can bring, e.g. the security challenges. Despite IPv6 dissemination, training and support from 6DISS[3] project, most ICT executives showed no interest. So ICT-oriented companies may not invest in or adopt the technology if the customers are showing no interest. The adoption of IPv6 may be quickened by Microsoft; as many companies are migrating to Microsoft Vista which has IPv6. Consequently, if the adoption is not smooth, it may cause challenges such as implementing the 64-bit space for individual interface IDs in IPv6 address structure. This is because the address structure is very large that may cause the appropriate scans of the available space to be practically impossible. Equally, there may be problems in effectively implementing address scanning for the purpose of security auditing and testing. This is a typical example of the challenges that ICT-oriented companies may be facing. Such problems coupled with ICT-oriented SMEs limited resources, skills and knowledge can slow down the process of adopting new technologies necessary for ICT-oriented SMEs competitive advantage.

Another major challenge faced by these SMEs is that which is associated with unavailable trustworthy, affordable and proficient consultants. The consultancy support given to these SMEs should be of high quality, independent and proactive (Maguire *et al.*, 2007). Like most SMEs, ICT-oriented SMEs may have to rely on external consultants and significant knowledge transfer to make viable contributions to their business. However, this has been problematic as most companies cannot afford to hire external consultants (Soriano *et al.*, 2002). Approximately 47 per cent of the companies involved in this study question the level of specialist knowledge being provided by external advisors. This is not a new problem, as it was previously addressed by Bennett and Robson (1999). As a result, SMEs are continuing to rely on formal and informal networks rather than utilising publicly funded sources and support (Anderson and Boocock, 2002). The specific problem that this paper attempts

to address is that: external consultants are knowledgeable but expensive, while public advisors are affordable but may lack sufficient knowledge.

The other obvious need is for ICT-oriented SMEs to have up-to-date skills so that they are able to provide the required services and products to non-ICT companies:

Re-skilling the existing workforce is crucial if the UK is to avoid an ICT recruitment crisis, although potential workers in the pipeline of school and university are important, most of the ICT staff that the UK economy will be relying on in 2020 are already working now (Thompson, 2007).

Review of ICT adoption

Different models have been developed in relation to diffusion and assimilation of innovation (Lee, 1998; Levy *et al.*, 1998; Rodgers, 1995) in business. However, Finchman (2000) suggests that researchers should develop mid-range theories “tailored to specific classes of technologies and particular adoption contexts”. In addition, most research has focused on the general factors on the use of technology in all types of SMEs. Although these types of research are important, but their work assumes that ICT-oriented SME needs are different from those associated with companies whose core business is not ICT (Costello and Chibelushi, 2007). This has led to the existing investigation gap for “ICT-oriented adoption research” presented by this paper.

On the other hand, most research that is related to SME technology adoption and the use of ICT has often targeted the use of the internet. This is from the assumption that the internet is a “booster” to national economies (Martin and Matlay, 2001). However, Swatman (1997) raises a concern that research into internet applications might differ from previous studies involving small businesses and their use of ICT. Figure 1 shows that ICT covers three major areas: technology, communication, and application, but the majority of research which is related to SMEs ICT adoption, focuses on the communication and application, and discounts the technology part. The research presented in this paper suggests that the internet is only one part of the adoption ladder; other parts (shown in Figure 1) may need to be incorporated if we want the SMEs to continue to support economies at a national level. Supporting SMEs in the adoption of the internet and ignoring other parts may result in the similar problems which UK and USA had with consequent demise of the dot.coms (Olsen, 2000).

Recently, Ritchie and Brindley (2005) introduced a model whose technology perspective comprises technology awareness, complexity, translation and embedding. Lefebvre *et al.* (2005), Grandon and Pearson (2004) and Mehrtens *et al.* (2001) model target issues concerning the efficiency and the advantages of internet as compared to traditional methods of communication (such as telephone, fax, and post). The issues included in the four models are shown in Table I.

Another model that is relevant to ICT adoption is the Department of Trade and Industries’ (DTI’s) linear model shown in Figure 2. This model is specifically discussed here because it has been used as an earlier benchmarking study to review the progress of small businesses on the internet (DTI, 2000). The model purports to represent the ICT adoption process involved in small businesses. This model has been utilised by AWM – the Regional Development Agency (RDA) in their new e-business adoption projects, despite the model critics who feel that the approach is far too linear (Martin and Matlay, 2001)

Table I.
ICT adoption models

Researchers	ICT adoption research	Included issues
Ritchie and Brindley (2005)	ICT	Technologic perspective Application perspective and Relationship perspective
Lefebvre <i>et al.</i> (2005)	Internet	Business growth Investing in IS
Grandon and Pearson (2004)	E-commerce	Organisational readiness External pressures, perceived ease of use, perceived usefulness
Mehrtens <i>et al.</i> (2001)	EDI	Perceived benefits Organisational readiness, external pressures, technical skills
Van Akkeren and Cavaye (1999)	Internet	Owner manager characteristics, firm characteristics
Rashid and Al-Qirim (2001)	E-business	Individual factors, organisational factors, environmental factors, technological factors



Figure 2.
DTI adoption ladder

Source: Martin and Matlay (2001)

However, it has focused its main attention on only one type of ICT, the internet. The model does not give emphasis on two crucial business activities, namely, innovation and research and development.

This research considers the technology part in Figure 1 as a major issue of concern when it comes to ICT adoption for ICT-oriented businesses. For example, ICT-oriented businesses have to quickly adapt to the rapid changes in programming languages, software packages and hardware in order to keep their businesses in the market. If they do not adopt new technologies quickly, then they will be unable to provide services or to produce automated procedures that may be required by their clients. In addition, the technology part contributes strongly to innovation, and hence gaining a competitive advantage.

Other literature on the adoption of ICT for SMEs (which includes SMEs from all sectors) which has mostly been concerned with the diffusion and absorption of innovation has contributed in providing the theoretical foundation for these issues. For example Levy *et al.*'s (1998) model suggests that innovation firms should integrate information systems in their business strategy plans.

Innovation, research and development for competitive advantage

ICT-oriented SMEs are involved in the manufacture of ICTs and services to support their operations. In order to facilitate their growth and manage the competition, not only should these businesses provide high quality services and products, but they should also provide unique and new services and products to the market. To achieve that, SMEs need to be involved in research and development, and innovation. A report published by Adroit Economics (Sheppard and Hooton, 2006) shows that 75 per cent of the European Union innovations produced between 2004 and 2005 were directly enabled by ICT. A typical example is that reported by Sheppard and Hooton (2006) in which ICT-oriented SMEs productivity was increased by 3 per cent after being supplied with high-bandwidth connections. Based on this fact, there is a potential need to support ICT-oriented SMEs to successfully adopt new technologies that will allow them to develop new business strategies in the region.

Research conducted by Sorey (1994) reveals that SMEs are more likely to introduce new innovation as compared to large companies because SMEs have less commitment to the existing practices and products. Also, they are less likely to be exposed to unproven technology (Gordon and Gordon, 1995). These statements are supported by Julien and Raymond (1994), who claims that SMEs are more innovative, flexible and responsive to environmental changes. However, SMEs are specifically limited in the formulation of their innovation strategies mainly because of their limited resources and technological competencies (Tidd *et al.*, 1997). Although 50 per cent of the companies reported innovation constraints are associated with cost of finance, shortage of technical and managerial skills, there is also research evidence that SMEs in-house technological and management capability to exploit new and advanced technology is low (Robson and Ortman, 2005). That is, SMEs are slow to respond to the opportunities offered by the new technology. As a result, these companies do not exploit the full advantages of the new technology to develop successful business strategies that encourage innovation for their business growth. This research examines the factors that need to be addressed to achieve that.

Research methodology

Most research that is associated with the adoption of ICT in SMEs has relied on different methodologies. The majority have used mailed questionnaires with follow up telephone interviews (Jeffcoate *et al.*, 2002; Maguire *et al.*, 2007), telephone and face-to-face interviews (Barnes *et al.*, 2007), sending questionnaires to companies (Duan *et al.*, 2002) and case studies (Ritchie and Brindley, 2005). Research into the impact of technology on SMEs is often limited by the difficulties involved in persuading the right companies to participate in the study (Jeffcoate *et al.*, 2002). This research has achieved that by using similar qualitative methods, including the questionnaire and interview approaches. The majority of prospective research contacts are usually identified from the list of companies registered in various directories (e.g. *Yellow Pages*), government

systems (e.g. tax registration records) and other institutions (e.g. banks and the post office). This research obtained its contact from a variety of sources, i.e.:

- A database with a list of SMEs in the region provided by the ICT Cluster at AWM.
- Through contacts made via attending business meetings and workshops.
- Through contacts made via attending business exhibitions.
- Through visiting various technology (or science) parks in the region.
- Through word-of-mouth referrals.

This research has elicited to rely on the above sources, rather than purely from registration-related sources, due to the limitations arising from SMEs not being registered in such systems in addition to the potential of outdated information as these SMEs move, merge, wind down or are bought by larger companies.

Exhibitions are a very good source of data, most SMEs attend such events with the view of wanting to sell or to buy, and hence many are attracted to the event. In this way it was easy to identify SMEs, even those that are not registered in some systems. In addition, data from the technology parks are very useful, as they contain information from companies that are starting (and may not have registered their company in many places), relatively inexperienced and those which are highly experienced. Also, the researcher identified other contacts by visiting the place and vetting the profiles of the SMEs on their doors[4]. Business meetings and workshops were a crucial source of contact as the researcher had more time to impress upon the companies the importance of the research and their involvement.

Based on the five methods of collecting data, 73 company managers (the majority of these being owners) were interviewed in various sub-regions of the West Midlands. Among the companies, 81 per cent of SMEs opted for face-to-face interview, while 19 per cent opted for a telephone interview. The questions used as a basis for the interview are semi-structured, involving two parts whose results can be analysed qualitatively and quantitatively respectively. The first part of the questionnaire recorded the company background, the second examined the existing infrastructure, the third elicited the ICT investment they had made and intended to make, whilst the fourth and final section discussed business performance as a result of the investment. These issues are directly related to those found in existing literature for example organisational readiness, which included factors such as: advice sought, main influences on the adoption, internal pressures to adopt, specialist skills in company, alternatives used to reduce investment costs, required support and any implementation issues experienced while adopting new technology.

Results and analysis

The following section gives an analysis of various areas covered by the study.

Part 1. SMEs involved in the study

I. SME categories. The study is dominated by micro SMEs (see Table II); this may be because micro SMEs are eager to grow, and understand that one way to develop their business is to participate and learn from different research such as this one. It also, however, reflects the profile of ICT-oriented SMEs within the West Midlands region.

Small and medium SMEs may have built experience and confidence when expanding their businesses, hence may treat participation in such research as less important to the growth of their businesses. The profile of companies also reflects the make up of the ICT Cluster in the West Midlands which is calculated as being predominately micro companies too, with the latest data from the ICT Directory and Survey project[5] showing 74 per cent of companies with less than ten employees.

II. SMEs profile. Four factors were used to represent each SME background, these are: the number of employees, the approximate turnover, number of years of operation, and SME registration type. Since 93 per cent of the interviewed SMEs are registered as limited companies, SME registration is not considered as part of this research analysis:

- *Micro SMEs.* The study managed to cover a variety of micro SMEs, in terms of employees (one to ten), years of operation (one to many) and varying amount of turnovers. Figure 3 illustrates micro SMEs with varying years of operation, classified into four categories: three months to one year, one to five years, five to ten years, and more than ten years.

Although there are micro SMEs whose business became successful in their first year with a turnover of more than £1 million, Figure 3(a) shows that

Micro	Small	Medium	Undisclosed
44	16	8	5

Table II. SME categories involved in this study

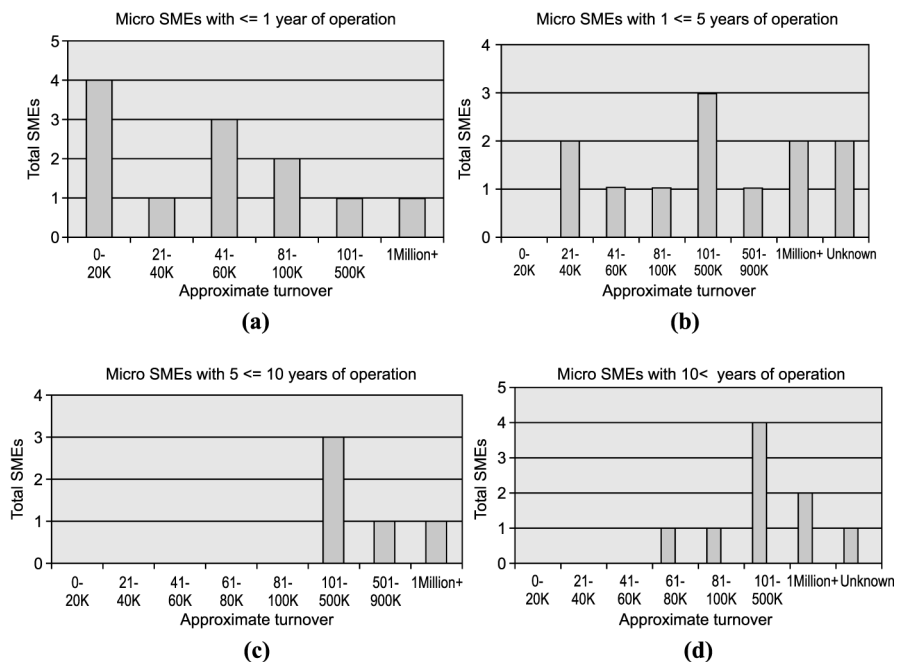


Figure 3. Micro-sized SMEs involved in the study

between one month to one year of operation, most micro SMEs will generate a turnover of up to £20,000. In other micro SMEs, however, there is a significant difference in turnover, with figures ranging from £21,000 to over £1 million.

The most encouraging aspect of this analysis is that Figure 3(b) shows that after a year of operation, the majority of the Micro SMEs almost double their turnover. Figure 3(c) and Figure 3(d) show that after five years of operation, most micro SMEs turnover range between £61,000 to £3 million.

- *Small and medium SMEs.* Small and medium-sized SMEs cover 22 per cent and 9 per cent of the study respectively. Micro SMEs cover 63 per cent, while the remaining 4 per cent are SMEs whose sizes were not disclosed. The analysis conducted in small sized SMEs (in Figure 4) shows variation in sizes and turnovers of the companies. The same applies to the results for the medium-sized SMEs (in Figure 5).

In general, Figures 3 and 4 provide evidence that there is no correlation between the years of operation, number of employees and their turnover. When the data in Figure 5 were analysed by SPSS, the output indicated that there is some significant correlation coefficient of about 0.006 at 0.01 level between the number of employees and the company turnover. However, when the number of years of operation of the SMEs was taken into effect, the SPSS output showed no significant correlation between the number of employees and the company turnover.

Figure 4.
Small-sized companies involved in the study

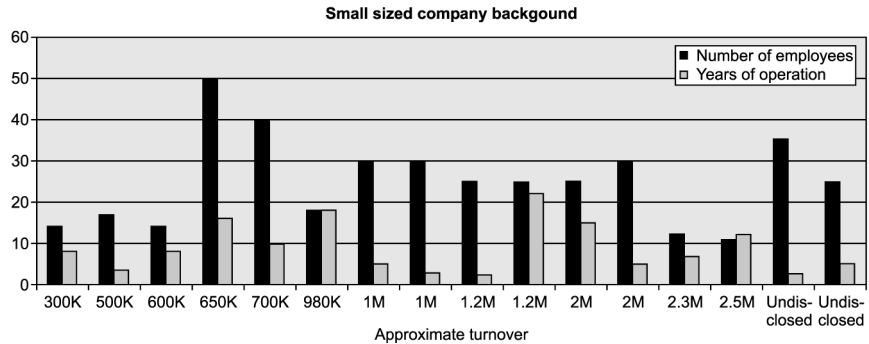
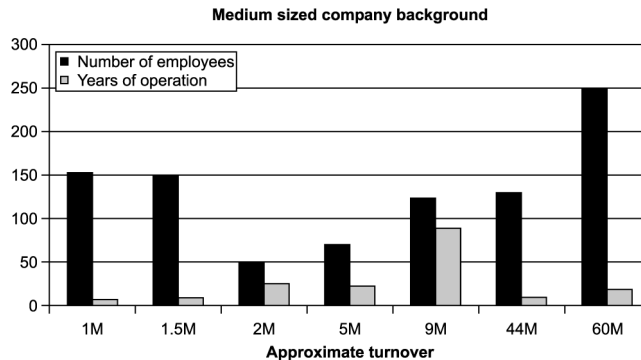


Figure 5.
Medium-sized companies involved in the study



III. Level of education of SME representative. Of the interviewed ICT-oriented SME representatives (of which the majority are the owners), 67 per cent are degree holders, among these only 23 per cent acquired their ICT skills through their degree education. A total of 44 per cent acquired their ICT skills through experience and hold a degree from fields unrelated to ICT, specifically, most hold a Masters in Business Administration (MBA), while the rest hold postgraduate degrees from biology, mechanical engineering and education disciplines.

IV. ICT infrastructure. Table III illustrates that more than 50 per cent of SMEs use networked PCs, inter-networked PCs, wireless LAN, and hand held devices a daily basis. Some SMEs use the ICT infrastructure on weekly basis. On the other hand, the results in Table III show some degree of contradiction as there are ICT-oriented SMEs which are not using networked PCs, or inter-networked PCs or use them on a weekly basis. Hence, there is an apparent need for this research to conduct further investigation to understand how these SMEs run their day-to-day businesses without any of these forms of ICT infrastructure. The speculative means that this research can think of is a broadband or a normal telephone connection. Other reasons may simply be because the SME representatives who were interviewed did not have the knowledge on ICT infrastructure and so did not answer the question correctly. The work on this research has been extended to follow up on issues that were unclear and the results will be published early next year.

It is encouraging to note that more than 80 per cent of SMEs have access to the internet and have company web sites. The research findings show that less SMEs use voice over internet protocol (VOIP), application service provider (ASP), electronic data interchange (EDI), and extranet in their business.

V. ICT investment (including purchases, sought advice, the impact of the purchases on the business). Most SMEs involved in this study invest more in non-specialised software tools (such as Laptops, PCs, external disks, printers) and minimum in specialised software[6] for their business. This is shown in Table IV.

Micro SMEs may not be able to afford to invest in specialised software tools because they are still small and may not have confidence in the future of their business. On the other hand, Small and medium-sized companies may have invested in the software in previous years and developed their companies to that stage. Because small and medium-sized companies are still loyal to their customers and these customers are

ICT systems	Per cent of SMEs which use ICT				
	Daily	Weekly	Not disclosed	Do not use	Do not understand
Stand alone PCs	25	–	–	–	–
Networked PCs (LAN)	71	1.5	17.18	9.37	–
Inter-networked PCs (WAN)	59.37	3.1	28.12	7.8	–
Wireless LAN	59.37	1.5	20.31	18.75	–
VOIP	35.95	–	25	37.5	1.5
Hand held devices	67.69	3.07	7.68	13.84	–
Access to the internet	84.61	1.5	–	–	–
Company web site	81.53	–	10.76	–	–
Application service provider (ASP)	44.61	–	21.53	0.2	3.07
EDI	10.76	1.5	27.69	49.23	7.69
Extranet	26.15	–	26.15	38.46	4.61

Table III.
SMEs ICT infrastructure

satisfied with the service they get, these SMEs may not see the importance of investing in the new technology. This was indicated in Kamath's (2007a) article, which quoted one of the ICT directors saying:

[...] organisations being technology-led rather than business-led is one of the main reasons why ICT projects fail [...] the company does not invest in ICT, it invests in solving problems.

222

However, innovation is an important factor in developing and sustaining competitive advantage (Tidd *et al.*, 2001a, b). Doing things better on its own is no longer enough, it is about "doing new and better things" (Slatter and Narver, 1995), and hence the need to invest in new technologies which can allow businesses to provide new and better services or products. Although Figure 6 shows an increase in businesses piloting new technologies, many managers are wary of the technology, and 35 per cent have taken no action on new technologies (Clark, 2007). Most of the companies involved in this study see the cost of software as being a major obstacle. Some companies do not perceive the benefit of these new technologies (Williams and Williams, 2007) while others find it difficult to invest in the technology, when there are no particular metrics to measure the benefits.

This study considers that SMEs may want to reduce the cost of buying software through using Open Source Software (OSS).

	Specialised software tools (%)	SME purchases Non-specialised software tools (%)	Undisclosed (%)
Micro	18	82	0
Small	17	71	12
Medium	25	62	13

Table IV.
SME investments

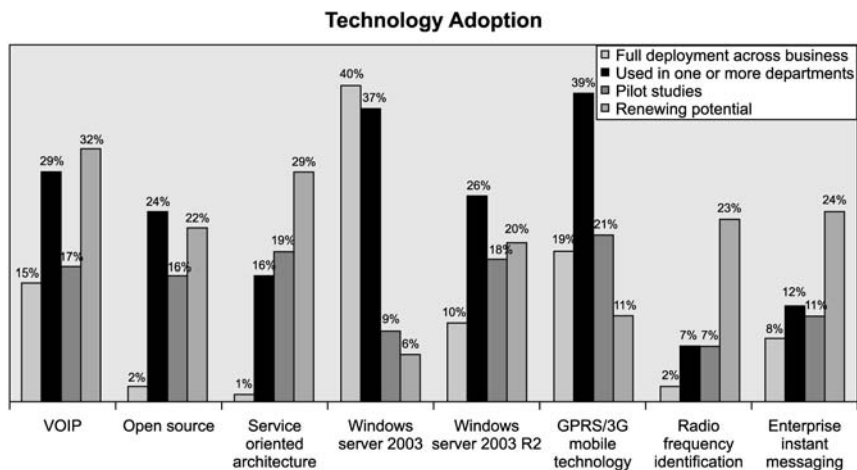


Figure 6.
The growth of ICT adoption as businesses target integration benefits

Source: Computer weekly CIO Index

Figure 6 showed that only 1 per cent of the companies (small and large) in UK made full deployment of OSS across the business. The research findings presented in this paper show an encouraging figure on the deployment of OSS by ICT-oriented SMEs in the West Midlands region. That is, 21 per cent of micro and 63 per cent of small-sized companies in this study use OSS. On the other hand, 50 per cent of medium-sized SMEs did not disclose the information, while the remaining 50 per cent said that they did not use OSS (as shown in Figure 7).

Most ICT-oriented SMEs in West Midlands use Linux, MySQL, PHP, XML, Open Office in their business, some are not aware of OSS, while others are aware but are not using it because they are Microsoft licensed companies, or are not sure on the liability of OSS software.

Investment in ICT may depend on SME's technology awareness, the cost of software or an ability to perceive the benefits. Lack of awareness may result in SMEs not understanding the potential that new technologies can provide in enhancing efficiency and productivity. Instead, some ICT-oriented SMEs opt to hire more employees and invest on non-core tools such as PCs and laptops. Figure 8 reflects the extent of this problem, these results are from the investigation about the future investments plans for these SMEs.

The same problem is reported by Savvas (2007) who said that 80 per cent of the enterprise ICT budget is spent on maintenance because enterprises do not make full use of system management tools. Consequently, these companies have little time or money to invest in products that could ease the work of technical staff and reduce departmental costs. Based on the collected data, it was found that a large percentage of SMEs in the West Midlands have no plans to invest on ICT. Despite the fact that micro and small SMEs may lack enough capital to invest in ICT (as the same capital is needed in other aspects of business such as marketing and sales), there are less micro and small-sized companies who have no plan to invest on ICT as compared to medium-sized SMEs. Some medium-sized SMEs gave the reason for not investing in ICT as:

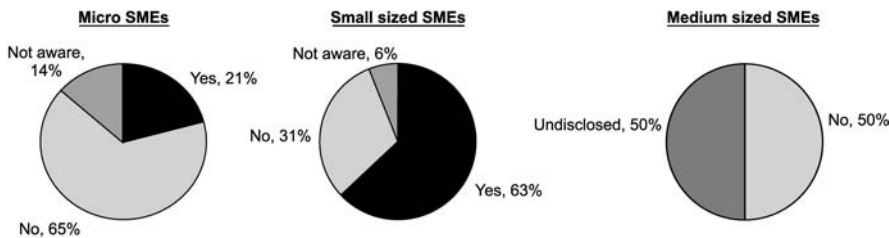


Figure 7. The use of Open Source Software in SMEs

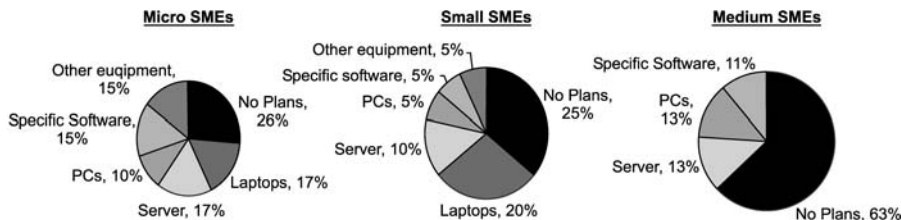


Figure 8. Future ICT investment

We are customer driven, we do not plan or purchase anything until we get a customer and know what customer needs.

This statement indicates that some SMEs are reactive rather than pro-active, which prevents them from developing business strategies that allow future planning for their companies. Consequently, important aspects related to business strategy such as improving efficiency, productivity and innovation are not catered for. After the dotcom downturn in 2000 and USA recession in 2001/2002, most companies in the world switched their business strategy from growth to preservation (Shutter, 2006). The results of Net Impact (2004) survey revealed that the primary drivers for adoption of ICT for large enterprises in the USA were to reduce cost and to stay competitive, SMEs in Canada were to gain a competitive advantage, increase revenues and reduce cost, whilst a smaller percentage of Canadian SMEs indicated that they were investing in ICT to meet customer demands. The research findings presented by this paper shows that 46 per cent of the SMEs perceive the benefit of their purchases to be a means of increasing their productivity and processing efficiency, 14 per cent out of the 46 per cent claimed that mobility provides them with an efficient means of running their business. As a result they mostly invested in laptops, handheld devices, and servers (which can allow them to access information remotely). Investing in such devices instead of specialised software (such as CRM) may indicate that SMEs in the West Midlands are not clear on their competitive strategies. Similar issues have been reported by Illuminus (Shutter, 2006) in relation to Canadian SMEs, where the top reason for not adopting ICT was lack of perceived business needs.

This study shows variation in the reasons that trigger SMEs in the West Midlands to invest in ICT, these are listed in Table V.

Table V results are positive as they show that SMEs in the region intend the benefits to be related to the competitive advantage they gain by investing in ICT. For example, 46 per cent of SMEs consider their business strategy as to meet customer demands, growth of sales revenues, and cutting costs.

This means that, producing better quality products or services, producing lower cost products or services and better customer services and operating more efficiently

A trigger to ICT investment	Business strategy	Description
Efficiency and effectiveness	Meet customer demands Growth of sales revenue Cutting cost	High productivity, reduced time and cost for business processing, improved working practices, ability to have control on their products, improved customer services and flexibility towards customisation
Marketing	Increasing market share	Increased sales, good customer service and relationship, increased market share
Reliability	Meeting customer demand	Reliable access to hardware remotely, remote communication system accessible to all stakeholders, network system for information and resource sharing
Change in technology	Meeting customer demand Increasing market share	Technology advances, work professionally, gain more skills that are essential to widen the market

Table V.
SME investment on ICT

are the advantage gained by investing in ICT. A small percentage (24 per cent) of SMEs considers establishing good customer relationships to be the most important competitive advantage that triggered their ICT investment. They see it as a strategy to increase their market share. High quality product or services has been considered as a competitive advantage to 12 per cent of the interviewed SMEs. These SMEs invest in ICT as technology changes, in order to demonstrate professionalism and high skills in their products or services. A total of 17 per cent consider reliability (meeting customer demands) as their business strategy which is a primary driver to their ICT investment. The remaining 1 per cent of the interviewed SMEs did not disclose this information.

This research considers business strategy as a factor that triggers the decision to invest in ICT. However, making decisions on which ICT to purchase depends on the advice provided to SMEs. This brings another interesting research finding about where SMEs seek advice from before investing on ICT. Their main sources of advice are shown in Figure 9, this includes: their company employees, internet research, external advisor, and exhibitions. An external advisor, in this case, indicates anyone who is not directly employed by the business. SMEs were asked who that external advisor was and results show that none employed a technical or business consultant as they were considered too expensive. There was a considerable number of SMEs who claimed that they did not seek advice from any source because ICT is the core of their business, implying that the expertise was in-house. The rest of the SMEs did not disclose this information.

This research has revealed that most SMEs seek advice from external advisors who are friends, relatives or another SME who has some knowledge of ICT. Such advisors, although close and trusted, may not be professionally equipped to advice in certain context; as a result most SMEs find their businesses facing different ICT implementation problems such as the ones shown in Figure 10.

The research reveals that it is not only the micro SMEs (which have less human resources and may be less experienced) who face challenges in adopting new technologies. Small and medium-sized companies also face the same challenges related to compatibility, limited skills, limited knowledge on particular technology, third party support and transferring data from one technological environment to another.

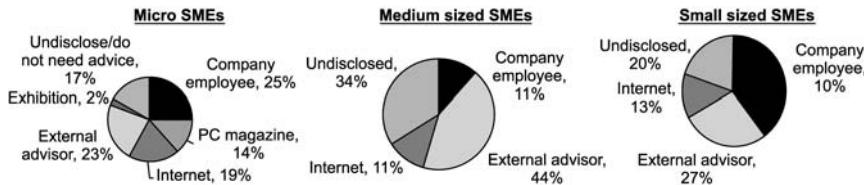


Figure 9. SMEs source of advice

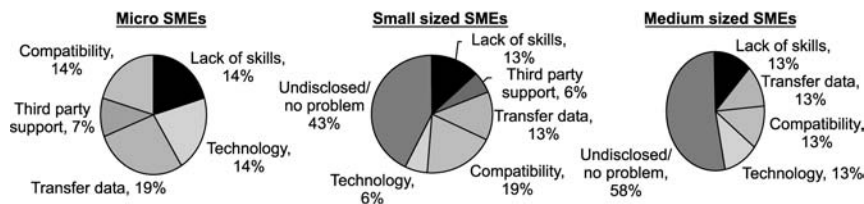


Figure 10. ICT implementation limitations

VI. General business performance and needs. Despite the common use of technologies such as internet and mobile systems for business, there has been no established criteria and metrics to measure their performance (Kamath, 2007b). As a result, most SMEs including those involved in this study do not measure their adoption success. Researchers' efforts in many countries are focusing on connectivity metrics as opposed to usage metrics (Jutla *et al.*, 2002). This includes: penetration figures such as internet connection, mobile telephone customers and internet users. Differently, SMEs use of sophisticated e-business software applications is not being measured. A small percentage of the SMEs in this study who measure their adoption success use a single factor to measure it, as shown in Table VI.

A report published by *Strategic Direction* (2005) journal claims that "metrics are a real source of frustration for the executives in the survey, and it is clear that their absence is holding many companies back on innovation. In fact lack of good metrics may be one of the biggest problems companies have".

This research considers factors shown in Figure 11 to be important in measuring adoption success as well as business success. The success in adopting new technology determines the business success, however in order for the adoption to succeed, SMEs need to have been educated in the business area, to invest in the latest technology, to use a proficient consultancy, invest in modern ICT infrastructure which allows efficient

Measure of adoption success	Description
Profitability	Any profit gained from income from the services provided to customers is measured as a success
No complaints	If there is no complaint from the customers related to the service provided then that may be used as a measure of its success
High levels of interest (more customers)	Some SMEs measure their success quantitatively; by statistically counting the level of interest of their service
Efficiency	Using less time to provide their services

Table VI.
Factors which some SME used to measure their adoption success

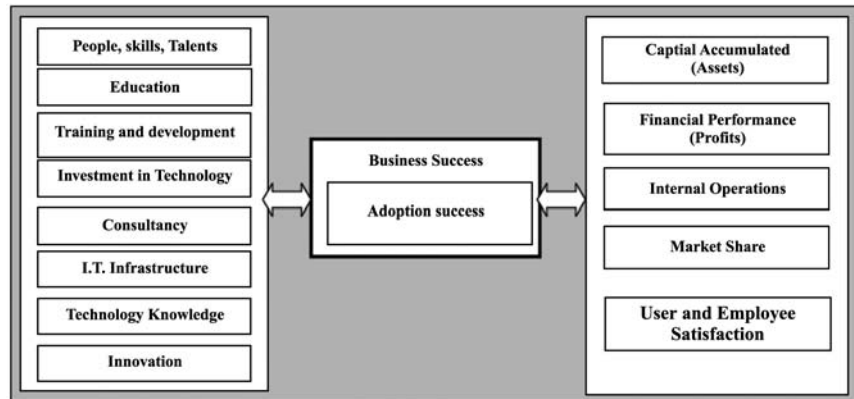


Figure 11.
Relationship between adoption success and business success

business processes, have employees who have technical knowledge and skills, as well as widening the market by investing in innovation. Business and adoption success can be measured through business outputs (as shown in Figure 11), i.e. measuring accumulated capital, financial performance, internal operations, and market share and user satisfaction (Ward and Peppard, 2002; Strassman, 1988; Willcocks, 1994). However, this is still a fuzzy area, and hence, is another avenue which warrants further investigation.

Unlike large companies, SMEs that adopt new technologies have very little choice, most start out in niche markets, with some focus or by differentiating themselves from their competition. From this competitive position, SMEs may grow to a broader market based on the differentiation, or into a niche market where they can offer a cost advantage. In order for SMEs to achieve that, different aspects of their business may need some support. This paper highlights the main areas identified by this research in which most SMEs need support. These areas are grouped into the six categories shown in Table VII.

Figure 12 highlights the areas and the corresponding number of SMEs who need support in adopting new technologies.

Type of the required support	Description
Equipment	Loaning equipment for short term projects, access to a server, handheld devices
Training	Training on specialised software such as e-commerce, CRM, PHP, MySQL
Human resources	Need students or staff for short-term contracts, to develop company web sites, or other online systems
Consultancy	Advice on networking, business performance measurement, wireless, innovation
Marketing	ICT for marketing purposes, ICT business marketing strategies
Funding	Help in financing business areas to allow growth

Table VII.
Description on the support needed by SMEs

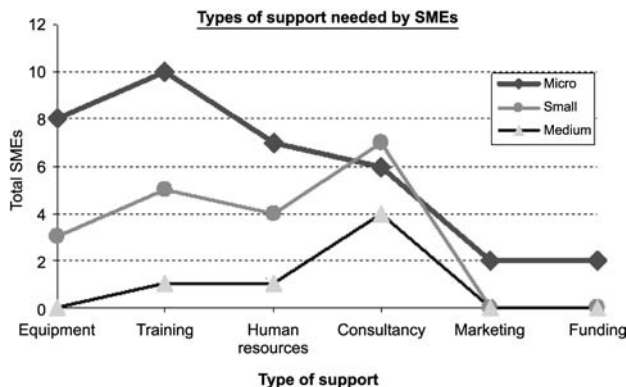


Figure 12.
Types of support needed by SMEs

Conclusions

This paper is developed based on the findings of the first research to be conducted on ICT-oriented SMEs in the West Midlands. This research is unique as it uses a considerable large data collected through face-to-face interview for which contacts were obtained from a variety of sources.

The ideas developed in this paper address an important theme in current ICT research – the importance of understanding how ICT-oriented SMEs can be empowered to support themselves and therefore support other sectors to acquire business value (Bharadwaj, 2000; Peppard and Ward, 2004; Sambamurthy *et al.*, 2003; Wade and Hulland, 2004) from their ICT investments. The paper has used three categories of ICT-oriented SMEs; the micro, small and medium sized. The ICT-oriented SMEs involved in the study vary in the number of employees, turnover, number of years of operation and the nature of their ICT business. This paper has considered various issues surrounding the use of ICT, these includes:

- The fact that the West Midlands region can achieve an uplift in GVA by 3-4 per cent if ICT is used strategically by the firms.
- There are 8,000 ICT-oriented SMEs in the region which is a considerable amount whose contribution can have a major impact on regional economy (*AWM ICT Cluster Strategy 2008-2011* (Musson, 2008)).
- Most firms in the region invest in ICT, and there are also high-class telecommunication facilities in the region.
- The government is supporting firms (Jutla *et al.*, 2002) in the region by providing training and services in different aspects.

SMEs appear increasingly to be crucial to the success of UK economy as it was shown that the majority of growth between 1995-2000 in size of the business population was from SMEs (Johnston and Loader, 2003), and ICT was at the centre of this growth (Maguire *et al.*, 2007). However, recent news state that for the first time the UK has lost its place in the elite top five nations for innovation, as measured by the World Intellectual Property Institute (WIPO). WIPO's information is based on the patents registered which showed that UK is not in the top five countries for patents filed under the Patent Co-operation Treaty. In February 2007, Britain fell into sixth place behind the USA, Japan, Germany, South Korea and France. This is a matter of concern as China is set to overtake the UK (i2010 Working Group, 2007) at a fast pace. This is a problem that is related to lack of appropriate skills and knowledge to adopt ICT and inability of firms to use ICT to its full capacity.

This paper, unveils an important issue not thought by many before; the need to identify the challenges faced by ICT-oriented SMEs, and the means to empower them so that they can use their skills and knowledge to support firms in other sectors. One of the main challenges faced by the ICT-oriented SMEs is to be able to adopt technologies in a sustainable way.

This study has identified factors to be addressed if ICT-oriented SMEs are to have a successful and sustainable adoption of new technology. This includes: involvement in research, provision of appropriate education and training, proficient consultation, measurement of the performance of the adopted technology, and specific support such

as consultation, marketing, training, human resources, and funding for individual business needs (Figure 13).

SMEs' involvement in research

The government is spending a considerable amount of money to sponsor research in many areas associated with SMEs, however, this research found that many businesses are not keen to be involved in research. For example, the DTI has been encouraging companies by offering R&D tax credits[7], but many companies are still reluctant to take part in research. The companies who were involved in this study claim that there is too much bureaucracy involved in applying for tax credits. In addition, a significant amount of time is needed by SMEs to prepare the requisite documents to justify their claim. Since most research such as this cannot get enough data, government initiatives and projects to support SMEs are often conducted without a large enough sample size to provide evidence to justify generalisations.

For example, many research projects involve telephone, email, or mail interviewing of between 50-200 companies (e.g. the research conducted by Rae (2006), Henson (2005) and Duan *et al.* (2002)) and reduce costs by not conducting face-to-face interviews. If the research entails case studies, then, the number of the companies involved is much less

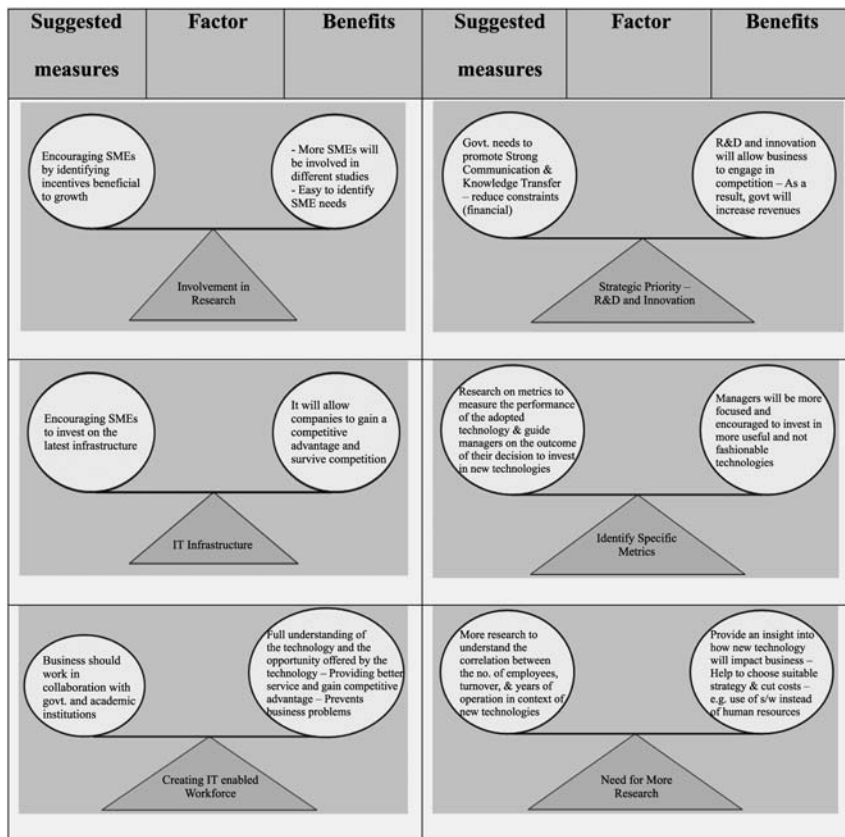


Figure 13. A summary of the main factors which need to be addressed as a result of the research findings

(i.e. between two and ten). These types of research have no means to examine other unknown factors that are not in their questionnaire that have major effects on SMEs. This research is unique as the majority of its interviews were conducted face-to-face, in which factors such as government regulations, tax credits and other factors emerged. In order for government intervention initiatives to support SMEs to be fully successful, the government should invest on large samples of data and preferably from face-to-face interviews, streamline its bureaucratic system and provide easy access for SMEs to different incentives and support.

This study highlights the importance to conduct research to understand the challenges faced by ICT-oriented SMEs and points out the resulting benefits gained as a result of eliminating these challenges. This includes, enabling ICT-oriented SMEs to support adoption in other sectors that may be the key to the success of all other SMEs in the West Midlands and indeed in the UK. Currently, ICT-oriented SMEs are left with challenges related to the speed to: adopt new technologies, upgrade equipment, up-skill its human resource (intellectual capital), innovate their marketing strategies, and justify these problems in a clear way to receive funding from the government.

SMEs' involvement in innovation, research and development

The Section entitled "ICT-oriented SMEs, their challenges" shows that ICT offers many potential strategic opportunities which go beyond storage and faster data processing enabling companies to stay competitive, innovative, and supported in research and development. Adoption of new technology could affect competition in different ways:

- It can change the structure of an industry that may result in the alteration of the rules of competition.
- It can be used to create a sustainable competitive advantage by providing companies with new competitive weapons.
- New businesses can be developed from within a company's existing activities.

The UK's communication infrastructure is well developed, inward government investment in technologies such as: cable, mobile telecommunications and networks, computing, satellite and digital telecommunication place the UK in a strong position in the global competition (ESIM, 2006).

In addition, there has been an improvement in UK's higher education (HE) sector, in which most HE institutions are undertaking collaborative research, establishing business networks, running courses for industries and companies (from different sectors), developing incubation, exploitation and spin-off companies and paying increased attention to the skills needs of business (ESIM, 2006). These are all essential weapons necessary for innovation, research and development and competitive advantage. What remains is for the government to focus its support on ICT-oriented SMEs financial, skills and knowledge, as well as other constraints that may be preventing them from taking advantage of these weapons.

Employees' level of education

Most SME managers involved in this study are educated to a degree level, but not in ICT-related disciplines. For example, some hold a degree in politics, in business management, neurology, in education, etc. These individuals acquired their ICT skills later through experience and self-interest. As technology is changing at a fast rate,

some of these decision makers may not be able to adapt to the changes at the same pace. Instead, they often increase the number of employees and PCs or laptops as a means of attaining high productivity, or use laptops to work extra hours to increase their productivity (as illustrated in Table IV). In addition, since these individuals ICT skills are acquired through experience, it may take longer for them to introduce innovation into their businesses as they will not have time to assess their business and discover new applications for their businesses. Sometimes they may not have time to fully measure their efficiency because they are more focused on gaining more customers.

Creating the ICT-enabled workforce

Although the UK generates 98.8 per cent of business from SMEs, compared to other European countries, the UK provides a smaller share of total employment, its turnover is rated as a third lower than the European average of 65 per cent, and their productivity is up to 30 per cent less than their French and German counterparts (Pye, 2000). Pye claims that this has resulted from poor support in the UK for workplace training where there has been constant changes on national training systems as compared to Germany and Denmark over the past 40 years. This may be supported by the evidence collected by the DTI which suggest that 50 per cent of SMEs agree that ICT skills shortages are one of the reasons UK businesses are not adopting or further developing e-commerce (DTI, 2000). For example, the potential benefits of e-commerce and e-business would only be realised by capable managers who can deal with emerging technologies and correctly implement that technology (Duan *et al.*, 2002). In addition, Corbitt (2000) reports that there is a concern that SMEs do not fully understand e-commerce, and that, SME managers are not aware of the opportunities presented to them by advanced ICT, especially newly emerging e-commerce and internet business. Therefore, coping with rapid changes brought about by ICT demands continuous education and training. This is currently not happening as 87 per cent of the companies involved in this research claim that they do not have time for re-training, despite the result of this research showing that most managers or owners of these companies have no ICT-related educational background.

The relationship between the years of operation, the turnover and the number of employees

Based on the statistical analysis conducted for this research, there is no evidence to indicate a significant correlation between three factors: the number of year of operation, the turnover and the number of employees. Correlation between these factors within the SMEs, may depend on other aspects of business such as the marketing strategy, location, nature of business, etc., and hence this provides an avenue for further research.

However, business experience (or years of operation), turnover (or business financial position), and the number of employees (human resources) are issues that are closely associated to the factors affecting ICT adoption. These include: lack of knowledge on the latest technology; less investment in ICT; poor decisions on the choice of infrastructure; lack of means to measure the performance of the business; and

lack of support for specific business needs. This research highlights how these factors may affect the adoption of new technology as follows.

I. SMEs ICT investment; factors affecting investment in ICT. A considerable number of SMEs involved in this study claim that their main internal pressure is the desire for business growth. However, the same companies' future plans are to invest in laptops, PCs or handheld devices, and not on latest software. This has posed the question as to whether ICT-oriented SMEs have a clear understanding of business strategy and the issues (in Table VIII) that drive investment in new technology.

Another important concern that is linked with the issues in Table VIII is how SMEs in the West Midlands decided on their latest technology investment. These companies embrace ICT either with "me too" or a "wait and see" approach (Brady *et al.*, 2008). Most ICT-oriented SMEs lack strict company guidelines for how or when to invest in the technology. This may put constraints on ICT-oriented SMEs budget and resources. On the other hand, it is a distinct advantage if ICT-oriented SMEs can experiment with new technologies and adopt one as soon as they prove its competitive advantage.

Most ICT-oriented SMEs interviewed in this research were not fully aware of the external pressures surrounding their businesses. This is a matter of concern because most of these businesses are having difficulties in implementing ICT in their business (as shown in Figure 12) and are not involved in any kind of research and development, or innovation. With the existence of outsourcing, the competition in technology is strong and global. As a result, ICT-oriented SMEs need to focus on the key and latest technologies, i.e. technologies that can improve their productivity and allow innovation in their businesses.

SMEs ICT investment is affected by the source of advice given to the companies. ICT-oriented SMEs cut cost on consultation fees by seeking advice from an ICT store, a relative or a close friend, a company employee who has knowledge in ICT, internet or a PC magazine. This research views professional consultancy as an important exercise that will help SMEs to define and manage their focus areas. That is, it will give ICT-oriented SMEs an opportunity to assess their current and new focus areas of their business and innovate the business or remove unsuccessful areas of the business. This is unlikely to be a simple task that can be easily identified by an ICT store employee, the internet or a PC magazine. Instead, companies should engage the services of a professionally accredited consultant for such purposes. This service can be expensive for most ICT-oriented SME, this is associated with the findings in Figure 10 which indicate that a considerable number of ICT-oriented SMEs are asking for consultation support. Hence, there may be the potential for an industry-wide initiative for ICT-trained professionals to provide walk-in consultancy slots on a voluntary or reduced-fee basis.

Driving issues	Description
Customer and quality	Using customer and quality as a differentiator for driving SMEs in adopting new technologies
Growth	Is the chosen ultimate business objective
Customer demands/needs	The reason for SMEs to continue to invest in the new technology

Table VIII.
Issues which drive SMEs to invest in new technology

II. ICT infrastructure used by the SMEs. Depending on their business applications, SMEs use relatively large amounts and various types of infrastructure. However, there are technologies such as VOIP, EDI, ASP and extranet which are not used by most ICT-oriented SMEs, because of their disadvantages or lack of knowledge to implement these technologies. If used by ICT-oriented SMEs, these technologies may cut the network maintenance costs of the business, and the key software systems will be kept up to date by the service providers. However, there is a need for further investigation on this aspect, as most SMEs may need extra knowledge related to these technologies and some means to secure their data and business as a whole.

III. Implementation problems. Research findings reveal that all categories of ICT-oriented SME are facing challenges in their ICT implementation as evidenced in Figure 12. Such problems prevent ICT-oriented SMEs from adopting new technologies necessary for their competitive advantage.

IV. Business performance. The impact on business performance is an aspect included in the study, and is examined qualitatively. The research found that ICT-oriented SMEs measure their technology adoption success as increased profit, no complaints, high levels of interest, or efficiency. Such measures are considered in this research as a hindrance to ICT-oriented SMEs, because these are basic measures of adoption success. ICT-oriented SMEs should have a dedicated and precise means to measure the adoption success, i.e. to examine the market share, compound growth, number of retailers, franchises, the assets, employees and customer satisfaction. If the performance of the adopted technology is not measured in this way, ICT-oriented SME will be unable to understand the importance and impact of adopting new technologies. In spite of extensive research in these areas there is still no standard metric to do so (Ward and Peppard, 2002; Strassman, 1988; Willcocks, 1994) and no link between that and the adoption of new technology.

V. Support. Although equipment, human resource, marketing and funding are the aspects of business in which some companies need support, the result of this study shows that training and consultancy are the major facets that needs immediate support. Some companies are not aware what is available, what new technology can do for their business, how to get it, or how to use it. Some mentioned that they have invested time and money on different consultants, and what they get is very minimal compared to what they have invested. These companies claim that there are relatively few proficient and professional ICT advisors, and those that are available are not cost-effective for ICT-oriented SMEs. The advice that the ICT-oriented SMEs get should be coupled with training to help them to adopt new technologies or systems.

All of the above factors need to be considered by government policy-makers aiming to support SMEs to achieve competitive advantage.

Notes

1. These figures are from www.thewestmidlandsregion.co.uk/bestConnected/Location/sectorCredentials/informationTechnologies/
2. GVA is gross value added, it measures the contribution to the economy of each individual producer, industry or sector in the UK.
3. 6DISS (IPv6 dissemination and exploitation) is a Specific Support Action in FP6 of the European Union. The project aims to promote widespread adoption of IPv6 by providing IPv6 training and knowledge transfer in developing regions. It is also establishing contacts

with networking personnel and organisations in these regions, in order to encourage cooperation and possible future participation in European R&D activities.

4. Most technology park offices are fairly new and may not be registered in many systems, and hence it was important to visit the parks.
5. ICT Cluster is an ongoing profiling project run by University of Warwick Science Park.
6. Specialised software is considered in this context as any software which is used to perform specific business operations and not for common ICT use (such as XP for, e.g. editing a Word document). For example, Microsoft.NET Framework which is used by software developers to develop automated applications for different business solutions, or SAGE which is mostly used for specific business accounting operations.
7. R&D tax credits help companies to invest more in R&D either by reducing a company's tax bill or, for some small or medium-sized companies (SMEs) not in profit, by providing a cash sum (www.dti.gov.uk/innovation/randd/).

References

- ACCA (2007), "Paper 3.5 – strategic business planning and development", The Kaplan Publishing Faulks Lynch Range, Wokingham.
- Akhavan, P. and Jafari, M. (2008), "Towards learning in SMEs: an empirical study in Iran", *Development and Learning in Organisations*, Vol. 22 No. 1, pp. 17-19.
- Anderson, V. and Boocock, G. (2002), "Small firms and internationalisation: learning to manage and managing to learn", *Human Resource Management Journal*, Vol. 12 No. 3, pp. 5-24.
- Atkins, M.H. and Lowe, J.F. (1997), "Sizing up the small firms; UK and Australian experience", *International Small Business Journal*, Vol. 15 No. 3, pp. 42-55.
- Barnes, M., Coulton, L., Dickinson, T., Field, J., Fisher, N., Saunders, I. and Shaw, D. (2007), "New approach to performance management for SMEs", available at: <http://citeseer.ist.psu.edu/> (accessed May 2007).
- Bee, F. and Bee, R. (1994), *Training Needs Analysis and Evaluation*, Institute of Personnel Management, London.
- Bennett, R.J. and Robson, P.J.A. (1999), "The use of special business advice by SMEs in Britain", *Entrepreneurship and Regional Development*, Vol. 11 No. 2, pp. 155-80.
- Bharadwaj, A. (2000), "A resource-based perspective on information technology and firm performance: an empirical investigation", *MIS Quarterly*, Vol. 24 No. 1, pp. 169-96.
- Bicknell, D. (2007), "Preparing your business for IPv6", *Computer Weekly*, pp. 26-8.
- Booz Allen Hamilton (2002), *The World's Most Effective Policies for the Economy*, Booz Allen Hamilton, London.
- Brady, M., Fellenz, M. and Brookes, R. (2008), "Researching the role of information communication technology (ICT) in contemporary marketing practices", *Journal of Business & Industrial Marketing*, Vol. 23 No. 2, pp. 108-14.
- Brynjolfsson, E. and Hitt, L. (1996), "Paradox lost? Firm-level evidence on the returns to information systems", *Management Science*, Vol. 42 No. 4, pp. 541-58.
- Brynjolfsson, E. and Hitt, L. (2000), "Beyond computation: information technology, organisational transformation and business performance", *Journal of Economic Perspective*, Vol. 14 No. 4, pp. 23-48.
- Carr, N.G. (2003), "IT doesn't matter", *Harvard Business Review*, Vol. 81 No. 5, pp. 41-9.
- Chen, J. and Ching, R. (2004), "An empirical study of the relationship of IT intensity and organisational absorptive capacity on CRM performance", *Journal of Global Information Management*, Vol. 12 No. 1, pp. 1-17.

- Clark, L. (2007), "Retailers lead rise in IT spending growth", *Computer Weekly*, 5 June.
- Corbitt, B.J. (2000), "Developing intraorganizational electronic commerce strategy: an ethnographic study", *Journal of Information Technology*, Vol. 15 No. 2, pp. 119-30.
- Costello, P. and Chibelushi, C. (2007), "Technology adoption issues in the ICT Cluster in the West Midlands (UK)", *Proceedings of the 30th Institute for Small Business and Entrepreneurship (ISBE) National Conference, Glasgow, Scotland*.
- Cragg, P., King, M. and Hussin, H. (2002), "IT alignment and firm performance in small manufacturing firms", *The Journal of Strategic Information Systems*, Vol. 11 No. 2, pp. 109-32.
- Deeter-Schmelz, D. and Kennedy, K. (2004), "Buyer-seller relationships and information sources in an e-commerce world", *Journal of Business & Industrial Marketing*, Vol. 19 No. 3, pp. 188-96.
- Department of Trade and Industry (DTI) (2000), *Business in the Information Age: International Benchmarking Study*, DTI, London.
- Desai, C., Wright, G. and Fletcher, K. (1998), "Barriers to successful implementation of database marketing: a cross-industry study", *International Journal of Information Management*, Vol. 18 No. 4, pp. 265-76.
- Duan, D., Mullins, R., Humblin, D., Stanek, S., Sroka, H., Machado, V. and Araujo, J. (2002), "Addressing ICT's skills challenges in SMEs: insights from three country investigations", *Journal of European Industrial Training*, Vol. 26 No. 9, pp. 430-41.
- Earl, M.J. (1989), *Management Strategies for Information Technology*, Prentice-Hall, Englewood Cliffs, NJ.
- European Society Information and Media (ESIM) (2006), *Adoption of Technology and Communication Technologies (ICT) by Business*, EC, Brussels.
- Feeny, D. (2001), "Making business sense of the e-opportunity", *Management Review*, Vol. 42 No. 2, pp. 41-56.
- Fincham, R.G. (2000), "The diffusion and assimilation of information technology innovations", in Zmud, R.W. (Ed.), *Framing the Domain of ICT Management*, Pinnaflex Educational Resources, Cincinnati, OH, pp. 105-27.
- Fincham, R. (2002), "Narratives of success and failure in systems development", *British Journal of Management*, Vol. 13 No. 1, pp. 1-14.
- Fink, D. and Disterer, G. (2006), "International case studies: to what extent is ICT infused into the operations of SMEs?", *Journal of Enterprise Information Management*, Vol. 19 No. 6, pp. 608-24.
- Fitzgerald, G. (1998), "Evaluating information systems projects: a multidimensional approach", *Journal of Information Technology*, Vol. 13, pp. 15-27.
- Geiger, S. and Turley, D. (2005), "Personal selling as knowledge-based activity: communities of practice in the sales force", *Irish Journal of Management*, Vol. 26 No. 1, pp. 61-71.
- Gibson, C.F. (2003), "ICT-enabled business change: an approach to understanding and managing risk", *MIS Quarterly Executive*, Vol. 2 No. 2, pp. 104-15.
- Gordon, S.R. and Gordon, J.R. (1995), *Information Systems: A Management Approach*, The Dryden Press, Hinsdale, IL.
- Grandon, E. and Pearson, J.M. (2004), "Electronic commerce adoption: an empirical study of small and medium US business", *Information and Management*, Vol. 42 No. 1, pp. 197-216.
- Gunasekaran, A., Okko, P., Martikainen, T. and Yli-Olli, P. (1996), "Improving productivity a quality in small and medium enterprises: cases and analysis", *International Small Business Journal*, Vol. 15 No. 1, pp. 59-72.

- Haughton, K.A. and Winklhofer, H. (2004), "The effect of website and e-commerce adoption on the relationship between SMEs and their export intermediaries", *International Small Business Journal*, Vol. 22 No. 4, pp. 369-88.
- Henson, J. (2005), "Factors that inhibit economic development in the information and communication technology industry at the regional level", *Management Decision*, Vol. 43 No. 3, pp. 317-30.
- Holden, R., Jameson, S. and Walmsley, A. (2007), "New graduate employment within SMEs: still in the dark", *Journal of Small Business and Enterprise Development*, Vol. 14 No. 2, pp. 211-27.
- i2010 Working Group (2007), "Ensuring the right conditions for an innovative, inclusive and competitive UK knowledge economy", October, available at: www.iapuk.org/sites/default/files/i2010_final_report_090507c.pdf
- Information Age Initiative (IAI) (2000), *Northen Ireland Business in the Information Age: ICT Benchmarking Report*, IAI.
- Irani, Z. (2002), "Information systems evaluation: navigating through the problem domain", *Information and Management*, Vol. 40 No. 1, pp. 11-24.
- Jeffcoate, J., Chappell, C. and Feindt, S. (2002), "Best practice in SME adoption of e-commerce", *Benchmarking: An International Journal*, Vol. 9 No. 2, pp. 122-32.
- Johnson, G., Scholes, K. and Whittington, R. (2007), *Exploring Corporate Strategy*, 7th ed., Prentice-Hall, Englewood Cliffs, NJ.
- Johnston, K. and Loader, K. (2003), "Encouraging SME participation in training: identifying practical approaches", *Journal of European Industrial Training*, Vol. 27 No. 6, pp. 273-80.
- Julien, P.A. and Raymond, L. (1994), "Factors of new technology adoption in the retail sector", *Entrepreneurship Theory and Practice*, Vol. 18 No. 4, pp. 79-90.
- Jutla, D., Bodorik, P. and Dhaliwal, J. (2002), "Supporting the e-business readiness of small and medium-sized enterprises: approaches and metrics", *Internet Research: Electronic Networking Applications and Policy*, Vol. 12 No. 2, pp. 139-64.
- Kamath, J.P. (2007a), "How Tesco shops for value from ICT", *Computer Weekly*, 17 April, pp. 18-20.
- Kamath, J.P. (2007b), "Wireless use slowed by lack of metrics", *Computer Weekly*, 24 April, p. 10.
- Kaynak, E., Tatoglu, E. and Kula, V. (2005), "An analysis of the factors affecting the adoption of electronic commerce by SMEs", *International Marketing Review*, Vol. 22 No. 6, pp. 623-40.
- Kohli, R. and Devaraj, S. (2004), "Realising the business value of information technology investment: an organisational approach", *MIS Quarterly Executive*, Vol. 3 No. 1, pp. 53-68.
- Lai, M. (2008), "Technology readiness, internet, self-efficacy and computing experience of professional accounting students", *Campus-wide Information Systems*, Vol. 25 No. 1, pp. 18-29.
- Lee, M.K.O. (1998), "Internet-based financial EDI: towards a theory of its organisational adoption", *Computer Networks and ISDN Systems*, Vol. 30 Nos 16-18, pp. 1579-88.
- Lefebvre, L., Lefebvre, E., Elia, E. and Boek, H. (2005), "Exploring B-to-B e-commerce adoption trajectories in manufacturing SMEs", *Techovation*, Vol. 25 No. 12, pp. 1443-56.
- Levy, M., Powell, P. and Yetton, P. (1998), "SMEs and the gains from IS: from cost reduction to value added", *Proceedings of the IFIP 8.2 Conference, Finland*.
- Li, E. (1995), "Marketing information systems in US companies: a longitudinal analysis", *Information and Management*, Vol. 28 No. 1, pp. 13-31.
- Loukis, E. and Sapounas, I. (2004), "The impact of information systems investment and management on business performance in Greece", *Proceedings of the 13th European Conference on Information Systems (ECIS), Ragensburg*.

- Loukis, E. and Sapounas, I. (2008), "The effect of generalised competition and strategy on the business value of information and communication technologies", *Journal of Enterprise Information Management*, Vol. 21 No. 1, pp. 24-38.
- McAfee, A. (2006), "Mastering the three worlds of information technology", *Harvard Business Review*, Vol. 84 No. 11, pp. 141-9.
- McLarty, R. (2000), "Evaluating graduate skills in SMEs: the value chain impact", *Journal of Management Development*, Vol. 19 No. 7, pp. 615-28.
- Maguire, S., Koh, S. and Magrys, A. (2007), "The adoption of e-business and knowledge management in SMEs", *Benchmarking: An International Journal*, Vol. 14 No. 1, pp. 37-58.
- Martin, L. and Matlay, H. (2001), "'Blanket' approaches to promoting ICT in small firms: some lessons from the DTI ladder adoption model in the UK", *Internet Research: Electronic Networking Applications and Policy*, Vol. 11 No. 5, pp. 399-410.
- Mehrtens, J., Cragg, P. and Mills, A. (2001), "A model of internet adoption by SMEs", *Information and Management*, Vol. 39, pp. 165-76.
- Musson, M. (2008), *AWM ICT Cluster Strategy 2008-2011*, Advantage West Midlands, Birmingham.
- Net Impact (2004), "Develop a strategy: four steps to strategic outsourcing", Gartner, available at: <http://gartner.com/pages/section.php.id.2215.s.8.jsp> (accessed May 2007).
- O'Regan, N. and Ghobadian, A. (2004), "Testing the homogeneity of SMEs, the impact of size on managerial and organisational processes", *European Business Review*, Vol. 16 No. 1, pp. 64-77.
- Olsen, S. (2000), *The Tally on Dot-com Deaths*, CNET-News.com, PT video, 16 November.
- Pavic, S., Koh, S.C.L., Simpson, M. and Padmore, J. (2007), "Could e-business create a competitive advantage in UK SMEs?", *Benchmarking: An International Journal*, Vol. 14 No. 3, pp. 320-51.
- Peppard, J. (Ed.) (1993), *IT Strategy for Business*, Pitman, Boston, MA.
- Peppard, J. and Ward, J. (2004), "Beyond strategic information systems: toward an IS capability", *Strategic Information Systems*, Vol. 13 No. 2, pp. 167-94.
- Pires, G.D. and Aisbett, J. (2003), "The relationship between business adoption and strategy in business-to-business markets, the case of e-commerce", *Industrial Marketing Management*, Vol. 32 No. 4, pp. 291-300.
- Pollard, C.E. and Hayne, S.C. (1998), "The changing face of information systems issues in small firms", *International Small Business Journal*, Vol. 63 No. 16, pp. 71-87.
- Pye, J. (2000), "Promoting workplace learning ICT: modes and models for organisational change", *Proceedings of the European Conference on Educational Research, Edinburgh*.
- Rae, A. (2006), *Abandoned Heroes, ICT Adoption Use in SMEs*, WestFocus ICT Network, Uxbridge, report for WestFocus ICT Network.
- Rai, A., Patnayakuni, R. and Patnayakuni, N. (1997), "Technology investment and business performance", *Communications of ACM*, Vol. 40 No. 7, pp. 89-97.
- Ramsey, E., Ibbotson, P., Bell, J. and Gray, B. (2004), "A projective perspective of international 'e-services'", *Qualitative Market Research: An International Journal*, Vol. 7 No. 1, pp. 34-47.
- Rashid, M.A. and Al-Qirim, N.A. (2001), "E-commerce technology adoption framework by new zealand small to medium enterprises", *Research Letters in the Information and Mathematical Sciences*, Vol. 2 No. 1, pp. 63-70, available at: www.massey.ac.nz/wwiims/~rlims (accessed 20 March 2007).
- Reis, F. (2006), *The Internet and Other Computer Networks and Their Use by European Enterprises to do Ebusiness*, Eurostat, Brussels.

- Ritchie, B. and Brindley, C. (2005), "ICT adoption by SMEs: implications for relationships and management", *New Technology, Work and Employment*, Vol. 20 No. 3, pp. 205-17.
- Robson, S. and Ortman, L. (2005), *First Findings from the UK Innovation Survey*, Economic Trent No. 628, Office for National Statistics, London.
- Robson, W. (1997), *Strategic Management and Information Systems*, Financial Times/Pitman, Boston, MA.
- Rodgers, E.M. (1995), *Diffusion of Innovations*, Free Press, New York, NY.
- Sambamurthy, V., Baradwaj, A. and Grover, V. (2003), "Shaping agility through digital options: reconceptualizing the role of information technology in contemporary firms", *MIS Quarterly*, Vol. 27 No. 2, pp. 237-63.
- Savvas, A. (2007), "ICT "spends too much on maintenance", *Computer Weekly*, May, p. 12.
- Speier, C. and Venkatesh, V. (2002), "The hidden minefields in the adoption of sales force automation technologies", *Journal of Marketing*, Vol. 66 No. 3, pp. 98-111.
- Sheppard, S. and Hooton, S. (2006), *Regional Economic Impact of ICT and the Role of RDAs/DAs*, Adroit Economics and Regeneris, Birmingham.
- Shiels, H., McIvor, R. and O'Reilly, D. (2003), "Understanding the implications of ICT adoption: insights from SMEs", *Logistics Information Management*, Vol. 16 No. 5, pp. 312-26.
- Shutter, J. (2006), *Net Impact Canada Small and Medium Enterprises*, Illuminas, Warton School of Business and Cisco Systems, Philadelphia, PA.
- Slatter, S.F. and Narver, J.C. (1995), "Market orientation and the learning organisation", *Journal of Marketing*, Vol. 59 No. 3, pp. 63-74.
- Smallbone, D., North, D., Vickers, I. and Roper, S. (2001), "Innovation and the use of technology in manufacturing plants and SMEs: an inter-regional comparison", *Proceedings of the 24th ISBA National Small Firms Conference: Exploring the Frontiers of Small Business, Hinckley*, pp. 289-308.
- Solow, R. (1987), "Books Review: We'd better watch out", *New York Times*, Vol. 12, p. 36.
- Sorey, D.J. (1994), *Understanding the Small Business Sector*, Routledge, London.
- Soriano, D.R., Roig, S., Sanchis, J.R. and Torcal, R. (2002), "The role of consultants in SMEs", *International Small Business Journal*, Vol. 20 No. 1, pp. 95-103.
- Sprague, R.H. and McNurlin, B.C. (1986), *Information Systems Management in Practice*, Prentice-Hall, Englewood Cliffs, NJ.
- Sprano, E. and Zakak, A. (2000), "E-commerce capable: competitive advantage for countries in the new world e-economy", *Competitiveness Review*, Vol. 10 No. 2, pp. 114-22.
- Strassman, P.A. (1988), "Management productivity as an ICT measure", in Berger, P., Kobielus, J.G. and Sutherland, D. (Eds), *Measuring Business Value Information Technologies*, ICIT Press, Washington, DC, pp. 17-55.
- Strategic Direction* (2005), "Innovation frustration, lacking management and metrics", Vol. 21 No. 11, pp. 36-7, available at: www.emeraldinsight.com/Insight/ (accessed May 2007).
- Taylor, M. and Murphy, A. (2004), "SMEs and e-business", *Journal of Small Business and Enterprise Development*, Vol. 11 No. 3, pp. 280-9.
- Thompson, R. (2007), "Employers struck by shortage of .net skills", *ComputerWeekly*, 4 September.
- Tidd, J., Bessant, J. and Pavitt, K.I. (1997), *Integrating Technological, Market and Organisational Change*, J. Wiley & Sons, Chichester.
- Tidd, J., Bessant, J. and Pavitt, K. (2001a), *Managing Innovation: Integrating Technological, Market and Organisational Change*, Willey, Bognor Regis.

- Tidd, J., Bessant, J. and Pavitt, K. (2001b), *Integrating Technological, Market and Organisational Change*, Wiley & Sons, Chichester.
- Van Akkeren, J. and Cavaye, A. (1999), "Factors affecting entry-level internet technology adoption by small business in Australia: an empirical study", *Proceedings: 10th Australasian Conference on Information Systems, Victoria University of Wellington, New Zealand, 1999*, pp. 1716-28.
- Wade, M. and Hulland, J. (2004), "Review: the resource-based view and information systems research: review, extension, and suggestions for future research", *MIS Quarterly*, Vol. 28 No. 1, pp. 107-42.
- Ward, J. and Peppard, J. (2002), *Strategic Planning for Information Systems*, 3rd ed., Wiley, Chichester.
- Wilkes, N. and Dale, B.G. (1998), "Attitudes to self-assessment and quality awards: a study of small and medium-sized companies", *Total Quality Management*, Vol. 9 No. 8, pp. 731-9.
- Willcocks, L. (1994), *Information Management: The Evaluation of Information Systems Investments*, Chapman & Hall, London.
- Williams, M.D. and Williams, J. (2007), "A change management approach to evaluating ICT investment initiatives", *Journal of Enterprise Information Management*, Vol. 20 No. 1, pp. 32-50.
- Venkatraman, N. and Henderson, D.J. (1999), "Business platforms for the 21st century", *Financial Times*, Vol. 29, pp. 12-14.
- Yang, K.H., Lee, S.M. and Lee, S. (2007), "Adoption of information and communication technology", *Industrial Management & Data Systems*, Vol. 107 No. 9, pp. 1257-75.

Further reading

- ComputerWire* (2002), "UK ICT firms make fewer profit warnings", available at: www.theregister.co.uk/2003/02/07/uk_it_firms_make_fewer/ (accessed May 2007).
- ComputerWire* (2002), "ROI faulty as measurement of ICT success – survey", available at: www.theregister.co.uk/2003/02/07/uk_it_firms_make_fewer/ (accessed May 2007).
- Clark, L. (2006), "SOa gathers pace in the enterprise", *Computer Weekly*, p. 14, 26 September.
- Love, P.E.D., Li, H. and Mandal, P. (1999), "Rework: a symptom of a dysfunctional supply-chain", *European Journal of Purchasing and Supply Management*, Vol. 5, pp. 1-11.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.