# SUPPLY NETWORK RISKS ARISING FROM E-BUSINESS: FINDINGS FROM EMPIRICAL RESEARCH

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## Abstract

The paper reports findings from empirical research conducted across a range of supply networks. Three key research questions are addressed, one at the level of the firm, one at the supply chain level, one at the national level. Risk is seen to take different forms at each level of intervention.

**Key words: Risk, SMEs, B2B, supply chains, supply networks, e-business**

## Introduction

Large firms need to motivate SMEs to respond to e-business challenges. Business is conducted in increasingly complex networks of organisations giving rise to different types of risk in supply chains and networks. Businesses are becoming more aware and more concerned about less tangible risks. The rapid development and adoption of e-business is significantly influencing exchange and there is evidence that contingent approaches to adoption of different types of e-business may be appropriate. It appears that SMEs have special difficulties in adopting e-business and that existing e-business models may not be appropriate. However, these issues remain unconnected and are not empirically researched in supply chains and networks.

This paper reports the findings of empirical, exploratory research to examine various aspects of e-implementation in supply networks to examine potential risk for upstream SMEs. First a review of literature of risk and loss, risk in supply chains and networks, general risks of e-business, and risks for SMEs arising from e-business is provided. From these reviews some research issues emerge; these emergent issues provide a set of questions for exploration. The

questions are addressed in initial exploratory interviews then in-depth case studies in four sectors. Conclusions are drawn to reflect on possible implications for SMEs and large firms in supply networks.

The following section summarises the literature on risk and loss.

**Risk and loss**

Much research takes a scientific view of risk, defining and expressing it in formulaic terms as the probability and significance of loss to an organization or individual (Mitchell, 1995). The Royal Society (1992) defined risk as *"the probability that a particular adverse event occurs during a stated period of time, or results from a particular challenge. As a probability in the sense of statistical theory, risk obeys all the formal laws of combining probabilities"*. Large organisations focus on less tangible aspects of risk, such as reputation; for example, Shell aborted the disposal at sea of its Brent Spar oil platform (Schwartz, 2000), bowing to media pressure covering the Greenpeace protesters; Nestlé battled against adverse impact to its reputation from its promotion of infant formula in less developed nations (Schwartz and Gibb 1999). Harland *et al* (2003) categorize 11 types of risk: strategic, operational, supply, customer, asset impairment, competitive, reputation, financial, fiscal, regulatory and legal.

Realization of risk leads to loss. Brenchley (2000) categorizes types of loss as financial, performance, physical, psychological, social and time. Harland *et al* (2003) highlight that losses can range from minor to catastrophic, and that more managerial and academic attention is paid to the potential scale of catastrophic loss, rather than the probability it will be realized. Also, little attention is paid to relatively minor losses that might relate to risk that could be managed. If minor losses are incurred repeatedly, the aggregate impact may be greater than a single, large loss.

The risk landscape has changed as, through outsourcing and globalization, products and services are delivered through complex networks of collaborating organisations (Harland et al 1999). Risk and loss should be examined beyond the firm boundary in supply chains and networks.

**Risk in supply chains and networks**

Souter (2000) suggests from an insurance perspective, that risks from the supply chain require managerial attention. However, Harland *et al* (2003) note that most risk research has been conducted at the level of the buyer / supplier relationship. Only recently academic studies have been conducted at the systems level of the supply chain or network. Norrman and Lindroth (2002) identify that downstream OEMs may have conflicting objectives to upstream firms regarding risk and its distribution in a supply chain; OEMs closer to ultimate demand want to adjust capacity to meet peaks in demand, whereas asset-intensive upstream businesses tend to be more risk averse as capacity increases require substantial investment. Harland *et al* (2003) find as outsourcing and globalization increase, causing increasing complexity in supply networks structures, the sources and types of risk increase. One factor in the increasing complexity in supply networks structures is e-business.

**Risk from e-business**

The tighter integration of customers and suppliers in supply chains and networks, spreads risk from an internal, intra-firm issue, to an external, inter-firm issue. Thus co-ordination mechanisms between firms become potential conduits for risk. Coordination mechanisms have changed recently as a result of modernisation through Internet-enablement (Garcia-Dastugue and Lambert 2002).

Garcia-Dastugue and Lambert's evaluation implies contingency in that different sets of characteristics relating to different products and services lend themselves to different Internet-

enabled coordination mechanisms. Easton and Araujo (2001) discuss contingency issues of the relationship between two kinds of B2B markets (competitive and relational) and two types of e-technologies (virtual marketplaces and inter-organisational systems). They suggest the characteristics of products and markets make e-technology more likely to be adopted in different situations. For example, virtual marketplaces will only work where products are of standard specification, low value and non-essential. In contrast, where relational market characteristics of a small number of buyers and sellers exist in long-term relationships, complex and differentiated inter-organisational information systems are more likely to be adopted. Thus, approaches to e-adoption should be contingent – dependent upon specific, but not unique contexts.

However, in line with the discussion on risk management, most academic attention on e-business has focused on relationships between firms, rather than on supply chains and networks. Despite initial speculation that the greatest benefits of e-business will occur under full supply chain integration (Currie 2000), there are few empirical studies of e-business in chains and networks, and none that specifically address effects on risk and potential loss. A small number of studies of e-business, however, highlight risks for SMEs (Caldwell et al. 2003).

**Risk arising from e-business for SMEs**

There are a number of major barriers preventing SMEs from successful e-adoption; Levy et al (2001) identify the lack of business and IT strategy, limited access to capital, over-emphasis on automating rather than changing business processes, influence of major customers, and limited IT skills. Further, SMEs often lack understanding of their opportunities and how to implement and use IT. Chapman *et al* (2000) report a case of the use of web-based alternatives to EDI between upstream SMEs and first tier suppliers to OEMs in an automotive supply chain. This

shows the importance of assisting SMEs not only in their take-up of IT, but also in business analysis and funding for creation and implementation of Internet solutions.

Cox *et al* (2001) find that the major SME driver/motivation for e-adoption is pressure from proactive customers, and competitive reasons. As SMEs felt they obtained fewer benefits than anticipated, the perception of benefits for SMEs from electronic integration may inhibit e-adoption. Evidence on Internet adoption is limited, but initial studies suggest that few SMEs that develop websites link them to their transactions processing systems (Zheng *et al*. 2003). It has been suggested that SMEs will follow a 'stages' model of Internet adoption and use – where one use leads to another (Venkatraman 1991). However, Levy and Powell (2001) argue that two forces drive information and communications technologies investment – customer dominance and strategic focus - and that 'stages' models are inappropriate for SMEs. Rather a segmentation model, contingent on SME characteristics is applicable. Levy and Powell's (2002) research suggests that there are a number of factors that influence Internet adoption and development in SMEs. Business need and perceived benefits figure prominently (Zheng *et al*. 2003). A contingent model that involves 'transportation' from one use to another without the implicit idea of growth may be more useful for understanding SME Internet adoption.

**Research Issues Emerging From the Literature**

Today's business is conducted in increasingly complex networks of organisations (Harland *et al* 1999) giving rise to different types of risk in supply chains (Harland *et al* 2003); businesses are becoming more aware and more concerned about these less tangible risks. The rapid development and adoption of e-business is significantly influencing exchange and there is evidence that contingent approaches to adoption of different types of e-business may be appropriate (Easton and Araujo 2001). There is evidence that SMEs have special difficulties in

adopting e-business (Caldwell *et al*. 2003) and that existing e-business models may not be appropriate.

However, these issues remain unconnected and are not empirically researched in supply chains and networks. Certain lines of argument appear reasonable to pose at this stage.

*At the level of the firm (or dyad)*

First, if large downstream organisations in supply networks forge ahead with their e-agendae, it is possible that upstream SMEs, several links removed from the larger firms, may have special difficulties participating in supply network information integration. If large firms continue to act in this way, irrespective or unaware of the implications of their action, their developing e-business capability will enable them to reach further internationally and discover sources of supply of which they were previously unaware. This may result in un-enabled upstream SMEs 'dropping out' of supply networks they currently depend on.

*At the level of the supply chain or network*

A second issue emerges relating to risk to larger firms. Risks in supply networks may not only be increasing for SMEs, but consequentially for larger downstream firms. Through application of 'focus', and 'core competencies', larger firms are outsourcing work to their upstream supply network, thereby leading to rationalisation of their supply bases. Dealing with a smaller number of suppliers effectively cuts their bonds, ties and links with those suppliers. If local upstream SMEs did drop out of supply networks, are there unpredicted potential losses for downstream larger firms?

*At the governmental or national level*

A third issue is governmental. Potentially, nations that are more e-enabled and develop competence and capability with their SMEs may benefit from international 'reaching' of larger,

e-enabled firms. Those less enabled may suffer national loss. The prosperity gap between developed and less developed nations may increase as e-enabled developed nations trade more with other e-enabled developed nations, and suppliers in less developed, un-enabled countries drop out of supply networks internationally.

**Method**

Cases studies were carried out in the following sectors: construction, assistive (medical) technology, apparel and computer consumables chains. The case approach taken was both novel and comprehensive, involving interviews at three levels – customer, supplier and supplier's suppliers - in order to build up a map of how e- works through a network of organisations. Each network was traced back to a set of SMEs - three or four were interviewed per network. The findings were derived from 28 interviews in four separate networks.

Three cases focus on upstream supplier networks, while one is a more complex network including large and SME suppliers and customers. Table 1 shows the characteristics of the supply networks and the SME sets. Nine large firms and 19 SMEs participated.

| | **Construction network** | **Assistive technology network** | **Apparel network** | **Computer consumable network** |
|---|---|---|---|---|
| **Product** | Lift / Elevators | Wheelchairs | Uniforms | Computer consumables |
| **Large firm interviews** | 1 customer and 1 supplier | 1 customer and 1 supplier | 1 customer | 2 suppliers and 2 customers |
| **SME interviews** | 5 suppliers | 4 suppliers | 4 suppliers | 4 suppliers and 2 customers |
| **Total** | 7 | 6 | 5 | 10 |

**Table 1: Characteristics of network case studies**

The supply network case studies consisted of three interview categories: focal firm, supplier to focal firm, and SME interviews. The focal firm interviews investigated e-business strategy and practice and the approach to upstream supply organisations. The supplier interviews examined two directions – downstream to the focal firm to investigate their perceptions of that firm's

approach to e-business, and upstream to their suppliers to investigate their perceptions of their approach to e-business with those suppliers. The SME interviews looked downstream to investigate perceptions of the supplier's e-business approach, and internally to examine behavioural and cultural enablers and barriers to exploitation of e-business. Each case was conducted with semi-structured interviews lasting 1-2 hours with a senior purchasing manager and/or IT manager in the case of a large firm and an owner/general manager in the case of SMEs. All the interviews were taped and documented. Multi-level analysis was conducted analyzing individual firms, by network, by cross-network analysis, as well as analysis across SMEs, focal customers and intermediate supplier levels.

**Key Findings**

*Current Use of e-Business in the Supply Networks*

e-business development was more advanced between large firms downstream in the supply network and their customers and, to a lesser extent, with their immediate suppliers. The large firms used email internally and external. They used their websites as interactive tools; examples included web-enabled enterprise systems. One large firm in the apparel network tried to use IT to support strategic moves. A few large firms had online-ordering and e-tendering. Others had e-marketplaces or e-procurement projects ongoing.

There was little evidence of use of e-business by upstream SMEs. Most external communications were by phone, fax or personal visit; there was limited use of email. Many did have a standalone web-site in the form of 'brochureware' containing contact details, but little else relating to prices, availability or ordering arrangements. There were few EDI links between the SMEs and other supply network players. Only a few SMEs had a network internally; there was little evidence of

internal/external interfacing; SMEs who received orders by email had to re-key these into their internal sales order management system, where they had one.

*Future Strategies for e-Business in the Supply Networks*

All the large firms and immediate suppliers had ambitious plans for e-business. For example, the focal firm in the construction network tried to re-launch a B2B exchange with full back-office integration and e-procurement. They planned to increase e-interaction with suppliers. In the assistive technology network, the focal firm planned to have full Internet procurement and electronic inventory management. The uniform manufacturer in the apparel network planned to automate all its business, except production; they were trying to implement an IT system for on-line ordering and stock control, with the aim of delivering customised 'man-packs' to police forces. However, these large firms tended to develop e-business strategy alone – in 'e-isolation'. Interestingly, their e-business strategies still focus mainly on their downstream customers. There was evidence of some slower development of strategy for e-business with upstream suppliers.

In contrast, none of the SMEs had plans for further e-adoption. They were cautious, holding a 'watching brief', responding to customer demand only. Some SMEs wanted to enlarge their websites but only to remain as a marketing tool, rather than have integrated, interactive capability. Only one SME saw the potential benefit of investing in a system that allowed its customers on-line purchasing and internal purchasing, bypassing intermediaries. In terms of priorities for future survival, e-business was low. They were more troubled by firms in low labour cost countries gaining their business; they did not connect this to the issue of e-enablement and whether other countries might pose a risk because of greater enablement.

*Barriers and enablers to e-adoption in the supply networks*

The cultural change required to move from paper to e- transactions required a level of trust that was perceived as not robust enough in the sample business relationships. Lack of understanding of management issues by the IT department was a further issue. Some firms were put off e-business by reported scares in the media. Also they were concerned that there were no e-best practice tools in action and a lack of real world examples that were working well.

SMEs seemed to perceive different types of behavioural and cultural barriers than their larger counterparts. The main issue for SMEs was the fear of losing the personal touch in business relationships. One issue that emerged here was just how much of SME owner/manager time was spent with customers in business retention. Their time spend is not seeking so much to sell new business as to remain in the customer's frame of reference when further business came along. Generally they did not view Internet business as any replacement for personal contact with customers (Caldwell *et al*. 2003). SMEs were vocal about their dependence upon inter-personal relationships for winning business by offering flexibility and personal services. Also, SMEs normally only bought from suppliers they trusted. There was a lack of trust in the unknown at the other end of an electronic transaction; they had little or no confidence in the Internet and wondered whether orders would 'get through' to them. SMEs tended to have strong loyalty to existing suppliers and were unwilling to jeopardise the trust relationships with them that they had built up.

A further organisational barrier was associated with owners' interest and attitude. Owners seemed to have no interest and motivation for e-business, as they could not perceive tangible benefits from investment in e-. SMEs stated they only invested when they needed to. There was a lack of understanding of e-business by senior management. Some SMEs felt they were too small to do e-business. They felt constrained by the expense and time it would take to learn about and

use e-business. There was a lack of a middle management layer in the SMEs – owners tended to drive most initiatives. The lack of ability to delegate substantial tasks further restricted the capability and motivation to change.

Many of the SMEs interviewed expressed concern about increasing adoption of e-. Most viewed their 'value-add' in the supply network as arising from personal, differentiated service to their customers; e-business was therefore perceived as a threat by some, in that it could potentially commoditise their differentiated product (Caldwell *et al*. 2003). There was evidence of technical barriers for large firms, including internal and external compatibility problems, re-keying, back-office integration and security concerns. Coding was seen as a barrier to supply network integration; for example there was no compatible coding system between the Disablement Services Centre in the hospital and the wheelchair manufacturers.

There were a few technical barriers for SMEs, the first being security. The SMEs were worried about e-hackers; they feared losing sensitive information to competitors. A further problem highlighted was the 'not always-on' system; these systems led to resistance due to the time and effort involved in having to log on. Broadband technology will provide 'always on' Internet links; however, SMEs will then be concerned about additional broadband costs (hardware, software, licenses, support and maintenance), and the potential for e-virus threats, e-saboteurs, e-hackers and e-espionage with an 'always on' e-pathway.

*Perceived Risks of e-Business in Supply Networks*

The cases show most SMEs were not fully aware of e-business threats and tended to identify risk in a narrow, pragmatic sense. For example, most cited financial risk, in terms of not receiving payment. Also, manufacturing SMEs seemed to perceive more risk of foreign competition and risk of over-dependence on one customer than e-business related risk.

For SMEs, there were fears of uncertainty relating to the effect of e-business on interpersonal relationship approaches. SMEs felt that these interpersonal relationships were critical to differentiate their position to offer flexibility and personal services. A further risk related to supply network power and e-adoption. There were fears of little benefits for SMEs in e-business challenges. For example, e-auctions were perceived as being price-focused, and failing to take into account the service and quality and relationship value. Further, transparency was a huge risk for the SMEs. The larger firms operated with more complex business models, and a portfolio of products and businesses to make their own activities less transparent. SMEs felt that they were more vulnerable than large firms to sensitive information being lost through transparent relationships. Larger firms with wider product or service ranges can also leverage bigger benefits through cross selling, for example.

There were variations in SMEs in terms of risk awareness. For example, three out of five SMEs in the construction network did not perceive any risk, the concept appeared alien to their way of working. In contrast, SMEs in assistive technology were much more concerned with risks of customers sourcing overseas, over-reliance on one major customer and foreign competition. These SMEs added more value through manufacturing than other networks. In the apparel network SMEs were trying to diversify their business due to shrinkage of the UK textile sector.

Regarding risk management, the dominant theme that emerged from the SMEs interviews was trying to diversify and not be reliant on a few large customers. Many of the SMEs had learnt this the hard way, having recent stories to tell of how a large customer had either dropped the supplier or reduced their spend heavily, resulting in a crisis for the SME. Use of credit checking packages was found in a few of the SMEs. One SME in the assistive technology network was proactive and took the risk to invest strategically to try to control its own destiny by making its

own product and looking for other new product potential. Further, they were trying to build partnerships with customers, providing a quality service by offering dedicated facilities at the customer site.

Most existing models address risk issues from a transaction cost perspective; for example, supply risk in Kraljic's (1983) Portfolio model; however, in order to assist SMEs with e-adoption development, it is important that they understand the risk implications in a wider context. There were fears of uncertainty relating to the effect of e-business on interpersonal relationship approaches. This enabled SMEs to differentiate their position to offer flexibility and personal services. Thus, there is a need to recognise risk and trust in relationships with SMEs.

The case findings show most SMEs are not fully aware of e-business threats and tend to identify risk in a narrow, pragmatic sense. For example, most cited was financial risk in terms of receiving payment. There is the need to be aware of strategic risk, such as risk of under-exploitation and risk associated with inappropriate use of e-. However, recognising the skills and innate talents of SMEs, current low take-up of e- is not a failure by SMEs, but demonstrates caution and contingency. No firm ruled out getting involved in e-business (except the apparel firm that saw no future for itself), however they were adopting a wait and see approach. Given not only the scale of change and investment likely, but also the 'over-hyping' of e-solutions, such pragmatism is to be applauded. The findings suggest that SMEs could benefit from assistance with risk management, specifically in e-business.

**Discussion and analysis**

The findings from this research are pragmatic but raise questions around the nature of SMEs and understanding of how they function in supply networks. In the analysis that follows it appears the three distinct concerns inter-connect on many levels. The issue of large firms forging ahead with

e-agendae that effectively exclude SMEs several links removed could lead to domestic SMEs being replaced by global suppliers. The risk identified here is of SMEs 'dropping out' of supply networks.

On one level the research found so little e- in place beyond upstream links with customers that this risk may be premature. Whilst the larger companies spoke of grand plans for e-, little was in place and signs of scaling back ambitions were evident. The networks here are all in functions central to the economy, however one of the four networks, the computer consumable network contained many firms with high internet capabilities. Yet in this network resistance and ambivalence was observed towards the internet (due to cannibalisation of existing business, fear of upsetting intermediaries/distributors, lack of integration with other systems, fear of loss of personalised service, and the likely transparency of the business model).

A further issue that complicates the situation is the role of personal contact for SMEs in retention marketing. Most of the SMEs did not employ sales personnel and did not tend to seek new customers; rather they market to existing customers, and do this through personal, social contacts. However, the customer also benefits from this marketing attention, and the issue is important when discussing SMEs being left out of newly developing e-global e-networks. In terms of risk the issue can be reframed as 'will e-business mean SMEs will have to reconfigure their marketing mix – to avoid the risk of dropping out of supply networks'.

The second core concern that informed the research was whether there were unpredicted potential losses for larger firms if local upstream SMEs drop out of supply networks. In part addressing this issue involves an understanding of the benefits larger firms derive from dealing with SMEs. The technology and learning that transfers through such links mean that a firm's external relationships may be seen as gateways to other knowledge bases or 'selection

environments' (Nelson and Winter, 1982). Where the current research is able to contribute to this issue though is in detailing just how important social bonds were found to be.

The social bonds between supplier and customer were a constant of the research, although at their extreme in the construction and computer consumables networks. What the research identifies as lacking is an understanding of e-use as well as e-adoption from the user perspective. In the supply field, research tends to focus on managers as decision makers. However, for example, in buying computer consumables (which can be stationery) the user, the person who is at the end of a telephone, may be highly influential – and the key target of the supplier's marketing. Such an individual, often of low status, may not be concerned at all with the price their organization will pay; other rewards, such as personalised attention, may be more important.

In the construction network, in which all the senior figures were male, a culture of rushing around, jumping into cars, responding to crises (usually the result of changes in building plans) was evident. There appeared to be a high degree of camaraderie, perhaps reflecting a shared interest and training in construction and engineering and distinct professional socialisation patterns. E- was seen as currently irrelevant as business was done face-to-face and with handshakes, not contracts, so the transactional capabilities offered by e- were not needed. To some extent this culture could be traced throughout the network; architects, project managers, site managers, civil engineers, all shared some background that currently united the network with effective communication links.

From a risk perspective, two aspects of social bonds are apparent: that it would be all too easy to implement e- without considering the strength of social bonds at work (both as a satisficer and as an influence on a purchasing decision); and as a barrier to technological innovation. The former

risk threatens e-implementation but is more easily quantifiable than the latter threat. At present UK civil engineering is held in high regard internationally, the construction industry though is seen as inward-looking, adversarial and backward in terms of innovation. The current culture of the UK industry observed here may appear an impenetrable protection from e- and technology. However there is a risk that technology and modularisation could change how customers want to conduct business and current approaches could be swept away. Then firms and SMEs that relied upon 'personality' rather than process in inter-organisational links could find themselves disadvantaged through facing more technologically capable rivals who are superior at electronic communication and transacting. As to a response, Granovetter's concept of weak ties seems relevant; networks that only communicate with individuals and firms in their own mould, like the construction network, may be more vulnerable to a tidal wave of e-technology-led change than other networks where change can be adapted to incrementally. Fukuyama (1999:201) noted that a problem with "informal networks is the inverse relationship between the strength of the values or norms linking the community (and therefore the degree of co-ordination they can achieve) and their openness to people, ideas, and influences from outside the network)". The research highlights the risk of seismic change from e-technology in networks that have a strong and unified culture, and which may appear impregnable at present.

The third core issue is at the level of national government, whether e- and non e- enabled nations will be created. (Table 2 gives examples of e-adoption risks perceived at sector and national levels). Taking such a national level perspective is a large step on from the firm-based data presented here. Nevertheless sector and national issues were observable. In the apparel network all respondents mourned the passing of garment mass production in the UK; the fact that a UK based apparel industry could be interviewed at all related to the core retained nationally of

military and other emergency services related apparel. [One SME retained a declining toe-hold in the mass market through constantly retreating to niches of such low importance and margin that no overseas competitor had followed them, yet]. The research suggested that the uniqueness and international reputation of British standards for textiles, and the standard of training for the textile specialists still available in the UK was critical for the remaining 'rump' of the UK apparel trade. Critically in the example highlighted here it is the ability to produce the fabric, to the strength and robustness required that is the key capability, not the sewing/assembly stage, which is exported on a cost based decision.

Here is an example of a risk from e-, that what were once highly proprietary standards and training may diffuse through the internet and e-technology allowing new and lower cost non-domestic suppliers in. But at the same time it is an example of the national interest being served by government procurement policies, back up with technical expertise. This highlights that at a national level the inter-connections of various parts of the economy go beyond a supply network concept linking trading organisations together. For example a decision taken to reduce public expenditure on textile-related training could move a shrunken and possibly marginal industry to below the critical mass necessary to retain domestic military uniform capability.

As the development of e- observed was not 'joined up', although pockets of expertise were found, it appears too soon to assess the emergence of an e-national 'gap'. The apparel example above highlighted how changes in an unrelated sector could have a decisive impact in another sector, the likely impact of e- in one (or many) nations across the world potentially reshape entire supply networks. On the other hand, those in the sample companies who complained most about overseas low cost competition were manufacturers, who are currently dealing with phone and fax equipped rivals, not e-competitors. Surprisingly some interviewees who imported rather than

purchase from UK manufacturers stressed the speed of response from overseas competitors (not using e-technology) as an important factor in making it easier to do business with overseas competition. UK manufacturers were seen as slow to respond to inquiries, drawings, changes etc.

| | **Sector** | **National** |
|---|---|---|
| **Construction network** | • Insular industry could be hit be seismic e-led change<br>• If new standards were created by this change not just those who work in construction would be affected, also those who supply construction | • Loss of skills and wealth through e-led modularisation of building techniques previously co-ordinated by managers<br>• Adverse impact on highly respected UK civil engineering |
| **Assistive technology network** | • Loss of manufacturing capability<br>• There may be a patient care issue when wheelchairs etc. are made by nations of different physical stature and attributes | • Risk of becoming an 'unbalanced' service only economy.<br>• Defence issues over loss of manufacturing capability |
| **Apparel network** | • Low cost e- competition reducing the industry to a marginal size<br>• Current barriers to entry (unique standards, high technical expertise, difficult and lengthy contracting process) could be reduced through diffusion | • Loss of national defence capability<br>• Potential leakage of critical military information e.g. buying Arctic uniforms is suggestive of future strategy |
| **Computer consumable network** | • E- cannibalises margins<br>• E- could reconfigure supply network. Cutting out intermediaries or leading existing intermediaries to new suppliers<br>• E- likely to benefit large scale, creating larger and larger transnational companies | • Governments could have to deal with multi national suppliers with global reach who may be impervious to domestic governments<br>• Security risk of a 'joined up' nation |

Table 2: e-adoption risks perceived at sector and national levels

**Conclusions**

There is a large gap between SME and large firm usage of any form of e-. Most SMEs are communicating with larger firms mainly through phone and fax and have little internal usage of e-, whilst large firms are using e- to improve internal business processes as well as communicating with external customers. SMEs tend not to have e-business strategies whilst most large firms do.

Cultural and behavioural barriers are perceived differently between SMEs and larger firms. The main issues for SMEs are fear of losing the personal touch, low confidence in the Internet, and trust. A lack of owner knowledge and motivation is another barrier, coupled with the intangible

or hard to quantify benefits to be gained from e-enablement. Resource and funding are barriers for both SMEs and large firms over education and training. It appears there is a need for large firms to motivate SMEs upstream in their supply networks to respond to the e-business challenge.

SMEs perceive more risk of foreign competition and risk of over dependence on one or more customers than e-business related risk. There is increasing customer overseas sourcing and global competition. The main impact of e-business on SMEs in supply networks relates to supplier reduction. There is little impact of disintermediation in the four supply networks.

The literature does not clearly identify that time and permanence are treated differently between small and large businesses. SMEs are generally reluctant to make investments that will generate vague or unsustainable benefits in the future. Smaller businesses have shorter time horizons than larger organisations and have less scope to get major decisions wrong. They have less ability to ride out, for example, a slow uptake, and neither do they have the ability to spread costs over many products/product ranges as a larger firm might.

The key issue is that SMEs do not think of e- as a concept of inter-linked applications able to transform their business. They see it as discrete tools, many of which are regarded as too expensive or esoteric to be evaluated (reinforcing the fragmented view of IS/e- technology applications). The fundamental lesson is to ground advice to SMEs in terms of their business model – which will take into account factors such as attitude to growth, age of owners etc. – and not in either the technology or theoretical statements about markets.

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