Sociotechnical Study of e-Business:
Grappling with an Octopus

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EXECUTIVE SUMMARY

This paper reports on a study that investigated the status and anticipated development of e-Business activity. A prime aim of the study was to increase understanding of the human and organizational issues that arise with e-Business, and the extent to which these are currently addressed. An expert panel method was used, which involved interviewing 70 leading practitioners of, and experts in, e-Business in the UK. The findings identify the distinguishing novel features of e-Business, highlight the key issues it raises, and provide evidence of current uptake and impacts. The findings include ideas on good practice. The study emphasizes the importance of taking a holistic, sociotechnical view of the complex set of interrelated changes involved in e-Business.

Keywords: e-Business; e-commerce; good practice; sociotechnical systems

INTRODUCTION

There has been rapid growth of interest in, and adoption of, e-Business since the late 1990s. As with many emerging phenomena, practice has moved ahead at some pace, with research of the underlying issues struggling to keep up. Research that has been undertaken has largely focused on four main perspectives: the strategic (e.g., Timmers, 1999); the technological (Shaw, Blanning, Strader, & Whinston,

2000); the business case (Dai & Kauffman, 2002); and the marketing aspects (Turban, Lee, King, & Chung, 2000). Relatively little work has been undertaken on the human and organizational dimensions, although studies of computer-based technologies in organizations consistently show that insufficient consideration of a system's social environment and the relationships between people and technologies has been a major reason why investments have often been assessed as being a failure, or only a partial success (Brynjolfsson & Hitt, 1998; Clegg, Axtell, Damodaran, Farbey, Hull, Lloyd-Jones, Nicholls, Sell, & Tomlinson, 1997; Nathan, Carpenter, & Roberts, 2003).

The research examining the human and organizational issues in e-Business has led to a number of predicted and observed effects, including the need for new skills (Andersen Consulting and Investors in People, 1998), changes in job content along with the creation of new kinds of work (IRS, 2000) and an increase in company relationships; in particular, the opportunity for companies to increase their supplier and customer bases (Leadbetter, 1999), and to move to relationships based on information-sharing, cooperation and trust (Donington, 1995; Richmond, Power, & O'Sullivan, 1998; Sako, 1992). Some work has also emerged stressing the need for a systemic approach to e-Business, recognizing the importance of changes in business processes (Bray, 2000; PriceWaterhouse Coopers, 1999; Richmond et al., 1998; Timmers, 1999) and the more general need to make a "host of changes in a coordinated fashion" (Cairncross, 2000, p. 2).

Nevertheless, to date there has been little research that identifies in more integrative fashion the range of human and organizational issues arising with e-Business, examines the extent to which such issues are currently being addressed by those undertaking innovations in this area and which sets e-Business in the wider context of earlier work on the use of Information and Communications Technologies (ICTs) in organizations. This research attempts to fill these gaps. More specifically, the main objectives are to:

- Investigate the current status and anticipated development of e-Business in the UK.
- Examine and increase understanding of the main human and organizational issues, and the extent to which these are currently addressed.
- Offer some early views on good practice.
- Set the situation in the wider context of earlier work on the use of ICTs in organizations.

The research adopts a sociotechnical perspective to meet these objectives, for several reasons. First, there is a substantial history of applying these ideas — they have proved useful in understanding the use and impact of technology-based changes of various kinds (Avegerou, 2003; Coakes, Willis & Lloyd-Jones, 2000; Mumford, 1968; Trist, 1981; Trist & Bamforth, 1961). Second, the ideas may prove useful in adopting a more critical and sceptical attitude than sometimes pertains when new phenomena arise, where there is a danger of exaggerated impacts and benefits (Bloor, 2000; Roberti, 2001). Third, the core proposition underlying sociotechnical thinking, that the social and technical aspects of any new systems need to be designed and optimized concurrently, appears valid in principle to this domain. It may help identify the key social (i.e., human and organizational) issues that merit further attention.

Fourth, the sociotechnical approach has identified some design principles which again merit application to this new topic area; for example, in assessing the extent to which such principles are being met in this domain and by helping formulate ideas on good practice. And finally, the application of sociotechnical thinking may help place e-Business in a wider context and tradition of technology-based change. This is not to argue that this is the only approach that could be used, but it is one that the authors felt was particularly appropriate.

This study was conducted by members of the Sociotechnical Group of the British Computer Society (BCS), and was supported by the BCS, the UK Department of Trade and Industry (DTI) and the Economic and Social Research Council (see Clegg et al., 2002).

METHOD

The study defined e-Business as "the transaction of business activities on open networks, such as the Internet, between corporate and individual participants" (Clegg et al., 2002, p. 79). The focus was on business-to-business (B2B) and business-to-consumer (B2C) transactions and relationships. The study team adopted an expert panel approach by interviewing some of the leading practitioners of and experts in e-Business in the UK. This approach seeks to capture some of the depth of the experts' experience while drawing on their breadth of knowledge. Interviews were conducted with e-Business practitioners and experts from users, suppliers, consultancies, advisors, academic researchers and government.

Leading experts were identified and asked if they would be interviewed on the topic. They were also asked to nominate other experts. Seventy people were interviewed (for a full listing, see Clegg et al, 2002), the vast majority between June 2001 and July 2002. The mix of experts was monitored to ensure they covered a spectrum of backgrounds, forms of expertise, business sectors and company types. Interviewees included specialists in strategic, managerial, operational, technical, human and organizational issues. They had experience in private and public sectors, and in B2B and B2C workings. They worked in or with large blue-chip enterprises, "dot.coms" and small- and medium-sized enterprises (SMEs). Some worked in conventional businesses that have added e-Business to their existing repertoire, including firms where e-Business now represents the main way of working. Others included e-Business start-ups, of which some have added more traditional channels of working. Aerospace, automotive, electronics and computers, finance and insurance, food, manufacturing, media/entertainment, retail, travel and telecommunications were among the industry sectors covered.

The study makes no claims that this sample of experts is representative of the general population of e-Business users. Rather, our claim is that the study has collected data from experts with a broad range of leading-edge experience in this area.

The interviews were conducted using a structured schedule. Interviews typically took around 90 minutes, and often longer. Where possible, interviews were recorded. Interviewees were given the opportunity to clarify detailed notes or transcriptions of the interview. In keeping with the guarantees offered in the study, the precise sources are kept anonymous in the quotations used in this paper.

Each interview covered four main areas:

- personal and organizational experience of e-Business;
- specific issues and themes, including uptake, impacts and effectiveness, management of change, human and organizational issues, technology and wider social issues;
- good practice; and
- future prospects.

The interview transcripts and notes were coded using template analysis, which involves developing a set of coding categories based on the interview schedule but allowing subsequent modification (King, 1999).

Interviewees were also asked to complete a short 20-item questionnaire that focused on current and good practice. The questionnaires were included to complement the interview findings and to provide further focus and quantification to the results. Questions used a 5-point response format. Example questions were:

- current practice ("In practice, in your experience, to what extent do senior managers in companies adopt an integrated and strategic approach to e-Business?" – response formats: "not at all," " a little," " a moderate amount," "a great deal" or "totally").
- good practice ("How important is it that companies invest adequate resources in getting the human and organizational issues right in the area of e-Business?" – response formats: "not at all important," "a little important," "moderately important," "very important," "imperative").
- future prospects ("To what extent do you agree that most companies will find that managing e-Business is harder than managing traditional businesses?" – response formats: "strongly disagree,"

"disagree," "neither agree nor disagree," "agree," "strongly agree").

For each question, there was an opportunity to answer "Don't know/Not applicable." In total, 63 questionnaires were completed and analyzed using a standard social science statistical package. Given the sample size, only straightforward analyses were undertaken. Copies of each of the research instruments are available on request.

FINDINGS

This section presents a summary of the main findings in relation to a number of key questions:

- What is the uptake of e-Business?
- What are its impacts?
- What are the key sociotechncial issues?
- What is new about e-Business?
- What are the future prospects for e-Business developments?

What is the Uptake of e-Business?

The study assessed the current uptake of e-Business using the 'adoption ladder' (Table 1) developed by the DTI's UK online for business.

First we note that participants in this study, by definition, have extensive experience of e-Business activity. As such, they may perceive higher levels of adoption than a general population. That said, the pattern of e-Business uptake found by the study is similar to that of larger-scale surveys, such as those summarized in Table 2. These revealed that the majority of companies were at the lower 1 and 2 levels, which essentially involve communicating and exchanging information via e-mail and the Web.

Table 1. e-Business adoption ladder

Level*	Key characteristic	Main activities and intentions
1	E-mail	Create efficient internal and external communications.
2	Web site	Establish a place in the worldwide market and a window on worldwide suppliers.
3	E-commerce	Build capabilities for ordering and paying online, reducing transaction costs and maximizing accessibility and speed.
4	e-Business	Integrate the supply chain so that manufacture and delivery become seamless; minimize waste at every stage of this chain.
5	Transformed organization	Offer open systems of information for customers, suppliers and partners, together with new business models based on inter-working between organizations and individuals.

* The extent of organizational change and degree of business benefit increase as the level increases

Table 2. Estimated uptake of e-Business

Level of activity*	Number of companies
Done nothing	Approx. 15-20% of companies
Marketing and interacting using Web sites and interaction (levels 1 and 2)	Approx. 66%-70% overall**, but around 100% for blue-chip companies
Transacting online (level 3)	Approx. 20% (with ordering electronically in most cases exceeding payment online)
Integrating (levels 4 and 5)	Very few

* Numbers refer to levels in the adoption ladder shown in Table 1.
** Includes many organisations still experimenting.
Source: Summary by this study based on Clegg (2001) and DTI (2002)

There is less evidence of enterprises achieving the upper two levels; that is, integration and organizational transformation. The annual DTI (2002) International Benchmarking Study of what is happening with e-Business in the UK and other industrialized countries suggests these figures are typical of the general pattern of e-Business adoption.

There is always a danger, because of the inevitable lags in any research and dissemination process, that data such as these become out of date quickly. It is therefore interesting to compare the results above with the recently published findings from the UK DTI annual survey of e-Business conducted in summer 2003 and based on findings from 3,114 UK companies (Booz Allen Hamilton, 2003). Note that this survey reports on the percentage of employees working in companies that adopt various aspects of e-Business (rather than the percentage of companies per se). This serves to elevate the percentages if larger

companies (i.e., those with more employees) tend to be users. Bearing that in mind, the 2003 DTI findings reveal that around 80% of UK employees work in companies who have Web sites (see levels 1 and 2 in Table 2). Regarding online transactions (see level 3), the figures are more complex: 54% work in companies that place orders online, with 32% working in companies that receive orders online; 25% work in businesses that pay online, with 17% working in companies receiving payment online. In companies where online transactions are undertaken, they remain in the minority by value in comparison with the value of traditional transactions.

The 2003 DTI report concludes that the 'dash for access' is now over in the UK, and the current effort in companies is to 'unlock value.' Our interpretation is that there may well have been some growth in the adoption of Web sites and placing orders online since our study in 2001-'02, but other than that, uptake has remained fairly stable. Certainly there are no grounds for believing the data in this study have become substantially inaccurate.

What are the Impacts of e-Business?

Many interviewees felt it was too soon to identify definitive widespread impacts of e-Business, in large part because the majority of companies are in the early stages of uptake. Furthermore, a number of interviewees reported e-Business systems proliferating almost without control in some large companies, particularly in the early enthusiastic days. The dot.com 'bubble and burst' was seen as both dysfunctional (for example, because it dashed high hopes that had been raised unrealistically) and as having a more positive influence (because it helped to raise awareness and allowed companies some breathing space within which to consider what e-Business means for them). Experts predicted that impacts are likely to become more apparent when there is a wider adoption of more ambitious forms of e-Business. The current basic level of online marketing through 'brochure-ware' and e-mail messaging are likely to have less impact on profitability than are online transactions and integration.

Within the overall pattern of e-Business use, some specific variations were identified. For instance, larger companies can benefit from having greater resources and market power, while smaller enterprises and the 'greenfield' sites of established firms can exploit their advantages of speed and flexibility. Small companies operating in niche markets based on operations that add high value are ideal candidates for developing B2C ways of working. New companies are positioned to be more innovative in the design of their operations, while traditional companies may be able to add 'e' capabilities more easily than dot.coms can provide traditional channels. B2C operations may be easier to build than B2B because of the complexity of B2B collaborations and supply-chain relationships, especially as there still is insufficient understanding of the appropriate B2B models for different contexts.

Variations between sectors could be a function of specific products and markets, some of which are more appropriate for an e-Business approach. The sectors reported to be leading the way with e-Business were financial services, retail, pharmaceuticals, electronics and fast-moving consumer goods. Differences of opinion were expressed over progress in manufacturing and media. In addition, many experts

believe the variability *within* sectors is as great as that between them, with a key distinguishing factor being senior management understanding, vision and leadership.

The study also found much general criticism and scepticism about e-Business performance. Key problems highlighted related to:

- ill-specified objectives;
- a lack of evaluation metrics;
- difficulties in managing change;
- loss of sight of business aims; and
- missed opportunities.

Together with the levels of uptake, these have resulted in much of the massive potential of e-Business innovations not yet being realized – or even fully understood. Experts also suggested that many SMEs in the early days were sold systems that have subsequently not met their needs. This may help explain the latest finding from the DTI survey that some small businesses are "clicking off" (Booz Allen Hamilton, 2003).

Notwithstanding all the above, many substantial success stories were found among both blue-chip companies and SMEs. Examples include a small retailer who sold his shop when he found he could build an international niche market by going online and selling both B2C and B2B. Another small retailer maintained his normal business, but has used the Internet to extend his reach and sales significantly, at little extra cost. Some blue-chip companies specified many impressive gains, such as the retailer who achieved on-shelf availability to customers at close to 99% instead of the previous 85%. Another blue-chip company reported: "98% of our procurement is effected by e-Business, involving some 27,000 suppliers on the Web … the

time to process an invoice has been reduced from 30 days in the early '90s to one hour, leading to total estimated savings in 2000 of about $380m."

At the same time, there was much support for the view that companies are gaining more confidence in e-Business as they learn the hard lessons of experience. Further examples of some of the potential benefits provided by e-Business are described later.

In the questionnaire, the experts were asked for their views on current practice, and the data supported the criticisms evident in the interviews, particularly on how changes are currently managed and on key sociotechnical issues. The results for these are summarized in Table 3.

Comparing these findings (and those from the interviews more generally) with core sociotechnical ideas enables us to make two points. Thus, there is no compelling evidence that the majority of organizations are designing and optimizing the social and technical issues concurrently (see, for example, items 1, 3, 4, 6 and 8 in Table 3). Similarly, it is not apparent that certain key design principles as advocated by sociotechnical theorists (e.g., Cherns, 1976, 1987; Clegg, 2000) are being applied by the majority of companies when developing their e-Business capabilities. Key examples include the principles that

- design is systemic
- systems should meet the needs of the business, its users and their managers
- system components should be congruent
- systems and their design should be owned and managed by their users
- evaluation is an essential part of design
- resources are required to address these issues

Table 3. Current e-Business practice

In practice to what extent do:	% 'not at all' or 'a little'	% 'a great deal' or 'totally'
1. Senior managers in companies adopt an integrated and strategic approach to e-Business?	36%	22%
2. Companies get caught up in the hype associated with e-Business?	13%	57%
3. Companies focus mainly on the technology when developing their e-Business?	15%	57%
4. Companies invest resources in getting the human and organizational aspects of e-Business right?	66%	3%
5. Companies evaluate their e-Business activities against their objectives?	34%	31%
6. Technical specialists dominate the development of e-Business in companies?	16%	62%
7. The users of e-Business in companies have influence over the design of their e-Business operations?	42%	22%
8. Companies plan in detail how their e-Business operations will operate?	45%	17%

We draw three main conclusions from these findings. First, these results are not unique to e-Business. Students of technological change more generally will be familiar with such patterns of findings (Clegg et al., 1997; Nathan, Carpenter, & Roberts, 2003). Familiarity, however, does not render such findings insignificant. Indeed, one could argue that it would be strange if the findings were radically different. Why should organizations suddenly be behaving differently with this innovation, in comparison with earlier instances of ICTs?

Second, it is clear that the application of sociotechncial ideas helps identify some of the problem areas with current practice. We shall argue later that it also helps identify ideas for good practice. And third, there is, implicit in the above, a strong critique of organizational practice and of the behavior of senior management and others in organizations. One direct implication of this interpretation is that ideas and actions on good practice should, at least at this stage in the evolution of e-Business, be targeted at the managerial community. We return to this issue later.

What are the Key Sociotechnical Issues in e-Business?

Many interviewees stressed that e-Business can perform successfully only if it deals effectively with a range of important human and organizational issues that lie at the heart of e-Business operations (Table 4). At the same time, the obviously vital role played by technology in the organizational innovation process was recognized. This was typified by an observation from a consultant: "If you get the technology right, it gives you the freedom to do everything else. If you get the technology wrong, nothing else can possibly work."

Two executives from blue-chip companies summarized the significance of managing all the dimensions of change identified in Table 4. One noted: "The biggest issues are getting people to act and behave differently." The other commented:

"People have to change their working practices and be aware of the fact that things are changing, that cultures are changing and the ways of working are changing. And it's

Table 4. Key sociotechnical topics

- Simplifying business processes
- Changing organizational structures and working practices
- Empowering users and operational staff
- Developing new business models
- Focusing on customers
- Developing appropriate skills and understanding through training and education
- Formulating and implementing an effective management-of-change strategy
- Changing relationships with customers and suppliers (to ones based on trust)
- In general, bringing about cultural changes involving new ways of thinking, behaving and organizing

facilitated by [a] greater flow of information. So the No. 1 lesson of e-Business is about people and the way they work; it's not about technology."

Interviewees pointed almost universally to the need to review, simplify and change core business processes. This usually results in the need to make changes in organization structures and working practices that were widely emphasized as being intrinsic to e-Business success. These generally require a move away from old-fashioned functional hierarchical 'silos' and command-and-control ways of working to more process-oriented, flatter, more-empowered structures. For instance, the use of e-Business to shift towards 24-hour working, globalization and quicker decision-making requires fresh analyses of structures and working practices. Such changes will also create many new forms of relationships with customers, suppliers and partners. Our study suggests that establishing trust in all these relationships is critical to success, but difficult to deal with effectively (Ratnasingam & Pavlou, 2003).

A question given a great deal of attention by interviewees in our study related to the notion of 'empowerment.' What should be the scope of the roles and responsibilities of employees working within e-Business operations? Many experts saw wide-ranging empowerment of users and operational staff, especially those 'nearest the action,' as a pre-requisite for effective e-Business working, particularly in order to meet the needs of customers. This is seen as important when dealing with customers experiencing problems and also supports the general notion of one-stop shops for customers. Unfortunately, many felt that jobs in e-Business operations are actually often designed around traditional hierarchical command-and-control principles.

The central message that emerged from our analysis of the evidence gathered in the study was succinctly summarized in a metaphor articulated by an advisor: "E-Business is a bit like an octopus: It has tentacles in all your operations." Those tentacles spread throughout the e-Business user's organization, along the supply chain (Richmond et al., 1998) and into relationships with customers. One researcher also noted that e-Business issues form "a complex, interwoven and in many ways seamless entirety" which is best dealt with through a systemic approach that treats "all relevant factors as a holistic set."

There was a clear consensus around the view that e-Business involves changes in five interwoven factors: people, process, organization, business models and technology — both within and between companies, and between a company and its cus-

tomers. Overall failure of an e-Business venture is risked if any one issue is not addressed, or if they all are not knitted together to work congruently.

Many experts stressed the need to ensure that education targeted at senior managers and others incorporates broad technical, managerial and social issues that go beyond just how to operate e-Business systems. Several believe a decades-old gap in understanding between the ICT and business communities is still hampering e-Business progress. An executive in a dot.com enterprise graphically highlighted the potential danger when business needs and expertise do not properly inform technical designs:

"The online stuff was crass amateurism and a lot of the sites still are. … If they had had any proper retailer in their organization, he would have gone mad at what they were trying to do in terms of presenting product to customers."

What is New about e-Business?

Many interviewees stressed the importance of enduring business verities, arguing that there is little new about e-Business. One advisor argued:

"There may be specific e-Business issues, but in general, the issues relate to the way work is organized, how people are treated, how change is managed; (they) are those that apply to any process of technological change. There is nothing fundamentally different about this."

As many stressed, e-Business is just another channel to market and it will become easier to think about and manage once it is de-mystified and seen for what it really is.

But at the same time, many were keen to point to some of the novel opportunities provided by e-Business working. Ten interrelated features were highlighted in this study; below we summarize each.

1. **Speed:** e-Business has the potential to speed up processes and ways of working. Examples include: reducing lead times and taking slack out of supply chains; quicker decision making when dealing with customers; upgrading catalogues in real time.
2. **Distance:** e-Business provides the opportunity (at least for some) to work with customers and suppliers anywhere in the world.
3. **Time:** e-Business allows a business to be open for trading at all times (24 hours a day, 365 days a year).
4. **Cost:** Electronic working provides the opportunity to reduce the cost of sharing information, of coordination in a supply chain, of marketing and reaching potential customers, and of transactions.
5. **Customer expectations:** There was some evidence that e-Business working may increase customers' expectations; for example, regarding speed of delivery, quality and security.
6. **Data visibility and integrity:** E-working provides the opportunity for companies to develop and use a single common set of data that may be accessed (subject to certain limits) by employees, customers and suppliers. This should reduce costs. For example, suppliers given access to the actual sales figures of their products in a supermarket chain are able to make their own forecasts of future demands. These may well be more accurate, thereby reducing overstocking and stock-outs, but also saving the costs of forecasting by the supermarket.
7. **New business models:** New ways of working and new channels with sup-

pliers and customers mean that new business models are becoming available. Their appropriateness for different circumstances, their fit and integration with one another, and their impacts may not yet be fully understood, but new opportunities are becoming available.

8. **Scope:** The Internet and Web give companies the capability to consider greater supply chain integration than has been possible previously. This extends the scope and potential complexity of the 'system' that one is trying to manage.

9. **Systemic thinking:** All the above imply that the capability to understand, manage and change complex systems is likely to be especially important as e-Business systems extend their scope through supply chains, as slack is taken out of the system and as timescales are speeded up.

10. **Competitiveness:** The above also imply opportunities to open up markets and to increase competitiveness. Issues such as speed, cost and customer expectations are central to the competitiveness agendas for all organizations.

Any innovation that offers such opportunities and potential benefits will (and indeed should) be of interest to organizations. However, as we saw in the previous section, such benefits may be hard to deliver, and there is potentially much to learn from earlier sociotechnical innovations. Furthermore, our study identified two special characteristics of e-Business that substantially increase its potential complexity. One is exemplified by the way B2B provides opportunities to create an extended enterprise along the supply chain, thereby extending the scope of the system that one is trying to manage. This is more complex

to manage than previous system innovations, because of the new interconnections created across organizational boundaries and responsibilities, as evidenced in the quote from a consultant:

"Having spent the whole of the 1990s trying to get firms to get all the departments to talk to each other and to get all systems integrated, and [having] spent 10 years of pain in most companies to do that, now saying that, having got here, what we really want to do is work across the supply chain. That's more hard slog – five years or more. I believe it will make 20%-30% difference to industrial costs, but it's going to take five years."

Such changes have deep implications for organization structures, roles, working practices and job content, as highlighted by an executive in a blue-chip company:

"We think that the sort of [e-Business] interactions with other companies will be fundamentally different. The opportunities for collaboration, the opportunities for working together, are quite immense, but it means that we have to operate in quite a different way. We think that, within the supply chain, we could actually achieve the vision of an integrated supply chain. But the impact of an integrated supply chain is quite different from the supply chain we have today. The boundaries of the organization, the way people behave at the boundaries, will be different, and we believe that partaking in [such] an exchange will be an important part of building up that understanding."

The other distinctive e-Business characteristic is the need for a better understanding of new business models for both B2B and B2C. An example is holding online auctions in the supply chain. This was felt to be well suited to the supply of certain indirect goods, such as pens, pencils and paper. However, it is not necessarily ap-

propriate for the purchase of products or services requiring longer-term stable relationships demanding high levels of expertise and quality, and/or with some variability that requires direct human interaction. A consultant exemplified this from experience with the shipping market and shipping exchanges:

"There are a number of our clients who are saying, 'How do we compete in this market?' There's a whole bunch of exchanges coming out there allowing a ship owner to deal directly with somebody who has a cargo. They can make this transaction like that. So, our position is threatened. But really, when you look deeply into the industry you find the nature of the transaction is so large and so complex that the introduction might be made over the Internet, the flow of information might be made over the Internet, but no way ... are you going to want to do the transaction over the Internet."

E-Business also offers fresh opportunities to be more customer focused; for instance, by adopting a 'one-stop' customer-calling system, which moves away from being internally organized along product, service or supplier lines.

These issues add a significant new and highly complex dimension to systems design, development and use. In metaphorical terms, the tentacles of the octopus typical of previous generations of ICT can be pictured as having been kept within the user's own organization, from where — despite many difficulties — its reach and consequences could be managed from the relatively straightforward perspective of a single organization. Now, e-Business releases the potential for its tentacles to extend through the supply chain and in relationships with customers.

What are the Future Prospects for e-Business Developments?

The study found a general anticipation of increasing e-Business use and effectiveness, built on technological evolution that fosters the further development of flexible and mobile working. Significant innovations among these were expected to include: broadband; digital TV; mobile and other forms of wireless communication; the convergence and integration of various digital devices; and voice recognition, digital signatures, biometrics and other authentication systems to enhance security. These advances are expected to be accompanied by increases in globalization and competition, along with some shake-up in markets. If this is to come about, new e-Business models that work in different circumstances will need to be established (Dai & Kauffman, 2002).

On balance, opinion among experts in the study tipped slightly towards two particular views: that e-Business will be harder to manage than traditional ways of working (for reasons described earlier), and that most e-Business developments will fail to meet their objectives in the short to medium term. A comment from a manager in a dot.com enterprise put such views in a broader perspective: "The impact of technologies in the short term is always over-egged and their impact in the long-term is always underestimated."

Many expectations were predicated on the way increases in flexibility and mobility will foster the further development of new working arrangements at home, in shared office spaces (e.g., 'hot-desking'), while travelling (e.g., in cars) and in hotels. Some thought progress would be gradual, incremental and not a sudden paradigm shift; others echoed the more radical posi-

tion of two suppliers. "There will not be another way of running a business in five years' time," said one. "We believe the Internet changes everything: the way we live and the way we play," noted another. No expert predicted the demise of e-working or thought its use had peaked.

There was some speculation that it may be easier to achieve quicker returns through B2C than B2B. The reason is that B2C operations are more likely to be within one's own control, except perhaps for delivery, compared to B2B's more difficult-to-manage integrated trans-organizational effort. Companies involved in commodity markets were thought to be especially threatened by e-Business, unless they can differentiate themselves in new ways. Various possibilities were imagined regarding the role of intermediaries, such as travel agents and estate agents. A general process of 'dis-intermediation,' as direct e-links bypass mediators, could lead to the disappearance of some mediators; but evidence was also provided to show how others may benefit by offering more comprehensive or value-added services.

IMPLICATIONS

Our interpretation of the findings from this study is essentially sceptical. We have found it useful to view e-Business as a recent example of technology-based change in organizations, and as such to set it in a wider context. The evidence from this study is that the majority of organizations are in the relatively early stages of e-Business development (Cairncross, 2000), and that current practice is open to criticism, especially when viewed through the lens of sociotechnical ideas (see also Kelly, 2001; Ranger, 2000). In our view, this is not surprising — there are no obvious

grounds for believing the implementation of e-Business should be different from earlier technology-based innovations (see Nathan, Carpenter, & Roberts, 2003).

More positively, it is also clear from this research that there are some important potential benefits from undertaking e-Business activities. Experts reported the opportunities to increase speed, reduce distance, overcome constraints of time, reduce costs, improve data visibility and integrity, offer new business models and in a range of ways become more competitive. Such potentials are central to the effectiveness and competitiveness of all organizations, and in that sense it is clear that e-Business represents a major strategic and operational opportunity that organizations have to take seriously. Furthermore, it is also clear from this work that some organizations are already capitalising on these opportunities.

More specifically, this research has identified the key sociotechnical issues that arise with the introduction of e-Business; for example, concerning business processes, organization structures and working practices, employee empowerment, new business models, the management of change and the need to evolve new ways of thinking, behaving and organizing.

The outstanding message from this study rests in the importance of adopting a sociotechnical systems view of e-Business, a perspective encapsulated in the metaphor of e-Business as an octopus with tentacles spreading throughout the host organization, but also along the supply chain and into relationships with customers. The effective development of e-Business will require a coherent understanding of the interplay between people, process, organization, business models and technology. E-Business innovations will change this interplay, perhaps radically, along these dimensions and

Table 5. Summary of good practice

1.	Senior managers should develop an integrated and strategic approach to e-Business.
2.	Senior managers should provide understanding, vision and leadership.
3.	e-Business initiatives should focus on meeting and developing the needs of the business. e-Business is primarily a business issue.
4.	A systems approach is required, encompassing all the major business, human, organizational and technical issues. This systems thinking should embrace internal systems, the supply chain and relationships with the customer.
5.	All the necessary skills and expertise should be included in the development of e-Business systems, and this extends particularly to the inclusion of users.
6.	End users working in e-Business operations should be empowered in order to meet the needs of customers, and to respond quickly to events.
7.	When developing new ways of working, companies need to learn as they go, to be pragmatic and to undertake changes in manageable chunks.
8.	Evaluation is a key requirement for learning.
9.	There is a need to educate everyone involved in e-Business on what it means, what it can offer and what are the issues. The stress here is much wider than on issues concerned with training in how to operate e-Business systems.
10.	There is a need to focus on customers, on appropriate business models for different circumstances, and the need to integrate activity across the various channels.
11.	There is a need to understand the importance of partnerships and alliances in capitalizing on e-Business opportunities, and to base these relationships on trust.

in all internal and external relationships. The complexity of coordinating these issues is one major reason why e-Business is likely to be harder to manage than traditional ways of working, but is essential if enterprises are to capitalise on the new opportunities.

Our results allow us to speculate on some of the practical implications of this work, and we have summarized these in the form of a short 'good practice' checklist (Table 5). This focuses on key sociotechnical concerns and is aimed, in the first instance, at the managerial community.

It is also clear that there are some urgent requirements for further research in this area. Here are some priorities that arise from our perspective and from the findings of this study. In our view, we need research and development into three main topic areas:

- Why do technology-based innovations in organizations continue to disappoint when compared against their objectives? Why does it prove so hard in practice, and in theory, to bring together the 'social' and the 'technical'? What can be done about it? And by whom?

- What new understandings in sociotechncial thinking are required, as we begin to try to organize and manage systems that cross traditional boundaries? (i.e., as we extend the scope of the systems we try to manage)

- What is fundamentally different about more advanced forms of e-Business working? And what could this mean for our understanding and theories of organizational and managerial behavior?

From both practical and research perspectives, there are significant challenges and opportunities ahead.

ACKNOWLEDGMENTS

REFERENCES

Andersen Consulting and Investors in People UK (1998). *Nil By mouth? Management and communication in the e-economy.* London: Andersen Consulting and Investors in People UK.

Avgerou, C. (2003). New socio-technical perspectives of IS innovation in organizations. In C. Avgerou & R.L. La Rovere (Eds.), *Information systems and the economics of innovation.* Cheltenham: Edward Elgar.

Bloor, R. (2000). *The electronic bazaar: From the silk road to the eroad.* London: Nicholas Brealey Publishing.

Booz Allen Hamilton. (2003). *Business in the information age: The international benchmarking study 2003.* London: DTI.

Bray, P. (2000). Harmonise the technology and the process. *Sunday Times*, (March 12, 2003), 13.

Brynjolfsson, E., & Hitt, L.M. (1998). Beyond the productivity paradox: Computers are catalysts for bigger changes. *Communications of the ACM, 41*(8), 49-55.

Cairncross, F. (2000). A survey of e-management. *The Economist*, (November 19).

Cherns, A.B. (1976). The principles of sociotechnical design. *Human Relations, 29*, 783-792.

Cherns, A.B. (1987). Principles of sociotechnical design revisited. *Human Relations, 40*, 153-162.

Clegg, C.W. (2000). Sociotechnical principles for system design. *Applied Ergonomics, 31*, 463-477.

Clegg, C.W. (2001). *E-commerce impacts: A review of 14 sector studies.* A report to UK online for business. Sheffield: IWP, University of Sheffield.

Clegg, C.W., Axtell, C.M., Damodaran, L., Farbey, B., Hull, R., Lloyd-Jones, R., Nicholls, J., Sell, R., & Tomlinson, C. (1997). Information technology: A study of performance and the role of human and organizational factors. *Ergonomics, 40*, 851-71.

Clegg, C.W., Chu, C., Smithson, S., Henney, A., Willis, D., Jagodzinski, P., Hopkins, B., Icasati-Johanson, B., Fleck, S., Nicholls, J., Bennett, S., Land, F., Peltu, M., & Patterson, M. (2002). *E-Business prospects: Findings from an expert panel.* Department of Trade and Industry: London.

Coakes, E., Willis, D., & Lloyd-Jones, R. (Eds.) (2000). *The new SocioTech: Graffiti on the long wall.* London: Springer.

Dai, Q., & Kauffman, R.J. (2002). Business models for Internet-based B2B electronic markets. *International Journal of Electronic Commerce, 6*(4), 41-72.

Donington, J. (1995). *EDI in the automotive industry.* London: Pearson Professional Ltd.

DTI. (2002). *Annual international benchmarking survey on e-Business.* London: Department of Trade and Industry.

Dutton, W.H. (1999). *Society on the line: Information politics in the digital age.* Oxford: Oxford University Press.

Franklin, T. (1997). *Electronic commerce: How soon? How? How much?* Norwalk: Business Communications Company.

IRS. (2000). *E-commerce*. London: Industrial Relations Services.

Kelly, L. (2001). Top firms fail to embrace e-Business. *Computing*, 29.1.01.

King, N. (1999). Template analysis. In G.J. Symon & C.M. Cassell (Eds.), *Qualitative methods in organizational research*. London: Sage.

Leadbetter, C. (1999). *Living on thin air*. London: Penguin.

Mumford, E. (1968). *The computer and the clerk*. London: Macdonalds.

Nathan, M., Carpenter, G., & Roberts, S. (2003). *Getting by, not getting on: Technology in UK workplaces*. London: The Work Foundation and iSociety.

PriceWaterhouseCoopers. (1999). *Guide to use of information technology in the supply chain: Making technology pay*. London: PriceWaterhouseCoopers.

Ranger, S. (2000). IBM predicts trouble ahead for e-Business. *Computing*, 14.12.00.

Ratnasingam, P., & Pavlou, P.A. (2003). Technology trust in Internet-based interorganizational electronic commerce. *Journal of Electronic Commerce in Organizations*, *1*(1), 17-41.

Richmond, C., Power, T., & O'Sullivan, D. (1998). *E-Business in the supply chain: Creating value in a networked marketplace*. London: IBM.

Roberti, M. (2001). General Electric leads the HYPE BRIGADE. *The Industry Standard*, 15/2/01, 52-57.

Sako, M. (1992). *Prices, quality and trust: Inter-firm relations in Britain and Japan*. Cambridge: CUP.

Shaw, M., Blanning, R., Strader, T., & Whinston, A. (Eds.) (2000). *Handbook on electronic commerce*. International Handbooks on Information Systems. Heidelberg and New York: Springer.

Timmers, P. (1999). *Electronic commerce: Strategies and models for business-to-business trading*. Chichester, UK: John Wiley & Sons.

Trist, E.L. (1981). The socio-technical perspective. In A. van de Ven & W.F. Joyce (Eds.), *Perspectives on organisation design and behavior*. New York: John Wiley.

Trist, E.L., & Bamforth, K.W. (1961). Some social and psychological consequences of the long wall method of coal getting. *Human Relations, 4*(1), 6-24.

Turban, E., Lee, J., King, D., & Chung, H.M. (2000). *Electronic commerce: A managerial perspective*. NJ: Prentice Hall.

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