Information and business performance: a study of information systems and services in high-performing companies

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Reports results of research into the relationship between effective information systems and business performance. The project involved a case study of 12 companies, selected as being 'high performing' according to specified criteria (profitability, productivity, quality, peer evaluation, and export success) and an interview and questionnaire survey technique which investigated: use of information technology to deliver information services, coverage of both internal and external information and data; constitution of the knowledge base; risks to the knowledge base caused by dependency on individuals rather than systems; value of key company staff to the value of information as a contributor to performance; and how far the company can be described as having an information ethos, through which the value of information is conveyed to all workers. Results were used to construct a Research Model of information flows within companies using the variables identified. Findings proved the legitimacy of the research model and validated the interconnected variables studied. Additional variables identified, including environmental factors and internal organizational factors led to the design of an Expanded Research Model

INTRODUCTION

This paper focuses on the relationship between information and business performance. It builds on previous work in the business information sector, including a number of studies carried out at the University of Sheffield – particularly the investigation of information needs in business by White and Wilson (1987), which used a case-study approach, and on research into the relationship between the ‘information culture’ of a company and its business performance by Angela Abell in the UK and Dr Mariam Ginman in Finland. Abell has drawn a number of conclusion from her review of the literature (Abell & Winterman, 1993) on information and business performance:

- the way information is managed and used is very much a product of the culture and management style of the organization;
- changes in organizational structures and methods of using human resources, together with the virtual universal implementation of information technology, could have a significant effect on the way information is perceived and used by organizations;
- current management thinking puts information and cross-functional access to information at the core of business operations;
- an ‘adaptive’ corporate culture encourages employees to work at their highest achievement level and is able to absorb change; this kind of culture, which is thought necessary for long-term growth, has characteristics in common with an ‘information culture’;
- information systems are being implemented to gain competitive advantage: the management of these systems and their content are seen as crucial to their effectiveness;
- corporate know-how, human resources, and information systems are being identified as ‘hidden assets’ and are now emerging from hiding.

Abell’s pilot study of a number of firms used an interview schedule devised by Mariam Ginman for companies in Finland (demonstrating the feasibility of cross-national collaboration). Abell concluded, from the pilot, that information as a concept has become a central issue for most firms, but that the interpretation of the concept varies considerably from person to person. Although internal and external information are not necessarily seen as different, the nature of the former and the means for its management and control are more readily understood. There is an increasing interest in information management, but this is generally thought of in relation only to internal information and the acquisition and effective management of external information is still given little thought in most places.

Other studies in this area have concentrated on the impact of information technology on business success and business competitiveness. For example, Loveman (1988) states:
Despite years of impressive technological improvements and investments there is not yet any evidence that information technology is improving productivity or any other measure of business performance.

How well a firm is able to convert spending on information resources such as investment in information systems may depend upon the type of work the firm is engaged in. For example, studies in the insurance industry have found the adoption of information technology has improved productivity (Harris & Katz, 1991). Studies that have found the opposite to be true have concentrated on manufacturing or information non-intensive industries (Lovemen, 1988; Olson & Weill 1989). Therefore, it is sensible to assume that information intensive industries are more likely to achieve measurably improved performance from investment in information resources and information systems.

Olson & Weill (1989) found that firms differ in their ability to benefit from investment in information resources. They found four internal factors that may contribute to this:
- top management commitment to IT and information investment;
- organization’s previous experience with IT and information systems;
- organization’s previous satisfaction with IT and information systems;
- the extent of political turbulence within the organization.

Within industries, other structural factors must also be considered when examining why some firms are more effective than others in developing and using information systems effectively. These external factors include:
- the state of the market;
- the financial standing of the firm prior to the introduction of information systems;
- the size of the firm, and its subsequent ability to benefit from economies of scale;
- the nature of the industry, i.e., traditional information intensive industries: banking, insurance etc. versus traditional non-information intensive manufacturing industries.

One additional factor that has emerged from this investigation is the nature of the company’s growth. In other words problems can arise when a company has grown through acquisition of an existing company, rather than through organic growth. This has led in a number of cases to the acquisition of information systems that are incompatible with the company’s existing information infrastructure. Adler (1989) points to four processes that conceptualize information resource management:
- formulating an information strategy;
- structuring for executing the information strategy;
- pursuing the right IT applications;
- managing IT projects effectively.

This study attempts to address some of these issues in addition to the more fundamental questions raised about the impact of information on business performance.

METHODOLOGY
The overall methodological approach was that of the case study: 12 companies were selected, all of which could be termed ‘high performing’ according to the criteria set out under ‘company performance’ in the diagram below.

The different criteria were applied to the companies according to an agreed sequence and only those companies that satisfied an agreed minimum number of criteria entered the final list.

In each company two methods of data collection were employed:
interviews with key staff to collect data that reflected the variables set out in the model; self-completed questionnaires to a larger number of organizational members to gain a more qualitative perception of the extent to which the views of key staff were replicated in the organization at large. On the basis of this analysis an attempt was made to relate the various factors to differences in the performance of the companies. Particular attention was paid in the interviews to: the ways information technology is used to deliver information services, covering both internal and external information and data; what constitutes the knowledge base; how far the knowledge base is at risk through dependency on individuals rather than systems; how sensitive key company staff are to the value of information as a contributor to performance; how far the company can be described as having an information ethos, through which the value of information is conveyed to all workers.

THE SELECTION PROCEDURE

The selection criteria sought to identify British companies that can be described as high performing, using a combination of financial and non-financial measures. The measures used are set out in the research model. In this model there are a number of factors that contribute to business performance. These factors are:

| Profitability |
| Productivity |
| Quality |
| Peer evaluation |
| Export success |

These factors have been used as the selection criteria. The companies had to fulfil a number of the following conditions to meet these criteria:

- have industry quartiles in the median or upper classifications;
- appear in the Times 500 list of profitable companies;
- appear in the Euro 500 list of companies, as published in Management Today;

During the selection process effort was made to include companies from sectors that have been affected by the recent recession, such as the manufacturing and building industries. Effort was also made to select several companies from the newly privatized utilities, water and electricity and from sectors that had been affected by government legislation, such as the recently deregulated television and financial sectors. Additional financial measures used include turnover, profitability, and market share.

THE SAMPLE AND DATA COLLECTION

Following the selection procedure twenty-five companies from a range of industrial sectors were contacted to be included in this study. The sectors covered were: manufacturing, media, leisure, retail, financial, water and electricity. Following the contact procedure twelve companies agreed to take part in the project, distributed as in Table 1.
Table 1. The Case Study Sample

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
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<tr>
<td>Company A</td>
<td>Water provider</td>
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<tr>
<td>Company B</td>
<td>Building society</td>
</tr>
<tr>
<td>Company C</td>
<td>Television company</td>
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<tr>
<td>Company D</td>
<td>Dairy and food producer/wholesaler</td>
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<tr>
<td>Company E</td>
<td>High street bank</td>
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<tr>
<td>Company F</td>
<td>Glass manufacturer</td>
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<tr>
<td>Company G</td>
<td>Life insurance company</td>
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<tr>
<td>Company H</td>
<td>Computer hardware/software company</td>
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<tr>
<td>Company I</td>
<td>Leisure/brewing company</td>
</tr>
<tr>
<td>Company J</td>
<td>Auto-repair company</td>
</tr>
<tr>
<td>Company K</td>
<td>Cosmetic manufacturer/retailer</td>
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In total, 15 senior staff members were interviewed in the 12 companies selected. On average the interviews lasted for one hour. The interviewees tended to be executive level staff from the information systems and business planning functions. Questionnaires were prepared and circulated among other staff members to gain a more qualitative perception of the extent to which the views of senior staff members were represented in the organization at large.

The questionnaire return rate of 35 per cent was rather disappointing, although not unusual in organizational research. A telephone interview was constructed based on the original interview schedule, and telephone interviews were conducted with information function staff in five of the sample companies. An attempt was made to interview information staff in the other companies. Three of the remaining companies had an information function, but staff were not available to be interviewed, the remaining companies could not identify a specific information function.

RESULTS

The interviews and the subsequent analysis of the questionnaire returns produced a great deal of qualitative data. The data collected were analysed within the framework of the research model. This analysis concentrated on the variables which lead into effective information systems, namely:

- technology
- company knowledge base
- information sensitivity
- company information ethos.

An attempt was then made to determine to what extent the organizations surveyed had developed effective information systems.

Technology

All companies had invested heavily in information technology (IT) as a delivery mechanism for information provision. The key points identified in this analysis are given below:

The majority of companies surveyed see IT as essential to their business. In total, 10 companies from the sample group saw investment in IT as essential to their business, with Company D and Company F offering a less enthusiastic response. The companies that viewed themselves as information-intensive were more positive in their responses than the companies that saw themselves as not information-intensive. For example, a senior staff member from Company E commented: ‘Banking is totally an IT driven industry and it’s key, absolutely key to the way it works...’

Another manager in the same company went on to explain the business benefits of investing in IT:

...the key to keeping alive is product innovation, speed of change, satisfying customers, and all that comes back to IT at the end of the day. Giving you summaries of information on your customers, what their habits are, if your products are right, all these sorts of things...
Company A had invested heavily in IT in recent years. A senior manager who felt this investment had paid off for the company, commented: *It’s a major competitive advantage for us in the way that we’ve implemented and managed our use of information technology.*

IT and Information Systems (IS) have been developed with the IT or IS department working closely with the business functions.

In the more successful companies representatives from the user-departments participate fully on information system development teams. The head of information systems in Company B explained his approach:

> We’ve de-mystified the systems development process to the point where those who really understand the information needs at the sharp end of the application have the biggest say in what the application does.

Companies have emphasized the importance of balance between involvement of user departments and technical IS or IT functions in the design of information systems.

One company which believed it had got the balance right was Company A. Each new project involves a multidiscipline team of people, the balance of this team will shift as the project progresses through four stages. For example:

- feasibility – four users to one IS professional;
- high level design – balance shifts to two to one;
- development – three to one;
- systems testing and implementation – two to one

Several companies surveyed stated they would prefer to adopt a similar approach to information systems development, however economic uncertainty in recent years had prevented them from doing so. Company G went through a period of crisis in the early 1980s. During this period a lot of systems work was concentrated on ‘fire-fighting’ and, as a result, users were not consulted at all. The company is now coming out of the crisis period and more effort is made to take the steps described above. To facilitate this the company has set up a department called Business Development, which consists of senior managers from operational functions in the company whose role is to discuss the IT requirements of departments and to develop systems that will support the business.

The majority of companies benefited from top management commitment to IT and information in general. Nine companies from the sample group identified top management commitment to IT and information as a major factor leading to business success. A senior manager in Company A explained:

> ...in information technology we’ve also done an incredible amount. I think from the CEO down we’ve created an environment, a culture, in which you can implement and use IT in a very effective way.

IS development in the more successful companies has been led by the Chief Executive Officer.

The more successful companies have identified the leadership of the CEO in the restructuring of business functions to create an information culture in the companies which can facilitate the successful development of information systems. A representative from Company G illustrated this point:

> I suppose one of our biggest advantages is that our chief executive is very switched on to the value of information... I believe our chief executive is, in effect, promoting the more effective use of information throughout the company and that’s obviously helping.

On the whole company libraries have been slow to take on board new technology. As mentioned above, only six companies in the sample group identified an information or library function in their organization. Those information centres or libraries that responded to a telephone interview commented that they had been under-resourced in recent years. While the majority did have
computer-based catalogues, many of these were on stand-alone machines. Therefore, access was available only in the library itself. Company F did not have its catalogue available electronically. The librarian explained: ‘The library isn’t catalogued on computer yet; again that’s something we want to do when we get the money and the people to do it’.

The library in Company B supplies a feed into the executive information system, as does Company A. Two of the company librarians interviewed did play a small part in information systems provision. The only occasions library staff did become involved in this area was in the purchasing or design of information systems for the library function itself. A number of the companies with libraries had CDROM readers and subscribed to a small number of CD-ROM titles. Company C has no CD-ROM facilities, although the librarian felt this would be useful. Company F has facilities but made little use of CD-ROMs. All companies made use of online sources of information, with Financial Times Profile being the most popular. Other online services include Dialog, Datastar and Reuters. Of all the companies surveyed, Company A had embraced IT most effectively. A senior manager commented:

I think the important thing about the library itself, the way it’s used: again, five years ago the library mainly dealt with giving people pieces of paper. Nowadays a lot of their work is done by doing electronic data searches in external libraries, electronic libraries...

Company knowledge base
An attempt was made to identify what constitutes the knowledge base of the companies surveyed. The extent to which this knowledge base is at risk through dependency on individuals rather than on systems was also assessed. The main conclusions from this part of the study are:

The majority of the companies surveyed felt their knowledge base relied more on individuals rather than on systems. The majority of companies surveyed felt their knowledge base resided in the accumulated knowledge and expertise of their staff. Representatives from Companies A, G, G, E and L noted the danger of allowing ‘information pockets’ building up in certain key business functions, which held information but which did not ensure its distribution throughout the firm. A representative from Company B described how such information pockets are created:

There are some who still work on the philosophy that knowledge is power. You will come across that in other companies. It’s an outmoded attitude, and every now and then you still find it...

A senior manager in Company L reinforced this view:

What you inevitably get is little information pockets developing. I don’t know of any company who would not raise that particular issue.

All the companies acknowledged the problems associated with having a knowledge base which relies on individuals. One company is taking steps to systematize its knowledge base. The main problem, highlighted by a number of companies, with having a knowledge base that is based on individuals rather than on systems was that as staff leave, the knowledge base diminishes. This problem was one that Company C, which had down-sized its labour force in recent years, had experienced.

Company A was undertaking a major project designed to systematize its knowledge base in order to avoid some of the problems which have effected the company in the past. A company manager explained one of the aims of this project: ‘Where I think the major systematic difference is in terms of expert knowledge ... we are now starting more and more to systematize this knowledge’.

The project is designed to create rule sets that can be integrated together with other information into systems. The project is managed by the Business Information Systems Department and is part of an overall strategy designed to reorganize the company. The project team described the process as follows:
We go into different functions within the company and ask a number of questions. Whereas, in the past, we might ask ‘What do you do?’ Our modelling people and the people who are now more business oriented are asking: ‘Why do you do that?’ And the difference is important, because we’re after the rule sets that people use… actually starting to try and understand why things work, and build it into the model that we’re starting to define now, is an enormous breakthrough in terms of getting the information together.

The need to conform to industry regulations, along with the perceived sensitivity of staff and customers to information issues, has prevented some firms from introducing recent IT developments for information systems.

For example, the companies in the financial industry had experimented with the suitability of knowledge-based systems for the systemization of part of their knowledge bases. However, these experiments did not proceed due to worries about customer reaction and restrictions that may be imposed by industry regulators. Company C also anticipated internal problems which may arise if the company attempted to systematize knowledge. A senior representative explained why it was difficult at the present time to systematise knowledge: ‘In the current climate any attempt to extract information from people will be a struggle. People would see it as another means of reducing the number of staff.’

Company libraries are under-funded and understaffed and are reluctant, therefore, to take on a larger role in the organizations.

In general, the libraries/information centres surveyed had seen their budgets cut in recent years. This has caused them to reduce their staff levels and has made them reluctant to promote their activities. In Company A the head of the library commented:

> Basically we’ve found the library hasn’t been that well supported in the past in terms of budgets, manning and so on… (therefore) we haven’t necessarily gone out very strongly and advertised our presence.

Company libraries are seen as service departments sitting on the fringe of the organizations. In some cases, library staffs had this perception of their services, and it can be argued that the very reason the information functions have seen their budgets cut is because they have failed to strongly advertise their services. The end result is illustrated by the following comment from the librarian in Company F: I think we’ve reached that point, much more cutting back and it just won’t be worth carrying on. The recent recession has been hard to us, and being a service department we usually cop it first.

**Information sensitivity**

Information sensitivity is defined by the extent to which senior staff are able to discriminate between internal and external information, and their view of the relationship between internal and external information resources. Linked to this is the sophistication of their understanding of the concept of information management. A number of questions were asked to explore these issues with key staff. The key points arising out of the interviews are:

Senior staff in the more successful companies surveyed are taking on board information management issues. One example of this move towards adopting information management issues is illustrated by Company A. However, senior managers from the company admitted they had some problems understanding information management concepts. One commented:

> What is the difference between running a data processing department and an information systems department? We did that very successfully. But what is the difference between running an information systems department and an information management function? That is a bigger jump.

The majority of the companies circulate information on a regular basis, however the major part of this information is generated internally. The emphasis the majority of the companies place on collecting and disseminating internally generated information is illustrated in Figure 2.
Given the significance attached to concepts like competitive intelligence and environmental scanning, one might expect ‘high performing’ companies to devote a significant amount of resource to monitoring their competitors. However, a number of the companies surveyed did not feel they had any direct competitors; for example, a manager in Company K commented:

> In some respect we don’t need to know what other companies are up to. The company sees itself as the market leader. Therefore, other people follow us, instead of the other way round.

An increasing number of companies are using information technology to support their information gathering and dissemination.

With very few exceptions all the companies surveyed stated that their computerized information systems enabled them to monitor their own performance effectively. In the main part these systems concentrate on collecting and disseminating financial information. A senior manager in Company I stated:

> I do think our financial systems, which are all computerized, actually help us to monitor our own performance very effectively. I do actually think that we’ve put an awful lot of money and time and effort over the last 25 years into building these systems.

Other, more general types of information is also increasingly disseminated electronically. For example, a senior representative from Company L commented: *We tend to have a policy of very open communication, extremely extensive use of e-mail. We’re trying to cut paper out, in fact we’re actually in the process of reducing our paper consumption.*

**INFORMATION ETHOS**

This section examined how far the companies surveyed can be described as having an information ethos, through which the value of information is conveyed to all workers. This is an area of research highlighted in recent literature as important in assuring business success (Abell and Winterman, 1995; Ginman, 1988). The key points that emerged from the study are:

- Information is seen as a valuable asset by the majority of the companies surveyed.
- Despite the apparent lack of resources invested by the majority of the sample group in the information function, information is seen as a valuable asset in the majority of the companies surveyed. To illustrate this a representative from Company A stated:

> We’re trying to get the message across to everybody... At the moment we’re doing a systems strategy in the business teams and the operational groups we’ve set up. But we aren’t calling it an information systems strategy, we’re calling it an information strategy... So in almost all business areas we’re starting to focus on, we want to manage information.

The creation of an information ethos or culture is seen as an important step towards ensuring continued success by the majority of the companies surveyed.

Company B is embarked on a similar process. Senior managers recognize the value of information and are attempting to create a management style in the company which is facilitative to the open communication of information to staff at all levels. A senior manager elaborated on this process:

> We do recognize that information is an asset and, thereby, we should maximize the value from that asset, and make it available to all those who can obtain value from it. We are working on the devolution of decision making responsibility. We talk a lot about flattening the organization structure, and we have achieved a certain amount of progress. I think we’ve got the right attitude, but we’re still going through a learning process. I believe the more enlightened
managers understand that a facultative management style is the right style for modern business practice. That staff working in the business processes are best placed to make these processes effective, and these are the ones who really need the information.

This creation of an information ethos is part of an ongoing process of change management, partly initiated by the widespread introduction of information technology into the workplace. Senior staff in Company D identified this as one area which could be improved. The Director of information systems in Company D stated:

I think there's certain elements of information like profit performance, that's all the financial indicators, you don't need to sort of...[worry about]; that culture runs through the business. In relation to other information I don't think we do it very well, I've taken on this role as Head of Information Systems to try and provide a catalyst for doing that, rather than have somebody that's an IT expert running the department, well I've still got a department to run. I think information and systems are as important as the technology, if not more so. We therefore need to find ways and means of letting people know what's available as well as talking to them about what I think they ought to know. Do you know this, do you not think it's important? As opposed to I don't know, why should I know.

Those companies which have successfully implemented change and created an information ethos have done so with the backing and leadership of the senior managers and the CEO in particular. For example, the process of change and the creation of an information ethos has been initiated and supported by the chief executive in Company G. Here, the CEOs contribution was described by a senior manager:

I suppose one of our biggest advantages is that our chief executive is very switched on to the value of information... I believe our chief executive is in effect promoting the more effective use of information throughout the company and that's obviously helping.

CONCLUSIONS
This research has highlighted some important issues that companies now face in the modern business environment. The recent introduction of information technology (IT) has confused the issue of information management and information provision. In the majority of the companies surveyed the traditional information specialist is playing a diminishing role in information provision. The role is being taken over by IT personnel who put the emphasis on effective storage and retrieval of information, rather than the quality of the information itself.

However, many of the senior staff in the more successful companies surveyed are now taking on board information management issues. The view that information is a valuable asset is almost universally accepted by the companies surveyed. Top management commitment to information as an asset has emerged as a major factor in the implementation of successful information systems.

The research has also highlighted the emphasis put on internally-generated information by many companies. One reason for this may be that the companies surveyed are high performing in their sector. Therefore, they expect other companies to follow their example rather than investing time and effort investigating their competitors’ actions.

The research proved the legitimacy of the research model and validated the interconnected variables studied in the model. However, in the course of the research other important variables were identified. The original research model has been expanded to include these variables which include environmental factors and internal organizational factors which can influence business success and the implementation of successful information systems. The expanded research model is illustrated below.
The expanded research model includes the following additional variables which have been identified in this study.
- the state of the market;
- the nature of the industry;
- changes in legislation/government regulations;
- changes in the nature of competition;
- internal political turbulence;
- the CEO’s information ethos.

The first four factors are external to the company and can have a profound impact on its internal structure and on its business success. The companies surveyed have identified these as factors which have prevented them from fully implementing successful information systems.

The fifth factor describes the reluctance of some staff members fully to embrace the creation of an information ethos and the introduction of IT into the organization. The sixth variable describes the information ethos of the Chief Executive Officer (CEO) which has been identified as an important factor by the majority of companies surveyed in assuring the implementation of effective information systems. It was recognized by all the companies surveyed that the CEO is the one member of their organization with the power to initiate a process of change that is required in order to foster an information culture or information ethos in the organization.

THE RESEARCH SEMINAR
The conclusions presented in this paper were discussed by the research team and information professionals at a seminar held at the British Library in March 1995. In response to the conclusions presented at the seminar, Mr Graham Higley commented:

*The study confirms our worst fears and prejudices. Abroad, the impression of British management and the use of IT is that we are way behind. It was interesting to have this confirmed.*

Another respondent, Melanie Goody, put forward the idea that, traditionally, information can be seen as having three stages:
- Data
- Information
- Knowledge (which is information interpreted and applied).

Increasingly, data now go straight to the end user, and we risk the loss of stage two. Users often do not know where the information is coming from, making it very difficult to interpret or evaluate. This is where the information profession must promote its role in this process.

Angela Abell explained that a changing attitude to information can be identified in many UK organizations. There has been a shift of emphasis from information technology (IT) to information systems (IS). The current perception is that IT and information systems can supply everything to the PC on the desktop. Suppliers are now offering whole solutions, rather than just hardware and software. She explained that the response to this change by the information profession has not been clear and that these changes raise a number of questions:
- Who is implementing the outcomes?
- Who is designing the systems and flows? The IT department, IS department, library or information staff or end users?
- What impact is the information profession going to have?
- Why are information systems designed by other people?

Abell went on to explain that the changing environment calls for new skills from information professionals. The core information skills are still required, but there is no guarantee that the information profession will still be the source for these. As other disciplines implement IS systems they will acquire the necessary information retrieval skills. Abell then described a new set of skills information professionals will have to acquire if their traditional role is not to be taken by other disciplines. The new skills identified are listed below:
- political ability
- business acumen
- IT skills
- communication skills
- innovation skills
- negotiation skills.

Abell explained that information managers often have the ideas, but lack the ability to effectively communicate these ideas and push them through. The implementation process is often left to others who have more political ability and a real understanding of business functions.

The responses by the seminar members can be summed up as follows:
- the information culture or role of the CEO represents the key to success;
- there is a fuzzy area between the IT and the information service. Should this grow even fuzzier?
- making a clear business case is the key to any development in information services;
- the reluctance of British management generally to take hold of the role of IT in organizations may relate to their view of information services in the organization;
- the situation found in the case studies does not hold true for the financial services sector, perhaps because it is more advanced than the manufacturing sector.

ABOUT THE AUTHORS

Ian Owens is currently working on the Primary Care Sharing the Evidence (PRISE) project at Oxford University’s Institute of Health Science. The project aims to provide primary care workers with access to high quality evidence, to support evidence-based practice. His interests include information systems to support health workers, business information systems and strategies, and the use of computers in history. He has been involved in the Netherlands Historical Data Archive project at Leiden University (NHDA) and the Training Information Service Specialists (TRAIN-ISS) project at Sheffield University. Other interests include networked information as a learning resource and computer assisted learning.

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NOTE The book Information and business performance: a study of information systems and services in high performing companies (ISBN 1 85739 108 X) by the authors of this article, is available from the publishers of this journal.
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How to cite this paper