International Conference
Session Summaries

BUTLER COX
FOUNDATION

Tenth Anniversary International Conference
Munich, 25-27 October 1987

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INTRODUCTION

The Tenth Anniversary International Conference for members of the Butler Cox Foundation was held at the Hotel Bayerischer Hof, Munich, between 25 and 27 October 1987. The aim of the conference was to help Foundation members recognise the opportunities presented by information technology and its use as an instrument of competitive strategy. This document contains summaries of the presentations made at the conference.

The summaries were prepared by Butler Cox consultants during the conference and are intended as an aide-memoire. They are not a verbatim transcript, but present as faithfully as possible an interpretation of the main points made by each speaker. For the sake of brevity, some points have necessarily been condensed or omitted.

Where appropriate, the summaries include a selection of the visual aids used by the speakers. We have also included a brief summary of the main points to emerge overall from the conference.

INTRODUCTION

La Conférence Internationale du dixième anniversaire de la Fondation Butler Cox s'est tenue à l'hôtel Bayerisher Hof de Munich du 25 au 27 octobre 1987. Cette conférence avait pour objectifs d'apporter aux Membres de la Fondation des éléments permettant une meilleure identification des opportunités offertes par la technologie informatique et son emploi comme outil de compétitivité.

Ce document présente le sommaire des présentations tenues pendant la conférence.

Ce sommaire a été préparé par les Consultants de Butler Cox pendant la conférence et leur objet est d'être un aide-mémoire. Ils ne sont donc pas la transcription des sessions mais résument, de faç on aussi fidèle que possible, les idées principales présentées par les Conférenciers. Pour garantir la briéveté de ce document, certains points ont été volontairement condensés ou omis.

Là où nécessaire, les supports audio-visuels sont incorporés dans le document.

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Summary of the Conference

The first theme of the conference was the recognition of the technology's potential. Mr Fields and Professor Negroponte revealed astonishing possibilities. The potential of IT was great, as Mr Imlay showed. Nevertheless, the high-advantage applications are difficult to find, as both Mr Cox and Professor Wiseman suggested.

Some practical help was described, however. Mr Leighfield described network-based services that helped companies in (for example) the travel, financial-services, and automative industries to achieve competitive advantage. Professor Wiseman proposed some basic approaches to the hunt for high-yield applications. Mr Cox was emphatic that most of the competitive-edge applications were led by users, not the systems department. But all speakers agreed that there is no cookbook solution.

Much was also said about the possible role of an information supremo in an organisation, the so-called chief information officer. So far it was not clear what the role and responsibility of this officer might be. Europeans remained somewhat sceptical.

The conference was held during a period of great turmoil on the world's stock markets, and Mr Imlay cast a chill over the proceedings by suggesting that a world economic recession was a 50/50 possibility: next day the world markets slipped still further. Was it possible that the next Butler Cox conference would address not the exploitation of opportunity, but the management of reduced resources?

The Information Technology Industry

John Imlay, Management Science America Inc.

John Imlay is chairman and chief executive officer of Management Science America (MSA) Inc., now the world's largest supplier of applications software for mainframe computers. He has been closely involved with IBM, partly because IBM's equipment defines the market for MSA's software products, partly because he represented ADAPSO in negotiations with IBM, and partly because he was invited by the chairman of IBM to advise their executive board on software strategy.

He opened his presentation by illustrating the very rapid rate of change in the IT industry. During the last ten years, words such as software, chips, apple, byte, core, and PC have taken on a new meaning. Over the next ten years, developments in superconductivity, graphics, system development tools, and artificial intelligence will transform the working and domestic world still further. He suggested that the challenge for systems people is to make these technological developments available to the chief executives of major organisations, most of whom have very little personal contact with IT at present.

One of the vehicles for exploiting these developments will be the software and services industry. Figures 1 and 2 overleaf show the size of this industry in 1986 and forecast for 1991. Figure 3 overleaf shows the ranking of the industry, indicating that over the period 1986 to 1996 it will have the second largest growth in employment and be number 11 in terms of revenue growth. The structure of the industry is as shown in Figure 4, also overleaf.

A particular sector of this industry is the standard-software sector. The implication of the way he described the benefits of using applications packages is that, by using them for core applications that are not strategic to the enterprise, resources can be freed to concentrate on those strategic applications that are unique to the enterprise and that give it competitive advantage.

In selecting a software partner a customer should look for the following characteristics:

- A good revenue stream and strong cash position.
- Good product range.
- Commitment to research and development.
- International presence.
- Ability to provide total systems support.
- Strategic alliances with other major industry players, particularly with IBM.

L'INDUSTRIE DE LA TECHNOLOGIE INFORMATIQUE : UNE PERSPECTIVE

Dans la première partie de son exposé, John Imlay présente les technologies qui seront — à son avis — les plus déterminantes dans un futur proche. Il s'agit de la supra-conductivité appliquée aux semi-conducteurs, des développements dans le domaine graphique (l'approche wyswyg), les techniques holographiques, les nouveaux outils de productivité pour le développement des applications et l'intelligence artificielle.

Il introduit ensuite les principaux acteurs de cette industrie dans le futur:

D'abord les constructeurs et notament IBM dont il explique les pôles futurs stratégiques dans les secteurs de l'informatique personnelle, des moyens systèmes (apparition possible d'une nouvelle machine basée sur l'approche S38 conjugée à l'approche 370 — le projet Silverlake —) et des grands systèmes.

Ensuite les fournisseurs de services de télécommunication qu'il s'agisse de communications en réseaux extérieurs ou locaux.

Puis les sociétés de logiciels et de services qui devraient être le premier secteur d'emploi dans le domaine informatique d'ici 1991.

John Imlay s'adresse ensuite à la stratégie d'IBM et plus particulièrement à l'importance des stratégies SAA et DB2.

En conclusion, Mr. Imlay met en valeur l'importance croissante du rôle du Directeur Informatique, promis à court terme à devenir le CIO (Chief Information Officer) et associé directement à l'équipe dirigeante de son groupe.

Figure 1 Software and services industry was a $54.7 billion industry in 1986

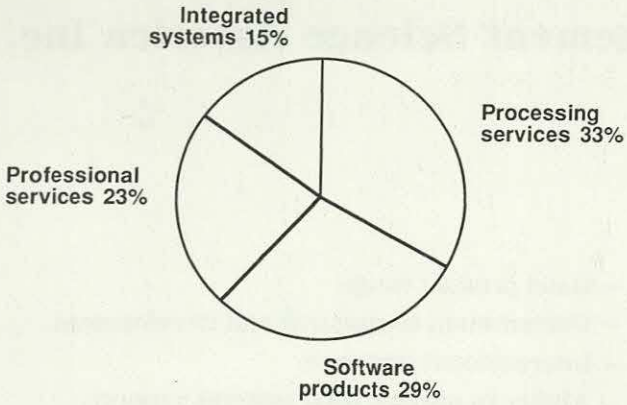


Figure 2 Software and services industry will be a $123.4 billion industry by 1991

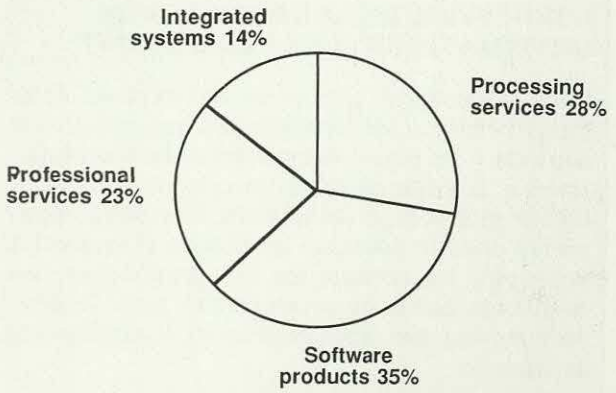
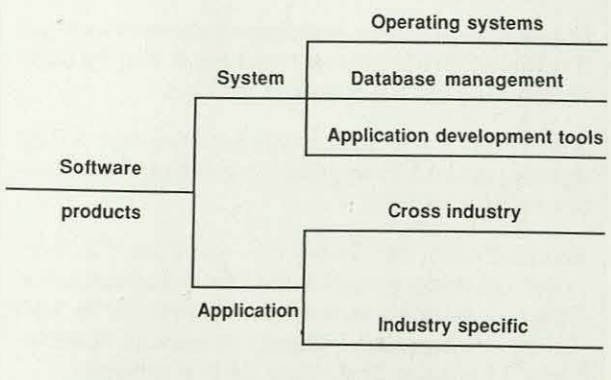


Figure 3 Growth ranking of the software and services industry, compared with 429 industries

1986-1991		1986-1996	
#1	Employment	#2	Employment
#20	Revenues	#11	Revenues

Figure 4 Overview of the software products industry



John Imlay then reviewed the current position of IBM itself, from the privileged position of having been their 'acting vice-president for software' for several hours. He regards IBM as strong in personal computers, particularly since the launch of the PS/2. The company is also strong in departmental computers, with the launch of the 9370 and the announcement in April/May 1988 of the new Silverlake range, which will integrate the S/36 and S/38 machines. Also, IBM is enjoying very strong growth in the large mainframe market.

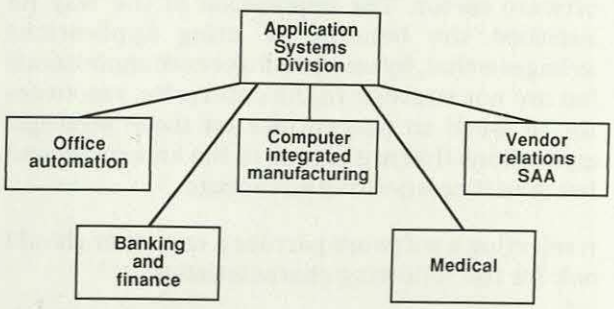
By contrast, he regards IBM as weak in the software sector, for the following reasons:

- Their senior managers do not have applications software experience.
- The company has lost contact with today's software customers, who are now end users rather than systems staff.
- The company is organised into separate geographical units, whereas the software market is global.
- It is antagonistic and distrustful of independent software producers.
- It is severely constrained by its software base (CICS, IMS, operating systems, and so on).

IBM has recently announced the creation of a new Application Systems Division, with the structure shown in Figure 5. In the system software area, it has announced Software Applications Architecture (SAA), which is the strategic product intended to do for IBM's software what SNA has done for its networking. SAA will provide a software bridge across all of IBM's equipment range, with SQL and DB2 as *de facto* standards. He predicted that IBM was moving towards the 'closed machine' which would lock out the independent software producers altogether.

In the applications software area, IBM has focused on specific industry sectors in which it intends to be the dominant player (see Figure 5). However, he believes it may take IBM up to five years to really sort itself out and to achieve an effective position in the market.

Figure 5 IMB's Application Systems Division



John Imlay reviewed briefly the position of other big players in the market. EDS will remain strong and may demerge from General Motors. The 'Big 8' accounting firms will become much more important in the IT market. They may be forced to separate their audit practices from their consulting businesses and, if this does happen, he expects them to become significant suppliers both of equipment and of software. Japanese firms are already strong in equipment and systems software, but their applications software is still weak. However, this position is changing rapidly; the Japanese are becoming much more aware of the importance of this market, and the largest Japanese software firms are now moving into the market in a big way.

He concluded with the following messages for information systems managers:

- Every organisation must develop a long-term information plan.
- Commercial companies should review their competitive position, perhaps by having a competitiveness committee alongside their salaries and audit committees.
- Every organisation should assess and organise its people resources to take account of the strategic importance of IT.
- Organisations should search for and develop 'mission critical systems' that are unique and contribute to competitiveness.
- The effective use of people, in harnessing IT, is the key to success.

This presentation was illustrated by several very amusing and pertinent stories. One concerned Pete the Pirate, who returned to his home port after several years' absence on the high seas with one hand replaced by a metal hook and a patch over his eye. He met an old friend in an inn who asked what had happened to him. "I lost my hand when I was attacking another ship, it was cut off by a defending sailor. And I lost my eye when I looked up at an albatross." His friend expressed surprise — "An albatross is a big bird but it surely cannot blind you?" "No" replied the pirate, "but it happened the day after I got my hook." The moral is that we should be careful how we use technology.

Communications and Competitive Edge

John Leighfield, ISTEL Limited

John Leighfield is Chief Executive of ISTEL Limited, a £70 million a year UK-based information technology services organisation that focuses particularly on advanced manufacturing systems and telecommunications services. It is now a private company, following a management-led employee buy-out from The Rover Group in June 1987. The company has particular strengths in telecommunications services, and provides private microwave telecommunications networks for several companies, a UK-wide managed data network, several value-added network services, and orthodox teleprocessing systems. It has also been deeply involved in the implementation of major local area networks, particularly in a manufacturing environment.

Over the last two or three years, its telecommunications services have grown very quickly, particularly in areas where customers are using value-added network services to gain competitive edge.

Mr Leighfield reminded delegates that we are living in an evermore competitive world. There are major structural changes going on within industries; traditionally strong nations are being assailed by newcomers; deregulation means that traditional boundaries around services are breaking down; changes in culture and expectation are putting ever-increasing pressure on suppliers of all sorts of products and services; and technology is offering opportunities and threats, and is magnifying many of these forces.

TELECOMMUNICATIONS SERVICES TODAY

Today, reliable, pervasive networks are in daily operation. (ISTEL's INFOTRAC network is a good example of this.) And, in those countries where deregulation has made it possible, a variety of networks are being established. Furthermore, those networks are being used to provide a wide variety of easy-to-use services, many of which are in the front office of organisations, or are linking organisations together. ISTEL was sufficiently confident of the reliability and ease of use of some of its services to demonstrate them live at the conferences used to announce the company's privatisation to employees. These services were accessed through a hotel switchboard and projected on a large screen, in the middle of a very tightly scheduled conference, without a hitch.

The facilities provided by some of the networks are developing very quickly and are offering quite new opportunities to those organisations that can match the opportunities and the needs of their own businesses with the imagination to steal a competitive advantage.

LES TELECOMMUNICATIONS ET L'ENVIRONNEMENT COMPETITIF

La session de M. LEIGHFIELD comprend quatre chapitres principaux:

— La présentation de sa société
— L'environnement compétitif
— Le marché des télécommunications
— Les conclusions.

En ce qui concerne l'environnement et les télécommunications, John LEIGHFIELD met en évidence le durcissement de la concurrence due à l'application de la déréglementation dans de nombreux pays européens ainsi que les exigences croissantes des consommateurs.

Le conférencier présente alors trois cas pratiques montrant l'impact sur la compétitivité découlant de l'emploi des télécommunications: L'utilisation de moyens videotex par des agences de voyage, l'aide apportée aux agents financiers par le réseau INVIEW et l'amélioration des processus de fabrication par l'utilisation d'échanges électroniques de données. Dans chacun des cas, l'investissement s'est avéré très rentable.

En conclusion, John Leighfield rappelle l'importance de bien faire comprendre aux utilisateurs quels avantages ils peuvent tirer de cette nouvelle utilisation des technologies informatiques. Coté fournisseur, il rappelle également la nécessité d'assurer un service de qualité et d'offrir des systèmes suffisamment conviviaux pour éviter le piège de la formation d'un personnel non spécialisé.

APPLICATIONS IN THE TRAVEL INDUSTRY

Of the 20 million or so holidays booked each year by the United Kingdom travel industry, approximately 12.5 million are package holidays, and the use of telecommunications services has been fundamental in the battle that has been taking place to win a growing share in what is a hideously competitive industry. Margins are low and it is formidably difficult to forecast how big the market will be in a particular year and how many holidays the tour operators should therefore 'buy'.

In one of the most well-known early implementations of videotex, Thomson Holidays stole a march on the rest of the industry by building a videotex booking system that made it very much easier for travel agents to book with Thomson Holidays than with any other tour operator. This helped Thomson consolidate an already dominant position in the industry. It was a good example of the early use of telecommunications services to gain a very clear competitive edge.

However, subsequent developments in the travel industry demonstrate that, where there are several energetic organisations in an industry, one member of that industry will not be allowed to keep the competitive edge that it has gained. By 1987, 50 per cent of package holidays were booked via videotex systems; by 1988 it will be 80 per cent. At the end of September 1987, when Horizon Holidays issued its 1988 holiday brochures, one per cent of the total bookings for the year were taken in the first hour, and three per cent in the first day.

However, there has been a growing tendency in the United Kingdom to book holidays very late, and ISTEL saw that this offered an opportunity to provide telecommunications services to some of the other tour operators and travel agent chains to enable them to gain an edge in what was becoming a very important part of the industry. ISTEL therefore developed a system called Travelbank that allows tour operators to make available to all the travel agents using the service the 'late-availability' holidays on offer, and then allows the customers of the travel agent to go in and browse through all the holidays that are available and pick the one nearest to their choice.

There is nothing with a clearer cut 'shelf life' than a holiday. Once it has gone it is unsaleable. A system that allows this very perishable commodity to be placed before the very eyes of the potential customer in a very easily assimilable way provides a very great competitive edge to the first users of the system. The Travelbank service (which is based on videotex) was launched in April 1987 and the early users of it had such an advantage that 55 tour operators are now putting late-availability holidays into the service, and 6,000 travel agents now use it.

Travelbank is a good example of telecommunications services shrinking geography and time. It gives a customer in the north of Scotland as much opportunity as one in London to book a holiday offered by a London company. And it gives the customer in Scotland instant access the moment that the tour operator makes the holiday available.

The system handles large volumes of data that are transmitted from the tour operators using ISTEL's EDI (electronic data interchange) system, called EDICT. Horizon Holidays — a very effective user of technology to gain competitive edge — uses EDICT to input the details of hundreds of thousands of holidays into the Travelbank service.

Another element of capturing the customer stems from facilities in the network system itself. Once the holiday from the list of all those available has been chosen, the potential customer can, with a single keystroke, be switched out of the Travelbank service into, say, the Horizon Holidays booking service. These telecommunications services are all designed to maximise the chance of the retail customer choosing a particular holiday, and then having chosen that holiday, make it easy for him or her to book it with the tour operator.

The original Thomson's videotex booking system created a *de facto* standard in the industry. It gave Thomson Holidays a competitive edge and forced those who wanted to stay in the industry to follow. In general, today's use of telecommunications to gain a competitive edge is tomorrow's norm in the industry. However, those companies that initially gain a competitive edge tend either to become totally dominant, or to provoke a response from their competitors who put in even more effective facilities. With INFOTRAC and Travelbank, ISTEL has been assisting tour operators and travel agents to do just that.

In most cases, the long-term winner is the end customer. The customer gets a better service from the innovative supplier, and this forces the whole marketplace to provide a better and better service.

APPLICATIONS IN THE MANUFACTURING INDUSTRY

The competitive pressures in manufacturing are different from those in the United Kingdom travel industry. In the United Kingdom automotive industry, for example, there have been massive incursions, initially from European motor manufacturers

and then the Japanese, and now other Far-Eastern and Eastern European manufacturers. This has put enormous pressure on every facet of the business. Michael Porter, in his book *Competitive Advantage*, says that competitive advantage cannot be understood by looking at a firm as a whole, but stems from the many discrete activities a firm performs in designing, producing, marketing, delivering, and supporting its products. In the motor industry, telecommunications services are being used to obtain a competitive edge at the supply end by linking suppliers into the motor manufacturers, and at the selling end by linking the motor manufacturers to their dealers and to their end customers.

Motor manufacturers are using EDI to improve their competitive positions by using electronic communications with their suppliers to gain some of the advantages of vertical integration without actually taking over their suppliers. EDI is being used by some organisations as a major competitive weapon in fighting off their mainly Japanese competition. For instance, JCB is using EDI strategically as a means of achieving better product availability and rationalising its whole supplier structure. And the recent Butler Cox report on EDI mentions anonymously some of the customers of ISTEL's EDICT — toolmakers in the West Midlands region of the United Kingdom, two of whom used EDI and caused a third to see its business reduced by 24 per cent. EDI can transform relationships with suppliers, can lock suppliers into a manufacturer, can release cash in significant amounts for use elsewhere in the business, and can increase revenues for suppliers. One supplier to the United Kingdom aerospace industry increased its business by 22 per cent at the expense of its main competitor by adopting EDI.

APPLICATIONS IN THE FINANCIAL-SERVICES INDUSTRY

The United Kingdom travel and automotive industries are fiercely competitive; competition has been intensified in the financial-services world as well, but for quite different reasons. Deregulation has opened up new opportunities for some of the traditionally constrained organisations; American and Japanese institutions are trying to take over business traditionally done by UK companies; technology is being used to offer new services, and services from new points of sale. The much-heralded 'Big Bang' (electronic trading) in the City of London has obviously transformed the Stock Exchange operations; an equally significant transformation is going on at the personal-finance level, with building societies now able to offer increasing ranges of services, banks invading the territories of the building societies, personal pension plans gaining momentum, and a wide variety of other developments.

ISTEL saw a major opportunity for offering insurance intermediaries a major competitive weapon at a time when insurance policies linked to house mortgages were becoming the norm. In 1985, the INVIEW service was launched, which enables an intermediary — and these include building societies, banks, and insurance brokers — to offer to the mortgage customer a very wide range of alternative insurance policies in an extremely easy-to-understand way.

Instead of looking through a partial list of policy offerings or telephoning one or two insurance companies, the intermediary can now use a videotex-based tool that provides access to the offerings of virtually all of the insurance companies' information, and enables him or her to tailor this precisely to the needs of a particular customer. This extremely powerful tool has been a major factor in changing significantly the proportion of insurance policies linked to mortgages being handled by building societies. This service provides a startling example of a competitive weapon bringing about a significant shift in a very important industry. Forty insurance companies now provide information through INVIEW to thousands of intermediaries. In 1986, those insurance companies that used INVIEW increased their life business by between 25 and 55 per cent. Those that were not using INVIEW typically increased their life business by about five per cent.

In the battle to win business and make it easier to do business with them, several insurance companies are now working on ways of transferring (via the INFOTRAC network) the basic details of the potential customer used to obtain the quotation from the INVIEW service to the insurance company's computer for the preparation of policy information — all during a single session at the terminal. Again, those involved in offering these facilities see them as a way of capturing customers by providing the easiest possible business interface.

John Leighfield believes that this type of communications facility, which provides easy switching between services, is going to offer major competitive opportunities to organisations that have the vision to use them over the coming years.

EDI is also being used extensively in many other industries, such as energy, health, and distribution. The business impact of EDI is so great that it should be of board-level concern.

CONCLUSIONS

Mr Leighfield closed by drawing the following conclusions:

— All of the opportunities discussed above stem from linking businesses together.

- In each case – particularly in the travel and financial-services industries – major transformations of those industries are being made possible through telecommunications services.
- In most cases, the competitive-edge battle is a continuing one, with those who have been left behind immediately trying to catch up – the result being that there is a continuing improvement of the service to the end customer.
- By applying the vision originally used by Thomson in the travel industry or by ISTEL in the creation of the INVIEW service, many other industry sectors could gain a similar competitive edge. The key is to combine business needs, technological understanding, a communications infrastructure, quality service, and easy-to-use applications.
- The successful provision of weapons to provide a competitive edge include a good managed data network, applications (in a value-added network services sense) that really meet the industry's needs, good marketing support, and a technical ability to continue to add evermore features.
- Telecommunications services today have become part of the infrastructure of certain industries, and, in many cases, have resulted in the removal of geographical barriers. And they have dramatically reduced the time required to handle quite complex business operations and have dramatically improved the ability to handle vast amounts of information from a variety of sources to meet a particular individual's needs.

Market leaders will use telecommunications services in evermore innovative ways, to put their products and services before the end customer, to add more and more value to those services, and to capture and retain the end customer once he or she has been convinced that a particular company offers the best service. This is the way that many organisations will emulate those mentioned above in using telecommunications as a major source of competitive edge.

Computers and Strategy

Professor Charles Wiseman, Columbia University

Professor Wiseman is the author of a recent book — *Strategy and Computers: Information Systems as Competitive Weapons* — that has developed the work of Porter et al into a methodology for defining strategic targets for information systems.

THE STRATEGIC USE OF IT

Historically, information systems planning has focused on the internal systems requirements — in support of planning and control activities. This focus has been reflected in the scope of planning methodologies such as IBM's BSP and Rockart's Critical Success Factors (although in both cases recent modifications have partially changed the overall direction of these methods). A consequence has been that formal systems planning has concentrated on meeting the needs of automating basic processes and on satisfying internal information needs.

Over the past few years, systems have been put in place that do not fit within this scheme — because they address corporate needs that are external to the organisation. These systems frequently shape or support strategic, marketplace-oriented, objectives. As a consequence, new methodologies for planning information systems are needed, in order to provide practitioners with the means of systematically identifying new, competitive-edge, systems opportunities.

The position of these new kinds of system in relation to traditional ones is illustrated in Figure 1 overleaf.

Much of the theory of competitive strategy is focused on *sustainable* competitive advantage. In practice, it is very difficult to sustain an advantage over a long period. For instance, two of the examples of competitive edge and IT — American Hospital Supply and American Airlines — have suffered reverses because of the dynamics of the marketplace. (In the former case AHS has been taken over by a *smaller* competitor, and in the latter case litigation by competitors is taking its toll.) Moreover, practitioners and top management are at least as concerned to find and exploit relatively safe short-term advantages as they are to work over the long term towards grander, but difficult to achieve, goals.

IDENTIFYING STRATEGIC SYSTEMS OPPORTUNITIES

Building upon the three generic competitive strategies (cost leadership, differentiation, and 'niche'), Professor Wiseman has identified five types of 'strategic thrust'. These add innovation, growth, and alliance (as a means of achieving the other three). Combined with these thrusts, he has identified four types of strategic target. These represent the other parties in the organisation's marketplace, namely:

— Suppliers.

— Distributors or intermediaries.

— Customers.

— Competitors.

By combining the concepts of strategic thrusts and targets it is possible to build a framework within which opportunities can be systematically identified.

DECELER ET SAVOIR EXPLOITER LES APPLICATIONS A BUT CONCURRENTIEL

L'utilisation de la technologie informatique dans un objectif de recherche de compétitivité (SIS ou Strategic Information Systems) demande une approche différente des schémas conceptuels d'applications informatiques traditionnelles. C'est là le premier message du Pr. Wiseman. Il décrit ensuite comment tenter de mettre en évidence de faç on systématique les opportunités (tout en rappelant qu'actuellement la plupart des choix se font sur des bases intuitives), puis sa méthode de mise en place des différents composants permettant d'aboutir à la création et à l'exploitation des applications à vocation concurrentielle, notament la planification des systèmes d'information et leurs liaisons avec la stratégie commerciale de l'entreprise. Il précise enfin les tendances qui émergent à ce jour des premières expériences de ce type.

Figure 1 IS varieties

Technical function	Organisational use		
	Automating basic processes	Satisfying information needs	Supporting or shaping strategy
Structured processing	MIS		SIS
Query and analysis		MSS	

Figure 2 Strategic option generator

Strategic thrust	Strategic target								
	Arena					System (user)			
	Supplier	Channel	Customer	Rival	Firm	Support	Channel	Customer	Rival
Differentiation									
Cost									
Innovation									
Growth									
Alliance									

Professor Wiseman adds one further dimension. Information technology can either be used internally to shape or support the initiative, or alternately it can be applied to the target (for example to lock in the customer). Collectively, he terms this methodology the Strategic Option Generator and it is illustrated in Figure 2.

He advocates that the Strategic Option Generator be used in the context of structured workshops, where systems staff and line management jointly identify and evaluate opportunities. The summary of his second presentation on page 10 describes a case history of this process.

INFORMATION TECHNOLOGY AND COMPETITIVE EDGE — MANAGEMENT ISSUES

The expansion of IT from supporting internal functions into the support of external (strategic) activities has led to its redefinition and the need for reorganisation. For example, some organisations are separating the systems groups that support the basic operational processes, the internal information needs, and the competitive-edge applications. Also, planning methods need to be modified to ensure that these new kinds of opportunity are systematically identified.

A crucial change is that the potential use of IT to support competitive activities has (at last) provided a genuine basis on which to link systems planning with corporate strategy.

New types of activity are also required in this new era — such as market research to support the evaluation of potential developments and the need to conduct R&D projects to explore the potential of new technology and application ideas. Also, organisations need to develop and maintain an awareness of their competitors' IT-related activities and their potential consequences.

In some organisations the strategic value of information systems has led to the creation of a new post — chief information officer — reporting directly to the chief executive.

GTE — A Case Study in Competitive Advantage

Professor Charles Wiseman, Columbia University

To complement the previous session's examination of possible approaches to identifying and exploiting competitive-edge opportunities, this case history illustrates the experience gained in one company when a framework was used to systematically search for strategic information systems.

THE COMPANY

General Telephone and Electric (GTE) is a conglomerate based in Stanford, Connecticut, with two major business streams, as Figure 1 illustrates.

The larger of these is a *Telecommunications Company*, manufacturing a range of telecommunications equipment and switches, and owning several local US telephone companies. The other arm is *Sylvania Lighting*. Total company revenue in 1986 was $15 billion, of which $11 billion came from telecommunications. One division of the telecommunications company — GTE Data Service (GTEDS), based at Tampa, Florida — has the specific responsibility of developing systems applications for the local telephone companies.

These local telephone companies originally operated in the regulated US telecommunications environment, offering a 'plain old telephone service' — POTS — and their overriding objective was to control costs.

Each company had its own Information Management (IM) Group, charged primarily with mechanising for operational efficiency. Their method for identifying IM opportunities was the classical approach, illustrated in Figure 2, which did not encourage identification of external opportunities.

RECOGNITION OF COMPETITIVE THREAT

As a result of the subsequent deregulation of the telecommunications environment, GTE recognised

GTE — ETUDES DE CAS: LA TECHNOLOGIE DE L'INFORMATIQUE, MOYEN D'ACCROITRE LA COMPETITIVITE

Le Professeur Charles Wiseman de l'Université de Columbia présente l'expérience d'une entreprise ayant identifié de maniére systématique les opportunités présentées par la Technologie de l'Information pour accroître sa compétitivité.

GTE (General Telephone and Electric) produit et commercialise une gamme étendue d'équipements de télécommunications et contrôle également plusieurs compagnies téléphoniques locales. Une division de GTE (GTEDS) est plus particuliérement chargé due développement d'applications informatiques destinées aux compagnies téléphoniques. La déréglementation actuelle due marché des télécommunications renforce l'intensité de la concurrence et fragilise ces compangies locales. Le Président de GTEDS s'est donc adressé au Professeur Wiseman pour l'aider à rechercher des applications informatiques stratégiques.

La méthode mise en oeuvre a consisté à sensibiliser la direction et l'encadrement aux concepts d'applications stratégiques et à identifier en commun les applications appropriées.

La recherche des opportunités s'effectue dans le cadre de réunions structurées en 7 étapes:

Etape 1: présenter des travaux pratiques sur la stratégie des systèmes.

Etape 2: appliquer une matrice à des cas réels pour s'assurer une bonnecompréhension des concepts de différentiation, d'innovation, etc.

Etape 3: revoir la position concurrentielle de l'entreprise.

Etape 4: travail en groupe et part théme (clients, fournisseurs, concurrence,etc) pour identifier des opportunités existantes ou nouvelles (100 pourGTEDS).

Etape 5: examiner en détail chaque opportunité.

Etape 6: évaluer grâce à des critéres tels que l'avantage attendue, le coût, lafaisabilité.

Etape 7: décrire les 'applications explosives' ou à haut potentiel (11 pour GTEDS).

GTE a largement investi pour 5 d'entre elles et a reconnu l'importance d'une telle démarche pour l'ensemble de ses division.

Figure 1 The GTE Company

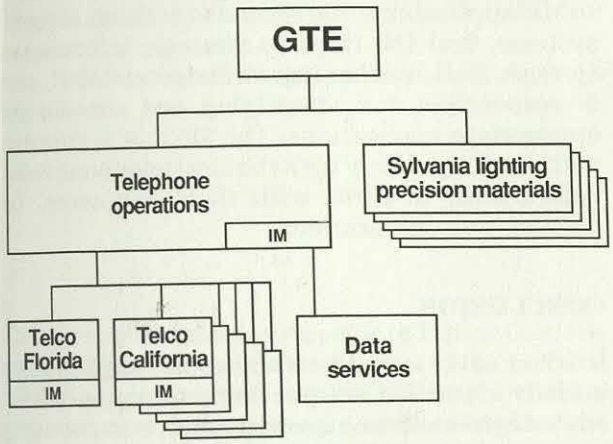
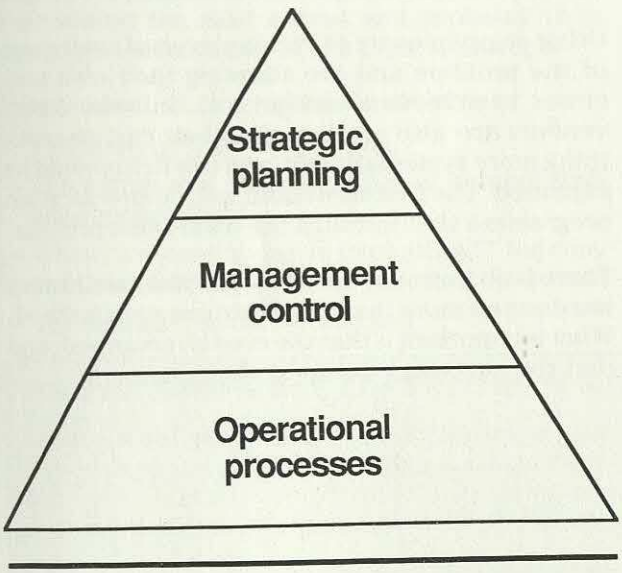


Figure 2 Classical approach to identifying IM opportunities



that its local telephone companies would come under increasing pressure from competition, that their future success was at risk, and, thus, that a new business strategy was required. GTE further recognised the strategic use of IM as a significant competitive weapon. As a consequence, the president of GTEDS asked Professor Wiseman to assist in identifying strategic information system (SIS) opportunities.

METHODOLOGY ADOPTED

Professor Wiseman exploited his framework (shown in Figure 2 on page 9) for identifying such SIS opportunities, where the strategic targets in this case related to suppliers, customers, and competitors. As a result, an SIS planning process, comprising five phases, was developed:

Phase 1: Introduce the chief executive of GTEDS's IM function to SIS concepts.

Phase 2: Conduct an SIS ideas-generating meeting for IM middle management.

Phase 3: Conduct an SIS ideas-generating meeting for IM executives.

Phase 4: Introduce the president of Telephone Operations to the SIS concept.

Phase 5: Conduct an SIS ideas-generating meeting for the corporate business planners who control the investment decisions.

Each ideas-generating meeting was run to a standard format, comprising seven key steps:

Step 1: Present a tutorial on competitive strategy and SIS, placing great emphasis on examples to highlight opportunities and threats.

Step 2: Apply the SIS matrix (as shown in Figure 2 on page 9) to actual cases to ensure a thorough understanding of the process of differentiation, innovation, and so on.

Step 3: Review the company's competitive position to ensure that all attendees fully understand the current situation and the existing strategies. This process included a full analysis of the company's markets, customers, products, suppliers, competitors, and so forth.

Step 4: Brainstorm for SIS opportunities by working in small teams. Each team was given a different brief, focusing for example on customers, suppliers, or competitors, or on leveraging existing IM opportunities, or on new IM opportunities.

A questioning technique was adopted to stimulate ideas, such as 'Can we use IM to:

- Reduce customers' costs?
- Increase customers' revenues?
- Increase customers' switching costs?
- Differentiate our offering from the competitors?
- Increase competitors' entry costs?
- Reduce our suppliers' bargaining power?
- Improve suppliers' quality?

Step 5: Discuss the opportunities identified in more detail.

Step 6: Evaluate the opportunities using criteria such as the degree of competitive advantage, cost, feasibility, and probability of success (risk). This enabled the opportunities to be ranked into one of four categories — 'blockbuster', 'very high potential', 'moderate potential', and 'silly'.

Step 7: Study further the 'blockbusters' by agreeing a technical description of each, listing their particular competitive advantages, specifying the specific thrusts and targets, and considering the implementation issues involved.

RESULT OF THE EXERCISE

As a result, over 100 SIS ideas emerged of which 11 were rated as 'blockbuster' or 'very high potential'. Many of these ideas were generated by traditional systems staff who had benefited from the confidence-building process generated by a number of intensive days' work.

GTE subsequently invested in five of the identified 'blockbusters'. More importantly, the company recognised that this was just the beginning of a much longer process to identify and implement further opportunities, and so each individual telephone company now follows a similar process to generate opportunities specific to their individual business requirements. Likewise, the functional strategy of each telephone company now focuses on SIS, which has led to senior management becoming aware of the strategic role of IM and ensured that IM is an integral part of each company's business strategy.

GTE has recently created the position of chief information officer (CIO) for each local telephone company, reporting directly to the president, and has created separate units within GTEDS to market three product lines internally. The first is devoted to MIS applications, the second to decision-support systems, and the third to strategic information systems. Each unit has its own budget and staff, and is responsible for identifying and developing appropriate applications. The SIS unit is charged with working closely with the local telephone companies and, in turn, with their customers, to develop new applications.

CONCLUSION

It is too early to judge whether the applications initially identified are providing the competitive advantage that was expected. What is important, however, is that GTEDS saw the need to take some action in this area and adopted a systematic approach to identifying such opportunities. In this case, the methodology was 'bottom-up'.

Other companies are at various levels of awareness of the problem and are adopting their own processes to achieve a similar goal. In some cases, vendors are also encouraging their customers to think more systematically, and this help should be exploited. The first step could well be an education programme that initiates the awareness process.

There is no 'formula' for success — this case history has done no more than illustrate one such method. What is important is that the *need* is recognised, and that the necessary *action* is then taken.

Competitive Edge — Today's Position

George Cox, Butler Cox

George Cox is managing director of Butler Cox. His session was a review of today's situation in applying IT for competitive advantage. Although it was a personal view, it drew heavily on the research done for several Butler Cox reports and on Butler Cox's consultancy work. In particular it drew on the research results for the forthcoming Foundation Report 'Competitive Edge: Myth and Reality'. This represented the most recent and probably most extensive investigation of the topic in Europe.

His presentation covered four main areas:

- The underlying developments.
- The nature and characteristics of competitive-edge applications.
- Where we stand today in exploiting IT for competitive advantage.
- The lessons that can be learned.

THE UNDERLYING DEVELOPMENTS

'Competitive edge' may be an overworked term, but behind the hype there is a real and very significant view of the exploitation of information technology. From top management's viewpoint it is the most significant development today. There is, however, widespread misunderstanding of what has brought about the great interest in competitive-edge applications. The topic has not been invented; it is not a sudden insight. Rather, competitive-edge applications are the natural, and inevitable, outcome of the way the exploitation of IT has been moving for many years. The underlying forces are as follows:

- The continuing advance of technology: increased power, more capability.
- The changing economics: more power, lower cost.

LES SYSTEMES A BUT COMPETITIF: PONT DE LA SITUATION

Le propos de George Cox est de présenter un constat de situation en matière d'applications informatiques à objectif compétitif et de tirer leç ons et enseignements des expériences déjà vécues.

La première partie de son exposé amène une constatation irréfutable: le développement de ce type d'application est un phénomène naturel et ne peut être enrayé. Il est du à la fois au potentiel croissant des technologies informatiques et aux pressions concurrentielles de plus en plus fortes que subissent les entreprises.

Les bénéfices que peuvent tirer les entreprises de ce type d'application sont multiples: aide au développement et au support de vente de nouveaux produits, extension de part de marché ou création de nouveaux marchés, valeur ajoutée à des produits existants, compression des coûts et des délais de réalisation de nouveaux produits, fidélisation de la clientèle, etc...

Le chapitre suivant de cette session porte sur les différences entre ces types d'application à objectifs compétitifs et les applications informatiques traditionnelles. George Cox estime qu'elles sont de nature technique identique aux applications traditionnelles et même qu'elles sont souvent des extensions de ces dernières. Par contre, leur justification économique est fondamentalement différente et ces applications demandent de la part des informaticiens une nouvelle attitude. L'expérience montre que ces applications sont de nature "opportuniste" et qu'en conséquence elles ne peuvent faire l'objet de méthodes de développement aussi structurées et longues que les applications traditionnelles. Le temps est le facteur critique.

Les clefs du succès sont liées à l'intervention d'utilisateurs imaginatifs et impliquent le plus souvent des partenaires extérieurs (Clients/Fournisseurs). Les actions à entreprendre pour faciliter leur développement sont tout d'abord de sensibiliser la direction générale à l'intérêt de telles applications, de raisonner la stratégie d'entreprise dans un sens nouveau et de modifier le processus de développement de telles applications.

En conclusion, il est important de comprendre et de faire comprendre que ce type d'application n'est pas une mode mais bien un élément fondamental du succès et de la survie de l'enteprise.

— The move of computing into everyday life, particularly PCs.

— The changing telecommunications environment.

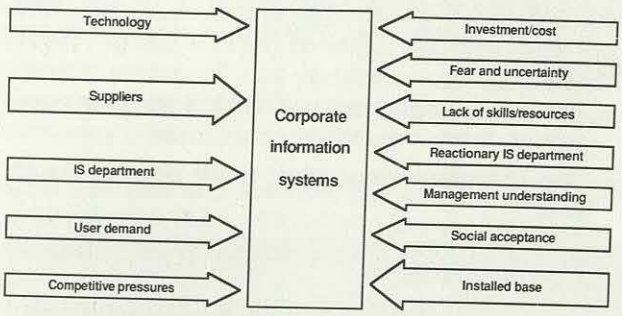
— Growing skills in systems design.

— Growing understanding of the potential of IT by line managers.

— Competitive and economic pressures.

However, it is important to realise that there is a time lag between the potential of a technology being recognised and the technology being used to advantage. This means there is a 'window of opportunity' for using a technology for competitive advantage. Before the window, the technology may be too immature. After the window it is too late: others will have already gained the advantage. There are also forces driving and opposing the changes that IT can bring (see Figure 1). The opposing forces can also slow down the use of IT for competitive advantage.

Figure 1 The forces driving and opposing change



THE NATURE AND CHARACTERISTICS OF COMPETITIVE-EDGE APPLICATIONS

It might be argued that since every system is designed to improve some aspect of corporate performance, every system is in fact designed for competitive advantage. But this could be argued for every single activity within the business. However, just as certain corporate moves are intended to give a significant, sometimes strategic lead over the competition, so too with certain systems. Such applications are far more widely spread than is generally realised. There are a limited number of well-publicised examples, but during the last 18 months Butler Cox's research has looked at more than 150 practical cases.

There are in fact several ways in which IT can be used to provide competitive edge:

— Assisting in the creation of new products and services.

— Changing the size and scope of the market.

— Differentiating products and services.

— Breaking down and facilitating the crossing of sector boundaries.

— Impacting the product life-cost cycle.

— Enabling more complex products to be introduced.

— Changing the value-added chain.

— Establishing market-entry barriers.

— Locking-in customers.

— Reducing supply costs.

In the research for the most recent Foundation project, the proportions of organisations using these different ways of gaining a competitive advantage were:

— Changing business processes	67%
— Locking trading partners in or out	58%
— Product differentiation	57%
— Influencing costs	39%
— Exploiting market niches	17%
— Creating new business	15%

Analysing competitive-edge applications by industry sector showed that different sectors use IT in different ways to gain a competitive advantage (see Figure 2).

Figure 2 Competitive-edge applications are different in each sector

Sector	Application (or thrust)
Food retailing	Outlet management and logistics
Consumer travel	Holiday sales
Clothes manufacturing	Production and Channel management
High Street retail	Sales
Wholesaling	Retailer support
Banking	Overall cost leadership
Pharmaceuticals	Product research and development
Life Assurance	Sales

In banking, finance, insurance, manufacturing, retail, and distribution, 20 per cent of the organisations researched claimed they were using IT to gain a competitive advantage. In travel and entertainment the figure was 13 per cent; 11 per cent in food and health, and nine per cent in energy and chemicals.

Figure 3 shows the prevailing attitude towards using IT for competitive advantage by senior management in several sectors. In many sectors it is seen as very important. The one surprise was government and public administration, where only one per cent were using IT in this way and the prevailing attitude was that it is of little importance

Figure 3 Senior management in many sectors believes that using IT for competitive advantage is very important

Sector	Majority view
Transportation/leisure	Very important (100%)
Financial services	Very important (60%)
Manufacturing	Very important (60%)
Retail	Some importance (86%)
Oil/chemical/utilities	Some importance (55%)
Government/ Government agencies	Little importance (66%)

to do so. At first sight, it may seem difficult to see how public-sector organisations can use IT for competitive advantage. However, in today's changing economic and political environment, they too will increasingly have to provide value for money in the services they provide, and the use of IT will be an important means of achieving this.

The question has to be asked whether competitive-edge applications are any different from more traditional applications. The answer, on today's evidence, is that such applications:

- Are technically similar to traditional applications.
- Are often extensions of basic internal systems, enabling those systems or their data to be used by suppliers or customers.
- Need to be justified on a different basis. Traditional cost/benefit is not sufficient. The risks involved must be assessed as well.
- Require different attitudes and approaches to systems development.
- Usually involve interorganisational links.
- Almost exclusively stem from user-identified opportunities.
- Usually have a 'champion' — not just an enthusiast, but someone who can provide the funds as well.
- Nearly always bypass the standard development process (at least in the early stages).
- Require investment in change rather than systems development or technology.
- Do not, so far, stem from strategic reviews.

Virtually every example of a competitive-edge application encountered during Butler Cox's research had been opportunistic. Very few, if any, had appeared in five-year strategic plans. This conflicts with the commonly accepted view, but, so far at any rate, the many different methods for linking corporate strategy with IT strategy do not seem to be delivering competitive-edge systems.

George Cox explained that there were three possible answers. One was that the openings were opportunistic by their nature; another was that most of today's techniques concentrate too much on known, internal issues, and not on the market or technology-related trends, or on what the competition was doing with IT. The third was that it was simply a matter of time; the results of pursuing longer-term strategic opportunities had yet to show through.

THE LESSONS TO BE LEARNED

Butler Cox has identified four keys to success in using IT for competitive advantage:

- An aware and imaginative user.
- The means and will to move quickly.
- Emphasis on speed of delivery and on user-interface design.
- The involvement of external parties (customers, suppliers, specialist system suppliers, and so on).

There were also several actions that could be taken to strengthen a company's ability to exploit IT for competitive advantage:

- Raise management awareness.
- Keep the business abreast of development.
- Keep track of what the competition is doing.
- Modify the strategic-planning process.
- Ensure the IT strategy provides a system infrastructure and the means of fast response.
- Modify the systems development procedures.
- Communicate the changed priorities.
- Review today's systems and the applications backlog for languishing opportunities.

George Cox stressed the importance (and difficulty) of improving top management's perception of the role and the importance of IT. Part of the problem is that from senior management's viewpoint, IT is boring. It does not have the appeal of subjects such as marketing, product strategy, or finance.

In the past, 'systems' has been synonymous with 'administration': important enough to get right but hardly something demanding continuous senior management attention, and certainly not at all in the strategic armoury.

That situation is changing fast. In future, the way in which an organisation is able to carry out its business, the manner in which it can be controlled and redirected, the speed with which it is able to change and move into new fields, will become a key to success, and, in some cases, to survival.

A Progress Report on New Technologies

Craig Fields, DARPA

Craig Fields is responsible for the direction and management of computer science projects within DARPA — which has a total research budget of some $800 million, of which approximately a quarter is spent on advanced computer science projects. It is the largest research organisation of its kind in the world.

DISCONTINUITIES IN TECHNOLOGY DEVELOPMENT

Organisations seeking to gain an advantage from the use of information technology need to look for and exploit discontinuities in the pace and direction of technology developments. At this point in time, all of the major discontinuities are occurring in the field of hardware, not software, and most of his presentation was devoted to hardware developments.

First, though, Dr Fields described briefly several areas where, although steady progress is being made, no major breakthroughs are likely in the near future. These are:

- Artificial intelligence.
- Software production (where having smart programmers remains the best solution).
- Data storage.
- Computer security.
- Networking.

The three main technology-development areas of current interest are multiprocessors, microelectronics packaging and production, and lightweight satellites. Each is examined below.

MULTIPROCESSORS

Until recently, virtually all practical development of computer processors has been concentrated on machines with the von Neumann architecture, in which one instruction is processed at a time. As is illustrated in Figure 1, it has become increasingly difficult to sustain the rate of development of this technology as performance has moved towards fundamental physical limits.

Since 1983/84, multiprocessor machines have become practical and cost-effective. These developments represent a genuine discontinuity in computer performance curves, as is illustrated in Figure 2. This new type of computer is particularly useful in applications that have parallel-processing characteristics (which many do when examined closely). Particularly relevant applications at this point in time include fluid dynamics, vision processing, weather forecasting, astro-physics, and chemistry.

Foreseeable applications, some of which are already emerging include:

LES TECHNOLOGIES A DEVELOPPEMENT ACCELEREE : ETAT D'AVANCEMENT

Dans sa session, Craig Fields aborde cinq sujets principaux: Les nouvelles générations d'ordinateurs à processeurs parallèles; la micro-électronique, les techniques de fabrication des puces, la supra-conductivité et enfin la nouvelle génération des satellites légers. Seuls, dans ces domaines, les technologies représentant un réel saut technologique sont traitées.

En ce qui concerne le logiciel, le Dr. Craig précise qu'à son avis aucun saut technique n'est à attendre, mais simplement un développement continu assez lent.

Le principe de fabrication des supercalculateurs est simple: Il consiste en la mise en parallèle de micro-processeurs. En principe il n'existe pas de limite apparente. Par exemple, le Butterfly Parallel Processor comprend 64000 processeurs et offre ainsi une puissance de 1000 mips pour un coût très faible. Dans le futur, on parlera de Teraflop (1000 milliards) et même de Pataflop (1 million de milliards milliard), ceci à horizon 1995.

En micro-électronique, il est maintenant possible de fabriquer des puces de très petite dimension au prix de 1000 dollars et ceci dans un délai de deux semaines.

Craig Fields termine son exposé en précisant que l'association Intelligence Artificielle + supercalculateurs permettra de développer des nouvelles gammes d'applications tout en rendant la machine capable de créativité.

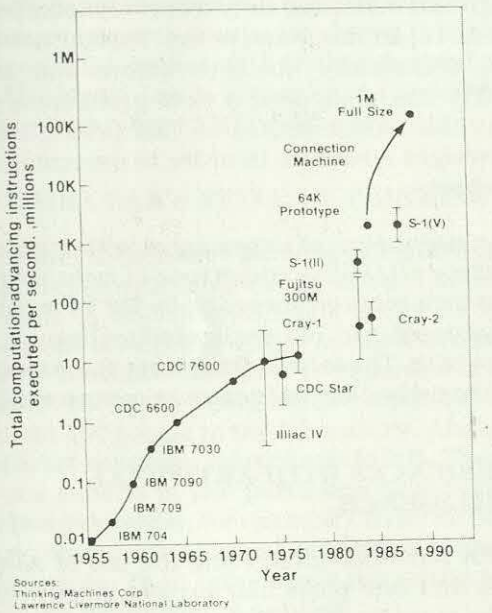
Figure 1 Experience at Los Iamos National Laboratory

Year	Years to Double Performance
1952	1.45
1962	2.06
1972	2.93
1982	4.50

'Silicon is within a factor of five of the maximum achievable limits.'

- **Riganati, J.P., and Schneck, P.B., 'Supercomputing,' IEEE Computer, October, 1984**

Figure 2 History and forecast of best available arithmetic performance levels



– Generation of television adverts.

– Optical/microelectronic design.

– Image analysis.

– Aerodynamic design.

– Simulators.

– Factory control and robotics.

– Speech analysis.

Dramatic improvements in absolute performance have been achieved – for example, expert systems able to process rules two million times faster than a large mainframe. In graphics generation, the cost of the end product has in one case been reduced a hundred-fold.

One of the important attributes of this new breed of computers is the ability progressively to add additional processors as the processing power required exceeds that which is available. They are able to span the size range between microcomputers and supercomputers – indeed, at the high end of the scale they redefine the limits of processing performance. Moreover, they do not have the disadvantages of scale associated with conventional computers, either with respect to cost or performance. Figure 3 illustrates the typical cost curve for a multiprocessor compared with a variety of conventional machines.

Figure 3 "The 68020 Curve"

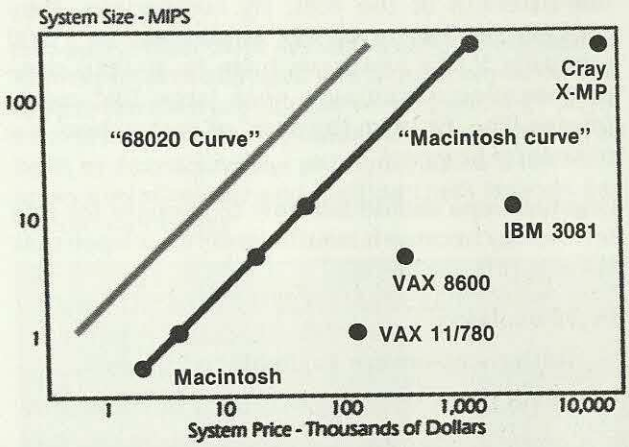
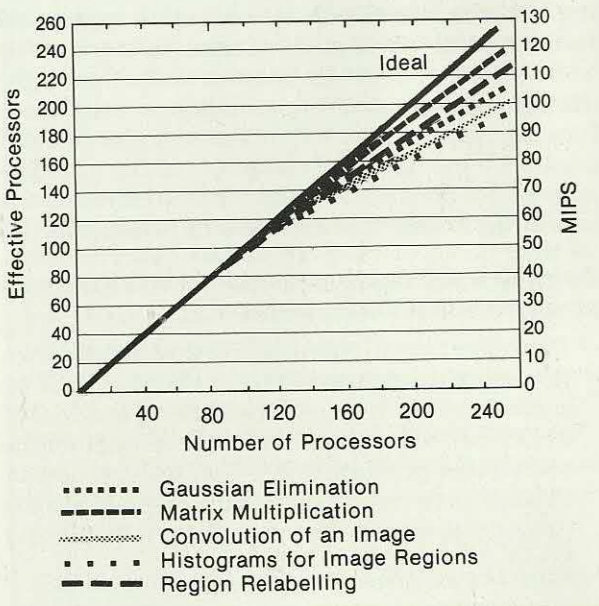


Figure 4 illustrates the actual performance of one particular multiprocessor – BBN's Butterfly System – and as can be seen this is close to the ideal performance.

Figure 4 Measured performance of butterfly system



However, there are certain tasks or situations for which the use of multiprocessors does not provide any particular advantage. These include:

- Calculations with very large databases where data retrieval is on the critical path.
- Nonparallel computations.
- Programs that have not been modified for parallel processing.

Currently available multiprocessors include the Butterfly, Thinking Machine's Connection Machine, and Floating Point's 'T' Series. Typically these machines provide between one to two times the power of a current Cray at between one-tenth and one-fifteenth of the cost. By comparison, they provide processing power equivalent to 1,000 scientific VAXs and have huge (x 40,000) cost-performance advantages over large IBM mainframes. The 'Cray on the desk' of researchers is a near-term prospect.

Organisations should act now to prepare for this technology because it is sufficiently developed that there is little or no risk.

In particular:

- Multiprocessors are available to buy now.
- Unix is the most frequently used environment.
- Current and future programs can be written with parallel processing in mind.
- Considerations of the scale of processing are no longer a dominant issue.

MICROELECTRONICS PACKAGING AND PRODUCTION

Current technologies for microelectronics packaging limit the scope both for reduction in size and for improvements in performance (light travels as 'slowly' as one foot per nanosecond). New high-density interconnection techniques are transforming this situation. Within the next year, GE will produce a one gigaflop computer of the approximate dimensions of a soup tin. Trillion bit memories measuring 1 cubic foot are also soon to be available.

Two important developments in microelectronics production should also be noted:

- *Prototype chip production.* New techniques are now making it possible to produce one-off or short-run chip designs in two weeks at a cost of $1,000 per chip (as opposed to six to nine months and volume products only). The consequences of this are more rapid prototyping of more designs (with consequentially improved products), and lower development costs.
- *Chip factory economics.* With increased chip density, the critical dust particle size gets smaller and the cost of providing a 'clean' environment increases. Currently, factory capital costs are $1,000 to $2,000 per square foot, with the prospect that the facility will be obsolete in three years. The situation is now changing as a result of a move to provide chip wafers with a clean environment — through vacuum cocoons — that can exist in a relatively 'dirty' factory. The consequence is higher yields for low capital investment.

LIGHTWEIGHT SATELLITES

Until recently, communications satellites were designed robustly. They took five to seven years to design and build, and they were very reliable, very expensive, and large and heavy. Furthermore, they were technically obsolete before completion. DARPA has pioneered a new production philosophy that concentrates on fast production and lightweight structure in order to overcome these drawbacks.

As a consequence of experiences with a prototype satellite — GLOMR — which took 11 months to build and which worked successfully for 14 months, a production run of 240 small satellites has now been authorised. These will transform the economics (and the technology) of communications satellites.

EXPERIENCES WITH ARTIFICIAL INTELLIGENCE

DARPA has been pioneering the use of AI techniques and one particular project illustrates the developments so far.

The commanders of the United States Pacific Fleet have an expert system that, given a set of goals and information on the state of available resources, suggests management actions in directing fleet movements, repair schedules, and so on.

After a period of initial trial, in which there was no compulsion to use the system, officers now make great use of the system and mainly follow its advice immediately. When disagreements between officers and the system occur, the system explains the reasoning behind its recommendation and the options that it has considered. So far, the advice of the system has always been taken once an explanation is given.

Novel Applications of IT

Professor Nicholas Negroponte, MIT

Professor Negroponte is head of the Media Laboratory at MIT. He began by describing the aims of the Media Lab, which had its origins in the late 1970s when it was formed to research ways of exploiting the 'new convergence' (see Figure 1 overleaf). The areas of interest are shown in Figure 2 overleaf, and the current research groups are shown in Figure 3, also overleaf, together with their industrial sponsors. The Media Lab is 85 per cent funded by its sponsors (the norm at MIT is 50 per cent).

THE MEDIA LAB'S STYLE OF THINKING

The focus of the research is the way in which people communicate with computer systems. The laboratory aims to find unique niche areas on which nobody else is working, either because of a lack of skills or because the area is regarded as 'too difficult'. Including postgraduate students, there are about 150 people in the laboratory. About half of them are computer science specialists. The other half are experts in the particular area being researched (education, for example). In terms of technology, many of the Media Lab's projects are relatively simple. Their uniqueness lies in the way in which the technology is applied.

As an example of a typical Media Lab project, Professor Negroponte described some of the lab's speech-recognition work. Most of today's speech-recognition projects work well under laboratory conditions but tend to break down when they are used for real. They cannot cope with the variations introduced by the stress a speaker finds himself or herself under in a live demonstration. In this situation, people tend to leave pauses, as if they are waiting for some sort of response. One of the postgraduate students had the idea of using a speech synthesiser to provide appropriate responses, which need be no more than something like "uh uh", or "mmm". An 'adaptive pause analyser' identifies the pauses and triggers an appropriate response from the synthesiser. The result is that the speaker is more relaxed and the performance of the recognition system is improved dramatically.

As another example of the style of thinking employed by the Media Laboratory, he cited the 'school of the future' project. Here, there are more computers than there are students. One application allows phonetically spelt words to be keyed in. The system can then provide the correct spelling ('pitsa' converted to pizza, for example). The system was built by extracting the phonemes from a low-cost speech synthesiser and loading them into an 'inverted dictionary'.

VERS DE NOUVELLES APPLICATIONS DE LA TECHNOLOGIE INFORMATIQUE

Nicholas Negroponte illustre quatre domaines de développements nouveaux au sein de son Laboraoire de Media Technology au M.I.T.

Le premier est le domaine de la génération d'images holographiques par ordinateur ainsi que l'animation automatique par ordinateur d'images en trois dimensions.

Le deuxième domaine concerne l'utilisation de la technologie informatique pour personnaliser automatiquement (et reproduire sous forme texte/graphique ou sous forme électronique) l'information fournie à l'individu. L'ordinateur apprend à discriminer la valeur de l'information suivant l'importance qu'elle présente pour le récipiendaire.

Le troisième domaine est la possibilité d'utiliser l'ordinateur pour anticiper les volumes d'information à transmettre lors d'envoi d'information visuelle et d'arriver ainsi à une 'compression intelligente" des données. De cette manière, il sera possible d'utiliser une ligne téléphonique standard pour faire passer des signaux vidéo qui seront alors ré-interprétés par la station réceptrice intelligente et remis en forme. Cette technique permettra également d'utiliser la puissance d'un simple PC pour faire de l'animation continue d'images.

Enfin le Professeur Negroponte illustre l'utilisation d'un PC en tant que terminal téléphonique intelligent : La machine reconnait l'interlocuteur appelant, prend les messages et réagit en fonction de ce même interlocuteur de façon pseudo-intelligente.

Figure 1 The new convergence

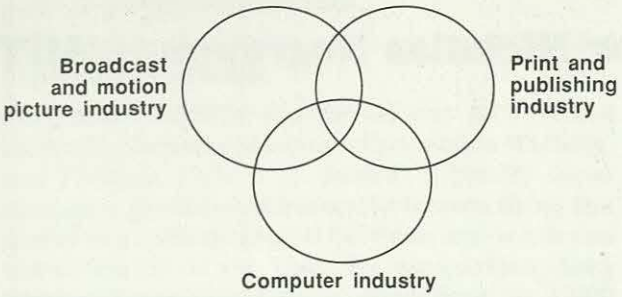
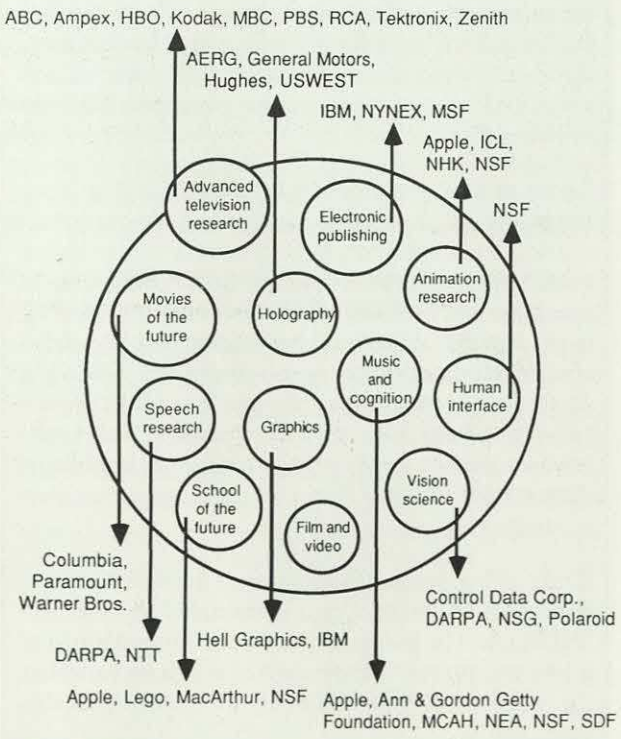


Figure 2 Media Lab's area of interest

- Learning research
- Personal computers
- Electronic publishing
- Telecommunications
- Advanced television
- Spatial imaging
- Film/video
- Graphics
- Computer music
- Computers and drama

Figure 3 Media Lab's research groups and their sponsors



Professor Negroponte believes this would not have emerged from a school of education, nor from a computer science department. It required the blend of specialists available at the Media Lab.

THREE-DIMENSIONAL DISPLAYS

Professor Negroponte described the Media Lab's work on computer-generated holograms, which is being sponsored by General Motors. A Connection Machine (described in Craig Field's presentation) is used to generate holograms in five minutes. Advances in computing power now in sight mean that realtime holograms will become a reality. An example of a computer-generated hologram is shown in Figure 4. Commercial applications of this technology will be available in five to ten years.

Figure 4

Another project concerns the estimation of depth. A photograph of a room of people will show some in focus, and some slightly out of focus. By comparing two photographs taken from slightly different angles, it is possible to reconstruct the original three-dimensional positions of objects, and then rotate it to provide different views. Once again, large amounts of computing power are required to do the calculations.

The Media Lab is also investigating the 'kinematics' of three-dimensional images so that, for example, the correct sound could be generated as one object strikes another. At this point in his presentation, Professor Negroponte showed a video demonstrating some of the lab's work on 'legged motion' — simulating the articulation of creatures with 'n' legs.

INFORMATION DELIVERY APPLICATIONS

The Media Lab is experimenting with a personalised newspaper, which will only contain articles of specific interest to the individual. Early on, there was concern about the need to include 'surprise' articles. This has turned out not to be a problem. The real opportunity provided is to redefine the concept of newsworthyness. For example, if today's session at the conference had been cancelled, this would have been the biggest headline

in delegates' personalised newspapers. However, no one else in the world would have been interested in this 'news'. The opportunities for personalised news are countless, particularly when different computer systems can be interconnected. For example, booking a flight could trigger a weather report for the destination on the day of travel.

Within five to ten years, Professor Negroponte believes that there will be a much greater 'computer presence' in individuals' lives. This 'presence' will trigger the provision of highly specific and tailored information at the time it is needed. As these developments occur, the distinctions between mail, messages, news, and advertising will blur. Even advertising could be tailored to the individual. A potential drawback of personalised newspapers is the need to stockpile paper in the home to print the newspaper on. However, the Media Lab is beginning to think in terms of reusable paper. It is also working on ways of producing high-quality, low-cost colour hard copy.

DEVELOPMENTS IN TELEVISION TECHNOLOGY

Using today's TV technology, it is possible for a computer system to scan the 'closed text' (or teletext) now transmitted with most TV broadcasts, and to identify and record those programmes likely to be of interest to a particular individual. However, the really startling developments will occur once TV broadcasting becomes an all-digital medium. Once this occurs, really high definition can be generated by high-powered computing devices in the receiver (think of the TV set of the future as a Connection Machine as described by Craig Fields). In this situation, it will be necessary to transmit only the information that has changed, because it will be possible to store and manipulate the image locally.

Today, a full-length feature film has been compressed (using digital techniques) to fit on a 500M byte compact disc. By 'looking ahead' at the action that is about to occur, the image can be reconstructed in time for it to be displayed. The compact disc data-transfer rate is 1.5 million bits per second. This means that it is now possible to perceive a time when TV can be transmitted over ISDN telephone technology. Alternatively, it would be possible to deliver a complete film in ten seconds over optical fibre links, opening up the possibility of anyone being able to watch any film at any time.

To demonstrate what can be achieved today with limited computing power, Professor Negroponte showed a video of moving pictures being generated by an IBM PC from data stored on a conventional disc.

SPEECH RECOGNITION

Speech will be a very important way of communicating with computers. Most researchers today believe that speaker-independent systems will be required, but this is hard to achieve. Professor Negroponte's own view is that speaker-dependent systems will be sufficient. For example, your telephone handset could be programmed to provide the interface to a general recognition system, or a general system could be personalised by reading an individual's speech characteristics stored on a credit card.

INTELLIGENT TELEPHONE ANSWERING SYSTEM

The Media Lab has built an intelligent telephone answering system that is so good that many people who use it do not realise they are talking to a computer. The concept of the system is based on two insights:

- It is not difficult to recognise automatically who is calling. For most people, 95 per cent of telephone calls are received from no more than about 30 individuals.
- It is usually possible to respond by asking a reasonable question ("where can Mr X reach you tonight").

Professor Negroponte demonstrated the system by showing a video.

CONCLUSION

In conclusion, Professor Negroponte said that the constraint today is not processing power or storage. It is the imagination required to see how to use the technology in new and innovative ways. Today, the hardware is way ahead of the applications. If so much can be achieved with so little, think what could be achieved if people can be motivated to think imaginatively.

List of delegates

AUSTRALIA AND NEW ZEALAND

Broken Hill Proprietary Company	Peter Littlejohn
Cadbury Schweppes	Richard Casey
Fletcher Construction	David King
Shell	Neil Smith
National Roads and Motorists' Association	Gordon Parker

BELGIUM AND THE NETHERLANDS

Aegon	T L Stehouwer
Ahold	Rien Van Marion
Akzo	J W Lubberhuizen
Amro Bank	S Betten
Douwe Egberts	M J A Mathijssen
	C A van den Hengel
Ebes	F Lagae
Générale de Banque	Karel de Boeck
	Patrick Lootens
	J Rogiest
	J J Verdickt
Automatiseringscentrum Ideta	K Schonbaum
Nederlandse Middenstandsbank	Peter Hanselman
Nederlandse Philips Bedrijven	J Arisse
Postbank	H Wiegman
Rabobank Nederland	W K de Boer
	J W M Wassenberg
TNO Den Haag	L G M Muijen
De Vaderlandsche	Leo Schoovaerts
Victoria-Vesta	E Stibbe
Volmac	Norbert Panken
Wavin	G J O D Dikkers

HONG KONG

Hongkong and Shanghai Bank	Peter Brockman

FRANCE	
Caisse Nationale du Crédit Agricole	Jean-Pierre Marcoff
Ciba-Geigy	Marc Burgé
	Yves Pelliet
	Henri Varlet
Crédit National	Gilles Claude
	Georges Brock
Compagnie Française Philips	Guy Darricaux
DFI	Jacques Leignel
	Jean-Rémy Pichon
EDF/GDF	Nicolas Nahas
	Claude Toulet
	Pierre Vassort
France Câbles et Radio	Jean-François de Gayffier
IBM France	Jacques Brisard
	Stanislas de Follin
	Patrice Biron
IGIRS	Philippe Parisot
Jeumont-Schneider	Michel Masson
	Maurice Renaudie
	Georges Touzé
Ministère de l'Economie, des Finances et de la Privatisation	Jean-Pierre Bonnell Alain Casanova
Peugeot SA	Jean-Serge Bertoncini
	Jean-Pierre Cabart
	Marc Tavernier
SNCF	André Bouzy
SNPE	Michel Nicolas
Thomson Grand Public	Jacques Leblanc
Total	Jean-Louis Lunel
Promodes	Maurice Hamon
GERMANY	
Bayer Sparkassen-u Giroverband	Anton Müller
Bayerische Vereinsbank	Eberhard Rauch
Beiersdorf	Bernard Kriens
BMW	Roger Quassowski
Digital	Frank Berger
Europaisches Patentamt	Walter Layes
Honeywell Bull	Karl-Dieter Hast
Otto Versand	Gerhard Broderson
Schering	Dietmar Borchers
Siemens	Albrecht Döhler
	Helmut Krefft
	Herbert Mildt

IRELAND	
Bank of Ireland	Edward Moroney
System Dynamics	Julian Drury-Byrne
	Tom McGovern
ITALY	
Banca Agricola Milanese	Luigi Fasolin
Banca d'Italia	Mr Michelangeli
Credito Emiliano	Luca Seligardi
ENAIP	Fabio Agostini
	Silvio Peverelli
	Giuseppe Tomai
ENEA	Agostino Mathis
Enidata	Barbera Daniela
Fiat	Franco Naccari
Fininvest	Mario Barel
	Giovanni Picaro
Istat	Franco Marozza
Krene	Pietro Carboni
	Paolo Fadda Adolfo Lagattolla
SAE SPA	Guido de Dario
Senato della Repubblica	Carlo Pinzani
Sisdo	Roberto Bellini
SWEDEN	
AB SKF	Hakan Landahl
	Goran Ljungdahl
Statskonsult	Bo Loven
	Nils Sjostrand
Vagverket	Kjell-Ove Blom
SWITZERLAND	
Digital	Lynne Gillon
	Michael Horne
	Francis van Huythen
Union Bank of Switzerland	Hubert Huschke
UNITED KINGDOM	
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British Airways	Geoff Miles
British Nuclear Fuels	Alan Harrison
British Steel	Dick Gilliver
British Telecom	Peter Chapman
	Joan Hardie
	Owen Williams
BPCC	Roy Dewell

BUPA	Barbara Simpkin
Burton Group	Penny Chilcott
Cardiff City Council	Mike Poulton
CCTA	Peter Skinner
Corporation of Lloyds	Ray Smith
Courage	Murray Short
Department of Trade & Industry	David Love
East Sussex County Council	Robert Briggs
The Electricity Council	Rodney Danes
Equity & Law Life Assurance Society	Robert Hutchinson
Glaxo Pharmaceuticals	Iain Lee
Grand Metropolitan Information Services	Jack Horsnell
Inland Revenue	Steve Matheson
	Andrew Pinder
ISTEL	Daman Singh
	Roger Gray
	Michael Dawson
Lloyds Bank	Peter Holland
Manufacturers Life Insurance Group	John Gregory Stuart Hastings
Monsanto Europe	Eric Marlow
National Westminster Bank	John Ball
	Rob Shepherd
Pirelli	Ian Addison
Post Office	John Handby
Reckitt & Colman	Geoff Gregory
Rolls-Royce	Stewart Wilson
Rowntree Mackintosh	Nigel Pells
Royal Insurance	Peter Steward
Securities & Investments Board	Brian Smith
Swiss Bank Corporation International	Christopher Lindsey
	Phil Reed
	Peter Hurst
Surrey County Council	Tony Preston
Sun Life Assurance Society	Peter Pudner
Touche Ross	Peter Bennett
	Keith Simons
	Graeme Norris
Westpac Banking Corporation	Kelvin Baxter

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David Seabrook

BUTLER COX FOUNDATION

Butler Cox

Butler Cox is an independent management consultancy and research organisation, specialising in the application of information technology within commerce, government and industry. The company offers a wide range of services both to suppliers and users of this technology. The Butler Cox Foundation is a service operated by Butler Cox on behalf of subscribing members.

Objectives of the Foundation

The Butler Cox Foundation is a service for managers responsible for information technology in large organisations. It helps them to do their job more effectively by providing information, guidance, stimulation, and contact with their professional peers in other organisations. The Foundation provides this assistance by publishing research reports and position papers, and by organising international conferences, national meetings, and study tours.

New developments in technology offer exciting opportunities — and also pose certain threats — for all organisations, whether in industry, commerce or government. New types of systems, combining computers, telecommunications and automated office equipment, are becoming not only possible, but also economically feasible.

As a result, any manager who is responsible for introducing new systems is confronted with the crucial question of how best to fit these elements together in ways that are effective, practical and economic.

While the equipment is becoming cheaper, the reverse is true of people — and this applies both to the people who design systems and those who make use of them. At the same time, human considerations become even more important as people's attitudes towards their working environment change.

These developments raise new questions for the manager of the information systems function as he seeks to determine and achieve the best economic mix from this technology.

Membership of the Foundation

The majority of organisations participating in the Butler Cox Foundation are large organisations seeking to exploit to the full the most recent developments in information systems technology. An important minority of the membership is formed by suppliers of the technology. The membership is international with participants from 19 countries.

The Foundation Research Programme

The research programme is planned by Butler Cox in consultation with the member organisations.

Each year six research projects are carried out, each resulting in a research report. The reports are intended to be read primarily by senior and middle managers who are concerned with the planning of information systems. They are, however, written in a style that makes them suitable to be read both by line managers and functional managers. The reports concentrate on defining key management issues and on offering advice and guidance on how and when to address those issues.

Position Papers

In addition to the research reports, the Foundation also publishes position papers. These papers are based on the views and personal research of their individual authors. Typically, four position papers are published each year.

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