Future Unit
Championing the knowledge economy

CONVERGING TECHNOLOGIES: CONSEQUENCES FOR THE NEW KNOWLEDGE-DRIVEN ECONOMY

Highlighting the potential impact that the convergence of information systems, telecommunications and broadcasting will have on companies and markets over the next 10 years

SEPTEMBER 1998

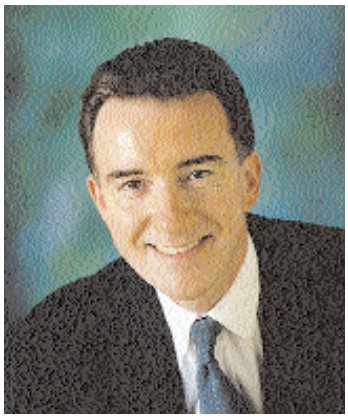
dti
Department of Trade and Industry

This report is also available at:
www.dti.gov.uk/future-unit

The Future Unit can be contacted at:
future.unit@cudv.dti.gov.uk

FOREWORD

My vision for the UK is to create a knowledge-driven economy, in which knowledge is exploited to the full in developing new products and services and in making existing industries more efficient and productive. An essential element in this vision of the future is how we make the maximum use of the opportunities offered by new information and communication technologies – and in particular how we meet the challenge of convergence of these technologies.



I am determined that we will be at the forefront of these changes. I want Britain to be Europe's digital pathfinder – the natural home for new digital products and services. We must give UK consumers early access to these and ensure that UK based companies are world leaders. By the end of this Parliament, I want the UK to be recognised globally as the best environment in which to trade electronically.

This report, the first from my Department's new Future Unit, examines the impact that the convergence of telecommunications, broadcasting and information systems – as exemplified by the growth of the global internet – will have across commerce and society. The report was written to be thought provoking and to initiate debate. It is not a statement of Government policy, but the issues raised do need to be seriously considered and are worthy of broad attention and debate. I have therefore decided to publish the report in full and the Government will begin the process of addressing these issues when it publishes its forthcoming Competitiveness White Paper.

Peter Mandelson
Secretary of State for Trade & Industry

CONVERGING TECHNOLOGIES: CONSEQUENCES FOR THE NEW KNOWLEDGE-DRIVEN ECONOMY

1. EXECUTIVE SUMMARY

The UK is well placed to take advantage of the new digital age, as part of an increasingly knowledge-driven economy. To exploit future opportunities to the full we need to know more about the implications of the *convergence* of computing, telecommunications and broadcasting. This report is aimed at promoting a debate on this important issue.

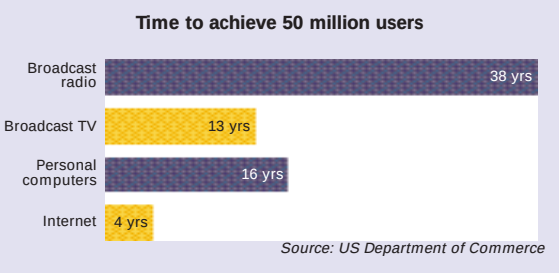
Advances in technology in computing, telecommunications and broadcasting have proceeded in a controlled manner. It has been of consuming interest primarily to engineers and to computer scientists. There have been dramatic improvements in quality and reliability of telecommunications with major reductions in real costs; substantial commercial use of computer networks and, coming soon, burgeoning choice from digital television in its many forms. These changes have however occurred at a rate which allowed them to be assimilated easily into existing practice and institutions. This comfortable state of affairs is unlikely to continue.

A catalyst for change....

The phenomenal growth of the global internet has started to act as a catalyst for the wide range of business and social change enabled by these digital technologies. For example, it challenges the very structure of industries and their supply chains and many existing approaches in regulation. Internet-centred convergence represents a major discontinuity in the evolution of both commerce and society. There are substantial economic and social gains possible for the UK if we can harness these forces of change.

....on an unprecedented timescale...

The speed of adoption into general use of the internet is unprecedented. By the end of 1997 there were more than 100 million users world-wide. The USA leads with more than 60m[2]. The illustration below shows the rate of public adoption of the internet in the USA compared to a series of comparable historic innovations. General use in the USA has risen three times more quickly than any comparable development.



...across commerce and society.

Convergence and the knowledge-driven economy will lead to significant changes for commerce and society over the next ten years. This report does not focus on technology but rather the business and social implications of the changes now beginning. It concentrates on the internet as a delivery mechanism for electronic

commerce. Internet-based solutions may increasingly be deployed across the information, telephone and broadcasting markets. This report is intended to complement the Government's Green Paper[1] 'Regulating communications: approaching convergence in the Information Age' published on 21 July. The Green Paper seeks public views on the future regulation of broadcasting and telecommunications, by 30 November. This report looks at other parts of regulation and policy affected by convergence.

What is driving this growth?

We need to learn from the experience of leading knowledge-driven areas of the US. These indicate several drivers for this growth in use of the internet. In business terms these include:

- more efficient and effective customer service – through on-line access by customers direct to company systems;
- enhanced sales and marketing reach – through leveraging 'trusted' brands into new markets;
- lower purchasing costs – through broader scope for cost effective purchasing;
- reducing the amount of inventory held – through improved logistics management; and
- increasing speed to market – through tighter development and supply chain integration.

Internet-based electronic commerce (e-commerce) creates the opportunity for major savings with *existing* business approaches and even greater gains where companies transform their approach to exploit specifically the new characteristics of the internet. For example, taking the more developed US market, just three companies (Cisco, Dell and General Electric) generated e-commerce revenues of $3bn in 1997 and confidently expect this to expand to $17bn within 3-5 years. Whilst this is not necessarily *new* revenue it is achieved on better margins and with greater competitive advantage.

Cisco – Customer service productivity up **200+%**.

Wal-Mart – carries **ten times** the number of products on its web site than in its largest store.

General Electric Lighting – **20%** reduction in materials costs and **30%** reduction in procurement labour costs through internet purchasing.

IBM Personal Systems Group – inventory turnover up **50%** on sales volume increase of **20%**.

Source: US Department of Commerce

Of particular importance to the UK, US research[3] suggests that business to business commerce from medium/small companies (1000 employees or less) will be the dominant beneficiary from e-commerce. It will generate more than 75% of the business revenues flowing to Internet Service Providers (ISPs) and to the operators of search engines and directory sites (Portals).

In social terms the drivers include:

- 'instant' access to information and to entertainment, even on the most obscure of minority subjects;
- the potential to make the process of education much more interactive and indeed *fun!*

- opportunities for telemedicine and, in particular, for remote monitoring of medically at risk sections of the community;
- options for those who wish (or need) to carry out some elements of work from home or local teleworking centres; and
- new possibilities for social interaction through 'chat rooms' and a wide range of interactive, multi-participant, games.

All these and related issues, such as a paradoxical re-emphasis on personal service to achieve market differentiation, the reduced need for physical distribution of information-based products (such as compact disks, videotapes, text books,...) and transformation of the nature of advertising; are covered in depth in chapter six of the report.

Disrupting business processes and structures

Internet-based electronic commerce is likely to transform the way in which many products or services are created and bought. On a ten year view it will:

- further drive industry structures away from conventional vertical integration to more complex structures based on the ability to contract out many elements at reduced cost but without loss of coherence in product or service development;
- greatly enhance the value of 'brands', in many cases sharply lowering the entry costs into new markets where the trust implicit in brands can be further exploited;
- sharply polarise retail between those (such as early retirees) with large amounts of free time for whom physical shopping will remain a valued social experience and those, for whom time is at a premium, who will value electronic shopping perhaps from a small range of 'trusted' suppliers with a huge breadth of product coverage, (fuelling a boom in same day or overnight delivery!);
- require many existing intermediaries to adapt or face being taken over by technology (financial advisers, travel agents, insurance brokers, pension advisers,...), and create many new ones (information brokers, quality guarantors, 'best buy' sites,...).

Impact of e-commerce on transaction costs (for suppliers)

- Airline reservation: **$8** via a travel agent but **$1** via internet;
- Typical banking transaction: **$1** via human teller **$0.01** via internet

Source: US Department of Commerce

These and related issues, such as the development of new institutional alternatives to companies to provide individuals with the framework of support once associated only with corporate employment and the crucial importance of gaining access to high quality information on customers' purchasing preferences, are examined in chapter four of the report.

Challenging existing DTI policies

We move forward into an increasingly knowledge-driven economy from an existing approach to regulation, much of which has been designed for a world of physical products and services where the lifecycles are relatively long and national jurisdictions have the key role. The revolution of global, internet-based, convergence challenges each of these points:

- the evolving UK approach to competition regulation, modelled on Articles 85/86 of the Treaty of Rome, will provide the competition authorities with enhanced powers (including the ability to impose interim measures) giving increased effectiveness. Similarly, the move to a prohibition regime and the provision of concurrent powers to sector regulators, will assist. Even with these changes, the sheer speed with which opportunities can be identified, exploited and closed with e-commerce may require further action;
- physical access to internet facilities and access to training in the basic skills required to exploit the internet will become a vital element of social inclusion. In ten years this is likely to be the new 'Universal Service' requirement;
- control of customer preference information has the potential to be the new regulatory battleground. Existing approaches to data protection are unlikely to meet either the growing concern for privacy or to liberate the genuine value for consumers of well targeted product/service bundling; and
- despite the improved tools such as 'digital watermarks' to enhance traceability, the intrinsic ease of copying in a digital world represents an immense challenge to our current means of rewarding the artistic creators of new music, television, and so on through copyright and licence fees.

These subjects, and the potential responses to them, form the heart of chapter five of the report. They represent a major opportunity for UK leadership on the world stage. In respect of communications, a discussion of these issues has already been initiated by the Government's Green Paper 'Regulating Communications'.

How can Government help position the UK to win?

This report focuses on three key components of the broader agenda:

- speeding the general adoption of successful innovation, to improve the UK's competitiveness in world markets;
- look for opportunities to pioneer regulation for the new digital knowledge-driven economy, to provide the vital positive framework of institutional support for business; and
- developing the project team-based approaches to working essential for the Department to support business in the much more fluid market and company structures of the future.

Accelerating the general adoption of successful innovation

This report highlights areas, such as personal communications networks – PCNs, where the UK has gained substantial economic advantage from accelerating the general adoption of successful innovation. We should seek to repeat this success in the context of the many opportunities flowing from convergence. Among the issues which will need to be considered are:

- establishing criteria for determining whether new innovations merit action to accelerate general adoption;
- applying these criteria systematically to convert 'suspects' into 'prospects' – potentially a joint process between 'Foresight' (through the Office of Science and Technology, OST) and DTI Sector Directorates; and
- giving preference in funding applications for cross-disciplinary work in the identified areas. Bringing together social scientists, engineers and business analysts, in advance of the general availability of new products or services to map out, for example, the changes to business processes required to take advantage of the innovation and to identify potential obstacles to take-up.

New approaches in the information age

We should recognise that the global nature of internet-based convergence, crossing many legislative jurisdictions, will drive a fundamental shift in power and responsibility away from the state and onto the individual. Among the issues which will need to be considered are:

- assessing how empowering the individual may provide the solution to otherwise intractable regulatory problems. Encouraging consumers to sell their preference information either via information brokers or via their own 'personal intelligent agents' on a transaction basis, may provide the key to major data protection issues. Making 'content filters' with very 'user-friendly' interfaces widely available for internet and television terminals may be a solution to content regulation; and
- determining the extent to which existing legislation and regulatory structures, well beyond the communications arena, will need to be progressively transformed in the coming ten years, setting key priorities and milestones.

Responding to more amorphous market and company structures

In the more complex markets and corporate structures of the future, there will be no simple model that the Department can follow to match its own organisation to that of its 'customers'. Among the issues which the Department will need to consider are:

- assessing how we might make much greater use of team working. Drawing together people with the appropriate mix of skills to address particular critical issues, without cutting them off from the sources of their continuing expertise;

- supporting our teams with the necessary knowledge management tools. Ensuring that teams can exploit the immense store of information locked away within the Department; and
- developing a range of scenarios for the future of UK industry and its trading patterns such that we establish a common appreciation of (and language for) the critical issues which *may* confront us.

The Future Unit's 'Mapping the Future' project, now in progress, should provide important insights into this area.

The broad change inherent in convergence represents a remarkable opportunity for the UK to be Europe's digital pathfinder so that consumers have first access to digital products and services and British business can lead the world. We believe the Government can and should lead in seizing the moment.

Acknowledgement

This report forms part of the work programme of the DTI Future Unit. The Unit wishes to thank the many colleagues from DTI, industry and academe, in the UK and USA, listed in appendix two of this report, for their invaluable help and insights into its development.

2. INTRODUCTION

The context for this project

This is the first report from the DTI 'Future Unit', established in April 1998. The Future Unit's vision is to make 'consideration of the future a conscious aspect of decision making throughout the DTI'. To achieve this vision, we will be championing the future and catalysing change through partnership with others in DTI and elsewhere. We will achieve this through:

- 'creating insights into industries and markets of the future;
- facilitating the sharing of visions; and
- breaking down barriers.'

Work commenced on this 'convergence' report in May l998 and it was delivered to the Secretary of State in September 1998. The development of the report has involved a wide range of discussions with researchers, private and public sector business teams, regulators, industry associations, and 'think tanks' (both in the UK and USA), as well as the help of colleagues in key areas across DTI and OST, as detailed in appendix two.

Two further reports are currently being prepared by the Future Unit:

- mapping future based activities across the Department and sharing best practice; and
- assessing the role of self employment and portfolio working in the UK economy in ten years time.

Project scope

The purpose of this project is to highlight the implications that the convergence of information systems, telecommunications and broadcasting has for the DTI. We considered how markets and supply chains may be radically altered, by the widespread adoption of electronic commerce and trading, and how what constitutes a 'company' may change through the application of outsourcing, partnerships and strategic alliances. Virtual companies of the future may have little in common with the majority of today's organisations. The extent to which we in DTI can anticipate these changes, and prepare for the new requirements that they will place on all the Department's activities, will be the real measure of our role in the knowledge-driven economy. This project is intended to complement the joint DTI/DCMS Green Paper 'Regulating communications', but to cover a broader canvas and take a longer forward look. The focus here is on the implications more broadly across commerce and society rather than the enabling technologies and their regulation.

3. BASIC SCENARIOS

It is important to establish a context against which the impact of convergence on commerce and society can be analysed. There follows three scenarios for the future. No originality is claimed for these. They are taken directly from the excellent work of the Royal Institute of International Affairs – Chatham House Forum; 'Unsettled Times'[4], published in 1996 and 'Navigating Uncharted Waters'[5] published in 1997. Both DTI and OST officials participated in developing these scenarios, alongside senior staff from major private sector companies (Shell, Unilever, ICL, Abbey National, Halifax,...), public sector bodies (BBC World Service, BNFL, DERA, Customs & Excise,...) and other Departments (DETR, DfEE, FCO,...).

These scenarios are *not* predictions of the future. They represent however, logical potential outcomes of current social, economic and institutional trends. The future, as it unfolds, may well contain elements of each scenario, hence the importance of thinking through the scenarios and their implications for major policy decisions.

Scenario one – Faster, Faster

'A world of starkly accelerating change, in which competition and commoditization are unceasing and industrial transformation is rapid.

The convergence of the industrialising nations upon the industrialised world is accelerated. Nations, as well as firms, can easily be ranked, as the criteria for success are more clearly understood. Markets become even more prone to amplifying success and penalising failure. Information Technology serves as the conduit through which ever more complex work is 'posted' to global marketplaces, where low-wage areas play an ever-expanding role. Those with the lowest skills are the most penalised.'

Scenario two – Rough Neighbours

'The world of 'Faster, Faster' proves socially intolerable. Populist politics, seeking to allocate blame, take managerial eyes off the balances that need to be struck. Relations with the industrialising world are simultaneously closer in commercial terms and more distant in terms of politics. The primacy of the liberal democratic model of government is weakened and regional associations increasingly follow their own, often authoritarian, paths. Moderate protectionism, based upon worthy alibis such as environmental concerns, stands in the way of international collaboration.

The result is a decade of muddled strife from which the industrialised world emerges fragmented and bruised, its former claims to global leadership compromised. 'Rough Neighbours' have arrived on the scene. The industrialised world is confronted by the Asian economic region, revolving around Chinese predominance and answering to different value systems and imperatives from those with which the industrialised world feels familiar. Other, less predictable and often 'de-located' political associations have also formed. The low-income world is cross-hatched with competing ideologies. Many of these ideologies, carried by IT, generate support among the less capable in the industrialised world'.

Scenario three – Post-Industrial Revolution

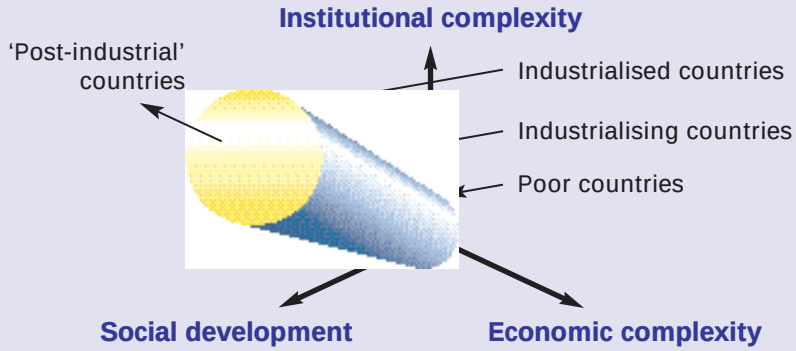
'Owing to huge advances in technology and the massive increase in market potential, firms have been able to retain and reinforce their sources of competitive advantage. Economic success creates the conditions for purposeful change.

The exploitation of knowledge and potential is found to occur best in physically connected, specialist networks. It takes the complex societies of the industrialised world to create such centres of excellence. Nations nurture these sources of distinctive competence and innovation with appropriate local regulatory and institutional support.

The forces which dominated 'Faster, Faster' remain potent, however. The need to co-ordinate a response to this dominates the concerns of government. Each nation in the industrialised world emphasises its distinctive competence, doing so within a common framework of knowledge-centred business'.

Building on these scenarios

The work of the Chatham House Forum stressed that 'desirable' futures inevitably lay in achieving development balanced carefully along the three axes of 'social development', 'economic complexity' and 'institutional complexity' (see diagram below).



Source: Chatham House Forum

The forces of convergence of information systems, telecommunications and broadcasting are likely to have rapid and profound effects on economic complexity and to exercise a potentially disruptive influence on social development. These are explored in chapter four of this report. Balancing institutional changes are suggested in chapter five.

This report argues that, in order to maintain the desired balance:

- a significant transfer of power and responsibility, in regulatory areas, from the state to the individual may be necessary;
- a more pro-active stance by government in driving through the economy the fruits of successful innovation is key to avoiding the treadmill of the 'Faster, Faster' scenario; and
- positive actions to counter the socially divisive effects of convergence, and to enhance social inclusion, will be essential.

4. TEN YEAR IMPLICATIONS FOR COMPANIES AND MARKETS

This chapter seeks to highlight the potential impact of the convergence of telecommunications, broadcasting and information systems on the new knowledge-driven economy ten years hence. It is important to develop and to test scenarios for the future. Whilst truly accurate prediction at ten years remove is unlikely, developing such scenarios and seeking to map the new battlegrounds of competition does create important insights. Developing an understanding of the changes likely and a familiarity with the key issues, is an essential preparation for managing the 'real' changes as these occur.

It is a truism that those looking ahead tend to overestimate the scope for change in the short term yet to underestimate it in the long term. None the less the predictions here are realistic and supported by the early developments already in progress documented in chapter six.

Manufacturing

The close integration of information systems and communications networks, pioneered by the internet is being taken a stage further with the development of both private systems within organisations (intranets) and systems which link together industry groups and supply chains (extranets). Extranets, whilst building on the internet infrastructure, are typically managed from end to end by a single specialist provider. They offer the enhanced levels of service and availability demanded for business critical applications. Extranets provide a potential 'double win' for both new and existing manufacturing industries. They can greatly shorten the time required for product design or for order information to flow accurately through a supply chain of manufacturers, contractors, sub-contractors, and so on. At the same time they broaden the scope for effective competition at each level and reduce the volume of inventory required to be held. Such networks change the nature of barriers to entry in markets. At one level they lower barriers allowing broader tendering, yet at the same time, the need for integration into the relevant extranet becomes itself the new barrier to entry for companies not yet equipped. It is clearly vital to ensure that UK industry participates fully in the development of international extranets, and leads in applying these within the UK. The DTI's own use of intranets will be addressed in the forthcoming Future Unit study on 'Mapping the Future'.

A trend away from traditional vertical integration towards greater contracting out of individual elements is already well established. On a ten year view the opportunities offered by intranets and extranets will strongly reinforce this change. It is likely that there will be much greater shipment of sub-assemblies between countries than finished products, (for example more engines than cars). Convergence will reward those who focus on being the best at a particular element in any process. If seeking to cover a number of stages in the supply chain does not bring genuine economies of scale and diverts management attention, this will be relentlessly exposed by the wave of competition enabled by electronic commerce linked to efficient supply logistics. Chapter six gives examples of extranets already being successfully pioneered in the USA.

This ruthless competition plays strongly to the concerns over progressive loss of profit margin implied in the 'Faster, Faster' scenario discussed in chapter three. In order to restore margin, we will need to emphasise the seeking of genuine overall innovation in products, opening new markets and possibilities. It will thus be vital to ensure a strong UK presence at the top level of design and assembly. These organisations will have much in common with the 'systems integrators' familiar in the IT industry. They will seek to bring new approaches to existing markets and to develop new ones, buying in many of the elements which comprise the final product or service.

Business to business services

A key advance from convergence is the extension of the opportunities offered by electronic commerce to small companies. Earlier developments, notably Electronic Data Interchange (EDI), have been seen as too expensive and perhaps too complex for many small businesses, unless supply chain links to large companies (for example in the vehicles sector) have forced adoption. On a ten year view, reduced communications costs and simple, cost effective, software will draw in almost all small businesses. Continued development of simple, intuitive, icon based, user interfaces will again be a vital pre-condition for success.

Full electronic integration of small business (for specifications, requests for proposal, tenders, orders, progress chasing, payments,...), into supply chains will allow levels of response time and accuracy simply not attainable using the traditional tools of telephone and fax. The US expectation is that annual total costs for a small business to run its own web site must be made comparable to taking a medium sized 'Yellow Pages' advert, of the order of £3K to £6K per annum, to be attractive.

Studies suggest that these pricing targets are rapidly being met in the US, ($5K to $10K, equivalent to a one quarter to one eighth page Yellow Pages advertisement in a major city). By 2002 some 75% of the total business revenues flowing to Internet Service Providers and to the 'Portals' (operators of the vital 'search engines' and 'directory sites') are expected to come from small/medium sized businesses (average size of 15 employees). Ensuring that UK small business recognises both the inevitability of electronic commerce, and the competitive importance of being early adopters, represents a significant challenge for the Government (see chapter five). This is now being addressed through the 'Advisers' Skills Initiative'.

Channels to market

The primary impact on channels to market from convergence will be from the:

- dramatic reductions in transaction costs;
- immense power for consumers or their agents to 'shop around' *in real time* for 'best buys' at minimum cost and effort;
- placing a premium on trusted brands as an indicator of quality and reliability;

- development of a lucrative (but specialist) premium market for personal service; and
- ability to leverage brand presence and reputation from one market to another at reduced entry cost.

This will have profound implications for a wide range of intermediaries from, at one extreme small individual specialists such as financial advisers, through major chains of travel or estate agents, to the supermarket and department store giants.

On the high street – physical products

In ten years time we are likely to see a sharp polarisation in shopping patterns. There will be those, such as early retirees, with substantial disposable incomes and ample free time, who will see shopping as very much a social experience. This group, favoured by demographic trends, will wish to spend a significant amount of time shopping in person. Others, for whom time is at a premium, will favour the convenience of electronic shopping, (with the personal service of same day or overnight home delivery). In practice, there will be some blurring between these two groups. Most people have special items that they will make the time to shop for and others they will do almost anything to avoid.

For the electronic shopper, brands both of the service provider and of the individual items purchased, will take on a greatly enhanced significance. It is likely that many consumers will want to offset the risks of shopping remotely by sheltering under trusted brands (as has been the case in catalogue shopping). The owners of trusted retail or generic brands can be expected, in ten years time, to have used this trust to broaden vastly the scope of products and services they sell. They will vie to be electronic one stop shops for the majority of all purchases. Convergence will free them from the floor area constraints of conventional retail sites, which force out slow moving lines. Home delivery direct from the warehouse, or more likely direct from the original manufacturer, will re-write the economics of such retailing. Chapter six gives examples of this trend already happening in the USA.

Competition between these mega-retailers will be extensive as electronic shoppers will have the means, via intelligent agent software in their home computers, or through specialist price comparison internet sites, to shop around in seconds, comparing prices in real time. This could lead to significant disorder and instability in pricing as rivals seek to gain brief advantage. The retailers are likely to attempt to maintain margins by investing heavily in the information systems (data mining) to record in minute detail customers' purchasing preferences. They will predict future needs and tailor special offer bundles and discounts to the individual. The interesting conflict that this might provoke between competition policy and the demands of privacy and data protection is explored in chapter five.

It may also be possible to exploit the unique characteristics of convergence, giving access to customers' purchasing behaviour in real-time. This offers scope for an immediate response, such as suggestions for further purchases consequential on the one just made. A raft of new marketing possibilities is opened.

On the high street – information-based products

CHALLENGES FOR RECORD AND BOOK RETAILERS

There are a range of products which consist essentially of packaged information. These include audio compact discs (CDs), digital video disks (DVDs), computer software (CD-ROMs), videocassettes, text books and so on. In ten years time it is likely that there will have been a substantial shift to purchasing these electronically, with no physical package and consequent reductions in distribution and sales costs. There are two potential routes. The first would be to purchase over the internet and to download the information into local mass storage in the home. This is analogous to the current purchase mechanism. The second route would be to download for each individual use (without long term storage locally). This would be analogous to the current rental mechanism. Both of these possibilities demand widespread deployment of broadband communications networks to the home, though the 'rental' model demands the highest peak communications capacity. In reality both models are likely to co-exist.

The success or failure of such individual download services is likely to hinge on contending human motivations. The wish to own (and to display) attractive physical objects against the convenience of instant digital delivery. This ownership motivation is at its strongest in books (Bound Optimally Organised Knowledge – as described by one writer). These are likely to be the last bastion of the physical representation of information – though new advances in highly flexible display technologies, which mimic the physical properties of book pages, may yet change this. The challenges to copyright, flowing from the ease of illicit copying and distribution in this digital world, are discussed in chapter five.

BANKS AND BUILDING SOCIETIES

At the heart of retail banking are information transactions about the location of funds. The use of credit and debit cards is already extensive. The use of electronic cash cards is now being trialled and is likely to be widespread within ten years. Chapter six describes the dramatic cost savings (to the banks) from the use of direct input by the customer, over the internet, of transaction information (funds transfers, bill payments, direct debits, and so on). Excess physical presence in the High Street is likely to be an increasing and costly embarrassment for many outside a premium market for personal service. The vast majority of routine financial transactions will take place electronically from the home.

Current banks and building societies will need to choose whether to focus their business around their retail brand – offering a complete portfolio of financial services (from banking to investment, pensions, insurance and tax advice), or on the efficient provision of back office functions such as clearing and international funds transfer to a range of retail banks. Those choosing the retail option will have similar incentives to collect and exploit aggressively customer preference information, as the large retailers discussed earlier.

Intermediaries

Historically, intermediaries (such as travel agents, pensions advisers, estate agents,...) have been organised vertically. A particular advisor or company was aligned specifically with a single industry (for example, travel) or industry segment (for example, pensions advisers within financial services). This structure is undermined by convergence through:

- instant electronic access to the principals without the aid of the intermediary;
- expert system software which can compare standard offerings and establish a best buy; and
- the substantial reductions in transaction costs from bypassing the intermediary.

Convergence will also ruthlessly expose spurious value added. Needless complexity, for example in financial services, which generates the illusion of value and differentiation, and increases the requirement for extensive regulation, will be much more difficult to sustain.

Chapter five expands on the regulatory implications of these new intermediaries. Chapter six details the potential ten fold transaction cost savings enabled.

Taking travel as an example, where real value can be added through the personal knowledge and experience of the agent, a market will still exist. However in ten years time routine bookings will be made direct on the internet to airlines', hotels', car hire companies', reservations systems etc, thus not incurring the agent's commission and costs. Whilst travel has been used as the specific example here, these forces of change are very broadly applicable.

In the knowledge-driven future most intermediaries are likely to be aligned horizontally with particular customer groups. These would be capable of handling a very broad range of requirements for their target customer set. These intermediaries might comprise four classes. Serving:

- the economically and technologically poor. Those who cannot afford computer access at home and the associated telecommunications costs or lack the (very basic) skills required to utilise the services. These people would be supported through access centres in the community. This might make a quite logical extension of the current public library services. (Chapter five expands on the issue of social inclusion). Multi-media terminals (or kiosks) would give access to software intermediaries capable of profiling the customers' requirements and matching these against standardised product or service offerings to recommend a best buy;
- those with simple standard requirements. These would access the knowledge in an intermediary system from home using the internet. As in the case above, the intermediary essentially comprises certified expert system software;
- those with more complex requirements. Here the intermediary would hold (with the customer's full consent) a detailed profile of the customer's

preferences across a wide range of areas (from food to travel destinations) plus extensive information on the customer's financial status, investments, pension arrangements, loans, mortgages and so on. Whilst some initial loading of this information by the customer would be required, much could be learnt by the system as it handles each individual transaction. As well as responding to specific customer enquiries, this more sophisticated expert system would autonomously analyse the offerings in the electronic market place, from late discounts on airline seats to new investment products, bringing those of genuine relevance to the customer's attention. Human advisers would be accessible on-line to jointly review and advise on the system's recommendations; and

- those who demand (and are prepared to pay for) pure personal service. Here the converged computer networks would still provide the core knowledge for the system but all contact with the customer would be via personal advisers.

This vision of the future for intermediaries has profound implications. The UK should be very well placed to lead in the development of the expert system and intelligent agent software envisaged. The Government should also have a leadership role (as already envisaged by the Prime Minister) in ensuring central and local government services are progressively made accessible in this manner. For individual intermediaries, the implied need for multiple skills is a serious challenge, as will be the temptation of retail brand owners to extend their presence into these services. There will be major challenges in assessing how to apply, for example, the extensive financial services regulatory framework to autonomous software systems rather than individual advisers!

Professional services

Over the next ten years, advances in expert system software will provide the converged world with computer generated advice which is likely to displace much routine professional services activity.
The extensive impact on company accounting staff of the personal computer and packages such as 'VisiCalc' in the early 1980s is instructive. The cutting edge of the accounting profession, (mergers and acquisitions, developing new classes of financial instruments, forensic accounting,...) was largely untouched but much mundane work in developing business plans and models was dramatically simplified (and staff numbers reduced). Similarly in the next decade, in areas such as law and architecture, much routine work will be displaced with professionals adding their value only at the end of the process.

Perhaps the area of greatest potential impact is in medicine. A genuine high functionality broadband network and attached databases, linking all layers of healthcare (teaching hospitals, general hospitals, GPs' surgeries,...), could bring immense improvements in efficiency. Unconfirmed reports suggest that for example in the USA as many as 25% of all

Potential health service cost savings

Broadband network linking teaching hospitals, general hospitals and GP's surgeries **(40,000 establishments)**:

- capital cost **£600M** (funded by the operator);
- annual rental costs **£100M**;
- indicative savings **>£350M** per annum.

Source: John Harper [6] Seaford Head Advisors

hospital beds are occupied as a result of drug interactions between different treatment regimes. In many cases these would be preventable through fully integrating treatment databases. Similarly, the scope for savings (or increased capacity) from remote monitoring and diagnostics, as well as in areas such as computer aided training, is great.

Press broadcasting and entertainment

Newspapers and magazines

The sector most directly linked to convergence itself is that of press, broadcasting and entertainment. Suggestions of the demise of newspapers and magazines, with their supplanting by screen-based information delivery are far too simplistic. Current indications are that the heaviest users of the web sites of major magazines and newspapers are also amongst the most loyal readers. The two forms seem to be complementary. The print medium is used for a broad overview of events and the web site is used to follow up breaking news, or the detail and background on specific items of interest. The print media may however be threatened in a different way, through the loss of advertising revenue, particularly for business to business advertising. This will be particularly acute for local and regional media. The US experience shows newspapers moving rapidly to develop their own advertising web sites in the fight to retain a share of this revenue in its new form.

Television

The move to digital broadcasting via terrestrial, satellite and cable is now underway in the UK. This is a very important change, but it is far from the end of the story. It will give consumers a greater choice of conventional free-to-air and subscription television services, and will also allow them greater access to interactive applications, such as home shopping. Electronic programme guides may become the dominant device for guiding consumers to various services. Some interactive services will be based on 'internet-type' solutions, and will therefore have the look and feel of the internet.

While free-to-air television services will still attract large audiences, on-demand and pay-per-view services will increasingly enable consumers to select their own services, rather than relying on scheduled services. There might be scope for consumers increasingly to assemble 'personal channels' to be viewed on demand. One scenario might eventually be for this personal stream of viewing to be assembled within a monthly budget and against preferences and interests both defined by the viewer and 'learnt' by the server as the viewer reacts to the selections made. In a sense this is the highly successful concept of specialist magazines taken to the ultimate limit, enabled by convergence. Such concepts are already being demonstrated by the UK start-up company WorldPipe.

This, coupled with the fragmentation of audiences caused by greater choice, may have implications for the advertising industry. Lack of synchronised viewing will prevent advertisers from holding an audience captive during advertising breaks. Advertisers may need to develop new ways of attracting the attention of viewers, such as programme sponsorship.

Games

Convergence will offer many new opportunities for interactive games across networks. These will be both single user (for individuals) and multiple user, effectively team or role playing in real time. Games may also be vehicles for other objectives, from education to advertising. Familiar issues of addiction and gambling will be at the forefront of social concerns as this area develops. Again, it is likely that games will substitute substantially for the existing television audience.

Successful clusters – overstating the death of distance?

There has been much speculation that ubiquitous, high quality communications, at low cost, will undermine the role of commercial centres and, in particular, negate the forces which create clusters of related activity, such as 'Silicon Fen' around Cambridge. This is far too simplistic a view and fails to address the social and innovation context. Indeed, the forces of convergence may well reinforce the role of existing clusters whilst changing the nature of the barriers to the creation of further clusters based on new industries and developments.

The people dimension is crucial. Face to face contacts, and the trust and personal relationships that these engender, are essential to the management of tacit knowledge, which is the core rationale for clusters. Whilst convergence makes access to formalised information both easy and distance independent, this merely increases the value of the unstated tacit knowledge which comes from years of direct experience. The quality of tertiary education, the attractiveness of surroundings and the social and lifestyle facilities will be key factors in the competition to site new clusters. Research also suggests that clusters have manageable characteristics, including optimum levels of diversity in their supporting companies and supply chain, and a defined lifecycle. The continued development of strong clusters will be one key to tilting probabilities in favour of the desirable knowledge-driven 'Post – Industrial Revolution' scenario discussed in chapter three and away from the treadmill of the 'Faster, Faster' scenario.

Convergence will allow more scope for working from home, and thus major opportunities for those who through disability or role (such as carers) are restricted in their ability to go out to work. Again, however, social contact is important. The creation of local or regional shared work centres will be essential to striking a balance between solitary work at home and the necessary broader social contact. This will have the positive effect of shifting some jobs from urban centres to lower cost provincial towns and rural communities. It should be noted however that work which does not require tacit knowledge (call centres, data entry, software coding,...) is at real risk of loss to lower cost economies.

5. TEN YEAR IMPLICATIONS FOR GOVERNMENT AND PROPOSALS MADE

This chapter explores the implications of the converging technologies for Government policy in general and the role of DTI in particular. It contains all the proposals for consideration, which are also listed in appendix one. These proposals may be grouped under three major themes:

- what steps can the Department take to speed the general adoption, throughout the economy, of the successful innovative changes catalysed by convergence?
- what new thinking is required to reflect the transition to the knowledge -driven economy in areas of regulation beyond simply that of the medium itself? How will these changes impact on a diversity of areas from consumer protection to fair competition? and
- in a world where companies and markets no longer have fixed and familiar structures, how can the Department work most effectively with these more heterogeneous clients?

Speeding the general adoption of successful innovation

The 1995 NERA – Smith study for the Department's Radiocommunications Agency illustrated the substantial economic benefits which can be unlocked if innovations, which have already demonstrated specific success, can be driven out more quickly into general adoption. The example highlighted was the early implementation in the UK (against considerable scepticism in Continental Europe and around the World) of Personal Communications Networks (PCNs – now familiar as One-2-One and Orange). The success of Cellnet and Vodafone in the business cellular telephone market was already clear. In the quarter before One-2-One launched its service in London, Cellnet and Vodafone spent more on advertising than in the entire previous ten years of their existence. Making additional radio spectrum available to new competitors expanded the scope of the market, bringing affordable cellular telephones into personal use.

NERA – Smith assessed the change in economic contribution if the introduction of PCNs had been delayed two years. Such a delay would still have allowed the UK to lead in Europe. Their results indicated a rising level of benefits foregone to the UK economy. By financial year 1999/2000, these projected lost benefits reached £480M per annum in Gross Domestic Product (GDP) and more than £2bn per annum in consumer surplus (benefits forgone by consumers). This example illustrates the scale of gains possible (and in this case already realised) through promoting early adoption.

The potential policy actions available to promote early general adoption include:

- enhancing general education and awareness – as is being successfully demonstrated in the 'Information Society' programme;

- specifically countering misplaced fears and myths – an example being the widespread public belief that credit card payments on the internet are at a high risk of fraud. The reality is that the protection algorithms used on the internet are substantially more secure than giving a credit card to a waiter in a restaurant or quoting the card number on the telephone;
- analysing the innovations flowing from convergence against hard criteria for success. For each 'success', systematically funding collaborative, multi-disciplinary projects to identify pre-emptively obstacles to more general adoption (for example business organisation or process changes implied) and demonstrating, through pilot projects, how these can be overcome;
- where such implementation paths have been mapped out, promoting adoption through the full range of policy tools from awareness raising and selective support to competition; and
- streamlining the Government's role in promoting and supporting innovation, reducing cycle times and ensuring decisions on support are made on timescales consistent with the increased pace of change.

This represents Government ensuring a favourable environment for the rapid exploitation of demonstrably successful innovation.

There is a need for a major programme of activities to promote early adoption along the lines discussed here.

It would also be helpful to gain a better understanding of the way in which innovation diffuses through the economy. There are five recognised modes:

- price and performance – the most pervasive (if rather slow) method based on demonstrated benefit;
- epidemic – where the innovation becomes a must have for all those who come into contact with it, (for example the Sony Walkman);
- competitive pressure – where those who do not have the innovation are at a severe disadvantage, (for example university departments which do not now have internet web sites get minimal undergraduate applications!);
- rising real incomes – a very gradual process which drives for example the extension of car ownership; and
- intensely social – where group or peer dynamics are dominant for example in the fashion industry.

Research into each of these modes, in the context of convergence, would be very helpful, identifying the points in each at which Government can have a catalytic impact, through regulatory decisions, bringing together a critical mass of participants, and so on.

Further work will be required to establish how resources to support early adoption could be most effectively targeted.

New challenges for regulation in the information age

Access to customer preference data – the new prerequisite for fair competition?

As discussed in chapter four, initial intense price competition amongst a diversity of e-commerce market entrants will place a premium on the knowledge held by companies on the detailed purchasing preferences and lifestyle characteristics of their customers. This knowledge will be both:

- a key source of differentiation and competitive advantage in maintaining margin and market share within their home market; and
- an effective entry route to new markets, delivering an extended range of services to customers who trust the brand or reputation of that company.

In the UK, moves by supermarkets first into the financial services market and more recently into internet service provision amply illustrate this point. Using customer loyalty schemes, detailed preference knowledge can be built up, over a period of time, simply through the automatic tracking and analysis of the pattern and nature of purchases made by the customer with that particular company. This base may be extended by:

- the use of commercial packaged software (such as Quick Address) to convert postcode information into a full address and link this to electoral roll data, Ordnance Survey data and demographic information about the area in which the customer lives. This generates inferences about social status and disposable income;
- purchasing further targeted information and credit data from a range of information brokers such as Equifax and CCM; and
- access to specialist databases such as Midas 50,000, listing information on 50,000 individuals earning more than £60K per annum.

Future possibilities include access to:

- telephone number information via the planned telephone directory enquiry database to be operated by a third party for all the UK Public Telecommunications Operators; and
- information on the programmes and advertising watched, downloaded from the new generation of interactive set top boxes required to support the introduction of digital television (whether on satellite, cable or terrestrial transmission).

This competitive edge in customer information represents both an opportunity and a threat. The opportunity comes from well researched and targeted one to one marketing replacing today's all too indiscriminate direct mail. Well researched propositions on bundles of products and/or services, offered at discounted rates, meeting genuine needs, could be highly attractive to consumers. The threat is that if excessive concentrations (or monopolies) of certain types of customer information develop, they could raise significant competition issues, particularly when used to extend strong presence from one market to another.

Society and Government will need to look again at how we treat customer information and who owns it. At present the regulatory framework varies by sector. Examples include:

- financial services, heavily regulated, under the general rule that 'data may only be used for the purposes for which it was collected';
- utilities, where the recent Data Protection Tribunal judgement in the case of British Gas Trading Ltd (BGTL) concluded that:
  i) although it was not unlawful for BGTL to process customer data to enable direct mail to be sent to customers to promote services and supplies not related or connected to gas supply, it was unfair to do so without customer consent or non-objection. This could be obtained in various ways, but it could not be inferred from, for example, a customer's failure to return an opt-out leaflet included with a bill; and
  ii) it would be fair for BGTL to process customer supply data to promote goods which were not gas related, but were available at the time in British Gas Energy Centres; or to offer an electricity supply as part of a scheme or incentive to retain a gas customer.

  At the time of writing this report both the Data Protection Registrar and BGTL have appealed these rulings further to the High Court; and
- the widespread commercial practice of requiring a positive customer action (for example ticking a box) to block the broader use of customer information gained from a transaction.

A broader debate will be required. There is little public understanding of the scale of information held, the scope for its integration into extensive profiles, and both the consequent benefits and risks.

There will be a continuing role for Government, but there would be little point in establishing an extensive (and potentially intrusive) framework of detailed regulation if it would be largely unenforceable. One solution may be to increase the role and responsibility of the individual. This could occur through informing consumers of the value of their information and encouraging them to:

- ensure that *they* have access to all this information themselves, rather than leaving the only copy with individual loyalty scheme operators and so on; and
- make this data (or such elements of it as they wish) more broadly available against the provision by purchasers of credits or discounts; (For e-commerce, personal intelligent agent software may perform this role. More generally information brokers may act as intermediaries).

High storage smart cards may have a strong role to play here. They could both hold the customer preference information and also be the personal repository for a range of electronic permits or tickets, (for example an airline ticket might be replaced by a permit coded onto the smart card during the electronic purchase transaction). In the end the demand for such convenience may, de facto, create universal personal identity cards, though this has the potential to raise significant civil liberties concerns.

A public consensus should be developed on the use (and abuse) of customer information. The Data Protection Registrar and trade associations should have important roles in this work.

Promoting social inclusion

The speed of convergence, based around the burgeoning growth of the internet, is only rivalled in significance by its potential for divisiveness. Optimists will argue that the price of computer hardware is falling so fast that the cost of a fully internet capable computer system will soon be similar to that for a television receiver. Others will suggest that interactive 'intelligent' television receivers will themselves become the primary means of access to the world of convergence. Both of these arguments overlook the facts that:

- software costs are not falling as rapidly as hardware costs;
- communications costs and internet service provider (ISP) charges will remain significant; and
- many people will lack the confidence, or perhaps the rudimentary skills, to 'break the ice' in learning to use the new systems.

Just as with the telephone network, there are strong social and economic justifications for promoting universal access to these services. Beyond simply the world of work, they will become fundamental components of education, health care, entertainment and social contact ten years hence.

It will be important for Government as a whole to develop a consistent strategy for the provision of universal basic internet access. Whilst the Department should have the lead role, this area will also be of vital concern across Whitehall, with key employment, education, health, taxation and other interests to be co-ordinated. This strategy must address the social issues of:

- overcoming the natural fears of new technology;
- providing the necessary basic familiarisation in a non-threatening and attractive way;
- ensuring that those with disabilities, and in particular the visually impaired, can also take full advantage; and
- maintaining a continuing programme of help and support, not merely an initial burst of enthusiasm.

It is likely that internet access for *all* from home will not be economically practical. Community-based centres will need to be developed, as suggested in chapter four. The parallels with the public library service are compelling, perhaps we need search no further than extending the scope (and funding) of these libraries – such that they can embrace the information age. This is indeed envisaged in the Government's response[7], published in April 1998, to the Library and Information Commission's Report – 'New Library: The People's Network'.

A debate should be initiated across Government to determine how the new 'universal service' should be developed, managed and funded.

Will the UK approach to protecting intellectual property need to change?

In an increasingly knowledge-driven economy, how can new knowledge, or information, be protected to allow creators to make a fair return on their investment? Much of our existing IPR framework has been optimised for physical inventions. The protection of, for example, new computer software is much less certain. General awareness of what can already be achieved under UK/European law is poor. How will our intellectual property/patent/copyright regime need to be developed? More comprehensive (if much less rigorous) regimes in other countries, such as the USA, are already placing the UK at a competitive disadvantage.

Early progress will be required to ensure that knowledge-driven companies do not desert the UK for jurisdictions offering stronger protection.

Can copyright be maintained in the digital age?

Counterfeiting is not a new phenomenon. Whether it be shoddy versions of physical goods or illicit (and often sub-standard) copies of copyright films, music or books, those who break the law have practised their trade for hundreds of years. There were enough pieces of the true cross in circulation in the Middle Ages to occupy several forests! The new challenge for the information age is to discourage illegal copying by the vast, otherwise law abiding, majority. Convergence technology allows the creation of exact copies of copyright digital material at a single keystroke and for minimal cost. Indeed, the falling cost of compact disk (CD) authoring stations allows the inexpensive physical creation of new CDs themselves. This was highlighted following the (accidental) release onto the internet of the software used to encode music CDs (MPEG 2 Level 3). Shortly afterwards, total CD sales in the United States started to fall particularly for the large university student population with easy access to CD authoring systems.

The objective of those, such as British Music Rights (BMR), who seek to defend copyright, is to raise sufficient barriers to discourage illegal copying by the general public and to improve the ability to trace 'professional' illegal copies back to their source. The barriers for the general public are technological and can easily be circumvented by those with specialist knowledge; they do, however have both practical and symbolic value. In convergence we will continue to see a technological race between the industry and the counterfeiters. Barriers will be raised, such as the inclusion of the MacroVision encryption software within digital terrestrial television set top boxes, to protect the digital (but not the converted analogue) version of the programming. The industry's hopes are however pinned on digital watermarks hidden within the copyright material. These will greatly aid the tracing of illicit copies.

Current UK and EC legislation needs to be updated to establish legal sanctions against removal of, or tampering with, electronic identifiers, such as digital watermarks, as required by the new WIPO Treaties of December 1996. This is subject to conclusion of the new EC Copyright Directive, and early agreement on this should therefore be pursued as a matter of priority.

A further area of concern is the differing levels of copyright protection in different countries, and the differing royalties payable in various parts of the world for the production of legitimate copies. Global networks make it easy to order copyright works from other countries where they are cheaper, even though current UK law allows rights owners to restrict commercial imports of copyright works from outside the EEA. On-line delivery will make this even easier, and also raises concerns about control of material placed illegally on the internet, where those placing the material on-line may be outside the rightholder's jurisdiction.

Increasingly, copyright material may need to be licensed on a global basis, and new international treaties making it easier to apply and enforce copyright protection, wherever material originates, should therefore be brought into force as quickly as possible.

Whither content regulation in a converged world?

The Government has already posed this question in its Green Paper 'Regulating communications'.

Leaving aside the print media, convergence makes it entirely possible to deliver the same programme content by satellite, cable, or terrestrial television; by internet; or by physical media such as videodisks and videocassettes. As was suggested in the Green Paper, for some years each channel of delivery is likely to remain distinct, appealing to different types of audience with different levels of expectation. In the future it may be reasonable to expect considerable blurring of these distinctions. Will it continue to make sense to apply different regimes of content regulation to each? Is there any practical way to enforce content regulation at source across the global reach of the internet? Will electronic programme guides wield excessive influence over viewing choice?

As with the case of customer preference data discussed earlier, a way forward would be to focus responsibility back onto the individual. The criminal law would still provide a basic framework for action against gross content abuse, (for example child pornography), but the free provision of software to support content filtering, designed to be very easy to use, could empower the individual and/or the family to make such decisions. Such software would have to have a straightforward iconic interface using familiar metaphors, lest we fall into the trap that the only people who could operate it were those we seek to protect – the children.

There is a need for a programme of work to develop and trial the style of, simple to use, content filters, applicable to all electronic media, described in this section.

A key feature of all these challenges for regulation in the information age is the extent to which they question the ability to respond effectively on a purely national basis. Data protection, intellectual property, copyright and content regulation all require a broad international consensus for effective enforcement in the internet age. The UK has a vital role in continuing to lead in formulating and winning acceptance for the new generation of multinational agreements essential to underpin the knowledge-driven economy.

Relating to changing markets and structures

A significant shake out of information jobs?

The changes flowing from convergence and, in particular, the mix of new opportunities and threats arising from electronic commerce, are accelerating a range of structural changes in companies and markets. Chapter four of this report gave a ten year view of the implications and chapter six gives examples of trends already evident today. It seems very probable that convergence will drive a similar shake out and redistribution of labour in the service industries to that which has already occurred in manufacturing over the last twenty years. It may seem paradoxical that many information jobs may be displaced – indeed we can already see this happening in financial services – at the same time that many personal service jobs may be created. This would however be entirely logical. There is a basic cycle, alluded to in chapter three under the 'Faster, Faster' scenario, of:

- benchmarking to determine sector best practice, ('we must improve or die...');
- reducing employment and deploying new technology to achieve the best sectoral efficiency levels, ('we have reached new levels of efficiency...');
- loss of differentiation against competitors, ('we now all look the same with the same cost structure...'); and
- searching for new ways to establish a business proposition different to that of competitors, ('our new services address our customers real needs better than those of our competitors...').

These 'new ways' frequently involve reintroducing people, in explicit customer service roles.

This trend is well illustrated in the supermarkets approach to retail. The single development which has generated the greatest productivity improvements in the post war world has not been the personal computer or total quality management, but instead the introduction of self service. In retailing, this has been at the heart of a cycle of aggressive in-sector benchmarking and cost reduction, leading to dramatic increases in efficiency (and consumer benefits through lower prices). Self service in the store, automated warehousing, just in time inventory control, all improved efficiency but substantially reduced overall employment. However the achievement of such efficiency, on a shared sectoral model, led to a general loss of differentiation and competitive edge. The inevitable consequence has been the search for new aspects of differentiation, some through technology (for example the loyalty cards discussed earlier in this chapter), but many through reintroducing people, personal shopping advisors, more packers at the tills, home delivery for electronic shopping... These changes will place a premium on flexibility and mobility in the labour market.

It will be important to develop a programme of work to encourage such flexibility and mobility in the labour market. There are a range of specific actions which would be supportive including, improving pensions and benefits transferability and further improvements in access to training.

More pro-active competition regulation?

The growing power of brands, as consumers seek islands of trust, in a sea of change, may present new challenges to competition regulation. The ability, through electronic commerce, to project de facto market strength in one market segment into a variety of adjacent segments, using bundling or packaging, perhaps based on customer information not available to the existing suppliers, may disrupt existing patterns of competition. The speed of market entry now facilitated by convergence, and the selectively lowered cost and resource barriers for major brand owners, will also place new pressures on the competition regime. Even with the enhanced powers envisaged in the new competition legislation before Parliament, current approaches will be pushed to the limit when new markets can be identified, exploited and exited in months rather than the traditional years.

Mapping the market terrain

The development (and regular updating) of market maps is likely to be helpful. Such maps would have to be based on a consensus as to the 'fault lines' which separate major market segments. The absence of such a consensually agreed boundary between the PC operating system and the internet browsing application is at the heart of the current US Department of Justice action against Microsoft.

A Departmental team should consider whether market maps should be developed by the market participants in particular areas, in order to provide assistance in the consideration of competition issues.

The amorphous market

The structure of markets and companies is likely to become progressively more complex. Former certainties like vertical integration in manufacturing are being overturned. Whilst some shift to new horizontal integration among intermediaries can be discerned, the overall impact is likely to be of an amorphous structure which changes rapidly in pursuit of new opportunities and developments. How can the Department best organise to address these requirements? There is no unique structure which will allow a best fit. Rather it seems likely that, as with industry itself, the rapid creation of time-limited teams to address specific issues may be the best approach. The familiar sector, trade, enterprise and professional competencies of the Department will remain vital, but the ability to put together multi-disciplinary teams will be essential. The need to assemble these teams at short notice, with team leaders capable of binding together and motivating such groups, will further stress management competencies. In future however, such teams are likely to become the normality rather than the exception. It will be important to avoid cutting off team members from their source of continuing expertise in their home units. A degree of matrix management will be inevitable. Similarly, it will be vital to ensure that these teams are supported by the right tools and information systems (such as Intranets), giving broad access to the Department's vast holdings of information.

Experience of project team working is now widely available in the private sector. Study is required as to how this might be applied in DTI, and Government more widely, to tackle the new challenges of critical issues arising from amorphous company structures and markets. Particular attention will need to be given to the development of personal action plans and to the process of performance evaluation within a matrix structure.

Making small business aware of the opportunities from electronic commerce

In Chapter four, under business to business services, the expectation that electronic commerce would have profound effects on small business was discussed. It will be vital for such UK businesses to:

- recognise the potential wave of intensified competition that e-commerce will unleash;
- have access to basic skills training to 'de-mystify' these new business approaches;
- be able to purchase (at reasonable cost) the basic e-commerce systems packages required; and
- have support through the difficult initial phase of changing their business practices to best exploit the new medium.

The aim must be to position UK small/medium business at the forefront of the adoption of electronic commerce with a good chance to be beneficiaries rather than victims.

There is a need to build on the rapport established through Business Links and the general awareness campaigns such as the 'Information Society' with specific demonstrations of the implications of e-commerce for small business on a sector by sector basis.

Government as an exemplar – ensuring we practice what we preach

Government has a unique leadership role and responsibility in exemplifying the benefits which can be gained from convergence in its own internal processes and external services. Quite exceptional improvements in both efficiency and quality of service may be possible, for example, in the National Health Service through the implementation of broadband networks and information systems allied to the necessary changes in training and working practices. On a more local level, the Department's significant difficulties in ensuring appropriate information flow across Command and Directorate boundaries should be greatly eased by the planned deployment of an intranet.

Emphasis should be given, as part of the 'Electronic Government' initiative, to the benefits not only within Central and Local Government of the convergence systems, but the opportunity to demonstrate these benefits to the private sector as a whole.

New institutions

As the process of contracting out continues apace – driven at least in part by the impact of convergence – it is likely that there will be an increasing number of individual contractors in the information economy. It also seems clear that many people crave the supporting frameworks of institutions. If the framework of the company is taken away, substitutes will be sought, thus new institutions are likely to be created. These institutions would meet the need for:

- training and continuous professional development;
- standard terms and conditions of contract;
- codes of conduct;
- norms for fees and charges;
- some degree of earnings protection or insurance; and
- indemnity insurance.

There are a range of candidates who might extend their scope to embrace this role, including:

- existing employment agencies;
- professional institutions;
- trade unions; and
- a renaissance of 'Guilds'.

The impact that this development will have on employment and the potential reaction of major companies warrants further study. (This area will be addressed in the Future Unit study on the role of self employment and portfolio working in the UK economy in ten years time).

A policy should be considered for the development of these new institutions and, if appropriate, support given as a necessary element of the evolving labour market.

6. POINTERS TO FUTURE CHANGE

The new knowledge-driven economy will make existing industries more efficient and productive. Many of the changes which will have a substantial impact on shaping companies and markets in ten years time will already be showing early signs today. This chapter marshals evidence to support the ten year implications of convergence highlighted in chapters five and six.

Manufacturing

Convergence is likely to have an impact at each stage of the manufacturing process, indeed it is already starting to do so....

Extranets – transforming supply chain management

As described in chapter four, extranets provide a potential 'double win' for manufacturers. They can greatly shorten the time required for product design or for order information to flow accurately through a supply chain of manufacturers, contractors, sub-contractors, and so on. At the same time they broaden the scope for effective competition at each level. A good example is the world-wide Automotive Network Exchange (ANX) system being developed collectively by the vehicle manufacturers and managed end to end by BellCore. Scheduled to be fully operational by the year 2000, the network will handle computer aided design (CAD) files, computer aided manufacturing (CAM) information, purchase orders, shipment details, electronic payments and a wide variety of other business information. Linking this to the demonstrated existing success of the Manufacturing Assembly Pilot (MAP), should lead to significant productivity improvements, with cost savings approaching £1bn for the global industry.

MAP results

- error rates reduced **72%**;
- on time shipments improved **6%**; and
- typical time for production schedules to flow from top to bottom of the supply chain cut from **six weeks** to **two weeks**

Source: US Department of Commerce

Extranets – broadening scope for competition at each stage

A good example of improving the efficiency of purchasing comes from the TPN Post extranet developed by the General Electric Information Systems Company (GEISCO). This was trialled in the US in 1996 by GE's lighting company. This organisation generates hundreds of purchase requests each day for relatively low value machined parts. The results of extranet purchasing against the previous people intensive system was:

- time to issue a request for quotation cut from seven days to two hours;
- number of competitive bids sought raised from two or three to essentially unlimited via internet posting;
- reconciliation of purchase orders and receipts greatly simplified (and largely automatic);
- purchased materials costs reduced by 20%; and
- purchasing labour costs reduced by 30%.

Extranets – reducing inventory held

Global networks bring the ability to match production much more closely to customer purchasing patterns, with a consequent reduction in the amount of stock held and a lower risk of having to dispose of surpluses at a discount. Electronic communication throughout the chain between the point of sale and production allows production planning to be fine tuned on a weekly or even daily basis.

The IBM Personal Systems Group illustrates how this can be achieved. They introduced their 'Advanced Planning System' (APS) in 1996. A monthly basic production schedule is reviewed weekly in the light of real sales results. The resulting changes are carried by intranet and extranet to re-balance or even relocate production across a range of factories as appropriate. In the year of introduction (1996) stock turnover improved 40% on a sales volume increase of 30%. The mature system is expected to improve stock turnover by a further 50% on sales growth of a further 20%.

Channels to market

Retail and the significance of brands

As highlighted in chapter four, electronic shopping will play a major role for that part of the population where time is at a premium. Strong indicators already exist in the US market. One example is Wal-Mart (a highly successful and profitable retail chain throughout the US with a strong reputation and brand trust). Wal-Mart has used the internet to expand beyond its traditional market. Freed from the cost constraints of floor space, its internet site provides a 'virtual store' with ten times the number of lines on sale that are stocked in its largest physical store. Simple and familiar metaphors are used with the customer moving a shopping trolley icon around the virtual store clicking on goods or services to examine them and dragging them into the trolley if they are to be purchased. Payment is by credit card at a 'virtual check out'. Delivery is typically via overnight parcel carriers.

A further example is the Cendant Corporation, already successful in the catalogue and telephone sales business, they are now also selling on the internet. Their business proposition is simply to link manufacturers and end consumers without holding any stock or retail premises. They are simply an advertising, marketing and order processing organisation. They offer over one million products and services from their current web site. These include cars, electronics, appliances, luggage, perfume, flowers, gifts,... This represents roughly 20% of an average family's total shopping needs. Sales closed over the internet in 1997 were $1.2bn. Cendant expect to cover 95% of the average family's shopping needs by the year 2000.

Cendant charge an annual subscription fee for their service ($69 at present) for access to their 'netMarket', whereas Wal-Mart offer free access to 'Walmart.com'.

US retail e-commerce figures

- 1996 – **$707M**
- 1997 – **$2.6Bn**
- 1998 – **$5.8Bn (est.)**

Market estimated at **$34-37Bn** by **2002**.

Source: Jupiter Communications

Challenges for record and book retailers

In only three years, the most well known internet-based book seller, Amazon.com, has grown to a business turning over $148m per annum; offering some 2.5 million book titles to customers in 150 countries; and offering discounts of up to 40%. By the end of 1997 more than 1.5 million customers had made purchases from Amazon. 58% of Amazon's orders are from repeat customers. Avoiding the cost of conventional retail space, the comparison between Amazon's cost structure and a typical conventional book store chain is fairly stark.

	Amazon.com	Retail Book Chain
Rent and depreciation as percentage of sales	4%	13%
Sales per operating employee	$300,000	$100,000
Stock turnover per year	20-40 times	2-2.5 times

In the music sector the two largest internet sites are 'N2K' and 'CDNow'. 'n2k.com' had revenues of $1.7m in 1996; revenue in 1997 is believed to have been around $10m. Like Amazon, N2K has put great effort into its on-line customer interface with sophisticated search and indexing tools. It has also assembled a major database of individual customers' purchases, interests and preferences, using this to send individual 'special offer' e-mails to each customer each month. Again an example of the central importance of customer preference information in electronic commerce.

Banks and building societies

The cost savings, open to banks and building societies through the deployment of internet-based electronic banking, are dramatic. Using the more developed US market as an example, the costs to the bank for a typical funds transfer operation, by a variety of means, are:

- in person through a teller at a branch – $1.07;
- by telephone to a call centre – $0.52;
- through an automated teller machine (ATM) – $0.27; and
- by internet – $0.01.

The incentive to promote internet access is very clear.

Similar economics apply to the more general bill issue and payment cycle. Microsoft has joined forces with First Data Corporation in the USA to pioneer electronic links between bill issuers and bill payers. The table below illustrates the expected cost savings.

	Paper based	On-line
Cost to bill issuer	$1.65 – $2.70	$0.60 – $1.00
Cost to customer	$0.42	$0.00
Cost to bank	$0.15 – $0.20	$0.05 – $0.10
Total/transaction	$2.22 – $3.32	$0.65 – $1.10
Potential saving	2 – 5 times	

Some 17 billion cheques are issued each year in the USA for bill payment, hence these savings could represent some $19bn to $46bn each year if electronic bill payment were fully implemented.

Intermediaries

Travel sector

A key area of growth within e-commerce in the USA is the travel sector. This growth is driven both by the dramatic reductions possible in transaction costs and by new opportunities flowing from the speed of access to customers enabled by the internet.

These new market opportunities include:

- Cyberfares – American Airlines has already pioneered offering, by internet e-mail, discounted leisure fares for the following weekend on routes where low advance reservations suggest that there will be unsold capacity;
- Auctioning – offering seats unsold the day before a flight to the highest bidder in a real-time electronic auction.

US travel industry internet data

On-line purchase of airline tickets: **1996 – $276M**; **1997 – $816M**; **2000 (est.) $5Bn**

By year 2000 **7%** of all US airline ticket revenue is predicted to come from INTERNET.

Costs (to airline) to process ticket purchases (per ticket issued):

- travel agent booking using existing reservation system – **$8.00;**
- travel agent books direct with airline – **$6.00;** and
- customer books electronic ticket direct with airline – **$1.00.**

These kinds of adaptive 'yield management' rely on the unique speed of contact and transaction available through converged systems.

Press and broadcasting

In the USA, content providers are very bullish about further internet growth. Organisations such as CNN and Disney see web sites as the way to leverage vast amounts of material available from their core business but not issued on the current media. All the major broadcasters in the USA and UK have their own web sites. The great success of the BBC On-line site in the UK is a good reflection of the general popularity. In the USA all 25 top daily newspapers have their own 'web businesses', often with searchable on-line archives. It must be acknowledged however that whilst revenues are growing at 50 to 200% per annum, costs continue to outstrip revenues and the vast majority of sites are not (yet) profitable. In the magazine field nearly 4000 titles world-wide are available on the internet. Print popularity is however not an accurate guide to internet popularity. The most popular titles on the internet are those which cover science, technology and entertainment.

7. CONCLUSIONS

The Future Unit selected this subject for its first report because of the opportunities offered by new information and communications technologies to make existing industries more efficient and enable the development of new products and services.

Against a backdrop of the three scenarios for the future developed by the Chatham House Forum, this report has highlighted the profound and rapid changes likely to flow from the convergence of information systems, telecommunications and broadcasting. The relatively gentle pace of change in commerce and society from convergence over the last twenty years must not be taken as a reliable guide for the future. The dramatic growth in the use of the commercial, global, internet in the last four years is acting as a catalyst for the transformation of many business and social processes. The global nature of these developments, across industrialised and industrialising economies, severely limits the power of individual governments to control or to forestall them.

This report has highlighted the key areas in which both government and industry must act if the UK is to ride this wave of change, extracting economic and social benefit, rather than being overwhelmed. There will need to be a programme of actions to:

- accelerate the diffusion of successful innovation throughout our economy;
- radically re-think regulation for the Information Age, moving power and responsibility progressively to the individual;
- ensure social inclusion, through a new definition of universal information services, available to all citizens; and
- respond pro-actively and flexibly to the needs of more amorphous and transient companies and markets.

If the UK can empower its citizens to take direct responsibility for their own preference information, making this broadly available, it could make UK consumers the most demanding in the world. This would have a profound impact in stimulating excellence in both existing and new business and help to establish the UK at the forefront of the global knowledge-driven economy.

APPENDICES

Appendix One Summary of proposals for Government

Speeding the general adoption of successful innovation

1. There is a need for a major programme of activities to promote early, general adoption of successful innovation.
2. Further work is required to establish how resources to support 'early adoption' could be most effectively targeted.

Access to customer preference data

3. A public consensus should be developed on the use (and abuse) of customer information. The Data Protection Registrar and trade associations should have important roles in this work.

Promoting social inclusion

4. A debate should be initiated across Government to determine how the new 'universal service' of access to internet based services should be developed, managed and funded.

Will the UK approach to protecting intellectual property need to change?

5. Early progress will be required, both to communicate what is already possible and to seek any necessary improvements in the intellectual property rights framework, to ensure that knowledge based companies do not desert the UK for jurisdictions offering stronger protection.

Can copyright be maintained in the digital age?

6. Current UK and EC legislation needs to be updated to establish legal sanctions against removal of, or tampering with, electronic identifiers, such as digital watermarks, as required by the new WIPO Treaties of December 1996. This is subject to conclusion of the new EC Copyright Directive, and early agreement on this should therefore be pursued as a matter of priority.
7. Increasingly, copyright material may need to be licensed on a global basis, and new international treaties making it easier to apply and enforce copyright protection, wherever material originates, should therefore be brought into force as quickly as possible.

Whither content regulation in a converged world?

8. There is a need for a programme of work to develop and trial, simple to use, content filters, applicable to all electronic media.

Relating to changing markets and structures

9. A programme of work will need to be developed to encourage flexibility and mobility in the labour market. (There are a range of specific actions which would be supportive including improving pensions and benefits transferability and further improvements in access to training).

More pro-active competition regulation?

10. A Departmental team should consider whether 'market maps' should be developed by the market participants in particular areas, in order to provide assistance in the consideration of competition issues.

The amorphous market

11. Experience of project team working is now widely available in the private sector. Study is required as to how this might be applied in DTI, and Government more widely, to tackle the new challenges of critical issues arising from amorphous company structures and markets. (Particular attention will need to be given to the development of personal action plans and to the process of performance evaluation within a matrix structure).

Making small business aware of the opportunities from electronic commerce

12. There is a need to build on the rapport established through Business Links and the general awareness campaigns such as the 'Information Society' with specific demonstrations of the implications of e-commerce for small business on a sector by sector basis.

Government as an exemplar – ensuring we practice what we preach

13. Emphasis should be given, as part of the 'Electronic Government' initiative, to the benefits not only within Central and Local Government of the convergence systems, but the opportunity to demonstrate these benefits to the private sector as a whole.

New institutions

14. A policy should be considered for the development of these new institutions and, if appropriate, support given as a necessary element of the evolving labour market.

Appendix Two – Interview Lists

Secondary research interviews

Interviews were carried out with the following people and organisations during the information gathering phase of this project.

Organisation	Contact	Role
AIRTO	Mr Brian Blunden	Director General
Analysys	Dr. David Cleevely	Managing Director
Aztec International	Dr. Colin Bell	Managing Director
Business in the Community	Mr David Grayson	Director
National Physical Laboratory	Dr R Whelan	Director
Demos	Dr. Ian Christie	Deputy Director
Durham University Business School	Dr. Ted Fuller	Head, Small Bus. Forum
Economic & Social Res. Council	Prof. Ron Amann	Chief Executive
Engineering Employers Federation	Mr Graham Mackenzie	Director General
Federation of the Electronics Inds.	Mr Anthony Parish	Director General
Industrial Society	Ms Jo Gardiner	2020 Vision Prog. Head
Kent University	Prof. Richard Scase	
National Economic Research Associates	Dr. Phillipa Marks	
OST-Foresight	Mr Stephen Spivey	Director
Royal Institute of International Affairs	Oliver Sparrow	Director
RSA 'Redefining Work'	Mrs Valerie Bayliss	Consultant

Primary research interviews – USA

Interviews were carried out in the United States with the following people and organisations to test the hypotheses developed from the research phase of the project.

Organisation	Contact	Role
Cambridge Strategic Management Group	Dr John Krzywicki	Chief Executive Officer
Harvard Business School	Prof Jeffrey Rayport	Assoc. Prof. Business Admin.
Federal Communications Commission	Mr Robert Pepper	Chief – Office of Plans & Policy
Federal Communications Commission	Mr Elliot Maxwell	Dep. Chief – Plans & Policy

Primary research interviews – UK

Interviews were carried out in the UK with the following people and organisations to test the hypotheses developed from the research phase of the project

Organisation	Contact	Role
British Music Rights	Mr Mark Isherwood	Director
BT	Prof. Graham Davies	Manager Res. Projs.
Centre for Study of Financial Innovation	Mr Andrew Hilton	Director
ESRC Virtual Society	Geoff Robinson	Chairman Virtual Soc. Prog.
ESRC Virtual Society	Prof. Steve Woolgar	Director Virtual Soc. Prog.
Hong Kong & Shanghai Bank	Mr John Yeomans	
IBM	Mr Chris Frost	Project Director
Innovation Unit Secondee	Mr Bob Duncan	Consultant
Independent Television Commission	Mr Gary Tonge	Director
Manchester Business School	Prof Peter Swann	
Nottingham University	Prof David Knights	School of Mgmt. & Finance
Patent Office	Mr Jonathan Startup	Director – Copyright
QuickAddress Ltd	Mr Simon Worth	Managing Director
Royal Mail	Mr J Cotton Betteridge	Strategic Marketing Director

In addition to those above, the Future Unit appreciates the help and guidance received from colleagues inside the Competitiveness Unit, as well as other DTI colleagues, most notably:

Richard King CII1,
David Coates ESU,
Paul Salvidge CACP,
Alistair Keddie IU,
Mike Coolican EFM,
Michael Hodson TS, and
Chris Thresh URT.

Appendix Three – References

[1] UK Government Green Paper 'Regulating communications: approaching convergence in the Information Age' published by HMSO on 21 July 1998. Available on internet at http://www.dti.gov.uk/converg

[2] US Department of Commerce report 'The Emerging Digital Economy' published April 1998. Available on internet at http://www.ecommerce.gov

[3] Studies on Internet adoption carried out by Cambridge Strategic Management Group, 1 Memorial Drive, Cambridge, Massachusetts.

[4] Report 'Unsettled Times – Three stony pathways to the Future', published by the Royal Institute of International Affairs – Chatham House Forum, 1996.

[5] Report 'Navigating Uncharted Waters', published by the Royal Institute of International Affairs – Chatham House Forum, 1997.

[6] Analysis complied by John Harper of independent consultants Seaford Head Advisors.

[7] Command Paper 3887, from the Department of Culture, Media and Sport, "New Library: The People's Network", available on internet at http://www.culture.gov.uk/new.library.htm

Printed in the UK on recycled paper with a minimum HMSO score of 25.
October 1998. Department of Trade and Industry. http://www.dti.gov.uk/