THE IMPACT OF DIGITAL INFORMATION ON SOCIETY?

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Abstract

Predicting the future is a dangerous occupation. While information technology has moved faster, and had more effect, than many other technologies which predated it, the impact has been largely, so far, on business and to a lesser extent the home. Will it effect changes in society? If so, how and when?

In this paper we look for early indicators of such changes, and suggest ways in which the changes may evolve. We conclude that early indicators suggest that society is already changing in ways which are linked to the use of digital information.

Introduction

The Software 2000 Workshop touched on a number of issues relating to the interface between Information Technology and Society. The tenor of these comments can be judged by the heading which appeared in the Report (1): "The vulnerability of Society to IT". It is certainly true that society does become vulnerable to failures of IT systems as they become pervasive - examples given in the Report included the A320 Airbus fly-by-wire system and the Vincennes disaster.

Society may also change in more fundamental ways as digital information systems become pervasive. In this paper we look for early indicators of these changes, and suggest ways in which society may develop, with technology as one of the enablers.

Why expect that digital information could have an effect on society?

Predicting the impact of technology on society seems to be at least as difficult as any other form of prediction. Herman Kahn published "The Year 2000" in 1967 (2) as referenced in (3). He included a list of "One Hundred Technical Innovations Very Likely in the last Third of the Twentieth Century". The dramatic developments ranged from artificial moons for illuminating large areas at night, permanent inhabited undersea colonies, inexpensive colour and photography reproduction (perhaps for home as well as office use), and many other things. Most of these have not happened..

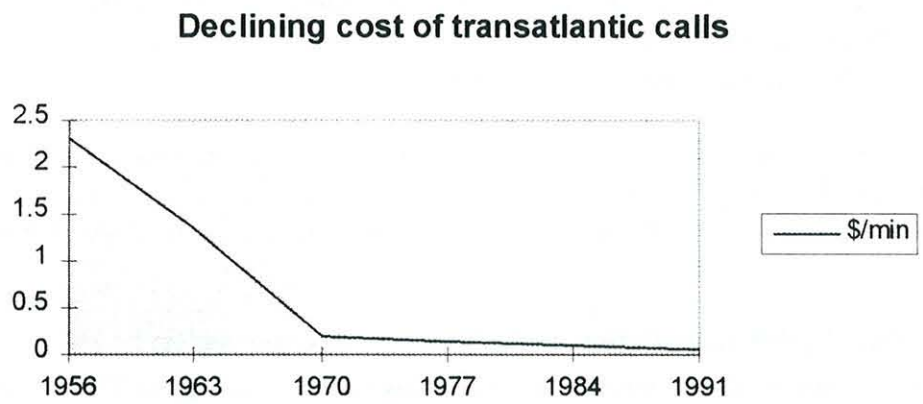
Two which have happened both relate to digital information, viz. "the pervasive business use of computers" and "personal "pagers" (perhaps even two way pocket phones)".

Why did these two technical innovations become ubiquitous while most of the others did not? Maybe looking at the evolution of some older technology can help.

Consider the telephone. (This discussion is taken from a paper by Sterling in (4)). It is difficult to imagine the fear it induced when first shown on the music halls, with sound transmitted from another building. The initial commercial idea was that telephones at a central source would transmit music and sermons to a paying network of wired up suppliers.(Of course, until there was a critical mass there was nobody to phone, so the early uses seen were essentially supporting remote broadcasting). It was only when a train accident in Boston was attended by doctors summoned by the telephone, that the phone was seen to have uses for ad-hoc communication.

It was this human aspect of the phone that distinguished it from the telegraph which was already in wide use: and the distinction was extended in the US from early days by having lady operators to make the connection, further demystifying the technology and marking the difference from telegraph boys. In Europe, the telephone was for much longer as a replacement for telegrams. In many houses in Europe, even in the 1950's, the phone was in the hall, perhaps symbolically as the place where bad news came, like the telegram?

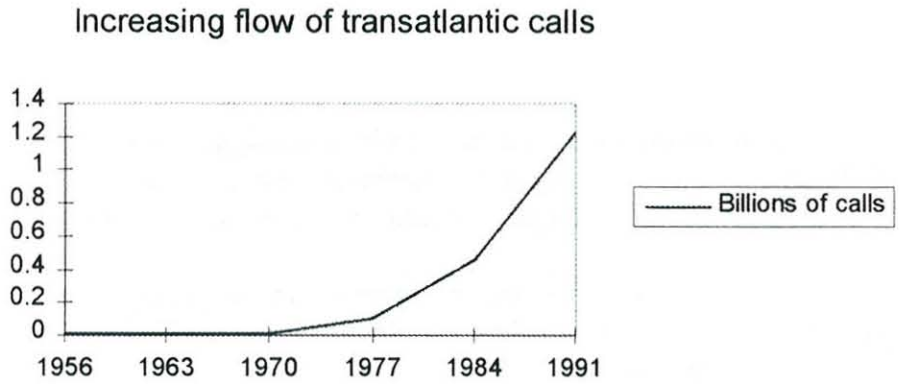
Figure 1



One other significant aspect which has caused major behaviour differences between the US and Europe in the use of telephony is surely that local calls have, for several generations, been free in the US. In Europe this has not in general been the case.

The effect of price on transatlantic telephone traffic is illustrated in Figure 1 and Figure 2, where once the price had reduced, the traffic started to build up. (These slides are taken from a talk by Saffo in (5)).

Figure 2



The linkage of price and volume is rarely so convincingly demonstrated!

The history of the telephone would seem to suggest two indicators for success of an innovation. They also apply to the two "successful" innovations in Herman Kahn's list:

* price/performance decrease so that accessible to a mass market

* visible benefits at each stage of the evolution of the use of the technology (but maybe to different groups at different stages)

The explosion of the Internet would suggest that the development of telephone networks for voice is likely to be paralleled if not exceeded by the development of networks for data. Already, more than 70% of the traffic across the Pacific between the US and Japan is FAX rather the voice traffic - while the language and time zone differences clearly both serve to emphasise this form of information transfer, it also suggests that the hurdles to electronic documents are being overcome.

However, even as different patterns of usage of the telephone emerged in the US and Europe, so have differences in the way that PCs are used. The penetration of PCs into industry and the home is higher in the US than Europe: the number of PCs connected via a FAX or modem is smaller still. This has been discussed in the parallel paper (19): the impact of this on the IT literacy of decision makers in Europe is a topic picked up again later.

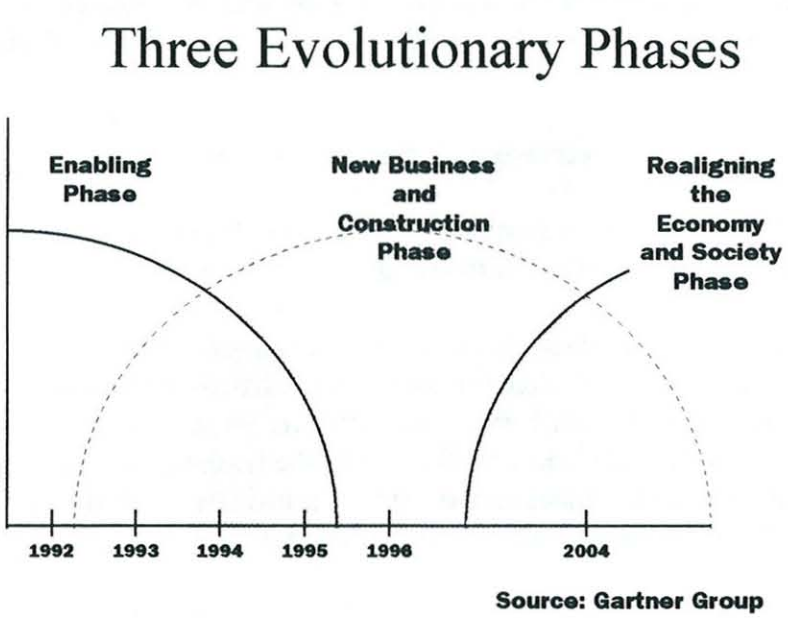
Factors influencing the next decade

Over the last several decades, the technology drivers have been the increase in processing power and decrease in price following Moore's law. This looks set to continue for the next decade, with sufficient processing power for "most" applications being available on the desk or set-top. This has facilitated the invasion of digital information into many areas of business, so that for instance packaged software shipments over the last five years in the G7 countries track parallel to GDP figures.

Also, the level of expenditure on digital information is a significant enough proportion of GDP that a range of political, economic and social factors need to be considered in assessing the use of digital information and its effect on society.

Rather than diverting to look at these factors, in this paper let us concentrate on the effect of the bandwidth explosion. This is likely to dominate the next decade in the same way that processing power on the desk has dominated the last decade, see for instance (6).

Figure 3



The companion paper, on "The Future of the Software Industry", discussed the effect of the "collision of industries" in creating new businesses. Figure 3 shows a Gartner Group view of how these new businesses and groupings start to effect the economy and society. (7)

The diagram is possibly over-simplistic - and assumes that there will indeed be a realignment of society and the economy - but does usefully suggest that we should be able to see some early indicators now if a realignment is likely to happen.

In the next sections we look at the indicators and predictions for nations and governments, for cities and towns, for individuals, and for education.

Nations and Governments

Consider three aspects of a nation and government: its ability to tax and to spend, its ability to maintain a national culture, and its representation or government system e.g. Parliament.

Consider first expenditure by the state. The twentieth century state has been anomalous - it has been able to collect in taxes of various sorts up to 50% of a nation's GDP to spend on war and welfare. This compares with the historical level of 10%.

It is predicted that digital information over the network will end this anomaly, by allowing tax revenues to vanish into cyberspace (see for instance (8)). Can we see any early indicators of this?

Yes: in Japan yuppies are starting to buy by credit card direct from the US because prices of many goods are significantly less than those in Japan. The taxes payable on retail transactions are lost to the Japanese economy. It is becoming acceptable for Japanese to use US banks for investment transactions particularly, using an 800 number, since Japanese banks mostly open only from 9am to 3pm.

Similarly, some white collar skilled jobs are moving out of the Europe and North America, using the network to link designers and engineers to the production plants, other team members or customers. So for instance Eastern European engineers are designing power stations in all parts of the world, and teams of software engineers spread across all three time zones speed up software implementation. This changes the tax base of governments.

We are also seeing the power of governments to limit the access of the nationals at home to material at odds with their cultural mores - so University students in Arab countries can access pornography over the Internet, and it is difficult for governments to intervene without draconian measures.

In the US, government is concerned to protect the value of American IPR and copyright of software, films and tapes. The experience of being offered leading PC software for $4 (2 disks) or $6 (3 disks) will be common to many travellers to the Far East. The importance attached to the current discussions with China highlight the weight that the protection of IPR has in the electronic society. The problems today are mostly being discussed in relation to stored media - discs and CDROMs. They become even harder to police when information is networked: and the existence of "Panamanian" databases (with a level of certification to rival Panamanian fleets) is a nightmare that many share.

Another change seen in many developed countries is a shift in balance of power to pressure groups - often using electronic communication to mobilise forces - from the

traditional elected representatives, who's existence and mode of operation is largely based on the communication capability available in the last century. Pressure groups also use the media for publicity - for instance the recent Greenpeace activities in the North Sea and the Pacific. It is not clear how democracies will change - clearly the "everybody plebiscited on everything electronically" school is unrealistic - not to say a recipe for boredom - but changes certainly seem indicated over the next decades.

Cities and Towns

Our cities and towns have been largely shaped by the railways and roads which have been used to transport people for work and leisure activities, and goods for manufacture or distribution. Are there signs of change in the shape of towns to reflect digital information?

One analogy (borrowed from reference 9) is the "Parable of the Pizza Parlor". Pizza Parlors were originally set up on Main Street, with advertising out front, counters for customers to place orders and pay, kitchens where pizzas were cooked, and eating space with tables, seats, maybe a jukebox or cigarette machine, or a notice board for "for sale" and "wanted" advertisements . All of these were in the same small space.

The automobile produced a different configuration. The Pizza Parlor was often part of a chain, it was by a highway, and it had parking. Many customers took their pizza away to eat, and often ordered by telephone for their order to be ready for pick up at a particular time. The logistics system behind pizza delivery got more complex as the skills of part-time workers replaced the "family" and the pizzas were sent semi-assembled to the outlet.

How will the Pizza Parlor look in the networked environment? Early experience suggests that the street address becomes a net address, and the counter becomes a screen display that allows a customer to design a pizza and pay for it. The kitchen becomes the nearest food preparation centre to facilitate delivery by radio controlled vehicle. The advertising is not at the kitchen - it is on the network or in Yellow Pages listings or advertising.

The new set-up gives the customer fast, reliable pizzas. It doesn't provide conversation, or the opportunities that the pizza Parlor provided to read the want-ads, hear the latest hit records, get some cigarettes or catch up on the community gossip.

This trivial example illustrates a more general trend, well discussed in the OST Technology Foresight Programme's Retail Report (10). It can be speculated that similar effects may be seen in other areas of daily life.

It is speculated that distance learning and telemedecine may replace travel to the school or hospital or doctors surgery. Increasing numbers of white collar professionals are already homeworkers- on a "most or some days" basis. PICT (The Programme on Information and Communication Technologies) run by the Social Science Research Council has published a number of studies on these and related areas - see for instance reference 11.

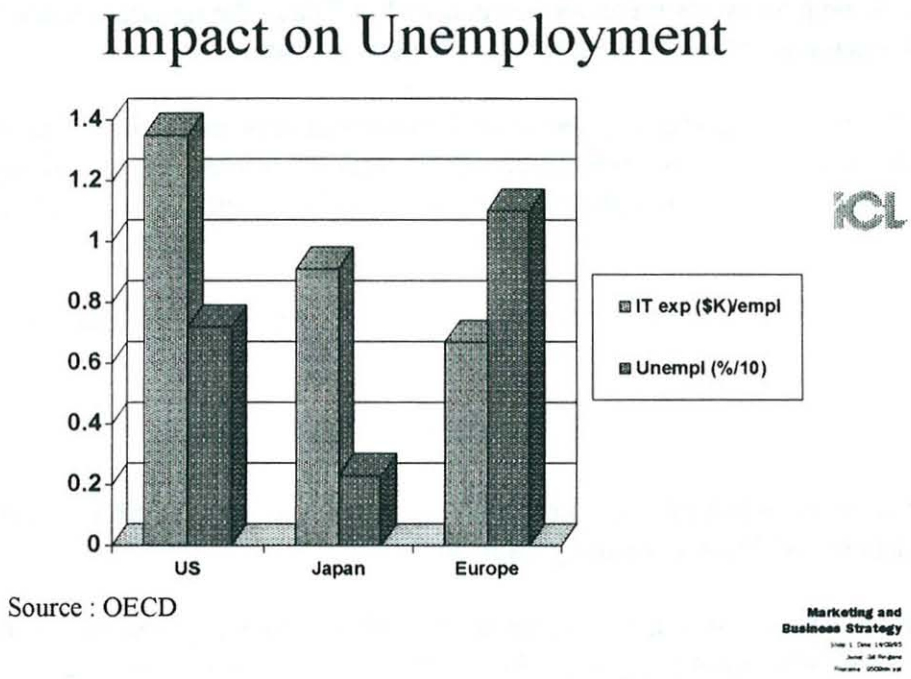
The combination of these indicators and speculations suggest that cities and towns could be transformed over the next 30 years in reaction to the changes in retailing, leisure and work. It suggests that more space will be needed in the home as it has to accommodate more activities. And the need for meeting places - perhaps with restaurants, health and leisure clubs - will be strong in the business and community worlds.

Cities will not disappear but their functions and roles may well change.

The Individual

The impact of digital technology on the Individual is widely thought to be as in the cartoon which shows a man arriving home and saying "Well, the new technology has made it possible for me to work at home full-time - I've been laid off". Technology is certainly destroying millions of jobs, and Rifkin for instance (12) predicts that within the next century the world's rich economies will have no need of workers.

Figure 4



Source : OECD

Is this fear justified? Are there any indicators of technology creating jobs? In what timescale and what sort of jobs?

There is some anecdotal evidence that, in an economy as a whole, investment in IT does not cause unemployment. Figure 4 shows the investment in IT per worker and the unemployment rate for the US, Japan and Europe in 1993. The US's low unemployment rate compared with that in Europe contrasts with its higher expenditure per worker on IT. Similarly Japan has more robots per worker than US

or Europe and a lower unemployment rate. It is not a persuasive argument for reducing investment in IT.

So the question becomes: since IT does remove jobs in many categories, what are the areas in which new jobs may be created in the US if not in Europe? The categories of computer systems analysts and programmers and home-health workers lead the growth league table for 1992-2005. Education and training is projected to increase, as are services like travel. Overall the OECD have concluded that the demand-boosting effects have more than offset the job destroying effects in countries which have undergone structural change (13).

Some jobs thought of as white collar may turn out to be easy to "computerise" - Klugman (14) cites lawyers and accountants as professions which may change dramatically, whereas professions such as gardening , he speculates, may change less.

Away from employment, the effect of IT on the individual is clearly to increase choice for those who have access to it. One anecdotal example: a group of hotel keepers in the Maldives (a chain of islands in the Indian Oceans where phones were mainly unavailable 10 years ago) noticed in November 1994 that they were nearly empty in early December. Using FAX they contacted a travel agent who booked a plane and put a special offer of ten days in the Maldives up on Teletext in the UK. Within 2 days the plane seats were booked and within 7 days the tourists were in the Maldives at a price which was about 30% of the normal price..

The effect of increased choice is reflected in the Japanese yuppies buying from US rather than Japanese outlets, in book purchases through the Internet, in the existence of a quilting user group on the network. These may all be thought of as middle class interests.

Are there any indicators that the technology may be used to decrease the gaps in society between the haves and have not's?

Education

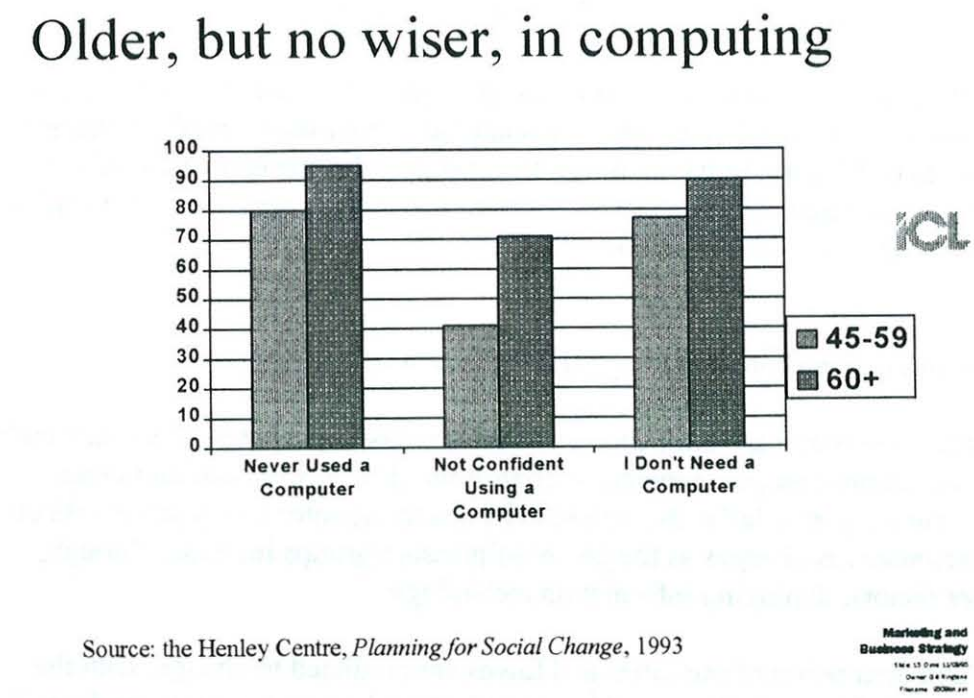
One place to look is education - are there any signs that access to digital information technology can be used to reduce the gaps in society?

One experiment which suggests that it can is based in the inner city area of South Bristol. A set of Cyberskills Workshops have attracted over 4000 people. Each attendee gets hands on experience of Internet, multi-media, commercial information services, library services. The Cyberskills trainers were recruited from the unemployed - some have also set up businesses. The age range has been from children to grandparents: the hands-on approach seems to work to reduce gaps in society. One graduate of the Workshops is even doing a degree in Russian at Moscow University over the Internet .

The hands-on approach is maybe the way to change the attitude to IT among the over 45's - who of course are most of our decision makers in politics, government and

business. Figure 5 shows the results of a poll conducted in Britain in 1993 (16): it shows that among the over 45's, information technology is not only largely viewed as a black box but it is not even viewed as a potentially useful black box.

Figure 5



Source: the Henley Centre, *Planning for Social Change*, 1993

Marketing and Business Strategy

These attitudes are different from those of children as reported in (17), which found that over 60% of children over the age of 5 had used a games computer/console, and nearly 50% of teenagers.

We in ICL have noticed that among our customers and employees that there seems to be a bow-wave of people under the age of the mid 30's in the UK who understand IT and expect to deploy it. Colleagues in the US report a similar phenomenon, but the age is higher - maybe 45. In Japan the age seems to be lower - possibly in the 20's. Is the only way in which society will be able to re-align to deploy IT, for it to wait for those who have not grown up with it to move on from positions of power?

There are some indicators that using technology to increase the human literacy of computers is effective in first time users of all ages and attitudes. One example is a database front end which is used by the Scottish Prison Service to support the warders in entering and updating data about prisoners. The front end is populated by cartoon characters (a prison officer, a manager and a lady officer) who guide the officers through the sequences of screens and appear on the screen for briefings, speaking with a Scottish accent. This system has been successful by any measure, with officers of all ages using the system on a daily basis.

Other examples of the technology being used in blue collar environments are in applications in aerospace maintenance, car repair and electricity plant work, where

virtual reality or computer images are used to guide engineers through the correct procedure - this was discussed recently in (18).

The spread of systems which are human literate rather than requiring an extensive use of its internals before using it must be the way in which IT literacy is increased. The training methods also need to be thought through. Too often we do not separate out the user needs from the maintenance or enthusiasts needs from IT.

The analogy is with a nervous new learner driver. If the first lesson takes him around the block safely, he is more likely to progress later to "under the bonnet". There are many examples of IT training taking the opposite approach - the equivalent of the first driving lesson being, not on driving, but from a mechanic who wanted to explain the delights of the four cylinder diesel engine.

Summary

There do seem to be indicators that digital information will change society.

The ability of nations and governments to collect taxes is impacted by electronic cash. The ability of nations and governments to control the flow of information to their citizens is reduced. particularly through television and the Internet. And the role of elected representatives changes as the power of pressure groups increases through, among other factors, deploying information technology.

The shape and orientation of our cities and towns are predicted to change, with the impact of information technology and bandwidth changing work routines and retail routines. The separate need for socialising is expected to be met by a number of different environments for electronic and personal interactions.

The impact of information technology has been to eliminate millions of jobs: in the countries where new jobs have been created this has been associated with structural change - new industries replacing old.

For the individual, the difference between access to digital information is significant. The role of technology - e.g. through multi-media- must be to reduce barriers to access.

So, overall the answer is that, yes, digital information is expected to have wide ranging impacts on society. The timescale may well be sooner in the US and later in Europe, reflecting the higher levels of exposure to digital information and the network in the US in relation to Europe.

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