THE SOFTWARE INDUSTRY BEYOND 2000

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Abstract

This paper looks at the environment for software and the trends driving the information industry. It explores the effect of these on two, very different, industries - both referred to as the software industry. One is the software products industry, the other is the services industry based on systems integration/custom software.

The paper investigates "mature industry" paradigms for these two types of business, and discusses the influences which will shape them beyond year 2000.

Introduction

The Software 2000 Workshop (1) discussed the forces at work on the software industry. This paper builds on that discussion by looking - with more evidence than was available during the workshop - at

the environment for software,

trends in the information industry over the next decade

the differences between the software product industry and the software services (systems integration/custom software) industry

the mature industry paradigms for these industries.

The environment for software

Software was, until a few years ago, primarily found in business environments under the aegis of corporate professionals. In this corporate environment, information technology has been in use for several decades. An infrastructure has been built which dealt with the business as it was: often it has difficulty evolving to met new business needs. Networks have been installed which may not have the capacity to transmit image inside or between buildings, and applications for many line of business applications have been in place for 20 years or more, through generations of hardware upgrade.

Forces on the Enterprise

Forces from outside the enterprise pressing for change include

> the dependence on IT for mission critical activities (eg the London Ambulance Service as quoted in (5))
>
> the corollary that IT is no longer a special case commercially: suppliers of software which does not perform are being sued by the customer
>
> new attitudes to liability, warranty and insurance - Lloyd's Register is to offer a Software Conformance Assessment to help buyers confirm the quality of software - but will not offer insurance (6)
>
> suppliers are looking to reduce the risk eg Microsoft licensing 400,000 beta test users for Windows 95.
>
> customers are looking to reduce the risk by evolutionary implementations, by pilot projects, by using semi-custom systems, and by commercially sharing the risk and rewards of a system with suppliers. New systems are increasingly outsourced, as IT departments reduce in size.

The drive to connect to the outside world, while maintaining information security, is a concern. The cost of increased bandwidth and storage for multi-media is difficult to justify. The lack of payoff from previous implementations may instil a "it doesn't work" attitude. And, in Europe, few senior managers over the age of 45 have direct experience of using information technology (see for instance (7)).

The pace of change has been so rapid over the last ten years that corporate IT is finding it difficult to cope. Many factors in the corporate environment combine to slow the rate of innovation possible in corporations, as new applications need to co-exist with the existing structure, and people's skills need to be upgraded.

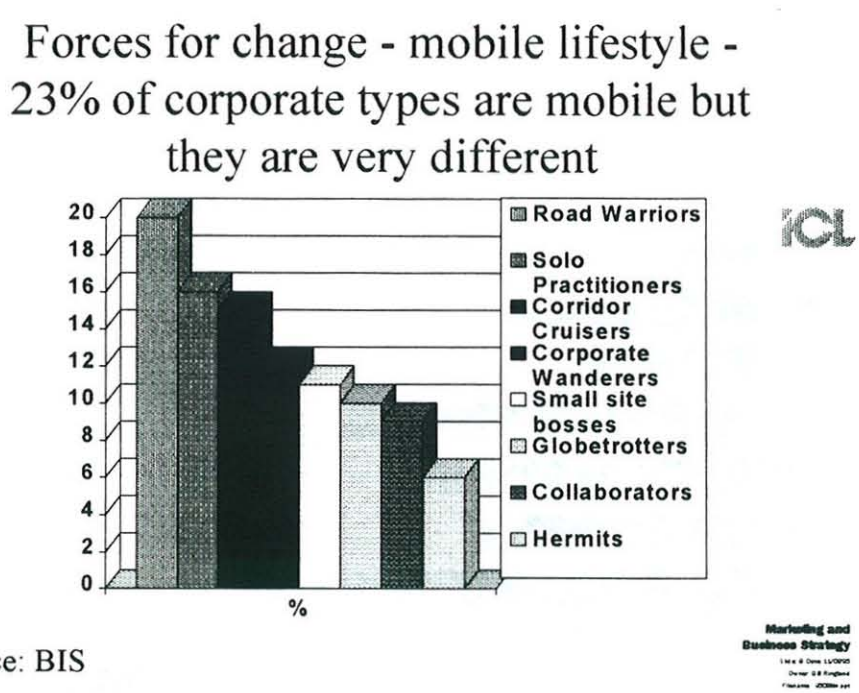
Effects of the semoconductor revolution

Among the effects of the semiconductor revolution of the last ten years have been

> the increase in the use of programmable semiconductor technology in embedded systems. A parallel paper (2) at this conference has looked at software which is embedded in consumer devices.
>
> the increase in the use of information technology away from the desk - with PC's and mobiles used in the home and for leisure and laptops and PDAs used away from the desk in business.

Figure 1 shows the range of types found among the 23% of corporate workers who are mobile (from reference 3)

Figure 1



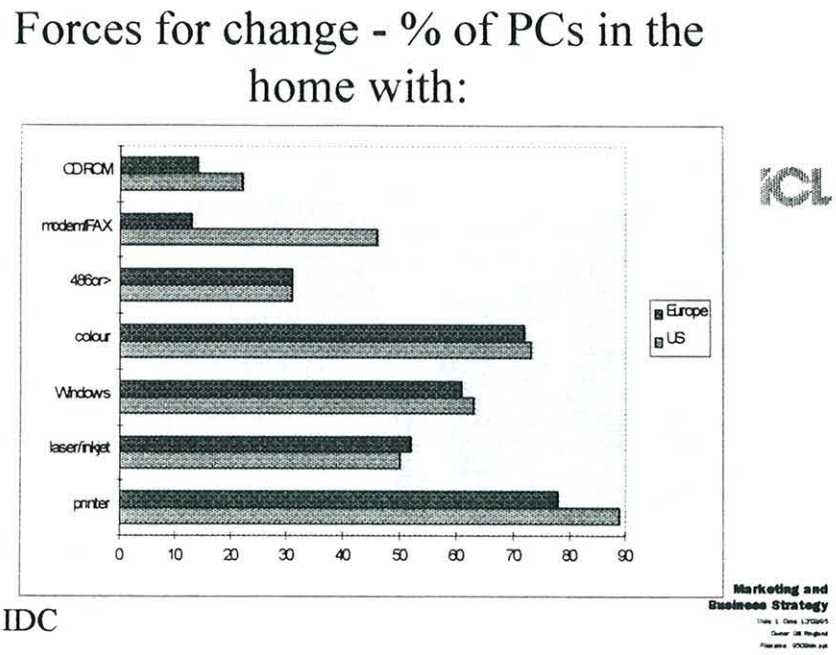
Source: BIS

Not all of the mobile types are the salesmen on the road: increasingly they are corporate specialists, or managers who manage by walking around. Small site bosses need to be accessible to customers, suppliers and the rest of the enterprise, while running the business, and globetrotters include some of the technology people. The increasing number of strategic alliances and joint bids cause off site teams of collaborations to be set up, and hermits include the person maintaining the twenty year old legacy system.

Many of these mobile users may also have a PC at home. Other users of PCs at home include the increasing number of consultants, marketing people, personnel and recruitment specialists, who work from home. Only 10% of homes in Europe have PCs, compared with nearly 30% in the US. But these PCs are significant machines, not toys - Figure 2 from IDC (4) compares the configurations in the US and Europe. The configurations are remarkably similar with one exception- the much lower proportion of PC's in Europe that have a FAX or modem. (The Minitel population in France is not included in these statistics).

With these pressures on corporate IT, and the swing to intelligence in Pcs, mobiles and embedded systems outside the corporation, the information industry is undergoing major changes. n the next section we consider some of these changes before considering the influences on the software industry beyond 2000.

Figure 2



Source: IDC

The Information Industry beyond 2000

The digital information industry beyond the year 2000 will be influenced by a number of technology trends.

Processing power will continue to increase in line with Moore's law for another decade or so. Innovations using the increase in processing power are expected to proliferate over the next decade - virtual reality and semi-realistic interfaces , voice recognition and language translation are expected to be a major growth areas.

Power usage will reduce as will the reduction in size of processing and memory components. But batteries will not be obsolete yet!

Information is inherently multi-media: within the next decade enough people will have the processing power and displays to exploit digital forms of multi-media.

The semiconductor content of electronics devices - including PC's - will increase as a percentage of the total - from 7% in 1985 to 26% in 2000 according to Dataquest (8). This will further increase the embedded software content of network controllers, servers, PC's, printers, intelligent disk drives, monitors and other digital information components.

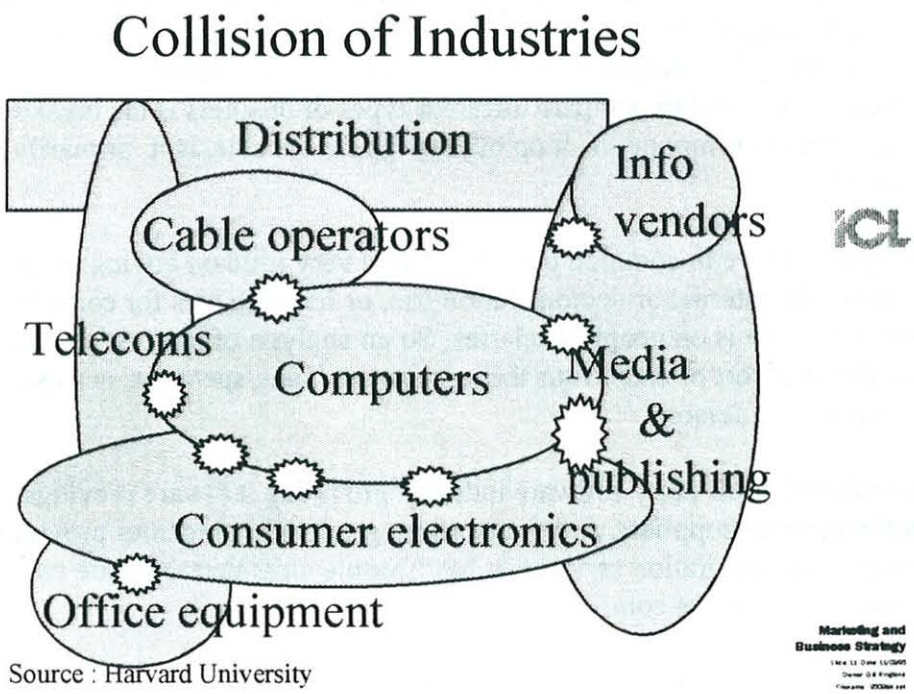
The industry will continue to evolve, with more functionality each year becoming commodity and new sources of value sought by the suppliers.

The major trend, probably dwarfing all of these in it's effect, is the explosion of bandwidth. This has two dimensions: an increase in the number of people who use electronic information "from the network"; and the increase in the width of connections. The impact of this on computer architectures, which have been designed to primarily to process and secondarily to handle input and output, will be dramatic. The speed of liberalisation and deregulation, allowing a competitive environment for the technology to be delivered, is an issue for us in Europe.

The likely impact of these trends on the extended information industry was captured by Harvard University in a famous chart, a modified version of which is shown in Figure 3. It has the title "Collision of Industries" rather than "Convergence " as in the original, because we see an enormous amount of commercial activity to create new businesses taking place in the explosions at the interfaces between existing industries.

The size of these markets in Europe was estimated in (9): the computers market is estimated at $100BN in 1993: by comparison, electronic commerce is estimated to be a $50BN market by 2005, and electronic publishing $30BN (10). These markets start to rival the computer market by the end of the decade - what impact does this have on software?

Figure 3



Source : Harvard University

Inside the computers sector of this enlarged information industry, there has been major restructuring during the last decade. Replacing the vertically integrated companies who supplied their own hardware, software and services - IBM, DEC, Unisys - are a set of companies who tend to specialise in parts of the total system offering. Intel and Motorola offer processors and memory; Compaq, IBM, Fujitsu and

Hewlett Packard offer systems; Microsoft, Novell and CA offer operating systems, networking and groupware; SAP and Adobe offer applications, CSC, CAP, ICL, Andersen offer integration services; EDS, Bell Atlantic, Capita, ICL Sorbus supply operational services. The rise of third party software companies, and services companies, has been heady over the last decade, creating companies with billion dollar turnover. What is the effect of this on the customer?

Who buys the computer system now and from whom? It was the IT department in the enterprise: now its sometimes the IT department, sometimes a department manager, sometimes the Board, sometimes individuals, sometimes a services company. This change has a major impact on the software industry - we will come back to it.

Among the sectors of the enlarged information industry, where will the lead come from in the next decade? Will it come from a sector shown on Figure 3? Or will new sectors grow up? IDC speculate (see for instance reference 11) that, over the next decade the industry will evolve under push from network suppliers, companies who supply media servers, suppliers of information security, and the wireless and cable service suppliers. What would be the effect of this on software companies?

Software Product and Custom Software/Systems Integration industries

What is a software company? Companies can be characterised in many ways - for instance by size, by key skills, by portfolio of products or services, by source of competitive advantage. One way of capturing a common representation of a company which can be used to compare different types of business is the breakdown of where they spend their money - is it on buying goods for sale, is it primarily on people's salaries.?

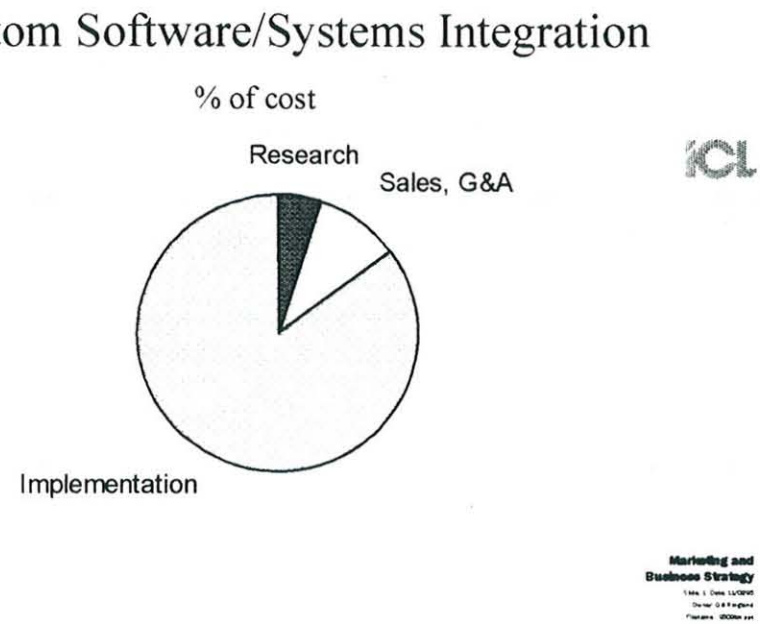
Software companies have in common that they spend very little on buying in good - maybe equipment for internal or demonstration use, or livcense fees for components. Most of the expenditure is on people's salaries. So an analysis of the cost structure, and in particular what sort of endeavour the salaries are being spent for, is a useful tool for comparing businesses.

Since the growth of a third party software industry providing software previously provided by the systems suppliers, and the increasing role of companies providing software and systems integration services, it has become clear that there are two types of company called a software company.

Custom Software / Systems Integration companies

Figure 4 represents the percentage of cost going towards research and development, sales/marketing and administration, and implementation, in a custom software/systems integration company. The implementation costs dominate, and the skills of the implementors range from project and risk management, customer relations, through to design and system building.

Figure 4



Some characteristics of custom software are

a long lifecycle - many systems are in use twenty years after they first went live;

the importance of ergonomics in its widest sense - with many system failures due to unexpected usage from unfamiliar users (the London Ambulance system);

maintenance and enhancement costs swamp initial implementation costs;

emphasis on reducing cost and risk of initial implementation from many customers.

An analogy which is often used for systems integration is the construction business, with its structure of prime contractors, sub-contractors, and consulting engineers. The analogy is useful in that it allows us to identify crucial skills - eg contract management for prime contractors - and the role of specialist sub-contractors - eg comms or retail systems specialists. It also differentiates large companies - who are often prime contractors "big enough to be sued" - and the smaller specialised sub-contractors.

From the discussion above, the influences which could contribute to the shape of the industry beyond 2000 could include:

a changed commercial environment, with customers and suppliers seeking to reduce initial risk through building and installing systems incrementally, using standard components or semi-custom systems, and parallel running;

the influence of service operator companies - network services suppliers or internal IT operational services suppliers - acting as prime contractor for customer systems. Their emphasis could shift to maintainability to reduce downstream cost to the operators, rather than initial cost;

high labour costs and scarce skills in Europe and North America leading to use of subcontractors in Asia or Latin America for custom implementation;

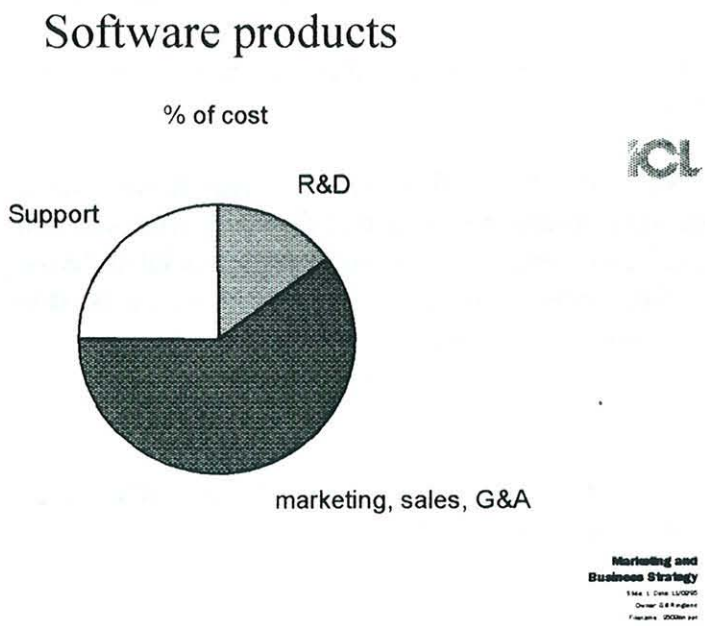
some high profile disasters due to lack of information security in the networked environment could lead to a new emphasis on track record in defensive systems;

multi-media and games style graphic front end systems are widespread, even if using twenty year old legacy systems as processing engines

Software Product companies

Software product companies are structured very differently from custom software/ systems integration companies. Figure 5 illustrates this, showing a typical allocation of costs in a software product company.

Figure 5



The product development expenditure, R&D, is normally a small part of the total expenditure, dwarfed by both support and most of all by marketing, sales and other expenses. Marketing in a software product company covers the product requirements as well as the promotion aspects - both are significant activities.

The key skills in software product companies are primarily in seeing what the product can and should do - it is easier to find people who can build it. Competitive advantage derives from size, form installed base and brand, rather normally from a specific product - though one exception to this was Lotus 1-2-3.

Software products appear to change rapidly, with new versions every six months. But components and designs, architecture if not code, may well last over many (computer) generations. Code too may persist for many years - does the PDP8 assembler hold the record? Though a recent round table (12) reflected the views of software product suppliers on their most important issues: these were oriented towards using new technology in order to reduce time to market.

As with custom software, maintenance and enhancement costs swamp the original cost - "never buy software before version 3" has been true for many years. And also as with custom software, the interfaces to the software - human and system - may determine its success more than pure functionality.

The software products industry is very new - what other industry can we look to as an analogy which may help us predict it's direction? Possibly, the films and publishing industries will help.

In the film and publishing industries, the cost of production of the book or film is not related to it's commercial success. Marketing expenditure and costs of distribution or access to channel are significant, while the costs of replication are vanishingly small. Markets are increasingly global, particularly for films and scientific / technical / medical publications, less so for books or newspapers. Distribution companies are much larger than production companies.

Could this be the mature industry model for software products? In some aspects, the answer is already yes: the main difference between the position now and the films and publishing industries appears to be that the distribution companies in software are also mostly production companies. Is this likely to persist? The software companies are profitable enough to innovate - will they also be able to provide the right stimulus for innovation? Or will there be a pattern of startups for innovation, selling out to the distribution companies, with the innovators then going on to a new product?

What other influences can be seen on the software product industry beyond 2000?.

The attitudes of buyers - whether end customers, outsourcers or systems integrators - to software is likely to be positive towards industry leaders and reduction of risk. It is probable that for many functions, there will be only a few major suppliers and multiple bit players. Innovation will be concentrated in the new application areas such as multi-media, information security, games and virtual reality, new

architectures able to handle high bandwidth and the rise of new devices - intelligent phones, PDAs, mobiles - leaving "old" products to ship unchanged.

The new customers will be network suppliers, cable and wireless device and service suppliers, suppliers of media servers. Much of the software will either be sold to them outright or rented to them for a per transaction fee. the attraction of ongoing rental income will cause attempts by the industry to find ways of ensuring rental income for software sales through the other channels, perhaps through bundling in support. The emphasis on information security in open - eg Internet - environments could give new impetus to certification of products and to visible access control mechanisms in products.

Conclusion

The software services industry and the software products industry are both new, and have grown fast. Only within the last five years have they become of comparable size to the system suppliers, with recognisably different dynamics.

The custom software / systems integration services industry is becoming more concentrated in the hands of a few large players as prime contractors, not so much because of economies of scale but because of a desire by customers to reduce risk. Small companies occupy specialist niches.

The software products industry has also many small companies, but increasingly they are being merged into the larger players to get more marketing clout and distribution. It is to early to be able to predict how innovation will be maintained as new markets develop - through existing major players or by new startups?

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DISCUSSION

Rapporteur: Michael Elphick

In response to a query about the data on home usage of PCs, the speaker felt that the figures didn't appear to be changing much; they were unlikely to catch up with US use, as phone tariffs here discourage the widespread use of modems. The questioner felt that there had been substantial change in the last few months in the UK, as evidenced by the widespread availability of multimedia PCs.

Professor O'Riordan and Professor Kopetz suggested that the extensive penetration of embedded software into car systems (given as 50% to 60% for Bosch) was not reflected in the figures given, to which Ms Ringland agreed that they could be misleading. Such data was derived from what the analysts could count, and could refer to things as different as the proverbial "chalk and cheese".

As to the figures for software production costs, Dr Simonyi agreed that they matched those he was aware of; however some items under "marketing" used to be lumped in with "development". Ms Ringland agreed, and noted that there were still lots of technical jobs in these other areas.

Dr Simonyi went on to question whether "distributors" was now the right term; in his experience, a lot of small companies had now created new niche markets; for example, the success of Visual Basic had been assisted by the rise of many small independent software vendors, providing software components. Since the 1980s, Microsoft and other large software companies had been moving (away from managing their own distribution and support) towards more encouragement of such small software ventures, and sub-contracting of support services.

Mr Gladman pointed out that network distribution of software offered an essentially zero cost distribution channel. To the speaker's comment that customers might prefer a friendly human interface, offering advice and support, Professor Randell suggested that proper use of the Net could well provide an equally friendly interface. He also referred to the need for some mechanism to support quality assurance and redress for purchasers buying from small software providers, as is provided by trade organisations in the travel business.

Miss Barraclough said that a typical situation that had not been mentioned was the very small organisation (with an equally small budget), that had outgrown its initial software packages and needed to upgrade to an incompatible system. They were often faced with the problems of extracting data from the initial package, as input for the successor. Professor Randell agreed that a degree of maturity was needed to avoid such cul-de-sacs, and it only needed bad luck or judgement for many to find themselves in this situation.

Finally, Dr Lesk referred to the debate in the US for some years that had been centred around the question of whether IT had actually increased productivity. Ms Ringland said that there had been an OECD study, which contrasted IT spending and unemployment rates across the developed world, which had concluded that such relations were rather complex ones.