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TECHNOLOGY FOR FRANCE AND THE UK IN THE EU

On 28 November 1996 a joint seminar and lunch discussion was held at the Royal Society on the subject: "High Value and High Technology Industries in the EU: Possible Roles for France and the United Kingdom". It was organised by the Foundation and La Chambre de Commerce et d'Industrie de Paris, and the Lord Butterworth CBE DL was in the chair. The speakers were: M. Alain Bensoussan, President of the (French) Centre for Space Studies; Dr J R Forrest FEng, Deputy Chairman, National Trans-Communications Ltd; and M. Hubert Flahault, President, Chamber of Commerce & Industry of Paris.

M. Alain Bensoussan*

Summary: A wide-ranging review was given of the evolution and implementation of high technology industry in the EU and the need to sustain and develop this in view of global activities. France and the UK, as a result of their past performance in research and technology, had a major role to play in leading co-operation among the EU countries.

Introduction

As it was pointed out by the European Commission in its "Green Paper on Innovation", "Europe suffers from a paradox: Compared to the scientific performance of its principal competitors, that of the European Union is excellent, but over the last fifteen years its technological and commercial performance in high technology sectors such as electronics and information technologies has deteriorated".

Two sets of figures summarize this situation:

One third of the scientific publications in the world are European, a figure equivalent to that of the United States and four times higher than that of Japan,

The deficit of exchanges between European countries and the rest of the world on high technology products has been multiplied by 10 in ten years, while the positive balance of Japan has been multiplied by 4.

What are the advantages and drawbacks of the approach of the European Union in the area of high technology and industrial transfer? In the specific area of space technology, what are the successes and difficulties encountered by Europe? What can enable France and the UK to play a stronger role in the race for innovation? These are the three questions on which I will give my personal views today.

I. Research and technology in the European Union

One clearly positive point, in my opinion, is the fact that the research and technology programmes of the European Union are structured within a framework, the Framework Program for Technological Research and Development (FP), which presents the advantage of ensuring the consistency of the actions carried out during a period of four years.

The structure of the FP itself is also a good element because it ensures that the activities are focused on major areas: in the fourth FP, covering the period 1994-1998, fifteen specific programmes are grouped in six themes (information and communications technologies, with in particular ESPRIT and ACTS, industrial and material technologies, environment, life sciences, energy and transport). The financial effort devoted to these activities is important (13 billion ECU, 3.5 of which on information and communication technologies), and globally, the result is rather encouraging: in 1995, more than 20,000 proposals were submitted for the FP, resulting in 3,000 projects, involving researchers from all the European countries.

Nevertheless, the FP has the drawback of non-focusing on clear challenges for the future, hence to cope with this drawback the initiative in 1995 of creating eight task forces was devoted to very specific innovation-oriented subjects and aimed at improving industrial competitiveness and quality of life.

An important drawback of the European Union framework is also the selection process of Research and Technology projects. After evaluation of proposals by experts from the Commission, the decisions take into account the geographical "return" criteria. Proposals have to include several European countries, hence the effort is more on co-operation across Europe, rather than on developing competitive industries.

Furthermore, the European Union does not address some important high technology areas, whether it is due to the existence of other organisations already playing this role or because it is legally out of its scope of action. In the case of space, for instance, the European Space Agency federates the efforts of 15 countries and ESA is at the origin of brilliant successes for Europe. The member states oppose the idea of the European Union playing a significant role in this area: today only 90 MECU are spent annually in the FP for space activities. Defence, another important element of technological innovation, is out of the scope of the European Union.

II. The example of the space sector

I would like to turn more specifically to the space sector, which is practically out of the scope of the EU. This sector represents, in my opinion, a good example of the leading role Europe is able to play in the high technology area, but also of the difficulties it may encounter facing the new challenges related to the increasingly important role of the market in this field.

Successes of the European space policy

The present situation of the European organization in the space field results from a continuous process of integration that began in the early 1960s. These 35 years of space co-operation led to striking successes in this area, demonstrating Europe's capability to be at the forefront of space activities in the world. One can mention the space transportation systems, a *sine qua non* condition to get independent access to space. Beyond the major role played by the Ariane launchers family development during the building phase of the European space industry this programme, thanks to a sound policy of rapid transfer to private operations, has enabled Europe to get more than half of the commercial launches market in the world.

Science is also traditionally a sector of excellence for Europe and this was translated in the space area with the successes of around twenty European missions encompassing the whole range of scientific disciplines, from astronomy and astrophysics to Earth environment, fundamental physics and more recently space biol-

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ogy and space medicine.

In the field of applications of space, I would particularly mention meteorology with a series of world class satellites, Meteosat, constantly in orbit since 1977 and the telecommunication satellites ECS which now form part of the Eutelsat space segment.

At last, manned space programmes and the building of big space infrastructures is going to become a reality for Europe through its participation to the international space station adventure. These successes were made possible thanks to the constant effort made by the governments of the European countries reflected by a sharp increase in public expenditures in the space field during the period 1970-1990. This in turn resulted in a very stable programming, leading to a policy of series of space systems. The European space programmes allowed the strengthening of a European space industry which can satisfy the needs of the government programmes, which plays a leading role in the field of launchers and which is able to win competitions on the telecommunication satellites world market.

Difficulties of the European space policy

Considering the successes enabled by European co-operation in the field of space, we must not forget, however, the difficulties that the European space policy is now facing, at a time when several factors combine to change the world landscape in the high technology area. One of the difficulties, in my opinion, lies in the lack of common priorities. Some countries view space merely as an element to respond to daily life concerns, like any other industrial product. For others it is a strategic issue and for others space is a tool for innovation and advanced research. These different approaches lead to difficulty in starting some programmes in the framework of ESA.

Moreover, when programmes have started, they have a tendency to grow, inconsistently with the users' needs or the budgetary resources, to take into account the desires of all the countries involved. Another major difficulty faced by Europe is the necessity to give to the various countries a fair industrial return on the investments they made through their participation in a common programme. That often leads to the duplication of some activities, infrastructures and means which represents a waste in a period in which economic arguments weigh increasingly heavily in the allocation of public resources, and which is also a significant drawback for Europe given the rise of competition at the world level in the space arena.

And last, I would mention the low reactivity of the multilateral heavy structure set up in Europe in front of the emergence, increasingly rapid, of new space applications. The constellations of small satellites, which are becoming a reality in the United States, are only being considered now in Europe as a major turn in the space business.

The growing importance of global and societal concerns

These difficulties inherent to the organisation of space policy and space industry in Europe were something we could live with as long as we were in a period in which space activities were only the business of governments and were devoted to the set up of European independence in the context of a bipolar confrontation. Today, because of the globalization of the economy, the rise of global concerns among public opinions (Earth environment) and the emergence of the so-called information society, a new dimension is added to space activities. The mastering of space technology is still a strategic asset but more and more in the sense that it allows a country's industry to answer these new global and societal needs and sell its products worldwide and competitively. In this respect, Europe has to adapt the way it carries out space activities.

The emergence of the market

Generally speaking, we assist the fast development of the market in areas that were still recently in the field of government action because they did not correspond to a demand sufficient to make profit, given the huge investments that they required. Computer technology has been the first example of such a trend with the emergence of personal computers in the 1980s that transformed a technology-driven market into a demand-driven market at a pace that was difficult to estimate only ten years ago.

Now, space technology is following the same path. A general feature of the world space landscape is the growth of the space applications market. Taken in its broadest sense to include space products and launch services, ground systems and the associated services, this market now accounts for the major share of civil space activities throughout the world. Over the next ten years a total sales volume of some 50 billion dollars is forecast for the space industry as such (satellites and launches), whereas for commercial activities in the applications branches (telecommunications, Earth observation, navigation, etc.) the figure is around 450 billion. Comparing the total civil budget of the world's space agencies for the same period, we arrive at a likely figure of around 200 billion dollars. Whereas the role of supplier of space services was for a long time the special preserve of the space agencies and their subsidiaries, it is now being taken over by private organisations capable of mastering a large part of the chain of space system activities, from the satellite to the final product and its utilisation.

The American and Asian responses

This trend has been very well taken into account by the United States. Whereas it previously took a political form, the American drive for supremacy in the space sector has shifted to the economic arena. Aid to industry in the form of partnership arrangements, the development of technology demonstrators, promotion of the development of new remote-sensing technologies, the striving for maximum synergy between the space sector and information technology, deliberate action by public authorities to bring about the concentration of industrial activities, all testify to the United States efforts to ensure that its space industry is highly competitive on external markets and receives a return on investment. The remaining importance of their investments in manned space flight programmes shows that the United States is taking into account the whole dimension of space activities. Competition is also growing in Asia, whose space industry is receiving support from a gigantic regional market and favourable cost structures.

Europe has to find new ways of action to face these new challenges if it wants to keep in this sector a position compatible with the political and economic force that it represents. As far as political issues are concerned, the need for Europe to maintain peace and security on its soil is directly related to its ability to maintain modern military assets which requires the development of high technology tools such as satellites for observation, communications or eavesdropping. Our continent has also to improve its ability to react rapidly to the evolution of the market. The success of some programmes carried out in bilateral or trilateral co-operation such as SPOT or Helios show that answers to these needs may be easier this way.

III. France and the UK: together for a leading world role

In many respects, France and the United Kingdom have a similar analysis of the factors that would enable European countries to face the new challenges offered by this rapidly changing context.

That is exemplified in the space sector as shown when comparing the BNSC's space policy forward plan and the CNES strategic plan, both issued in July this year. Both countries have the opinion that it is the government's role to create favourable conditions for ensuring the satisfaction of users' needs through space programmes and for structuring the markets, and to support Research and Technology, including technology demonstration projects, in order to promote industrial competitiveness in promising sectors such as information technology. To this end, both countries stress the necessity and the advantages of a policy of

partnership, between the government agencies, the users and the industry, both nationally or between European countries, in order to make a better use of scarce public resources. More generally, this concern of partnership towards industrial competitiveness in several areas of technology, is present in several studies published in France and in the UK, such as the Technology Foresight exercise undertaken in Great Britain.

As far as industry is concerned, the need for industrial convergence at European level is seen as essential in both countries. It is only within a European framework that our industry can achieve the critical mass needed to face up to the American and Asian giants. In the field of space, activities in the United States and Japan are conducted by industrial conglomerates with a multitude of activities extending far beyond the space sector, which are thus in a position to benefit from their enormous strength, especially on the export front. These groupings also have a captive domestic market allowing competitive series production. Our only possible response is from within a European framework that will enable us to achieve economies of scale beyond the reach of individual states and equip us better for the struggle in a sector in which the market now plays the major role. In 1990, General Electric Company and Matra formed, as a joint venture, Matra Marconi Space, the first fully integrated European space company, which then acquired the space activities of British Aerospace. The successes of MMS on the world market show it is a good example of the virtues of industrial convergence.

On the military side, France and the UK, the two European nuclear powers, have always had a strong defence policy. In particular, the asset that space technology represents for the armed forces in telecommunications, observation, navigation, meteorology and the threat represented by the US defence industry is a common concern shared by our two countries.

Each of our countries has the assets necessary to follow separately these common paths. But the differences in the Science and Technology policies followed in the past in the UK and in France led to a complementary set of competencies on both sides of the Channel. Used together, they could lead our two countries to play a stronger role in the race for innovation.

The United Kingdom

With many universities at the forefront of academic research in the world, the UK has a tremendous potential for innovation. One must not forget that prestigious and powerful institutions such as Cambridge University, Oxford University, Imperial College, University College London or Edinburgh University have inspired the American model so often regarded as a reference in the field of innovation and dynamism.

The characteristics of the academic system in the UK have favoured partnerships between universities and industry. In this respect, the original structure that was set up in 1985 within the University of Surrey by the Centre for Satellite Engineering Research is worth mentioning. The Surrey Satellite Technology Ltd company was created to provide an interface between the University and industry to enable efficient technology transfer and commercial development research in order to attract finance. Owned by the University, the company builds and sells small satellites and re-invests the profits it makes into the engineering department of the University (£300,000 a year). With six satellites built and launched by Ariane since 1990, Surrey Satellite Technology has gained a worldwide reputation and makes the UK a European leader in low-cost microsatellite technology.

This example shows that the structuring and functioning of higher education and research in the UK favours the creation of small dynamic companies in direct interaction with the market and keen on utilizing high technology. UK software and applications companies are vigourous and innovative. It is no surprise, for instance, that the UK is now the largest user of space in Europe and the second largest in the world after the United States. The revenue of the UK space service sector accounts for about 15% of the estimated world market for these services, focusing on areas such as telecommunications and information technology, mobile services and meteorology.

This potential for innovation in the UK is sustained by powerful financial markets that can offer essential advantages when they react positively to high technology proposals. City institutions such as venture capitalists and the insurance sector are critical assets to expand the role of the private sector in the funding of high tech projects, in particular space projects. The idea of a "City Science Dialogue" programme, organizing seminars between investors and researchers, is an interesting start in this direction.

As far as the space industry is concerned, British industry has for many years focused on telecommunications and in terms of the number of satellite prime contractorships, British Aerospace was Europe's leading manufacturer of communications satellites during the 1980s. Now, the activity of British space companies is rather re-oriented towards the provision of satellite sub-systems and payloads.

As far as defence is concerned, the UK has been a pioneer in the field of synthetic aperture radars (SAR), a very interesting asset in the field of military surveillance, and runs a comprehensive military satcoms programme with a number of Skynet-4 satellites and a comprehensive ground segment. Another asset in this area lies in the investments made in the field of Earth observation and the corresponding data processing activities.

France

Since the beginning of the 1960s and following the impulsion given by General de Gaulle, France has benefited from significant and constant public funding for "strategic" Research and Technology, especially nuclear research and space technology. That led to the constitution of powerful science and technology institutions whose expertise is recognised throughout the world, in particular the Centre National d'Etudes Spatiales (CNES).

As far as space is concerned, France has been a driving force behind the development of European activities since the 1960s. The constant involvement of successive governments has led to the set-up of a comprehensive programme, carried out on a national basis or within the framework of ESA, that encompasses all the fields of activity from launchers (and the particular role we play in the development of Ariane) to Earth observation (with the SPOT satellites series), telecommunications (with the TELECOM satellites series) and scientific satellites. France originated many successful European programmes such as Ariane and Meteosat and our country remains ESA's largest contributor.

The development of these programmes, under CNES's supervision, created in France a strong industrial base with competencies in every domain of space technology. Representing today 40% of European space industrial capacity, the French space industrial base is led by four major companies able to compete successfully on international markets, three of whom have prime contractorship capabilities (Aerospatiale, MMS, Alcatel, SEP).

The growing importance of the market in the space applications area was anticipated by France in the beginning of the 1980s and led to the set-up of private companies in charge of commercialising space services and products. Arianespace and Spot Image are now well-known companies. Today, the market has taken on such an importance that, even in a field like space, traditionally viewed as a government preserve, it is no longer possible to orientate our applications activities without having in mind, from the beginning, the necessary questions: "Is it good for the market? Is it good for the European industry?". The PROTEUS and STENTOR programmes are the precursor of a partnership between governmental bodies and industry which has become a vital issue for the space activities.

As far as defence is concerned, unlike Great Britain, France has no dedicated system for military satellite communications. Military payloads (Syracuse) are embarked on civil telecommunications satellites. Our country has, however, a long experience in reconnaissance capability acquired through the use of Spot satel-

lites for military purposes and with the Helios 1 satellite, built in co-operation with Italy and Spain.

Lines of co-operation

This list of our respective assets, though not exhaustive, enables one to propose some lines of co-operation in the future if our two countries want to remain at the forefront of international competition in the field of high technology.

I think it is essential that we join our efforts in what appears as the main challenge Europe will have to meet in the coming years if it wants to strengthen its political power, to expand its economic weight and to preserve its cultural identity: be an active player in the information society. This is about telecommunications capabilities and the two big operators, British Telecom and France Telecom, give the UK and France a particular role in Europe in this area; this is also about satellites and the wonderful capabilities offered by constellations of small satellites to communicate with anybody from anywhere, anytime. There again, we have the prime contractorship capability and a big technical centre on one side, the flexibility of innovative small companies and the financial power on the other side. That could lead to original solutions for the development of new programmes, devoted to new specific applications. I would just mention the possibilities that could be offered to the finance sector with the development of a real-time data transmission capability through satellite (financial services account for about 12% of UK's GDP).

France and the UK could also work together towards the development of new applications of space activities. We could, for instance, join our efforts to create European structures to organise the demand in new areas. Satellite navigation was one of the markets mentioned by the EC's Industry's High Level Group as undergoing exponential growth. The creation of Eunavsat is a recommendation we could support together.

At the other end of the spectrum, we need to achieve dialogue and find a way to strengthen our co-operation in pre-industrial research, beyond what is already done in the framework programme of the European Union or in the "Alliance" programme between France and the UK. This could be done in particular in the space business with the exchange of people between CNES and the relevant institutions in the UK.

As far as industry is concerned, the example of MMS and the creation of giants such as Lockheed-Martin in the US show that we need to accelerate industrial restructuring in Europe if we want to be able to compete efficiently in the international arena.

In the defence area, European co-operation, involving France, Germany and the UK, is being considered on the next military communication satellite system (Milsatcom). Beyond the fulfilment of operational needs, this would help our two countries to position the companies involved for opportunities in civil telecommunications markets.

It will take the combined effect of investment by industry, national governments and Europe collectively in well targeted improvements in technology and overall competitiveness to position European industry to meet the challenges offered by international competition in high technology. France and the UK possess a number of assets that give them, individually, world leadership in some areas. Together, we can play a significant role to meet the challenges ahead of us.

Dr J R Forrest FEng*

Introduction

The concern, expressed in the abstract of this seminar, that the European Union may be losing position in the evolution and implementation of high technology is not new. A particular example of this was seen ten years ago in relation to information technology, which itself now represents some 10% of Gross Domestic Product in the European Union, more than any other single sector, but, more importantly, critically influences the efficiency and competitiveness of some two-thirds of all industrial and service sectors.

ESPRIT

In 1975, the European Union still had a trade surplus in information technology products, but by 1980 the trade deficit had reached $5 billion and this deficit was doubling every few years - clearly an untenable situation. It was in this environment in 1984 that ESPRIT, the European Strategic Programme for Research and Development in Information Technologies was launched - with the goal of providing the European Information Technology industry with the technology base it needed to become competitive and stay competitive with the USA and Japan in the 1990s. I have been fortunate to have been a member of the Review Board of this major programme since the start and I would like to share with you some perceptions about its effects and the matters that still remain to be addressed.

The first phase of ESPRIT was very much associated with the promotion of European collaboration in research and development on the basis that a unified market in Europe had a similar scale of trade to that of the USA. To reverse the growing trade deficit quickly was clearly impossible, but by 1989, five years after the start of ESPRIT, it was concluded that although the European Information Technology industry was still weak, it was better positioned and more optimistic about its future. The key change that had occurred was that national boundaries in Europe had declined greatly in significance and those involved in the Information Technology industries had identified very much with a single market environment. Professionals in the Information Technology industry thought no more of telephoning a colleague in Toulouse, Rome or Frankfurt than one in London.

Interestingly, the collaboration led also to a process of acquisitions and mergers in various industrial enterprises and this was significant in influencing the creation of the larger industrial units necessary to compete in global markets. A good example was the fusion of SGS, Thomson and Inmos in microelectronics. Collaboration in research and development, however, was only the first step in the overall process of adaptation and renewal. The second phase of ESPRIT from 1989 onwards placed focus on market pull as opposed to the traditional technology push; this was done through the involvement of the user community to drive the implementation of the new technologies into the market and to place more emphasis on using new technology to improve the competitiveness of products in global markets. This, once again, also encouraged consolidation within European industries, giving benefits in terms of economies of scale.

Many other factors have also had important beneficial roles, particularly the drive towards privatisation of many industries and the increased liberalisation in telecommunications and broadcasting regulation; overall, the rapid slide in Europe's position that was apparent in the mid-1980s has been halted. While in 1987 Europe had only an 11% world market share in Information Technology, it now stands at 30%, similar to that of the USA, but still grows little in some key market sectors and has unfortunately declined in the important area of microelectronics.

Effects of consolidation

The consolidation in major industries and service sectors in Europe, while essential for their improved competitiveness and survival, has had a negative effect on employment. It is the small and medium sized industries that are now the major contributors to employment and to an increasingly dominant proportion of European Gross Domestic Product. They now comprise some 99% of the number of companies in the European Union and are associated with 65% of the Gross Domestic Product. This is a very posi-

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tive sign. Because of their limited size and management hierarchy these companies are able to react quickly to market opportunities. They operate with low overheads and interact compatibly with universities. Yet the start-up phase of such companies is frequently very difficult in Europe. The next challenge for Europe is to emulate the environment of areas like Silicon Valley in the USA.

The next steps

Although I started with the very important role that the European Union has played in revitalising the European Information Technology industry, you will not be surprised, since you are in the UK, to know that I feel that we should not be continually looking to Brussels for our solutions! Arguably, many of the next steps can be initiated by bilateral or multilateral initiatives between the various countries of the Union, setting new standards of best practice which others can emulate or implement in their own way.

Two major changes are essential, the first material and the second cultural. Although in recent years the availability of finance for business, particularly in countries like Britain, has been excellent, it is mostly development capital - investment available to businesses that already have products and a good trading track record. True venture capital for the start-up of high technology businesses is much more difficult to obtain. Also, in the UK's so-called venture capital industry, which is the most developed in Europe, only about 20% of investments are made in technology-based companies; the comparative figure for the USA is 65%. A recent report of the Bank of England highlighted the fact that despite strength in technological innovation and financial innovation, there is a weakness in creating new well-financed, technology-based companies. The weakness appears to lie in the risk averse attitude of many financial investors and in the limited abilities of the scientists and technologists to put a business case.

The cultural change required is in the attitude to success and failure. In the USA, it is not unusual for an entrepreneur to fail once or twice prior to making a success of a high technology business. This is accepted both socially and by the venture capital industry. Also the taxation system makes it advantageous for larger industries to absorb both successful and failing small companies. This creates a very dynamic and innovative commercial environment in which personal financial success is highly regarded. It is not uncommon for a successful high-technology entrepreneur to have initiated and sold on a number of successful businesses in his or her career. By contrast, the acquisition of small companies by larger units in Europe is less common and also bankruptcy in Europe is a serious matter, which usually inhibits further attempts at developing business. Amazingly too in Europe, personal financial success can often be almost a stigma. One only has to look at the attitudes in the press to those who have achieved financial success in business!

Both the UK and France have realised the value of encouraging high technology business parks located close to key university and research centres - an essential ingredient in providing a fertile environment for innovation and start-up in high value, high technology industries. Maybe there is a role now for these two countries to lead Europe into the creation of a Europe-wide venture capital industry and to formulate changes in legislation related to bankruptcy and taxation which would encourage greater risk-taking in the start-up of high technology industries on a par with that which occurs in the USA. To achieve the culture change in developing the entrepreneurial approach to business, an understanding of risk, a willingness to take risk and a desire in individuals to achieve financial success will require efforts reaching back into schools. This will require teaching experience outside that of our current school and university teachers, and will need to involve those who have experience of successful business innovation.

Education

Focus on the education sector is particularly important at the present time because also of the increasing excellence of teaching in the Pacific Rim countries and the decline in interest among students that is occurring in science and technology subjects in Europe. This is a particularly worrying phenomenon and is already creating a shortage of well-qualified professionals in the high technology sectors. Unless checked, this trend is likely to result in virtually no students studying physics in the UK in ten years time.

The reasons are not understood as yet, but probably relate to the perceived higher difficulty of science and technology courses compared to the less rigorous arts courses. Traditional cultural attitudes to business and concerns about the effect of technological developments on our environment may also be having a role, the latter showing a complete misunderstanding of how much our standard of living now depends on unseen technology. I have always admired the way in France that cultural and technological aspects seem in closer harmony than in Britain. Major technology infrastructure projects are also seen as artistic or design challenges, and by learning from the French approach this could be a way for us jointly to revitalise interest in technology.

The Internet

The seminar abstract posed a question about the technologies of the future and no discussion of high technology, high value industries is complete today without some mention of the Internet. While very different views can be found about the commercial significance of the Internet, there can be little doubt that it opens major opportunities for new business and presents threats to traditional business. In particular, it allows small businesses operating in niche areas to have easy access to world markets. It opens massive new markets for software and services, but it will also influence greatly the future architecture of computers as local computing is enhanced with network computing.

It is said that some 40% of the traffic on the Internet originates or terminates in the small geographic area of Silicon Valley; this has the potential of strengthening even more the position of this already very powerful high technology area. Not content with the current lead of the US in the use of the Internet, the US government recently pledged to spend $100 million next year on a nationwide high speed Internet for key universities and government research establishments; this overlay is designed to re-establish the competitive advantage that occurred with the original Arpanet infrastructure. Why does Europe not do the same? Maybe France and Britain should lead the way?

Software

Both France and the UK have good strengths in software and need to be more active in developing software and services for the future communications and networked computing environment. Much of the past technology strength of the USA has been built on the enormous defence budget. Defence-related expenditure is declining in the industrially-developed countries and arguably the only domain that offers similar impact on commerce and industry is communications, rapidly being redefined through the integration of telecommunications, broadcasting and information technology. The Pacific Rim countries, unencumbered by large defence budgets, have already embraced this area, as has the USA. I might have mentioned transportation too, but this is probably not the best subject for a Franco-British forum at present!

Beyond the immediate challenges posed by maintaining a competitive position globally in the communications industries, a clue to another area of importance lies in the recent announcement that Microsoft had made significant investments in the biotechnology and genetic engineering industry. It is not an area that I know well, but it seems that Britain and France do have strong track records in pharmaceutical and biotechnology innovation. It seems inevitable that in the decades ahead, our most important engineering and wealth creation will be at the molecular level.

Conclusions

My propositions are as follows:

- there is an important role for bilateral initiatives within Europe, such as between France and Britain; these can be complementary to European Union initiatives, but can operate faster and in a more streamlined manner, defining best practice for others to implement in their own way;
- the major challenge in Europe at present is to create an innovative high technology environment of the type which exists in Silicon Valley; to do this requires the encouragement of a European venture capital industry and effort to shape the cultural attitudes that go along with this;
- the decline in interest in science and technology subjects among students is particularly worrying and must be reversed; this has to be tackled in the schools, particularly by teaching which encourages innovation and reflects the importance of wealth creation;
- the global competition in wealth creation is now focusing on the communication industries. We need to progress liberalisation in telecommunications regulation as quickly as possible in Europe, following the UK lead, and capitalise as quickly as possible on strengths in software and services associated with networked information technology;
- looking ahead further, we need to assume that molecular engineering will lie at the heart of wealth creation in the next millennium and put major effort into understanding how Europe will take the lead in this;

I would like to leave you with my favourite quotation from Hippocrates:

"Time is that within which lies much opportunity, but within opportunity there lies little time"

M. Hubert Flahault*

Introduction

It is with real pleasure that the Chamber of Commerce and Industry of Paris has seen its co-presidency of the French-English conference on innovation and high technology industries renewed. The success of the earlier session has greatly contributed to the renewal of this event and I am very pleased about it. I want to thank especially Lord Butterworth, Chairman of the Foundation for Science and Technology, for having welcomed us this year in England, as well as the Royal Society which has received us in these prestigious surroundings. I also thank the French Ambassador who invites us to a reception after these fruitful discussions.

The economic future of Britain and France

Indeed, the subject which has preoccupied us today is really crucial for the economic future of our societies. We asked ourselves how could the European Union keep its traditionally important role in high value and high technology industries, and, of course, what could be the respective roles of the United Kingdom and France?

It was relevant to focus the attention of this seminar on high technology industries because their strength reflects the strength of the economy and the technical progresses generated by our countries. All that contributes to make these industries more competitive is valuable and must be strongly encouraged. This remark applies to many sectors of industry, like telecommunications, space, biotechnologies or computers.

The firms wanting to develop in this area are numerous. But access to high technologies is often difficult and demands investments which are very heavy to finance, especially for small and medium-size enterprises, as Mr Forrest has rightly underlined. I entirely agree with him when he says that we must encourage their interaction with major enterprises or even the market itself. These small and medium-sized firms are more flexible and we must help them to generate new employment in our countries. Our Chamber of Commerce and Industry is aware of the role it can and must play in this field and dedicates itself to it.

I take the liberty of mentioning its action, because it actually illustrates the problem very well. Innovation is always, but never exclusively, a matter of education and information. Innovation is also always confronted by financial constraints. Finally, innovation can only rarely be looked at in a self-contained way and in a purely national context. Furthermore, its development generates economical growth by creating new products which favours consumption in our countries and competitiveness through exports.

Regarding education, the Chamber of Commerce concentrates on innovating sectors and, besides an excellent technical education, tries to give the students of its schools the open-mindedness that will promote their professional success and the future of the country. Also, innovating firms which hesitate to engage themselves in investment programmes or in co-operation with research laboratories can successfully take advice from us and be referred to the adequate partners.

As you can see, our Chamber of Commerce tries to meet the challenge of high technology industries. Furthermore, it strongly supports international co-operation, especially within the European Union.

The European Union makes the ideal framework to develop such co-operation. Attempts have already been made, for instance in the space sector, and we have to draw lessons from the successes and the difficulties encountered in this field, as presented by Mr Bensoussan, to further this co-operation.

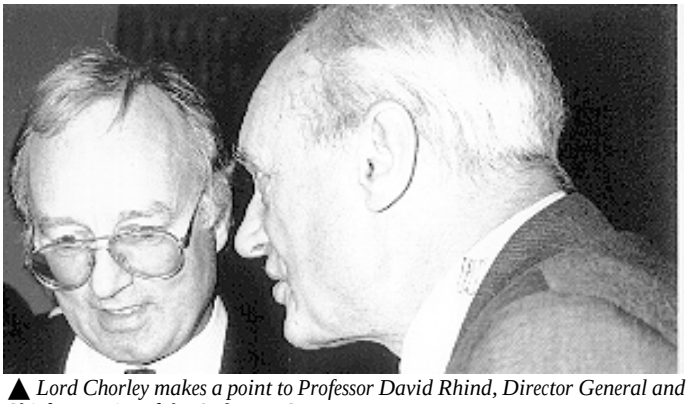
Successes in this field are many: let me mention Concorde, a plane due to Franco-British co-operation and whose commercial failure was not deserved, or Ariane, the finest example of technological co-operation within the European Union. These experiences should be generalised to every sector, to every business, including the smallest, to make our countries even more powerful economically. The idea according to which we have a lot to learn from the others and vice versa seems right to me and each of us must be aware of that in order to become more efficient and more competitive.

Indeed, especially in the high technology sectors, strengthened co-operation is necessary to become more powerful and to confront international competition. I think "strength through unity" is, especially in this field of economy, really suited to the situation.

Both previous speakers have underlined it and I am in complete agreement with them: much remains to be done and the suitable measures to make the scientific and industrial co-operation easier are numerous. It was precisely the aim of this meeting to encourage co-operation between two so different countries as France and the United Kingdom. But both their cultures have, for more than three centuries, given a central place and a social acknowledgement to science and operational research.

** President, Chamber of Commerce & Industry of Paris*

FOUNDATION NEWS SPECIAL



▲ *Lord Chorley makes a point to Professor David Rhind, Director General and Chief Executive of the Ordnance Survey.*

PROBLEMS WITH SOFTWARE?

On 10 July 1996 the Foundation held a lecture and dinner discussion at the Royal Society on the subject "Is the Software Engineering Industry Really Serving UK Industry Well?" The Lord Butterworth CBE DL was in the chair and the evening was sponsored by The British Computer Society and The Institution of Electrical Engineers. The speakers were Professor P A Bennett FEng, Chairman and Managing Director, Centre for Software Engineering Ltd, Ms Jill Hill, Director and General Manager, Rolls Smith Engine Controls Ltd, and Professor John McDermid, Professor of Software Engineering, Department of Computer Science, the University of York.

Professor P A Bennett FEng*

Summary: There was criticism of the ability of software suppliers to deliver quality software on time and within budget. On the other hand, project managers were often ignorant of computer technology as well as leaving too little time in projects for the computer element. Industry needed to be more critical. Although British industry had a good reputation in software engineering, more had to be done, including education, to enhance the position.

Introduction

In my presentation I shall be concerning myself with the ability of software suppliers to deliver quality software on time and within budget. To which the answer to the above question is, regrettably, No! I hope to discuss some of the reasons why I believe that software engineering is not serving UK plc very well at all I will also seek to alert you to some of the potential problems.

In all sectors of industry designers are increasingly making use of computer-based solutions. Many of these applications require high integrity and high reliability while at the same time being at low-cost. Over the last 20 years there have enormous improvements in computing, in the hardware and in the software, which allows designers to be more adventurous. This trend will continue as the hardware becomes more globalized and industry searches for lower element costs based on standard components and standardised hardware. It is the software which now embraces much of the functionality previously held in the electronics.

The growth in the use of computer technology can be seen in applications as diverse as 'white goods' and nuclear reactor control both with surprisingly large amounts of software. For example, at a recent meeting of engineers it was reported that the modern television has 300,000 lines of software while a portable telephone may have half million lines of software! Good reasons exist for this, but it does demonstrate how many functions previously carried out by electronics are now vested in the software.

Flexibility in design

As the cost of computer hardware has fallen and the manner in which software is developed has become more structured, so there is the increased likelihood of achieving a resultant lower overall development cost. This is an important benefit, but not the only benefit. To develop electronics alone to achieve the levels of functionality now required by society takes considerable investment in both manpower and materials. Should the resultant design need to be changed the cost increases dramatically.

With software, once the initial system has been developed it is easier to make the changes. This is, of course, a simplification of the processes involved but it serves to make the point that the use of software and computers brings flexibility in the design and development process. It also brings more clarity into the design because of the exhaustive logical analysis carried out by qualified engineers. But the result may be a more complex product: recall a washing machine which had its over-speed brakes removed because of misplaced faith in the software controllers.

Large infrastructure projects

The opportunity for the application of computers in industry is tremendous. A very good example of this is in the Channel Tunnel where the applications ranged from rail traffic management, through SCADA, traffic management and radio to ventilation and drainage, not to mention the various systems housed in each locomotive and each carriage. Similarly, large and numerous software-intensive packages are being developed for the new HKG Airport and other projects we are presently involved in. They all are dependent upon software to varying degrees.

On such large infrastructure projects it is often said that when computers are used extensively on such major projects that "the computers (including software and hardware) represents less than 1% of the total capital cost and yet represent about 99% of the functionality". The Channel Tunnel was no exception. Why then is the computer element so often disregarded by the project management team until very late and why is so little time given to complete the development? The answer is that project managers are:

i) still naive about the technology;
ii) ignorant of the complexity involved and believe the software suppliers;
iii) continue to believe that 'turnkey contracts' can work with software; and
iv) consider software to be trivial till it goes wrong.

They couldn't be more wrong. This not only applies in industrial systems, it also applies in the business community. Remember the embarrassment felt in the City when the Taurus dealing system was scrapped following the over-ambitious IT people, poor management and worse testing.

More software engineers needed

To gain the productivity bonus from computers industry is adopting this technology at an ever increasing rate. To service this demand industry needs a significant growth in the number of software engineers, yet our universities are producing only a marginal annual increase in the numbers of such specialists. The government must realise the importance to UK Ltd of engineering in general, and software engineering in particular. Governments have neglected to acknowledge and protect the UK lead in software engineering and given the initiative to our international competitors; in short, they need to wake up to the importance of growth in the economy resulting from high technology.

For industry to compete in the world market it is often forced to use engineers from other disciplines, with inadequate training, in software development. Now this may be a sensible business approach but many of the systems being developed today have a safety dimension. If, as we keep being told in the press, high technology is our future why do governments do little more than give it lip service? Surely, we should be deploying only the best skills and practices!

During my time in a senior position on the Channel Tunnel project it was necessary for me to closely examine the system and software development processes used by many of Europe's largest

* *Chairman and Managing Director, Centre for Software Engineering Ltd, and Chairman of the Hazards Forum*

system suppliers and software houses. It is sad to relate that the standard was not as high as one might have expected, especially from some UK suppliers. This view is endorsed by quotations taken from Senior Executives of these organizations:

i) "We don't need to test our software as we know it's OK once our engineers have been involved." While this expresses confidence in the suppliers' staff, it fails to provide confidence that few problems will be encountered during the extremely costly commissioning phase;

ii) "There is no point doing module testing, we'll sort out all the problems during commissioning." This approach is often advanced by suppliers of control systems and provides them with an ideal opportunity to extract large variation orders from the vulnerable client;

iii) "Configuration Control? There's no need as each engineer tracks his own patches". It is remarkable that there are still suppliers and software houses allowing uncontrolled patching to software;

iv) "So long as the supplier complies with ISO 9000, there's no problem since the supplier will give you a good product." This statement demonstrates an unfounded faith in QA as the arbiter of a good product simply by having a good set of procedures: ISO 9000 is a process standard, it is *not* a product standard;

v) "I know we have no experience using Ada or structured design but there will be no problems since our engineers consider them to be little more than programming in BASIC." This comment was made mid-way through a complex project when the supplier decided to reject the existing and adequate design (and project team) in favour of a completely new approach while still maintaining that there would be no slippage or additional cost: there was both;

vi) "We use C++ because we can do fancy things with it." This comment came from a developer working on a safety-critical application where the arithmetic operators '+' and '-' had been redefined as multipliers in one module! Now this does not mean that the programming language C or its derivatives is fundamentally flawed; it does mean that unless extreme caution is exercised the resulting software can be hazardous.

vii) "We employ fresh graduates on all our safety-critical projects because they are bright and cheap." There are many comments one could make here, but suffice it to say that on such systems one might reasonably expect experienced people to be deployed. In this case the executive maintained that safety critical software was no different from any other. Therefore, he used the cheapest available labour regardless of discipline!

The role of the supplier

Is it unreasonable to expect that suppliers bring 'best world practice' to the project and continue that commitment through to completion? As one can see from the above comments, this is not universally so. However, at the level of the development engineers there is usually considerable knowledge of, and desire to use, state-of-the-art methods. The same cannot be said of the supplier management whose motivation is often solely financial, regardless of the consequences. With these and similar comments it is difficult to believe that one can have confidence in the system suppliers or software houses delivering systems which are required to meet the contract in terms of time scales, costs, or quality, leaving aside the increasing assertion of independent assessment of safety seen in such recent standards.

Now these comments may amaze, they may even surprise. They certainly would if the organizations were identified. When one realises that in some cases the people were talking about systems which, on failure, could put life at risk they suddenly become more shocking. Computer-based systems are increasingly used in applications which have become known as 'safety critical' - a phrase well known in industry, and sometimes also known as 'safety-related'.

The use of computers allows the designer to build in more functionality leading to improved performance coupled with safety. To do this:

i) The suppliers of systems need to recognize the pitfalls inherent in poor software, particularly where safety is an issue, and adopt better practices in line with the work of the standards-making bodies (IEC and ISO);

ii) Industry needs to recognize the need for effective software management, software testing and assessment, especially where there is a safety issue;

iii) Industry needs to use computers to increase the functionality of the systems which can in turn lead to increased productivity, cost-savings *and* safety. But this will only be maximised if due account is given to the software in terms of process QA and product assessment; the former being satisfied by IS09000 and the latter by trained assessors;

iv) Universities need to be properly funded to enable a greater number of adequately qualified to enter the employment market each year; and

v) Government needs to do more!

What should industry do?

So what should industry be doing? There are a number of simple improvements industry could implement to great effect:

i) they should embrace existing standards from ISO, IEC and CENELEC;

ii) use only competent, well-trained and experienced engineers;

iii) evaluate the software suppliers on grounds of capability *not* price alone;

iv) there should be an evaluation of the software and the system; and

v) manage the software development rather than leaving it to the supplier.

If industry adopts these points they will begin to get the service they need rather than the one they presently deserve.

Ms Jill Hill*

Introduction

The view I take of this question is that of a part of UK industry whose business is to produce complex engineering products, frequently for the export market, for which software is a key component - often offering significant competitive advantage. I therefore need the software engineering industry to provide me with all the necessary skills, technology, methods and tools which I need to support me in undertaking my business - which involves maintaining and growing some of the most successful UK engineering and manufacturing sectors.

And has the software industry served me well? I am afraid my answer must be, in the main, no.

I justify this response by looking at the historical perspective, over the last 25 years, during which I have been involved in the development and manufacture of products which make significant use of software.

Early days

Twenty-five years ago software engineering, as such, had not arrived. Development was still very much in the realms of basic technology.

There were a few departments in universities studying the engineering of computers, and certainly none looking at the engineering of software. That work which was under way was mostly being generated in the pure science and mathematics departments.

Having said this, in the early and mid seventies some very good research work was done in the universities on the theory of software development. The trouble was that that was what is was - theoretical. Not only that, different universities proceeded in different directions, always believing theirs was the best and only route

* *Director and General Manager, Rolls Smith Engine Controls Ltd*

to produce good software.

In the middle of this the industrialists were at best confused, whilst the academics argued it out, and at worst ignored them and carried on in their own way without as yet the imposition of any engineering disciplines.

At this point the government decided to take a hand. There have been a series of government initiatives, all of which have attempted to address some of the problems in different ways with greater or lesser success.

The ALVEY initiative sponsored industrial/academic consortia which developed concepts for the structure of software development - IPSEs - Integrated Programming Support Environments. These were beautiful, elegant structures but were an ephemera - the body never existed and few real working products were delivered by the software engineering industry.

The trouble was again, in the meantime, in the real world, we were struggling to build real projects using tools which already existed, often having been developed by other companies with similar problems, which had little support and which did not interface with each other.

ALVEY was followed by JFIT. This reflected some of the lessons of ALVEY - less grand schemes - and concentrated on developments in specialist technical areas. But although significant advances were made in these areas, the real need to have systems which integrated was not further developed, so we ended up with a few improved pieces of the jigsaw but still no effective tool set to support and help those of us who needed to use the software engineering discipline.

The present

And now? Now we have FORSIGHT. FORSIGHT examined key technologies by industry sector, and of these nine out of sixteen identified software issues as being key to the competitive development of their industry. Some sectors, such as Aerospace and Defence, are taking this further to generate recommendations as to future action. However, FORSIGHT does not yet seem to have taken any action to identify this technology as a whole as being key to a large proportion of UK's business and thus to UK's future competitiveness. The competition for funding resulting from the first stages of FORSIGHT did not give rise to any areas being short-listed which related to the development of the UK technology base in this area.

The future

So what should we do? Let me answer this by example. Manufacturing technology is in a similar position to software engineering - a key technology used by many industrial sectors in the UK, whose competitiveness is affected strongly by the availability of high quality basic manufacturing technology. Manufacturing has an academically based "Centre of Excellence" in the UK, supported by a great number of large and medium sized UK companies. This allows new techniques to be developed cost effectively, provides technology transfer, as well as providing a research facility that companies can use on individual projects. A parallel government funding programme which concentrates on this area allows the development of an effective industrial/academic/government partnership.

It is now necessary to recognize that software is as key a fundamental technology to UK industry as is manufacturing, and a similar relationship between a university-based Centre of Excellence, the industrial base in the UK and government need to be established.

The UK now works in a global marketplace, and it must be competitive in that marketplace. To do this we need a foundation of key technologies which will maintain and increase our competitiveness, and software engineering is one of those key technologies. We have many good individual academic centres working in the technology; we have a number of internationally competitive companies which use the technology; we have a number of specialist systems and software houses successfully providing international support in these areas; and we have a training and development system through the universities and institutions which could provide the skilled resources we need to support the technology. What we need is the vision and support to bring these together and provide a real competitive advantage for UK industry.

Professor John McDermid*

The following brief paper is based on the text of a talk given by the author at a meeting of the Foundation for Science and Technology at the Royal Society on 10 July 1996.

Introduction

By analogy with other engineering disciplines, software engineering can be viewed as:

> *the science and art of specifying, designing, implementing and evolving with economy, timeliness and elegance programs, documentation and procedures whereby computers are made useful to man*

Here 'man' is to be taken in the broad sense of mankind, corporations and, more generally, UK industry.

Many industrial sectors, e.g. aerospace, automobiles, chemical process and financial services, are now dependent on computers. In many cases, software is a critical success factor, even if it is not the dominant technology. Thus, for software engineering to serve UK industry well it would need to:

- enable differentiation of UK products or services, perhaps by providing a unique selling point (USP);
- offer reduced cost or time to market, thus giving competitive advantage.

This is significant to the UK as 'high-tech.' industries accounted for 22% of the UK manufacturing output in 1994, and 37% of exports,[1] and computers now pervade even the 'low tech.' products, such as washing machines, and many services.

This leads to the question of whether or not software engineering has served UK industry well, based on the above definition. There are some notable successes, including certain 'high-tech.' products, e.g. IBM's CICS, Formula 1 racing cars, the Psion Organiser and aeroplane engines. The last three depend on software; the first is the single most major software export from the UK, and has benefited from collaboration with academia - a theme to which I will return. Also, the UK has a strong position in the production of bespoke software systems - being the base of many leading system and software suppliers trading on a global basis. In this sector growth has been good, averaging 9.2% pa since 1988 against an average of 1.7% GDP overall.[2]

However, all is not rosy. The UK has little in the way of a packaged products industry - and certainly no Microsoft - yet this is the high volume, high profit sector of the market. The bespoke area is under threat from the Far East where high educational attainment is matched to low salaries - presenting a major competitiveness challenge to the software industry, *per se*, and to the wider 'high-tech.' industry.

Opportunities and challenges

The UK can build on its current relative strength in this area, and should endeavour to make strength in software engineering:

- an international business in its own right;
- a solid UK base on which other industries can call.

In order to achieve this, it is necessary to meet a number of challenges.

** Professor of Software Engineering, Dept of Computer Science, University of York*

Education and training

There are a number of limitations and inadequacies of tertiary education.[3] The primary problem is that there is a poor match between the results of university courses and the needs of industry. On the academic side, the problems include:

- inappropriate initial training, too much driven by individual research interests, and too little focused on fundamentals;
- inadequate treatment of engineering issues, as opposed to the basic science;
- too much focus on technician skills, e.g. programming, and not enough on professional skills, including management.

On the industrial side, the problems include:

- requests for short-term skills, including fads, e.g. use of the latest software development tool;
- an expectation of graduates being 'immediately useful' rather than being in need of professional induction, as in more mature engineering disciplines.

The primary source of problems seems to be lack of mutual understanding, and perhaps respect. Contributions to a solution include:

- definition of a better syllabus, used as the basis for course accreditation - here the British Computer Society (BCS) and the Institution of Electrical Engineers (IEE) can have most influence, as the assessors of software engineering courses;
- more exchange of staff between universities and industry, perhaps extending the current Academy of Engineering schemes - this requires government funding, and should be a facet of course accreditation by the BCS & EE;
- continuing professional education needs to be raised in status, and made a requirement to retain CEng - this needs to be policed by the BCS and IEE.

The latter point is perhaps more general, and should be adopted by the Engineering Council - it is raised specifically in this context, as the discipline has been established for a shorter period (about 30 years) than a typical working career!

Research collaboration

Industry, particularly in the 'high-tech.' areas, needs access to the latest research results to stay competitive. Work needs to be done with universities for several reasons - perhaps the most telling is that industry typically needs to deploy its most able people on more immediate problems and by 'outsourcing' research, industry can get continuity of skilled resource in a way which it can't internally. There are some success stories, e.g. at York we have the long-running BAe-funded Dependable Computing Systems Centre and the Rolls-Royce-funded University Technology Centre in Systems and Software Engineering.[4] Both these centres have demonstrated the value of long-term collaborative links, as has work between IBM and Oxford on the CICS system.

However, there are some general weaknesses affecting such research links:

- industry does relatively little research - in absolute terms and with universities - by comparison with international competitors;
- too much academic work is irrelevant; although long-term and speculative research must be carried out, it is essential to ensure that the *balance* of effort goes towards addressing problems that do, or will, exist in industry, and to support transfer of results into practical use.

The latter point is controversial, but I believe it reflects commercial reality - the UK is simply not rich enough to be able to devote significant levels of intellectual resources and funds to projects which do not have the *potential* for high payback. The underlying problem seems to be to do with undervaluation of collaborative research. Contributions to a solution include:

- better recognition of the value of collaborative research - in the University research assessment exercise and in academic promotion - here the onus is squarely on the university system;
- more research awards reflecting the value of collaborative work - RoPAs and LINK programmes through the EPSRC and DTI are key mechanisms (although the political will and funding also needs to be there);
- industry needs to become better at defining research requirements, and to reduce calls for 'firefighting' (i.e. problem solving on projects);
- academics need to be prepared to understand industrial problems *before* offering solutions, and to realise that their technology is only a part of a larger process - and will need adaptation to be useful; academics also need to be prepared to do some 'firefighting' in order to understand the 'real' problems in industry.

Perhaps the most important issue is to build long-lived working relations and mutual trust - this will facilitate effective collaboration and give benefits to UK industry.

Professionalism

Action is also needed to raise the average level of professionalism in the UK industry to that of the best, and this could then be used as a USP for the UK. This is a complex issue, which involves legal factors as well as technical ones, e.g. regarding liability law. For the sake of brevity, I do not amplify on this issue here.

Conclusions

UK industry deservedly has a good reputation in software engineering: there are world-class products and services, and there is first-rate research in the universities. However, the 'whole is less than the sum of the parts', and action is needed to preserve software engineering as a UK strength - both in itself and to benefit other industries:

- the academics and industrialists need to collaborate more and to take the long-term view, as both can benefit from sustained working relationships;
- the professional bodies (IEE and BCS) need to focus on issues of professionalism and professional standards, particularly through accreditation and CPD;
- the funding bodies and those involved in research assessment need to recognize the crucial value of collaborative work, and reward it properly.

The above may not be sufficient to secure continued commercial success in software engineering - but I firmly believe that they are essential actions.

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[1] Source: OECD.

[2] Source: Office of National Statistics.

[3] Primary and secondary education are very important, but outside the scope of this paper.

[4] In the last year for which we have data (1994) York had over 20% of direct industrial funding to UK Computer Science departments - an accolade for York, but perhaps a worrying statistic for the UK.

FOUNDATION NEWS SPECIAL

◀ *Dr S Suzuki (left), Head of Technology, Kobe Steel Ltd, with Dr Kimura, NEC Tokyo, at the lecture and dinner discussion on "Research, Collaboration and Competitiveness in Industry - Perspectives in Japan and the UK".*

THE WOOLF REPORT AND I.T.

The Foundation held a lecture and dinner discussion at the Royal Society on 17 February 1997 on the subject "After the Woolf Report. Generating Change with Information Technology". The Lord Butterworth CBE DL was in the chair and the evening was sponsored by EDS. The speakers were The Rt Hon The Lord Woolf, Master of the Rolls, Mr I M Burns CB, Director-General Policy, Lord Chancellor's Department, and Professor Richard Susskind, Masons.

Mr Ian M Burns CB*

Summary: The magnitude of the Lord Chancellor's Department's "business" was described and the way in which it is seeking to reform the machinery of Civil Justice. The role of Information Technology was seen as a tool with which to make changes, including the Legal Aid Board, Magistrates' Courts, the Department's own headquarters financial and business administration and the administration of the civil and the criminal courts.

Introduction

My main task this evening is to comment on how we are picking up the challenges set out in Lord Woolf's report, and then to focus on the relevance of Information Technology both to that task and to our wider responsibilities. But first I think it might be helpful to try to set the context.

The Department

The Lord Chancellor's Department is a relatively young Department as things go in Whitehall - until 25 years ago the Lord Chancellor had an office, but no Department, no responsibility for the courts outside the Royal Courts of Justice, no responsibility for the Magistrates' Courts and little for tribunals or for legal aid.

Today, the Department has all these responsibilities and has in addition acquired increasing responsibilities for the substance of the civil law.

We are in many respects the equivalent of a Ministry of Justice. This does not give us total responsibility for the justice system. On criminal justice, the policy lead rests with the Home Office and in the delivery of both civil and criminal justice. The Department, as a branch of the executive arm of government, is of course entirely separate from the judiciary, whose independence is crucial to the justice systems we operate.

The business we "run"

We run a large business, a lot of courts, a lot of staff and a business that touches a very large number of people. There are over 800 courts in England and Wales, two thirds of them Magistrates.

These courts are run by a total of 21,000 staff, about evenly split between the Court Service (which supports the County Courts, Crown Courts, etc) and the Magistrates Courts (which are run locally, but mostly paid for by the Lord Chancellor).

The courts deal each year with over 4 million civil cases and nearly 2½ million criminal cases. Many cases, both civil and criminal, are relatively routine and may take up little time in court - about half the civil cases do not need any formal hearing at all. But although many cases are relatively straightforward, they are always important for those involved in them. The 2½ million criminal defendants are matched by at least the same number of people involved as witnesses in criminal cases. The 4 million civil cases similarly involve another 4 million people as defendants: making allowances for some double counting, and for some under estimates in some areas, the overall total is somewhere between 10-15 million people a year.

Its importance to people

Anything which touches so many people is a big business, and the annual budget of some £800m confirms this. It is also a business of immense sensitivity. It in many ways represents the ultimate authority - in civil cases determining the rights of those who appear before the courts; and in criminal cases deciding, in the ultimate, whether or not to strip a person of his liberty.

Keeping up to date

The importance and sensitivity of these tasks means that we have a duty to ensure first that the code of law that is being enforced is itself up to date, and second that the way cases are dealt with is also kept up to date. These activities are the main business of the Headquarters of the Department, working with not only the judiciary and the Court Service, but also with a range of specialist bodies - associated with the Department - the Law Commission, the Judicial Studies Board, the Council on Tribunals, the Legal Services Ombudsman and so on.

Civil justice reform

Of all this, the most relevant this evening is the work we are doing to reform the machinery of Civil Justice. That work is a direct consequence of Lord Woolf's report. The Lord Chancellor has formally accepted the thrust of that Report and a steering committee is now driving progress forward. Appropriately, that committee is composed of senior judges, including Sir Richard Scott as the head of civil justice and Chief Executive of the Court Service and myself.

The consensus for change

The unique achievement of the Woolf report rests on the consensus across the interested parties (the Government, the Opposition, judiciary, the Bar, the Law Society, litigants and lay advice and consumer agencies) that the general tenet of his recommendations cannot be disputed and change to the Civil Justice System is vital.

This achievement provides historic opportunity to change fundamentally the provision of civil justice.

Our task is now to turn that consensus into an operating plan, and to implement it. We have made a good start.

Where we are on the road to achievement

Our aim is to deliver the main body of the civil justice reforms by 1 October 1998.

Legislation

The Civil Procedure Bill is well on its way through Parliament. It provides for the appointment of the new single Civil Procedure Rule Committee which Lord Woolf recommends and for an advisory Civil Justice Council. Preparations have been made for the early appointment of both.

Rules

A Rule team of 4 under the supervision of the Lord Chancellor's Legal Adviser is working on incorporating draft rules' consultation responses into second draft. The brevity of that statement does not do justice to the task. The new rules will make or break the reforms.

* *Director-General, Lord Chancellor's Department*

Fast-track procedures

One important novelty in the reforms is the new fast-track complex cases. Outline procedures and draft allocation questionnaires have already been produced, shortly to be made available to interested groups for informal comment and testing.

We aim to go out to formal consultation on them and the supporting rules in June 1997.

Multi-track procedures

Similarly, the outline framework for general (multi-track) cases (ie those which do not fall into a specialist jurisdiction) also already produced. Procedures for the specialist jurisdictions are to be developed around this framework.

As with fast-track, multi-track procedures are being tested with relevant players before formal consultation with supporting rules.

Costs

One aim of the reforms is to drive down the costs of litigation. Preliminary, informal discussions have opened on the fast track costs' regime with key stakeholders (eg Law Society, APIL).

Judicial training

The Judicial Studies Board, which is responsible for the training of the judiciary in these reforms, is in process of appointing the Access to Justice course director.

The Board plans for introductory training for all judges will be piloted a little later this year, followed by intensive training in 1998 based on the new detailed procedures. The Board is also exploring a third stage, providing training for specific needs, and possible joint training, bringing practitioners, court staff and judges together at local level to work through new procedures. The Law Society is one of the organisations which have been involved directly with JSB in those discussions.

Additional resources and conference centre have been provided to JSB to support training (£160,000 and £520,000 respectively).

Judicial manpower

An exercise to identify the number and level of judges needed for the new structure is nearing completion.

There is a great deal yet to be done. In many ways we are only just starting. A particular challenge that we face is the extent to which a change of culture is required - a change of culture both within the courts and outside. We face a major management task in devising new systems and procedures that will deliver the new policy requirements, and will at the same time be ones that our own staff, and the legal professions and others outside, can be expected to adjust to. There is a major training commitment both for the Court Service and, as I have already mentioned, for the Judicial Studies Board.

Information technology

I have not so far mentioned Information Technology because I see it as a tool with which to make changes; and if that tool is to be used properly, we first need to know clearly what are our objectives.

IT can also add to the size of the change that is required. We are fortunate now in having a wide range of staff who are already practised in the use of Information Technology, and in having an increasing number of judges who take a vigorous interest in exploiting the advantages which IT can offer. But we also face the difficulty that many of our new procedures are likely to rest heavily on computerised systems, and those who find difficulty in adjusting to them will find that this increases the challenge of working with the new procedures.

There is one other general observation I would like to make about IT before I try to describe to you what is happening at the moment. We have I think all long ago passed the stage at which we simply computerise existing administrative processes, but we are still learning how to develop IT strategies that will make the best of the opportunities across a range of different functions. Central government has learned the lesson that big is not always beautiful, and that a vast centralised system will not always deliver the improvements one hopes. We have learned that integrated systems allow for the advantages of centralisation, whilst retaining the flexibilities of separate stand-alone systems. But we are still learning just how to develop strategies to make the best of integrated arrangements, and how to mix in the right proportions the use of solid dependable technologies and techniques and reaching out for new imaginative, and sometimes untested, solutions.

It is in this context that the present strategy of using private contractors to deliver services, and not merely to deliver the equipment, seems to provide a truly valuable opportunity. The Department is currently working on three major public finance initiative contracts. Each is of major strategic importance to the Department as a whole, and each of them faces out to its own class of customers and users. At least for us, they are big projects. Taken together, their lifetime costs will run to around £200m.

The three contracts are known by their acronyms - LOCCS, ARAMIS, and MASS. LOCCS is the Local County Court System, but has long since been expanded in concept to cover civil business in other courts and some of our criminal business. It is, in essence, the IT contract for the Court Service. Our second project is ARAMIS, which will eventually provide for new resource management finance accounting and corporate management information systems for the whole of the Lord Chancellor's Department. MASS, the third of the projects, is the largest of all and will provide a standard IT system for all Magistrates' Courts.

LOCCS

The Court Service has been planning LOCCS for several years. The role-out of the first module of the system is imminent. This will be a project known as Caseman which will computerise the records of civil cases. The importance of that simple statement is easy to underestimate. With the best part of 4 million cases going through the civil courts each year, and with each case going through a wide variety of procedures and processes before it is dealt with, keeping track of the file, and being able to get hold of it whenever one wants it, is fundamental to the efficiency of the system. Computerising the main record card should mean that tracking the file down no longer poses a problem, nor does updating it. That very simple factor alone will save considerable time and effort, particularly in the County Courts. But it will also provide us with a database about the cases going through the County Court that will enable the Court Service to study other ways of improving its management of cases. Role-out of this vital change should be completed by the end of 1997.

By then the Court Service will also have taken delivery of the scoping study which has been commissioned from the PFI contractors. The purpose of the scoping study is to advise the Court Service on the further development of IT. Our primary responsibility is of course to run the courts well, but they must also be run well in the context of the time. The context of the time now includes the civil justice reforms, as well as the reforms to family law which flow from last year's statute. It is to this scoping study that we shall therefore be looking to identify the more precise steps we should be taking to provide IT support for the civil justice changes.

▲ *Lord Woolf (left) who introduced the topic "After the Woolf Report. Generating change with Information Technology" and Sir Brian Neill who did much to help and advise over the preparation of the event.*

We shall similarly be looking to the same scoping study to take account of some of the broader horizons. We look to it, for instance, to take account of the IT requirements for the judiciary over the next five years or so, building on a study commissioned by the Court Service last year, and only recently received. We shall be looking to the scoping study also to identify the wider opportunities, including possible interfaces between the courts and the legal professions or advice agencies, and including the provision of kiosks for enquiries to the court system.

The Court Service expects to receive the scoping study report soon after Easter. Since it is a policy requirement of the civil justice reforms that the principal reforms be delivered by 1 October 1998, that requirement is part of the remit which has been fed into the scoping study, and we will therefore be looking to the study's report to propose to us ways of delivering those reforms, and the Lord Chancellor's reforms to family law, on timetables set down.

Caseman itself is a major exercise; delivering new systems on the back of the scoping study will involve other major exercises. And I have not mentioned the work that is currently in hand to reach decisions, also by the mid-summer, on how we should develop the Crown Court IT systems, known as CREST.

MASS

Computerisation for Magistrates' Courts presents its own separate challenges. Magistrates' Courts are not run directly by the Department and the collaboration of individual Magistrates' Courts Committees is needed if there is to be a successful provision on a national scale. The object here is to produce management information systems and data-links which are consistent across the Magistrates' Courts service, and will allow an exchange of data between the Magistrates' Courts and other agencies.

Legal Aid Board

The third major project, ARAMIS, is at a rather earlier stage than the other two, but will be just as important for the operational management of the Department and for our preparation for the introduction of resource accounting across the whole of central government. But rather than take up your time with talking about that, I want to add a few words about another major computerisation exercise which we regard as vital to the successful control of two-thirds of our budget. That is the two-thirds which we spend on legal aid - about £1½ billion a year. The Legal Aid Board has, with financial grants from the Lord Chancellor's Department, been developing an £8m new Corporate Information System, of which the roll-out should begin this Summer. Like many of today's new IT systems, this one will enable the organisation to make significant internal management changes and to shorten the path towards taking crucial decisions. The system is an integrated system, covering the whole of the Headquarters and its 15 area offices. Again, like the best of other systems, it is designed to allow for the sharing of information with other bodies - in this case the Department and the Law Society.

Conclusion

The Legal Aid Board, Magistrates' Courts, the Department's own Headquarters financial and business administration and the administration of the civil and the criminal courts - these are four major themes of computerisation which we regard as crucial to the successful delivery of the services for which we are responsible. The true benefits of this new wave of technology will build up over time. We will get some early benefits in terms of the economy of operations, but there will be longer-lasting benefits in terms of our ability to sustain new policy approaches and new management styles. Nowhere will this be more important than in the successful delivery of the civil justice reforms. I do not want to minimise the value of any of the other projects I have mentioned, nor do I want to minimise the opportunities which LOCCS gives us for imaginative future developments in the courts, but I do have to say that the greatest value of the LOCCS project is likely to be the ability it gives us to deliver on the ground the information processing capacity, and the IT support to judges, which seem to me to be essential elements in the creation of the swifter, simpler and less costly delivery of civil justice to which Lord Woolf has opened our eyes.

FOUNDATION NEWS SPECIAL

▲ *Mike Heath, Director-General of the Engineering Council, The Rt Hon the Lord Jenkin of Roding, newly elected Chairman of the Foundation, and Professor Ron Amann, Chief Executive of ESRC at a recent meeting of the Foundation.*

Appointments following the AGM

The following appointments took effect from the Annual General Meeting of the Foundation for Science and Technology which was held at The Royal Society on 20 May 1997:

The Rt Hon the Lord Jenkin of Roding became Chairman of Council of the Foundation for Science and Technology, succeeding Lord Butterworth who was appointed President;

Sir Robin Ibbs, Professor Malcolm Jeeves and Dr Fiona Steele became members of the Council of the Foundation for Science and Technology, in succession to Mr Patrick McHugh, Dr Tom Johnston and the Baroness Platt of Writtle.

▲ *Michael Dadd, Director of BIOSIS UK (left), one of the sponsors of the meeting, speaking to Professor Malcolm Jeeves, President of the Royal Society of Edinburgh.*

BUSINESS & UNIVERSITIES GROWING TOGETHER: WHAT ARE THE ISSUES?

The Foundation held a lecture and dinner discussion at the Royal Society of Edinburgh on 6 November 1996 on the subject "Business and Universities Growing Together. What are the Issues?" The Lord Butterworth CBE DL was in the chair and the evening was sponsored by Biosis UK, Zeneca plc and the Foundation's Share Sponsorship Scheme – Comino Foundation, Esso UK plc, RHM Technology Ltd and Premmit Associates Ltd. The speakers were Mr Gerald R Wilson CB, Secretary & Head of Department, The Scottish Office, Education & Industry Department, Professor Sir Graeme Davies FEng FRSE, Principal & Vice-Chancellor, University of Glasgow, and Professor Charles Skene OBE, Council member, CBI Scotland.

Professor Charles P Skene OBE

Summary: Professor Skene commented on the reasons for the inability of Britain, and particularly Scotland, to create sufficient wealth and employment. He had concluded earlier that, in addition to having a culture which was anti-industry, our culture was also anti-enterprise and anti-competition. There was, he suggested, much to learn from the American universities' approach to business.

Introduction

Many of the important issues confronting business and education have already been raised and I agree with nearly everything that has been said, but I wish to concentrate on what I consider to be the seven most important issues.

1. the creation of more wealth and employment in Scotland, which is closely linked to
2. the need for universities and graduates to be more enterprising and entrepreneurial;
3. changing patterns in employment;
4. accreditation;
5. fund-raising;
6. collaboration; and finally
7. the financing and expansion of higher education.

Next month I will be time-barred from continuing as a Governor of The Robert Gordon University, having completed 12 years. In that time I have been a member of ten committees of which I have chaired three over a period of nine years and I have thoroughly enjoyed my involvement.

I also chair the Advisory Board, Centre for Enterprise Education at Strathclyde University. I have found most of the senior staff, with whom I have worked closely over the years, to be dedicated and hard-working.

My commitment to education is not a small one and any criticism I make tonight is from a desire to secure a more financially viable H.E. sector, and more enterprising graduates, more able to help business and industry to create more wealth and employment in Scotland.

The creation of more wealth and employment in Scotland

We Scots are always saying what an incredibly inventive and innovative people we are. True, but it is not enough!

Two years ago Scottish Enterprise published the excellent "Scottish Business Birth Rate" Report, which showed that, per head of population, fewer Scots start businesses in Scotland than do people in England.

This year they published an update which shows that, between 1978 and 1990, new Scottish firms created 125,000 new jobs, but, if we had been as enterprising as the West Midlands, we in Scotland, per head of population, would have been enjoying an additional 70,000 new jobs. If we had been as enterprising as the south-east of England, we would have been enjoying an additional 195,000 new jobs. These figures and other information to which I will refer, have been tabled.

I have recently been praising, at CBI Council and elsewhere, the joint RSE/Scottish Enterprise Publication "Technology Ventures", which proves the point that our universities are very successful at innovations and inventions, but are less enterprising at commercialising them. I believe that the most telling facts are on page 29.

You will see that, if Dundee University's Amorphous Silicone Technology had been commercialised in Scotland, both the university and Scotland could have benefited from some, if not all, of the 40,000 jobs which the invention underpins around the world. You will also see that, if Aberdeen University's Magnetic Resonance Imaging Technology had been commercialised in Scotland, both the university and Scotland could have benefited from the £1 billion a year market.

The report shows that Scotland has only 60 surviving spinout companies with 1500 jobs, while Chalmers University of Technology in Gothenburg has generated 200 surviving spinouts, employing 2,700 people locally, and M.I.T. claims 700 spinouts, employing 200,000 in Massachusetts.

I gave the opening address at our Governors' Conference in January this year when I spoke of my vision for Higher Education. I said that while I was disappointed that The Robert Gordon University had not agreed with my initial proposal, made some years previously, to purchase the 1200 acre estate at Blairs, six miles from our Garthdee campus, there were still many advantages of an interface between our Science and Technology Faculty and a Science and Technology Business Park which could still be built at Blairs. The Governors agreed, and we have successfully reached an agreement, with the current owners, for 70 acres.

I do not underestimate the difficulty in obtaining permission or in raising sufficient funds, and I remain unconvinced that the private finance initiative can be afforded by universities in the current funding system.

I do not suggest that it is a unique concept, but the changes, which I will propose later, in the organisation of the university year would, if adopted, allow and encourage students in our Science Faculty to work part-time for companies in the Science Park, thus encouraging

and facilitating the recommendations in the "Technology Ventures" Report.

Columbia University has recognised that they have a similar problem and have set up their Audubon Business Technology Centre in New York - even though in 1994/95 they received a staggering $34.3 Million from 152 licensing agreements!

COSHEP's submission to Dearing quotes from "The Technology Ventures" - "there was in Scotland a significant body of high quality commercially relevant research which compares with the world's best". True, but in all honesty I do not believe that we in Scotland can pat ourselves on the back, when the number of spinouts from all the universities in Scotland is less than from one university in Gothenburg! While research is vitally important, I believe, as a businessman, that it is what you do with it that counts.

The "Scottish Business Birth Rate" and the "Technology Ventures" Reports prove what I have been saying since 1983 that all sectors in Scotland, including universities, business, banking and venture capitalism, are insufficiently enterprising compared with many other countries, and we are suffering the consequences.

Comparison of GDP growth rates per annum from 1960-1993 illustrates our problems dramatically. The four fastest growing countries over the 33 year period are, first, Malaysia at 9.44% average per year followed by South Korea at 8.94%, Singapore at 8.44%, Thailand at 7.72% and Japan, in fifth place, at 6.27% per year. These countries are followed by Canada at 3.61%, France at 3.50%, Italy at 3.39%, USA at 2.78%, West Germany at only 2.72% and Scotland at 2.17%. This shows that the older industrial countries are being overtaken by the emerging countries.

The projection for 1996 suggests that Scotland's GDP will grow by 1.8%, which is similar to the USA and Canada, better than West Germany and Japan, but still a long way behind South Korea and Singapore at 9.9% and 9% respectively. These facts then lead me to my second main issue:

The need for universities and graduates to be more enterprising and entrepreneurial

Our lack of ability to create sufficient wealth and employment in Britain must surely now be accepted by all. It is not a new problem. Ten years ago the Royal Society of Arts became so concerned about Britain's falling share of world trade that they persuaded the government to designate 1986 Industry Year.

I was Chairman in Grampian, under the Scottish Chairmanship of Dr Tom Johnson, and when I researched the reasons for our decline as an industrial nation, I concluded that, in addition to having a culture which was anti-industry, our culture was also anti-enterprise and anti-competition. I believed that it was essential to introduce an enterprise culture as early as possible, so I introduced our own Young Entrepreneurs' Award for primary and secondary schools throughout Scotland. This year, we celebrated our Tenth Anniversary.

The Government acknowledged that such a problem existed in higher education and in 1988 introduced the Enterprise in Higher Education Initiative. I chaired the RGU Committee.

There is currently another excellent initiative operating in universities with which many of you may not be familiar. Two years ago I was invited by Scottish Enterprise to go to Boston to take part in Babson University's "Symposium for Entrepreneurship Educators" and to recommend whether or not I thought it should be introduced into Scottish universities. There are 350 universities teaching entrepreneurship around the world and Babson is the recognised leader under the direction of Professor William Bygrave, who is English, and had lectured at Oxford before going to Babson.

I was enthraled by the quality of the teaching by professors from both Babson and Harvard Business Schools, and by the way in which they use "pracademics". These are successful entrepreneurs, who teach through the use of case studies. My recommendation was positive and contracts were awarded to a number of universities in Scotland.

Regrettably, too many teachers in primary and secondary schools and academics still do not accept the need to integrate enterprise throughout primary to tertiary education.

I have tabled the recommendations of the CBI Scotland Enterprise Group, which included the leaders of all the political parties in Scotland. We recommended enterprise education for all, starting in primary schools, and we concluded with the statement: "students in higher education should be educated to be more enterprising in adult life and to consider the option of self-employment".

Despite Columbia's success at commercialising its inventions they continue to promote the: "development of an entrepreneurial culture within the university", as you will see from the report I have tabled.

I am so impressed by some of the latest developments at Glasgow Caledonian University, which mirrors my own views, that I have tabled a report on their activities.

Changing patterns in employment

Another major issue for business and higher education alike is CBI's belief that life-long employment for most is likely to be a thing of the past. We believe that most people will hold a "portfolio of jobs" for contracted periods of time, with people having to update their skills regularly, and with many having to do so at their own cost.

The COSHEP submission to Dearing concludes: "were students to exit our universities and colleges with a mountain of debt, that would be hardly likely to inspire in them a desire to return to full- or part-time study later in their lives, if by doing so they merely incur further debt". I do not agree.

This is part of the new concept of life-long learning, and I believe that this, and continuing professional development, will offer universities a growth area for income generation - far and away above what is happening at this moment. I believe that people will be willing to pay additional fees for additional training, certificates, diplomas or degrees, which will in turn help them to obtain employment or better paid employment.

Accreditation

Another issue is that of accreditation. Universities should not underestimate the influence of the various professional bodies which accredit a large number of courses.

One of our professional bodies has been expressing dissatisfaction with a course in one of our Scottish Universities for some time - not RGU! I understand that the university has disregarded the criticism, has not made the required changes and may therefore be on the point of losing the accreditation. In the ever faster, ever changing commercial world, universities must pay close attention to the requirements of business expressed through the professional bodies.

Fund-Raising

I believe that universities will have to adopt the American system of continuously raising funds, with one campaign following another for specific projects.

A major issue for business is how can we afford to contribute to these and the hundreds of other requests we receive. Perhaps universities should study the American system of tax relief and if theirs is more tax efficient than ours for businesses and universities, then our government should be lobbied. Universities will have to set up permanent campaign offices with high quality professional staff, and the courting of business and alumni will have to be pursued more vigorously.

Collaboration

I understand that SHEFC has a duty to achieve the best value for money, and, clearly, considerable savings could be made through amalgamations and/or takeovers of HEIs. At RGU we believe that that of Aberdeen University that we should continue to serve different markets - differently.

However, I do recognise that financial pressures will encourage more and more universities to collaborate, in ways they have never considered previously. For example: the sharing of plant and buildings, courses, perhaps even lecturers, student unions and recreational facilities. We also need more collaboration between HEIs and local business.

The COSHEP submission to Dearing comments that there has never been an "Ivory Tower" attitude in Scottish HEIs. Perhaps not, but there are many successful men and women, especially entrepreneurs, who have little if any involvement with their local university. Perhaps one way to improve this situation would be to have local "Guid Clubs" connected to each university.

The financing and the expansion of higher education

Two years ago we discussed the funding and the expansion of higher education when I chaired the CBI Scotland Education and Training Committee. Our conclusions differed from those of CBI England in that we stated that maintenance grants should continue as at present, but that tuition grants should be replaced by income contingent loans along the lines of the Australian system.

We stated that this recommendation, coupled to modularisation and semesterisation - in my opinion, three per year and not two - could bring tremendous advantages to universities and students alike. Such a change would allow: greater use of university buildings; the opportunity for students to fast-track or slow-track; students to work to pay their way through higher education; and encourage customer rights among students.

We concluded that this system would free, relatively speaking, higher education from treasury control and allow higher education to become a growth business.

If Dearing recommends the adoption of the Australian system, I think that the government will use some of the "savings" to introduce nursery education for all, as recommended by the excellent National Commission for Education Report "Learning to Succeed". Some of the "savings" will have to be returned because otherwise the £1 billion required for the maintenance of university buildings will otherwise not be affordable.

With income contingent loans, modularisation, semesterisation and perhaps rationalisation of courses, greater collaboration, more enterprising universities and students, I believe that Scotland's businesses and universities can grow together and increase the prosperity of the Scotland of Tomorrow.

FOUNDATION NEWS SPECIAL

VISIT TO THE PUBLIC RECORD OFFICE

Mrs Sarah Tyacke welcomed a group of some 35 Foundation members to the Public Record Office in its relatively new and somewhat spectacular building at Kew on 16 April 1997. Guests were briefed on the history and the strategy of the Office and told something of the technologies being used to serve the visiting public with the records. Visitors saw old and new: a display of important historic records and the new record delivery system. The building itself, with its special environmental and security controls, caused interest. The evening culminated with a buffet supper and discussion held in the Director's house at the Royal Botanical Gardens.

▲ *Mrs Sarah Tyacke talking to The Rt Hon Lord Jenkin of Roding PC during the Foundation's visit to the Public Record Office on 16 April 1997.*

▲ *Oscar Roith, past Deputy Chairman of the Foundation and a recent winner of the Foundation Medal, with Viscount Caldecote, a member of the Foundation, at a recent meeting.*

▲ *Visitors to the Public Record Office arrive at the Director's house of the Royal Botanic Gardens.*

LORD LLOYD OF KILGERRAN PRIZE

The 1997 award of the Lord Lloyd of Kilgerran Prize for "the application of science and technology for the benefit of society" is to Mr Berners-Lee for his work in the creation of the World Wide Web.

NEW ASSOCIATE MEMBERS

House of Lords Committee Office
Contact: Mr Andrew Makower

Contendere SA
Contact: John Beveridge QC

PowerGen plc
Contact: Mr Roger Jump

SmithKline Beecham Pharmaceuticals
Contact: Dr Robin Fears

▲ *David Finberg (left) who chaired the Foundation's seminar held jointly with ALPSP at the Royal Geographical Society (with the IBG), poses with Professor Bernard Donovan, John Day and Kevin Horlock. It was reported as being a very practical day for learned societies developing their ideas and knowledge about the use of the Internet.*

▲ *The Lord Butterworth, Sir Richard Morris and The Rt Hon Peter Brooke at one of the Foundation's events at the Royal Society.*

SUSTAINABLE DEVELOPMENT

On 7 February 1996, the Foundation held a lecture and dinner discussion on 'Sustainable Development – How Can Industry Manage its Environmental Liabilities?' The Lord Butterworth CBE DL was in the chair and the evening was sponsored by British Nuclear Fuels plc, Brown and Root Environmental, Department of the Environment, Railtrack plc and The Royal Commission on Environmental Pollution. The speakers were Mr F.A. Osborn CB, formerly Director General of Environmental Protection, Department of the Environment, Mr Rodney Chase, Chief Executive Officer, BP Exploration, and Mr Georges Kremlis, Head of Unit, European Commission DG Environment, Nuclear Safety and Civil Protection.

Mr F.A. Osborn CB*

Summary: Mr Osborn discussed risk management in relation to the common law and Statutory law, the role of government, the requirements for a legal framework for environmental liabilities and the role of the European Commission. He concluded with an exhortation to industry to come forward with positive proposals for the return of old sites to beneficial use and to reduce the clamour for new green field sites.

Risk

Risk is an inevitable part of life and of all economic activities. We are all familiar with this in our personal lives, and in the operations of organizations. We are familiar too with the various different types of risk that a business may encounter, such as: commercial risk that a product will not sell or not at the price and volume anticipated; risks that the workers of an organization may be hurt in their work and the employer may have to pay them compensation; environmental risks that activities may cause harm to the environment.

Environmental risks

Harm to the environment may arise either from a process or activity, or from the product of the activity. Some familiar examples of harm arising from processes are: the damage caused to forests and fresh waters by acid rain from industrial emissions; water pollution caused by industrial emissions of heavy metals or other chemicals; contamination of land or soil caused by industrial processes; risks of nuclear pollution from nuclear power plants or other nuclear processes.

Some examples of harm from products include: the damage to the ozone layer by the release of CFCs from old refrigerators, aerosols, etc.; or the release of PCBs from the many industrial products in which they are used.

Our knowledge about every kind of risk, particularly those arising in the environmental area, is increasing all the time. And each new technology and innovation brings its own new crop of risks to be considered, assessed and managed.

Science and industry are at the forefront on both sides of this process:

• inventing the new products and processes that sometimes give rise to new environmental problems;

• and inventing the new technologies and safeguards to handle those risks.

Occasionally it turns out that the environmental disbenefits of a process or product are so great that the only way to deal with the situation is to discontinue the process or ban the product. But one hopes that that will continue to be the exceptional case. In general, the history of human progress has been one of overcoming or reducing the various risks around us - first the risks we found in the natural world, and then the various risks we have created ourselves.

Risk management

Risks of all kinds, including environmental risks, need to be managed so as to minimize them - as far as is reasonably practical. Industry has developed many methods for risk analysis and risk reduction. Industry throughout the world is becoming increasingly sensitive to this issue, and more sophisticated about establishing proper methods of risk assessment and risk control.

Industry and standards organizations have also developed management systems for good management generally, and for environmental management in particular. The chemical industry's responsible care programme is one justly well-known example. And at a more formal level BS 5750, 7750, the European Environmental Management System -EMAS, and the corresponding ISO standards are all making headway gradually.

The common law

Nevertheless, if, things do go wrong and damage to the environment occurs, those adversely affected have a number of remedies at common law to take action for damages, compensation or restitution with actions under nuisance, negligence or strict liability.

Given all this activity by industry and these common law remedies for environmental harm, what need is there for government action? Might it not be sufficient to rely wholly on common law remedies and civil actions to provide the necessary discipline on those who undertake activities that may harm the environment, and to bring home to them the liabilities they ought to bear?

It is worth pausing a moment to consider why that could not really work - at least for a large class of the more generalized environmental problems. Take, for example, acid rain. It derives from very large numbers of industrial and domestic combustion processes all over the world. Its consequences are equally widespread and affect forests, fresh waters, health (perhaps), buildings, again over many countries. It would be impossible to relate any one bit of damage uniquely to a single source. The nature and extent of the damage done and the degree of responsibility of individual sources of emission would be impossible to establish satisfactorily through a judicial process. And the class actions that would be implied if one tried to associate whole classes of plaintiffs for the consequences of acid rain against whole classes of defendants is beyond credibility.

The role of government

This example and the many others that could be given are, I think, sufficient to demonstrate that in the field of environmental harm there is a clear need for governments to provide the legal framework to establish reasonable standards of what could or should be required of industry to guard against risks, and to determine what should happen when things go wrong. The framework

** Formerly, Director General of Environmental Protection, Department of the Environment*

needs to provide a number of things, including: the setting of prudent standards in a reasonable and rational way based on good science; incentives to comply with prudent standards of risk management, or penalties for failure to do so; remedies for when things do go wrong, either by way of compensation or by restitution and remediation; a system for dealing with past damage not previously identified, or not prevented or dealt with at the time the damage arose; machinery for establishing and enforcing the necessary standards on behalf of the public and the environment at large.

The legal systems and government frameworks need to achieve all these things without creating such unnecessarily onerous requirements and heavy bureaucracies as to discourage new enterprises that would be worthwhile and not unduly risky.

In order to have these effects, the legal framework needs to have two cardinal features:

• it needs to provide certainty both as to standards and as to the consequences of damage being caused or rules being broken. People need to know where they stand and what is required of them. And they need to know that if they take due care and diligently seek to comply with all the rules their efforts will not be undermined by competitors getting away with non-compliance and unsatisfactory standards;

• it needs to provide proportionality in the rules for compensation or restitution in the event of damage so that the liabilities to which undertakings are exposed and for which they are rightly held accountable bear a reasonable relationship to the nature of the risks involved and the capacity of the actors involved.

Special features of environmental risk

Environmental risks and environmental liabilities are proving particularly difficult to handle in this respect all over the world. There is first the problem of causation. Some environmental risks and the damage that may be caused are close enough for the chain of causation and liability to be obvious enough. The damage caused by the accident at Seveso is an obvious example.

But in other cases the chain of environmental causation is much longer, and may involve multiple causes operating over a long time. The damage caused by PCBs or CFCs are good examples. In such cases the chain of causation may be unclear and uncertain.

The persons adversely affected may be equally difficult to determine. And questions may arise as to whether damage to the non-human environment is a damage that should be taken into account by the legal systems.

Furthermore, problems and damage may only be identified many years after the activities which caused them. Pollution from old industrial activities may take many years to work through the subsoil to contaminate sources of fresh water. The effect of heavy metals or other chemicals as they accumulate in humans through the food chain may equally take a long time to discover. Science is continually discovering new potential for harm, and new pathways by which harmful substances can affect us.

Then there is the problem of the scale of environmental damage or alleged damage that may be caused by something going wrong. Sometimes the effects may be so extensive and the cost of compensation or complete remediation so enormous that they are out of all proportion to the means of the business undertaking the activity.

Some, of course, might argue that in such cases the activity in question ought not to be undertaken. But sometimes there may be an interest for the economy or for society as a whole that some of that activity should nevertheless be undertaken - under proper prudent conditions. In that case what is needed is some arrangement for providing some form of insurance cover to an individual undertaking that could not responsibly undertake the full risk by itself.

But in some parts of the environmental area insurance companies and other financial institutions have had their fingers burned by environmental claims in recent years and have now become reluctant to provide cover because of uncertainty about the extent and amount of liability that might arise, and the length of time over which positions may remain open, during which liabilities from past actions may arise.

Requirements for a legal framework for environmental liabilities

In the light of these special features of environmental risks, how can a legal system provide the certainty and the proportionality which industry needs?

In looking at this question it is useful to distinguish the future from the past. For the future the primary requirement is for industry to make as responsible an assessment as it can of all the environmental risks and problems that may arise from its activities, and to take all reasonable steps to guard against them. They need to comply with all statutory and other standards and to make provision for problems which are foreseeable in advance, such as the need to deal with wastes and any contamination which may inevitably arise during operations.

The chemical industry has developed this concept admirably in their ideas on responsible care. The mineral extraction industry has found its way after earlier errors towards strong and effective restitution requirements after mineral extraction. The waste disposal industry is gradually finding its way towards similar requirements for after-treatment of land-fill sites.

The nuclear industry has perhaps the most extreme examples of what society requires in this respect. They have to make certain that nuclear operations are as safe as they can possibly be and make provision for dealing with the restoration of sites and disposal of wastes after operations cease.

Since it may be very many years before nuclear plant can be safely decommissioned and since the final disposal of nuclear wastes must be guaranteed secure for many thousands of years, this is an onerous requirement which needs to be very carefully assessed, particularly in the context of privatisation, to ensure that proper arrangements can and will be made at the right time for decommissioning and final disposal.

In all these areas the government and its various regulatory bodies need to establish the framework and the machinery for ensuring that industries keep up to the mark with proper standards and practices. In my view, governments ought to provide a framework whose primary focus is on the encouragement of best practice rather than the penalization of mistakes, and which is dynamic rather than static. Of course, there must be standards for emissions, discharges, etc., and penalties for breaking them. But the more interesting challenge for government is how to give effective support to industry's own forward-looking concept of continuous improvement.

I make two observations here. First, it ought to be at the core of the BATNEEC (Best Available Techniques Not Entailing Excessive Cost) idea embodied in IPC (Integrated Pollution Control) and now in the European version IPPC to give effective support to the environmentally dynamic and progressive elements in industry. As new techniques are developed by progressive industry to carry out operations in better ways with less harm or risk to the environment the regulatory authorities need to be continually alert to keep abreast with these developments and to embody them in the BATNEEC standards at an appropriate pace. In that way progressive firms which take the trouble to develop new techniques of environmental protection become the pace-setters who set the standards for others to follow and will be rewarded accordingly.

Secondly, the regulatory authorities ought to be continually striving to encourage the development of responsibility in industry itself. One essential component of this lies in the law of liability. It would be quite wrong ever to countenance the suggestion sometimes made that mere compliance with all the statutory requirements and conditions imposed by regulatory bodies should be the sum total of all that is required of industry in the environ-

mental area or that it should be a statutory defence if things do go wrong. Full responsibility must always lie with industry themselves and their duty of responsible care.

But when an industry does take this to heart, when it does carry out environmental audits and subject itself to external scrutiny, when it does monitor its environmental performance and publish the results regularly, when it does adopt BSI7750 or EMAS or IS014000, then the regulators in their turn ought, I suggest, to take note of that. They ought not, of course, to relax any of the standards required of such a firm. But they ought to be able over time to relax the frequency and intrusiveness of their own inspection and monitoring - and thereby to save cost to industry and to the public purse. This is a form of deregulation much to be encouraged.

The legacy of the past

Looking at the past, the prime regulatory task in relation to environmental damage is to identify those responsible for causing damage and to ensure that they are made responsible for putting matters right and, where appropriate, for compensating those affected or paying appropriate penalties - all in accordance with the polluter pays principle. I am not going to discuss this evening in relation to all kinds of environmental damage. I shall concentrate solely on the area which has recently given the most difficulty, and about which the government has just legislated - for the second time in five years - namely, land contaminated by past industrial activities.

In principle, it seems desirable that those who are responsible for contamination that is still with us should be liable for dealing with it and clearing it up, just as with other forms of environmental damage, in accordance with the polluter pays principle. But, as we all know, there can be many problems about this. For example:

• land may have been contaminated many years ago and the persons responsible or their organizations may no longer be identifiable.

• Contamination may have migrated over a wide area to a point at which it is very difficult now to deal with it in any practical way.

• The process and operations concerned may have been operated according to best practice at the time concerned, with the nature of the problems, and possible solutions, only being identified many years afterwards.

As a result, there has been, until recently, a great deal of uncertainty and unfocused alarm about past contamination. People have not known how big a problem it is either in total or in specific sites, and how much it is reasonable to do to put past problems right. Even when action is clearly needed it has not always been possible to identify who should be required to act and who should be financially responsible for whatever has to be done. There has not been certainty. There has not been proportionality.

In some countries, notably the US, over-zealous enforcement activities and attempts to compel clean-up of past contamination has resulted mainly in a lot of litigation. Very expensive remediation solutions have been imposed in a few cases but with no sense of proportion between the costs imposed and the benefits to be achieved. The fear of similar policy developments here has cast its own shadow.

The upshot in the UK was a widespread disinclination to get involved with any sites which might have been even potentially contaminated. They were seen as bad news with a large hassle factor, and there has been a widespread problem of blight.

I believe, however, that recent developments in the Courts and in the Statutes, together with improvements in administrative arrangements and improved technical understanding of what needs to be done to deal with contaminated sites, have done much to counteract the uncertainties, and to enable owners of contaminated sites to tackle the problems in a more confident way.

Clarification of the common law

On the common law side, the position was first complicated by the early stages of the Cambridge Water Company case. But it was eventually clarified by the final House of Lords' decision in 1993. The crux of that decision was that owners conducting potentially hazardous operations on their land (including ones that may potentially contaminate land and water) owe a duty of care to their neighbours not to let dangerous substances or contamination escape onto their neighbours' land - but only to the extent that the damage concerned was reasonably foreseeable at the time of the operations. This appears to have established the law satisfactorily as between neighbours, and the government have made it clear that they see no reason to seek to alter this position by Statute. I shall say no more about this aspect this evening.

Clarification of the statutory law

On the statutory side, after one false start in 1990, the UK has attempted to develop a more systematic and rational approach in the 1995 Environment Act. That Act limits the liability to public action on contaminated sites by establishing that the public authorities should only insist on remedial action being taken when there is clear evidence of harm or potential harm to human health, property and protected eco-systems, or pollution of water; and that they should only require to be done so much as is necessary to deal with unacceptable risks and to make sites suitable for use, and then only when the action to be taken is reasonable, having regard to the costs involved and the seriousness of the problems being addressed. Finally, the Act establishes an equitable system for determining who should be liable for bearing the costs of remedial work.

The provisions in the 1995 Act were the subject of very wide consultations and the issues were intensively discussed both before and during the passage of the Act.

I think it is fair to say that there is now widespread agreement among industry and others that the basic framework now established by the House of Lords' judgement on the Cambridge Water Company case and the 1995 Act is on a much more satisfactory basis than before. The enforcing authorities under the central strategic guidance of the Environment Agency will now act in a much more certain and systematic way in dealing with the worst cases first, and aiming to achieve restoration only to such levels as will make the land suitable for use and not to some notional pristine state. Costs will lie, in principle, on those whose actions have led to the creation of the problems in accordance with the polluter pays principle, but there will be equitable arrangements for sharing the burden where other parties are or ought to be involved.

The last point is, of course, a critical one, and there are still details to be elaborated in guidance which I understand will be published shortly. There are no completely tidy solutions here. Sometimes the responsibility for dealing with contamination should clearly lie with the original polluter. But sometimes when a subsequent owner of land has bought it in full knowledge of its polluted state (with this knowledge doubtless influencing the purchase price) or when he has taken further actions which may have exacerbated the problem (e.g. by disturbing a contaminant that would otherwise not have caused problems), then it may be that the responsibility should pass at least in part to the purchaser.

Normally, a financial institution which has lent money to purchase a site that turns out to be contaminated should not simply by virtue of that fact have to assume any liability for clean-up. But if it becomes more closely involved in the management or takes possession it may be right for it to accept some of the liability.

Occasionally, it may happen that a contaminated site is an orphan site in which it is not possible to find the original polluter, and on which it is not possible or reasonable to hold the present owner fully liable for the necessary remediation. In such cases there will be some limited public sector funds available in the form of local authority borrowing approvals or in the hands of English Partnerships, or possibly from the Environment Trusts which may be created to receive funds otherwise payable under the new landfill tax.

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PROFILES OF COUNCIL MEMBERS

The Rt Hon The Lord Jenkin of Roding PC

The Rt. Hon. the Lord Jenkin of Roding, perhaps better known as Patrick Jenkin, achieved some prominence as a member of Mrs. Thatcher's Cabinet between 1979-1985. He had been made a Privy Councillor when he was Chief Secretary to the Treasury in 1973 (in the Heath Government) and was made a Life Peer in the Dissolution Honours List in 1987.

Though not a scientist himself, he comes of sound scientific stock. On his father's side, his great-grandfather, Professor Fleeming Jenkin, was the first Professor of Engineering at Edinburgh University; his grandfather, Professor Frewen Jenkin, was the first Professor of Engineering Science at Oxford University. Both achieved FRS. On his mother's side, a forebear was Professor Sir Robert Christison, Professor of Materia Medica at Edinburgh University and Physician to Queen Victoria.

Despite his genes, he was early attracted to politics and studied law at Cambridge where he gained first class honours. Called to the Bar by the Middle Temple in 1952 and after practising for 5 years, he entered the chemical industry, joining the industrial group of the Distillers Company Limited at St. James's Square. The combination of a legal training with business experience in a research-based industry was not a bad preparation for Parliament and Office.

After service as a local councillor in Hornsey, North London, his first real break came when he was selected as the Conservative candidate for Wanstead and Woodford, a seat held until 1964 by Sir Winston Churchill. He represented that constituency for nearly a quarter of a century.

In the House of Commons he quickly caught the eye of Conservative leaders and in 1965 was invited to join Mr. Heath's Shadow Front Bench team as a junior spokesman on Treasury, Trade and Economic Affairs. There, he worked closely with the late Iain Macleod and, in 1970, became Financial Secretary to the Treasury, rising in 1972 to Chief Secretary to the Treasury. When the Department of Energy was carved out of the DTI in January 1974, Jenkin became the Minister for Energy and the Department's principal spokesman in the House of Commons. It was a turbulent few weeks dominated by the 1974 oil crisis and coal strike and in February the Conservatives lost the election and went into Opposition.

Jenkin then joined the Shadow Cabinet as Shadow Spokesman on Energy and was immediately determined to understand the industries covered by his portfolio, notably the off-shore oil industry, the gas and electricity industries and the nuclear industry. With regard to the last, perhaps as an antidote to the loss of office, he set himself the task of understanding the competing nuclear technologies, seeking wisdom not only in the UK but also in Canada, the United States, France, Germany and Brazil. His parliamentary colleagues sometimes said that he could build a nuclear plant in his own garden! He formed a close friendship with the late Walter Marshall (later Lord Marshall of Goring) who became something of a nuclear mentor. The off-shore oil industry, too, fascinated him and at the time he could have told you the names of every oil and gas field, the principal operator and the other participating companies.

Then in 1976, Margaret Thatcher appointed him Shadow Spokesman on Health & Social Security. For three years he led the Party's policy-making on these subjects, incidentally becoming familiar with the UK pharmaceutical industry.

So it was no surprise, when Mrs. Thatcher formed her first Government, that Jenkin was appointed Secretary of State for Health & Social Security. He restructured the Health Service and carried through legislation to trim social security commitments to what the country could afford. He rebuilt the confidence of the medical profession, badly shaken by the "Winter of Discontent".

In 1981 he was moved to the Department of Industry where he led what became one of the Conservative Government's major achievements - the privatisation of the public utilities. His White Paper on the privatisation of British Telecom stunned Whitehall with its boldness and he takes a quiet satisfaction that the UK's example has been imitated right across the world. Some key appointments paved the way to the privatisation of Rolls Royce. His resolute support for Sir Michael Edwards at British Leyland was crucial in ensuring that management regained control of the company - an essential precursor to privatisation.

Following the 1983 election, he became Environment Secretary and was immediately plunged into the controversies surrounding rate capping and the abolition of the GLC and the Metropolitan County Councils. Nevertheless, he found time to study the water industry and initiated the steps that led to its eventual privatisation. He became closely involved in the major environmental issues such as acid rain, global warming and atmospheric pollution, subjects that have engaged him since he left the Government. In September 1985, he returned to the backbenches and two years later became a Life Peer.

Since leaving office he has built what he calls a "third-age portfolio" - a mixture of public service, private enterprise and voluntary work. He is chairman of Friends Provident Life Office, a member of the Supervisory Board of Achmea Holdings (Netherlands), a member of the International Advisory Board of the Marsh & McLennan Group, an advisory director of National & Economic Research Associates Inc., and an advisor to the Sumitomo Trust Bank and other companies. He is chairman of Forest Healthcare NHS Trust, chairman of the Queen Mary & Westfield College Public Policy Research Advisory Board and chairman of the Westfield Trust. He is a Fellow of QMW and also holds an honorary Doctorate of Law at the South Bank University. He is president of Clifton College, Bristol. In the voluntary sector, he was founder president of the British Urban Regeneration Association, a council member of the UK Centre for Economic & Environmental Development, a council member of the Guide Dogs for the Blind Association, vice chair-

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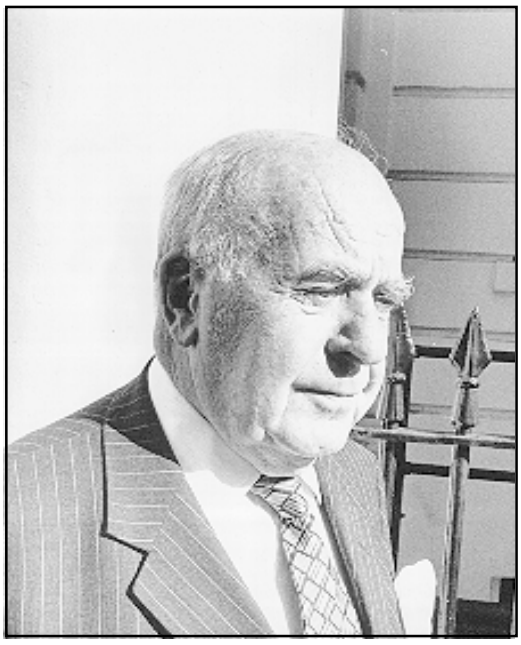
CHAIRMAN'S REPORT FOR THE YEAR ENDED 31 DECEMBER 1996

Chairman: The Lord Butterworth CBE DL

1996 has been a year of success for the Foundation with a number of records being broken. During the year we held more events than in any previous year. At the same time the Foundation's wings were spread to Berlin and once again to Edinburgh, also giving a "return match" to the French following our 1995 event in Paris.

The Foundation achieved a record level of sponsorship which must surely be one measure of its success. The Council set a level of £7,000 to cover the indirect as well as the direct costs. Naturally, it is impossible to raise full sponsorship for every event, but an overall level of over 90% was achieved. The Foundation's Council is grateful to all those who sponsored events and also those important contributors to the Shared Sponsorship Scheme. Thanks are also due to The Royal Society, the Royal Academy of Engineering and the British Academy for their very helpful donations in support of our work; and, in the case of The Royal Society, for allowing us to use their rooms throughout the year.



Our events covered a broad span of subjects and in a number of areas we were able to explore our chosen problems in greater depth. On some evenings we reflected further on current education issues, an area which is bound to receive even greater attention in the immediate future. Many of our subjects provoked discussion on matters of science policy, ethics and the general impact of science, engineering and technology on society. Let me remind you of some examples: "Science, Industry and Government - the place of pressure groups", "Human genetics - ethics, society and legislation", "Investing in growth issues for technology based firms", "Younger scientists and engineers - it's their future", "A-Levels and the qualifications framework", "Information technology - the police and society" and "Partnership in technology - USA & Europe". I think that this demonstrates the breadth of interesting subjects being maintained by the Foundation, all with excellent and relevant speakers.

A particular highlight of the year was the event in Berlin, organised jointly with German organisations, but especially the German-British Chamber of Industry and Commerce. Collaboration between industries in the two countries was the theme for the afternoon discussions followed by a dinner at which Frau Yzer, Parliamentary State Secretary in the German Ministry for Education, Science, Research and Technology spoke. The visit on the following day to the BMW Rolls-Royce plant at Dahlewitz enabled us to see a first rate example of collaboration.

Other visits during the year were to the new air traffic control centre at Swanwick, to the Rutherford Appleton Laboratory and to the Warwick Manufacturing Group.

In the early winter we received guests from France for meetings and a lunch around the topic of "High value and high technology industries in the EU - possible roles for France and the United Kingdom". These were followed by a visit to the Thames Water London Ring Main.

The Foundation's Council sought to have some younger scientists and engineers present for many of the events, and the Associate Members are encouraging their younger "high flyers" to come along from time to time. We hope that these efforts will be continued and that our meetings may increasingly be enlivened by the contributions of younger generations.

I turn now to the Foundation's work with learned societies. It is perhaps a role little known to many, but important not only to the 230 subscribing societies but also to many others, especially the smaller ones. The work is particularly important at a time when the Charity Commission has been changing its stance. It is becoming more proactive, giving advice, providing guidelines and becoming very much more approachable. A measure of this can be seen in the frequent assistance given by them to the Foundation at its seminars. At a major seminar we arranged for Honorary Treasurers both the Chief Charity Commissioner and one of his officials spoke to a large audience from many different learned societies. If learned and professional societies can put and keep the management of their affairs in good order, then they can concentrate their resources on advancing sciences, engineering, technology and the humanities. I should like to pay tribute to the Harold Silman Fund, a special fund held by the Foundation which assists in the work with learned societies.

The Lord Lloyd of Kilgerran Prize for 1996 was awarded to Sir William Stewart and Dr W Graham Richards, and Foundation medals for outstanding service to the Foundation went to Oscar Roith, David Andrews and John Pascoe, all of whom had been closely involved in the management of the Foundation's affairs.

During my Chairmanship of the Foundation I have had enormous support from the Honorary Officers, and this last year has been no exception when Sir Richard Morris as Deputy Chairman, Roger Davidson as Honorary Treasurer and Professor Chris Elliott as Honorary Secretary have all played important roles. My very warm thanks go to them. Likewise, I would like to thank our Vice Presidents and the members of Council and of its committees. The Foundation continues to be most fortunate in having their support. I should also mention the membership at large: the individuals and the Associate Members who all play such a crucial role in the Foundation's development. Finally I would like to thank the staff: David Hall, Jennifer Grassly, Lucy Stopford, Chris Staffurth, our book-keeper, and Derek Eddowes, our Journal Editor; and a special word of welcome to Keith Lawrey.

I am delighted to retain some involvement in the Foundation's affairs by following my predecessor as President of the Foundation, and I am sure that under the chairmanship of Lord Jenkin of Roding the Foundation will continue to develop and play its part both nationally and internationally. I wish him very well with the Foundation for a great and effective future.

FOUNDATION FOR SCIENCE AND TECHNOLOGY – STATEMENT OF FINANCIAL ACTIVITIES FOR THE YEAR ENDED 31st DECEMBER 1996

INCOME AND EXPENDITURE	Unrestricted funds £	Restricted funds £	1996 £	1995 £
Incoming resources				
Donations	19,093	-	19,093	21,112
Sponsorship Income	127,872	-	127,872	104,673
Accreditation fees and subscriptions	99,257	-	99,257	103,476
Learned societies' activities	13,832	-	13,832	11,550
Fixed asset grant	967	-	967	967
Listed investment income	8,456	-	8,456	8,019
Bank deposit interest	16,909	532	17,441	15,720
Total Incoming Resources	286,386	532	286,918	264,517
Resources Expended				
Direct charitable expenditure	182,395	65	182,460	163,004
Management and administration	51,691	-	51,691	54,125
Total Resources Expended	234,086	65	234,151	217,129
Net Incoming Resources for the year	52,300	467	52,767	47,388
Other Recognised Gains and Losses				
Unrealised gains on investment assets	11,709	-	11,709	14,289
Net Movement in Funds	64,009	467	64,476	61,677
RETAINED SURPLUS BROUGHT FORWARD	479,314	10,629	489,943	428,266
RETAINED SURPLUS CARRIED FORWARD	543,323	11,096	554,419	489,943

TOTAL RECOGNISED GAINS AND LOSSES

The company has no recognised gains or losses other than the surplus or deficit as shown above.

CONTINUING OPERATIONS

None of the company's activities was acquired or discontinued during the accounting periods shown above.

FOUNDATION FOR SCIENCE AND TECHNOLOGY BALANCE SHEET – AS AT 31st DECEMBER 1996

	1996		1995	
	£	£	£	£
FIXED ASSETS				
Tangible assets		7,969		9,085
Investments		355,801		337,112
		363,770		346,197
CURRENT ASSETS				
Debtors	23,544		14,340	
Cash at bank - on deposit	189,669		138,803	
- Current account	500		500	
- The Harold Silman Fund	11,132		10,347	
Cash in hand	38		136	
	224,883		164,126	
CREDITORS - amounts falling due within one year	34,234		20,380	
NET CURRENT ASSETS		190,649		143,746
TOTAL NET ASSETS		554,419		489,943
Financed by:				
FUNDS		543,323		479,314
Unrestricted		11,096		10,629
Restricted				
		554,419		489,943

Approved by the Council on 18th March 1997 and signed on its behalf by council members: THE LORD BUTTERWORTH and R G L DAVIDSON

◄ 21 Lord Jenkin, concluded

man of the Imperial Cancer Research Fund and a vice president of the Foundation for Science & Technology. He was, for four years, chairman of the UK-Japan 2000 Group. In between, he manages to find time to be fairly active in the House of Lords and was a member of the Special Select Committee on Sustainable Development.

Lord Jenkin's friends and associates speak warmly of him. Professor Ian Bruce, Director-General of the Royal National Institute for the Blind, writes: "*Patrick Jenkin is a man of principle who weighs up situations carefully, and is not prepared to be rushed and pushed into the latest fad be it political or social*", and of his chairmanship of a co-ordination committee comprising representatives of all the major organisations for blind people, he recalls his "*tact, diplomacy, wisdom and intelligence*" and how these abilities enabled the sixteen organisations on the committee to "*move together co-operatively, harmoniously and to the benefit of blind and partially sighted people in this country*".

In another tribute, Sir Walter Bodmer FRS, of The Imperial Cancer Research Fund, describes Lord Jenkin as: "*a great friend, supporter and helper to me personally, and to the Imperial Cancer Research as a whole*".

Now aged 70, he is beginning to reduce these commitments and greatly looks forward to following Lord Butterworth as chairman of the Foundation. He likes to think that his three professional ancestors might approve!

SPONSORED LECTURES, LEARNED SOCIETY SEMINARS AND FOUNDATION VISITS – 1 JANUARY 1997 - 31 MAY 1997

LECTURE TITLE	SPEAKERS	SPONSORED BY
"University Research: How should limited funds be deployed?"	Sir David Harrision CBE FEng, Dr Clive Booth Professor Sir Brian Follett FRS, Dr Polina Bayvel	ICI
"Scientific Judgement: Contribution to or Substitute for Policy?"	Miss J H Bacon, Mr Robin Grove-White, Professor Sir Tom Blundell FRS	AEA Technology, Health & Safety Executive, Ministry of Agriculture, Fisheries & Food
"After the Woolf Report: Generating Change with Information Technology"	The Rt Hon the Lord Woolf, Mr I M Burns CB, Professor Richard Susskind	EDS
"What after Gas?"	Sir Crispin Tickell GCMG KCVO, Dr Robin Jeffrey FEng, Mr Roger Rainbow	Shell International Limited, Foundation's Shared Sponsorship Scheme
"Priorities in Medical Research. A Dilemma in the Late 90s?"	Professor John Swales MD FRCP, Professor Sir Micheal Bond, Dr James Niedel	Glaxo Wellcome plc, The Kohn Foundation, Zeneca Group plc
"UK Research and the Framework Programme: Future Directions?"	The Earl of Selborne KBE FRS, Sir Robin Nicholson FEng FRS, Mr Richard E Escritt	British Telecommunications plc, Office of Science and Technology, Unilever plc
"The City - Its Role in the World of Virtual Financial Markets"	Professor Richard Susskind FRSE, Mr Vernon Ellis, Sir Brian Jenkins GBE	Andersen Consulting
"Space in our Lives. Sound Business or Expensive Illusion?"	Sir Robert Wilson CBE FRS, Mr Iain Green Mr James V Zimmerman	AEA Technology, British National Space Centre, Foundation's Shared Sponsorship Scheme
"The Digital Race to the Home. Winners & Losers"	Dr Alan Rudge CBE FRS, Dr Ade Peled Mr Huw Jones	Science Systems SGS-THOMSON Microelectronics

FOUNDATION TECHNOLOGY VISITS

"A high tech laboratory in the UK: An International Asset" - Visit to Nortel Laboratories, Harlow

"Domesday to the 21st Century. Public Access to 9 centuries of the National Archive"- Visit to the Public Record Office, Kew

"Oceans of Wealth. Science and Exploitation"- Visit to the New Oceanography Centre, Southampton

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◄ 20 Sustainable development, concluded

The way in which all this is to be established in individual cases will have to be elaborated in the guidance and in the light of experience with actual cases. But I believe that the framework which the government has established has now put this subject on a basis which should both provide the means for dealing with bad cases of past contamination in an orderly and sensible way, and provide reassurance and security for industry for the future.

Europe

I very much hope that whatever proposals are brought forward on the general subject of environmental liability The European Commission will not disturb the basic framework for dealing with land contaminated by past industrial action now established in the UK. In relation to that subject, I understand that several European countries as well as the UK have now established appropriate regimes for dealing with past problems in accordance with the legal systems and administrative structures of their own countries, and would not wish to see a different European framework imposed on the arrangements they have painstakingly worked out. In respect of land contaminated by past industrial action, I believe, therefore, that the most useful Commission role would be to concentrate primarily on co-ordinating, thinking and developing technical understanding throughout Europe on the assessment of risks and on methods of remediation. The legal rules about liability necessarily differ from country to country throughout Europe depending on their past legal traditions. So any common legislation, if needed at all, would need to be at a very broad framework level, perhaps simply indicating the kind of issues which need to be dealt with in each national code.

In particular, it would not, in my view, be desirable to pursue at European level any concept of liability so severe as to require remediation of existing contaminated sites to an excessively high pristine state regardless of the costs and benefits of so doing. The objective should be to deal with risks and dangers to the public as far as is necessary to make sites fit for use.

A challenge to industry

I conclude with a challenge to industry. Industry has had difficult problems to deal with in facing up to issues about contamination and liability. Until the last legislation government has not helped as much as it might. But

- now that the legal position is becoming clear,
- now that the duties of the enforcing authorities have been clarified and their actions will become more predictable,
- now that public expenditure provision has been increased for dealing with orphan sites for which there is no clear private sector responsibility,
- now that English Estates is getting into full stride in helping to clear up past dereliction and sites with negative value,
- now that a landfill tax regime is being established which will allow the taxpayers to offset their liability if they put money into Landfill Trusts for clear-up of old landfill tips and other related purposes,
- now at last I believe that the country is entitled to turn to industry and to the financial and insurance industry, and to say loud and clear, "Now it is your turn"
- your turn to bite the bullet, and to come forward with positive proposals for remediation and return of sites to beneficial use,
- your turn to play your full part in regeneration of old sites, and to reduce the clamour for new greenfield sites,
- your turn in the financial and insurance industries to cease running away from any sites on which there may be queries about contamination, but to come back into a proper commercial assessment of the extent of what will now be much more ascertainable risks and to do good business once more in providing the necessary cover.

I believe that many companies are gearing up to do just this. My challenge is to all firms to do likewise.

ASSOCIATE MEMBERS & MAJOR DONORS

Whose support of, and involvement in, the affairs

of the Foundation is gratefully acknowledged

1 MAY 1997

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Birmingham University
Blake Resource Development
Bristol University
British Aerospace plc
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British Antarctic Survey
British Council
British Gas plc
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Chameleon Press Limited
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City University
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Contendere SA
Cookson Group plc
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Coutts & Co
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David Leon Partnership
De Montfort University
Department for Education
Department of Health
Department of the Environment
Department of Trade & Industry
Department of Transport
Director General Research Councils
Dundee University
East Anglia University
European Public Policy Advisers
Edinburgh University
Engineering Training Authority
Ernst & Young
Esso UK plc
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Glaxo Wellcome plc
Glasgow University
Graduate School of the Environment
Greenwich University
H J Heinz Company Limited
Heads of University Biological Sciences
Health & Safety Executive
Hertfordshire University
Higher Education Funding Council for England
Higher Education Funding Council for Wales
Hinckley Group
Hitachi Europe Ltd
House of Commons Library
House of Lords Committee Office
Hull University
IBM United Kingdom Limited
Imperial Cancer Research Fund
Imperial Chemical Industries plc
Imperial College
Institute of Food Research
ISIS Electronics
Japan Society for the Promotion of Science
Johnson Matthey plc
Jones & Shipman plc
KPMG
Keele University
Kent University
Kesslers Manufacturing
Kings College London
Knoll Pharmaceuticals
Kobe Steel Ltd/Kobe Steel Europe Ltd
Kvaerner Enviropower Ltd
Kraerner John Brown Holdings plc
Laing Technology Group
Leeds University
Leicester University
Liverpool University
Lloyd's Register of Shipping
London Guildhall University
Loughborough University of Technology
Lucas Varity
Luton University
Machine Tool Technologies Association
Management Technology Associates
Manchester Metropolitan University
Merck Sharp & Dohme
METCOM
Meteorological Office
Metropolitan Police Service
Middlesex University
Ministry of Agriculture, Fisheries & Food
Ministry of Defence
Mitsui & Co UK plc
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New Law Publishing Co plc
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Newcastle University
Nortel Ltd
Nottingham Trent University
Nuclear Electric plc
Office of Science & Technology
Oracle Corporation UK Ltd
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Ordnance Survey
Ove Arup Partnership
Oxford University
Parliamentary Office of Science & Technology
Perkins Technology Ltd
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PowerGen plc
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Premmit Engineering Services Ltd
ProMicro Limited
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Queen Mary and Westfield College
RHM Technology Ltd
Railtrack plc
Reading University
Research into Ageing
RINGI Ltd
Roche Products Ltd
Rolls-Royce Power Engineering plc
Rossmore Dempsey & Co Ltd
Rover Group Ltd
Royal Botanic Gardens, Kew
Royal Commission for the Exhibition of 1851
Royal Commission on Environmental Pollution
Royal Holloway & Bedford New College
SAP (UK)
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Science Policy Research Unit
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Scottish Higher Education Funding Council
Sebastian Conran Product Identity Design
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