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9 February 1983

TO: SIR ROBERT ARMSTRONG

FROM: DR NICHOLSON

cc: Mr Sparrow
Mr Gregson
Mr Hancock
Mr Coles ✓

VERSAILLES WORKING GROUP ON TECHNOLOGY, GROWTH AND EMPLOYMENT

The Versailles Working Group on Technology, Growth and Employment duly completed its work on 26 January and formally presented a copy of its report to President Mitterrand. - in folder attached to file

2. Only the French text was available for presentation and there remained a fair amount of tidying up of both the French text and the English text, which has been carried out subsequently. I enclose a copy of the final English text. The French and English texts are the only official reports from the Working Group, but versions in other languages will be prepared by some of the other countries.

3. Now that the final texts have been prepared, President Mitterrand will shortly be communicating the report to Heads of State and Government, and the Prime Minister can expect to receive it from him in the course of the next few days. There will also be a covering letter which we hope to have a sight of before it is despatched, which will contain President Mitterrand's proposals for future treatment of the report.

4. It is likely that this letter will propose publication of the report on or about 2 March. The benefits of early publication in terms of avoidance of leaks and some public discussion of the report before Heads of State and Government meet in Williamsburg were felt by most nations to outweigh the disadvantages. In particular, it was felt that publication at the time of Williamsburg would result in the report being submerged by all the other material which will be released to the Press at that time. I have reserved the position for the United Kingdom but

my advice to the Prime Minister will be to agree with the majority view.

6. On the day that the report is published, it is likely that President Mitterrand will also send copies to Embassies of foreign countries in Paris, except for Soviet Bloc countries. However the Group agreed that the possible involvement of non-Summit countries in the projects and any other activities resulting from the report should be postponed until after Heads of State and Government have had an opportunity to discuss and comment on the report at Williamsburg.

7. There would seem to be some benefits in the United Kingdom distributing copies of the report on publication day to Commonwealth High Commissions in London. I am taking advice from the FCO on this matter.

8. As far as the mechanics of publication are concerned, the possibility of central printing and distribution being arranged by France was examined but turned out to be disadvantageous because of the charge which the French would have to make, and some doubt as to whether they could print the report in English. The simplest and cheapest alternative seems to be to have the report reproduced and published through the Department of Industry, and I am seeing their Publications Department later this week. We do not anticipate large-scale public interest but it will probably be necessary to prepare about 500 copies for distribution to Departments, the media and other enquirers.

9. As far as projects are concerned, some now appear by title only as anticipated, and this group includes the Renewable Energy Sources project developed by the Department of Energy. The other projects in which the United Kingdom is leader or co-leader were all retained in full form and the responsibility for pursuing these will now be passed to Departments, as will the responsibility for participating in projects led by other countries.

RBN

REPORT OF THE WORKING GROUP ON TECHNOLOGY, GROWTH, AND EMPLOYMENT

EXECUTIVE SUMMARY

General Introduction

> "Revitalization and growth of the world economy will depend not only on our own effort but also to a large extent upon cooperation among our countries and with other countries in the exploitation of scientific and technological development. We have to exploit the immense opportunities presented by the new technologies, particularly for creating new employment. We need to remove barriers to, and to promote, the development of and trade in new technologies both in the public sector and in the private sector. Our countries will need to train men and women in the new technologies, and to create the economic, social and cultural conditions which allow these technologies to develop and flourish. We have considered the report presented to us on these issues by the President of the French Republic. In this context we have decided to set up promptly a working group of representatives of our governments and of the European Community to develop, in close consultation with the appropriate international institutions, especially the OECD, proposals to give help to attain these objectives. This group will be asked to submit its report to us by 31 December 1982. The conclusion of the report and the resulting action will be considered at the next economic Summit to be held in 1983 in the United States of America."

Declaration of the Seven Heads of State and Government and Representative of the European Communities

Chateau of Versailles, June 4, 5, and 6, 1982

Consistent with this instruction, and at the initiative of the President of the French Republic, a Working Group of Representatives of Seven Heads of State and Government and the Representatives of the European Communities was set up to consider the opportunities, problems, and challenges presented by technology, with special regard to economic growth and employment. The Working Group met for the first time on August 20th, 1982.

Operating on the basis of consensus, the Working Group has produced a report which is essentially policy-oriented in nature and is addressed to Heads of State and Government*. The report is selective: it concentrates on our own countries except where we state otherwise. It also concentrates on problems where science and technology offer potential solutions, but it does not pretend that science and technology provide a panacea.

The Group has completed its task, and has offered the following conclusions and recommendations:

-- Major advances in science and technology have caused profound changes in our way of life for more than two centuries. These developments continue today at an even greater pace.

-- Fundamental scientific research is one source of technological progress in industry and should be given special support by governments.

-- Technological innovation can play an important role in the increase of the level of employment and the improvement of labour conditions. Special training programmes are necessary to promote flexibility, mobility and adaptability of labour.

-- Our nations should make a better effort to prepare their citizens for living and participating in a society of an increasingly technical nature.

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*In this report the word "government" is also taken to include the European Communities.

-- The fate of our scientific and technological innovations is largely a function of the willingness of the public to accept them. More attention to the problem of public acceptance of new technologies is needed.

-- Special attention should be paid to the rejuvenation of mature industries through the use of science and technology.

-- Sustained technical progress is best promoted through a balanced distribution of productivity gains between further investment and increased consumption.

-- An open and competitive trading system between autonomous but collaborating partners should be strengthened by harmonising and making more compatible our regulatory and testing systems. Care must be taken by governments to control the transfer of sensitive technologies of military significance to our countries.

-- Science and technology can be applied to many of the problems faced by the developing world. As developing countries create infrastructures in science and technology, our own countries should recognise the constructive role which they are able to play, mindful that it is the responsibility of the developing countries, as sovereign nations, to establish their own national policies and priorities.

-- The market introduction of new technologies is primarily the task of the industrial and commercial sectors. A competitive atmosphere is essential for this type of innovation, since it creates a continuous evolution of technological progress and, thereby, long-term economic growth. Governments should support fundamental science and long-term, high-risk research and development activities.

-- Governments need to generate and support the framework conditions for workable competition and provide incentives for innovation through the encouragement of invention and investment in innovation .

-- National policies in areas such as regulatory standards, tax, patent and trade all influence our ability to innovate and to reap the full benefits of innovation. The Group recognises and endorses the efforts of the OECD to resolve some of the problems faced in this area. We reaffirm our commitment to removing barriers to an open multilateral trading system, to strengthening the rules in this connection, and to promoting the development of trade in new technologies, particularly for creating new employment, and therefore, shall seek to intensify our contacts bilaterally and in all relevant fora. In this regard, the Group takes note that discussions of these items will be pursued in the GATT Council.

-- Science and technology are a source of national and international strength and can provide immense opportunities for revitalisation and growth of the world economy. They should therefore be given due consideration in all policy decisions for national development and international cooperation.

-- International cooperation in science and technology has demonstrated its value. Governments should continue to support cooperation, including the international scientific organisations.

-- With current economic difficulties and with national budgets subject to greater constraint, it makes even more sense to cooperate internationally, in particular, in long-term, high-risk research and development projects.

-- Already existing international cooperation in science and technology should be continued and, where appropriate, enlarged. An effective exchange of ideas and researchers must be strongly encouraged.

-- The cooperation begun under the auspices of this Working Group forms a solid base for future action and should continue in the relevant fora.

-- Finally, we recommend to our Heads of State and Government that, bearing in mind the role that science and technology can play in improving economic growth and employment, and in stimulating culture and education, they take science and technology into account in their policy decisions and continue to include the subject on their agenda at future Summit meetings.

The Working Group has also reviewed a number of scientific and technological issues with a view towards determining where additional international collaboration could best contribute to increased understanding and improved social and economic conditions, not only for our own people, but for all the world.

In this process, we noted that a wide range of cooperation is already under way in important and wide spread areas such as:

- Conquest of space
- Renewable sources of energy
- Research on safety of light water reactors
- Deep ocean drilling

We appreciate this effort and encourage its development using existing multilateral and bilateral frameworks.

We also propose the following collaborative projects which are either new or incorporate significant re-focussing in order to achieve:

1. Stimulation of the conditions for growth by better management of energy resources by:

   - Photovoltaic Solar Energy
   - Controlled Thermonuclear Fusion
   - Photosynthesis
   - Fast Breeder Reactors

2. Better management of food resources by:

   - Food Technology
   - Aquaculture

3. Improvement of living conditions, employment, and protection of the environment, through:

   - Remote Sensing from Space
   - High Speed Trains
   - Housing and Urban Planning for Developing Countries
   - Advanced Robotics
   - Impact of New Technologies on Mature Industries
   - Biotechnology
   - Advanced Materials and Standards
   - New Technologies Applied to Education, Vocational Training, and Culture
   - Public Acceptance of New Technologies

4. General increases of scientific knowledge, particularly in:

- Biological Sciences
- High Energy Physics
- Solar System Exploration

REPORT OF THE WORKING GROUP ON TECHNOLOGY, GROWTH, AND EMPLOYMENT

GENERAL INTRODUCTION

"Revitalization and growth of the world economy will depend not only on our own effort but also to a large extent upon cooperation among our countries and with other countries in the exploitation of scientific and technological development. We have to exploit immense opportunities presented by the new technologies, particularly for creating new employment. We need to remove barriers to, and to promote, the development of and trade in new technologies both in the public sector and in the private sector. Our countries will need to train men and women in the new technologies, and to create the economic, social and cultural conditions which allow these technologies to develop and flourish. We have considered the report presented to us on these issues by the President of the French Republic. In this context we have decided to set up promptly a working group of representatives of our governments and of the European Community to develop, in close consultation with the appropriate international institutions, especially the OECD, proposals to give help to attain these objectives. This group will be asked to submit its report to us by 31 December 1982. The conclusion of the report and the resulting action will be considered at the next economic Summit to be held in 1983 in the United States of America."

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* In this report the word "government" is also taken to include the European Communities.

1. IMPORTANCE OF SCIENCE AND TECHNOLOGY AS A BASIS FOR ECONOMIC REVITALISATION AND GROWTH

HISTORICAL ANALYSIS

Two hundred years ago, James Watt's invention of the steam engine, together with other inventions were to change the face of the world. In the following decades, our methods of work, our towns and countryside, our systems of transportation were all transformed. The introduction of the railway, the steamboat, and the telegraph stimulated our economies. Later, the internal combustion engine automobile, airplane, telephone, electricity, and the chemical industries began to change the quality and style of our lives.

This process of transformation and change stemmed from conviction that scientific inquiry and advance are central to progress. This confidence in science, which, since the Renaissance, was popular in intellectual circles, was to spread gradually to many disciplines, such as engineering and technology, and eventually, to industry itself. This was most evident by the end of World War II, when entire sectors of our economies existed as the result of the spin-off from scientific research. The progress which resulted was substantial in the agricultural, industrial, services and public health sectors.

While science and technology were modifying our method of work and our machines so profoundly, our organisations and institutions were also changing. Financial, trade, administrative, educational and legal systems all underwent far-reaching transformations in order to adapt to the new world that was emerging. Thus, in a thousand of different ways, science and technology has penetrated the very fabric of our societies and of our lives.

Research, which can start modestly in the form of a laboratory experiment or an equation written on a blackboard, can eventually lead to a vast and varied number of applications. This has been the case with fundamental research carried out on the structure of atomic nuclei, which led to the discovery of nuclear energy. Research on solid state physics has radically transformed or created an immense range of products and systems such as digital watches, television receivers, video-recorders, health care equipment and many other familiar products. Space research programmes have yielded many valuable benefits in fields such as telecommunications, remote sensing, new materials, and transport systems. The theoretical understanding of the part played by nucleic acids in the transfer of genetic information arose from the discovery of DNA but also promises a vast range of applications in the field of biotechnology, from health to food.

These examples of successful technological innovation have one thing in common: ideas emerging from excellent fundamental research have been developed by entrepreneurial industrialists into goods and services which meet the needs of society.

But industrialisation has also created new problems: severe strains on our material resources and on our environment, fundamental changes in our life style, and increased attention to modern weapon systems. More recently, the slowdown in economic growth and increasing unemployment has coincided with some lack of public acceptance of new technologies. At the same time, we have witnessed an explosive growth of population, particularly in the developing countries, many of which are suffering from severe economic strain.

Thus, despite all mankind's achievements, many problems confront the industrialised and the developing countries today.

Major advances in science and technology have caused profound changes in our way of life for more than two centuries. These developments continue today at an even greater pace.

FUTURE POTENTIAL

In the near term, new technologies will be diffused throughout society largely through the mechanism of competitive enterprise. Advances in information technology combined with progress in computers, video-recorders, and telecommunications can transform education, increase the efficiency of our organizations, and permit better use of human and material resources. Incorporation of microprocessors into existing technologies can produce a generation of new products of improved performance.

Robotics whose development is seen by some as aggravating an already serious unemployment situation, instead can free workers from hazardous and repetitive labour and can improve the productivity of industry. The same technology can be applied to the problems of the physically handicapped to produce artificial limbs and other devices that may help them.

Remote sensing can improve our capacity to protect our environment and to live in harmony with it, develop our natural resources, and predict our weather. Improvements in materials can create new technologies and enhance existing ones. The evolution of catalysis from an art to a science and improvements in membrane technology offer the possibility of new and more efficient chemical processes. Biotechnology has vast potential for the production of pharmaceutical products such as insulin, the synthesis of industrial chemicals, the development of new agricultural species and the more efficient recovery of mineral resources.

In the field of energy, fast breeder reactor technology will soon offer a major increase in the efficiency of electricity generation from uranium. In the longer term, thermonuclear fusion, one of the most challenging technologies ever conceived, may offer a virtually inexhaustible source of energy from ordinary seawater.

It is vital to remember that the technologies we are applying today are founded upon the scientific research and development of yesterday. Hence, the well-being of society in the next century will rest on the application of scientific research which is being carried out now.

The importance of fundamental scientific research in the birth of new industries cannot be over-emphasized. The role of government support of science to inspire the future economic and social development of our countries should be widely understood.

Finally, the historical tradition in science of international cooperation and free communication, which has been so important in the past, should be continued and expanded in the future for our mutual benefit and progress.

Fundamental scientific research is one source of technological progress in industry and should be given special support by governments.

2. THE EFFECT OF SCIENCE AND TECHNOLOGY ON THE LEVEL OF EMPLOYMENT, THE IMPROVEMENT OF LABOR CONDITIONS, AND THE ADVANCEMENT OF CULTURAL AND EDUCATIONAL STANDARDS

THE LEVEL OF EMPLOYMENT

The problem of unemployment and its costs in human and social terms is a major pre-occupation in our countries. For this reason, the positive role which science and technology can play in increasing employment should be closely examined.

The transformation of new technological knowledge into investment in innovation is essentially a micro-economic decision for individual firms and entrepreneurs. The process is conditioned by the individual decision-makers' perception of the predicted profitability and of the economic and social environment, including the probable behaviour of government.

Thus, individuals decisions increase employment in innovative firms while causing lay-offs in others. Overall, it is even possible that innovation could, at least in the initial stages, destroy more jobs than it creates.

However, through the whole period of industrial history, technological innovation has not only proved to be one of the major sources of social and economic progress, but it has also markedly increased the overall level of employment.

To outweigh the potential of job destruction from innovation with job creation, a growth conducive economic and social environment is essential. The existence of a stock of promising but unrealised innovation certainly favours the creation and maintenance of such an environment, as does a high degree of price flexibility and labour mobility and adaptability. However, this is insufficient if public and private demand is shrinking and confidence in future growth and stability is low.

Technological innovation can play an important role in the increase of the level of employment and the improvement of labour conditions. Special training programmes are necessary to promote flexibility, mobility and adaptability of labour.

SOCIAL EFFECTS

The benefits derived from the use of new technologies can result in real progress for the worker. The implementation of new technologies in the work place can free the worker from hazardous and repetitive tasks that can be readily automated. Technology can infuse a new prosperity into a region and give firms an opportunity to organize more effectively for growth. There will inevitably be changes in existing structures as the result of new technologies, although these changes can ultimately not only increase the level of employment and encourage growth, but create a more human environment for the individual. Further studies should be carried out on the links between technological changes, the reorganisation and quality of work, and the effects of employment.

The expected changes present a challenge to society which demands an effective response. First, there is a relation between the types of technology developed and perceived social and cultural needs as well as purely economic ones. Hence, there is a need for wider public debate in science and technology. Secondly, education and training are necessary to prepare for technological change. Thirdly, the initial labour displacement effects, both qualitative and quantitative need to be allowed for: careful consideration must therefore be given to the reorganisation of work as well as to policies designed to give protection to the disadvantaged segments of the labour force, such as women and older workers.

Finally, as we have stated, although measures to increase the flexibility, mobility and adaptability of the labour force are very important, it is equally important that a good climate in industrial labour relations be maintained.

<u>Our nations should make better efforts to prepare their citizens for living and participating in a society of an increasingly technical nature.</u>

PUBLIC ACCEPTANCE OF NEW TECHNOLOGIES

Developments in industrialised societies show that new technologies often present problems of public acceptance. If a technology is regarded as unacceptably risky, threatening to the environment or to jobs, it may be resisted.

Resistance to new technology is not new. For example, in the ninteenth century, the introduction of steam cars was inhibited by the requirement that they should be preceded by a man carrying a red flag. More recently, there has been strong resistance to nuclear power and, in some cases, to new technology at the work place.

But a great many people are ambivalent in their attitude towards new technology. Those who resist new technology in the work place may accept it enthusiastically in the home. Microwave ovens, electronic calculators, video recorders and home computers are becoming increasingly familiar features of everyday life.

In many of our countries, much of the more vocal opposition comes from groups that are not in the majority. Some of this opposition may be justified, some may be widely exaggerated. Some of the fears expressed may even go beyond the technical considerations into the broad area of political grievances about society's values or about democratic processes. Diagnosis of this complex subject requires an appreciation that there are many technologies, many publics, many institutions and many cultures. Although some work has been done in this area, there is little to suggest that we have any real understanding of the factors which shape public attitudes to a new technology. We need to improve this understanding if we are to derive the maximum benefit from the new technologies.

The fate of our scientific and technological innovations is largely a function of the willingness of the public to accept them. More attention to the problem of public acceptance of new technologies is needed.

IMPACT OF NEW TECHNOLOGIES ON MATURE INDUSTRIES

The impact of new technologies on "mature" industrial structures is most apparent in those industries which started the process of industrialisation and which, in former times, have constituted the most dynamic and dominant centres of economic progress. In the process of economic development, the old industrial centers were particularly vulnerable to technological change in other places. Efforts by governments to protect traditional industries against structural change, whether by subsidy or by other means, cannot be successful except in the short term.

On the other hand, there are clearly cases where adoption of new technologies can positively influence the development of mature industries by providing new opportunities for growth. It is industry which has the primary task of responding to the challenge of structural change: market forces will condition industry's response but social and other factors must also be taken into account. Governments, for their part, should pursue positive adjustment policies while bearing in mind future demand and supply structures and the opportunities for further technological development.

Further specific studies, such as those being carried out in the OECD, should be made to determine the extent, and the methods by which science and technology can contribute to the easing of the widespread adjustment problems in some regions which are often posed by the decline of traditional industries.

Special attention should be paid to the rejuvenation of mature industries through the use of science and technology.

3. IMPLICATIONS OF SCIENCE AND TECHNOLOGY FOR THE WORLD ECONOMY

IMPLICATIONS OF SCIENCE AND TECHNOLOGY POLICIES FOR WORLD ECONOMIC ACTIVITY

In the present circumstances of high and still rising unemployment in the world, the creation of new jobs in competitive industries has become an objective of central importance to our governments. Investment in innovation can play a decisive role in reaching this objective. In addition to its direct effect on demand, there are three distinct ways in which investment in innovation can help generate the basic conditions for a return to higher economic growth and employment:

Accelerating the process of innovation will:

- First, facilitate the structural adjustment of the supply sides of our economies, easing inflationary pressures related to structural rigidities.

- Secondly, improve cost/price ratios through productivity increases.

- Thirdly, generate an investment-led recovery, which will reduce potential supply bottlenecks, and thus, the risk of fresh inflation occurring before more satisfactory employment levels have been restored.

If the process of innovation is to have these effects, productivity gains should be used both for higher consumption and increased investment. In this way, an increase in demand can be sustained. A proper distributional balance of productivity gains may improve not only the over-all economic outlook, but also the employment situation.

Sustained technical progress is best promoted through a balanced distribution of productivity gains between further investment and increased consumption.

THE ENCOURAGEMENT OF ECONOMIC GROWTH BY THE INTERNATIONAL FLOW OF TECHNOLOGIES

The international flow of technologies takes many different forms: it occurs between countries, universities, firms and individual scientists. The pattern is complicated: some links are carefully planned and organized, others occur by chance. But the result is a flow that has encouraged the birth and growth of new technologies. At a governmental level, numerous formal cooperative arrangements serve to facilitiate contacts and augment already extensive informal arrangements.

Important exchanges also occur in the private sector. An open trading system encourages this flow of information which strengthens the innovative process.

Nevertheless, care must be taken by governments to control the transfer of sensitive technologies of military significance to our countries.

The impact on the world economy of advanced technology industries can be enhanced by creating, through international cooperation, a climate which fosters advanced technology development, application, and exploitation. The following factors are conducive to such a climate:

- an open and competitive trading system to promote technological development by reducing trade barriers and other barriers and facilitating the cross border flow of technology in the most appropriate ways.

- compatible and, where possible, harmonized regulatory and testing systems to facilitate free trade.

- interdependence amongst partners who nevertheless respect each other's autonomy.

Such conditions will contribute to a healthy world economy characterised by steady non-inflationary growth. This will provide the foundation for long-term social benefits.

An open and competitive trading system between automomous but collaborating partners should be strengthened by harmoninzing and making more compatible our regulatory and testing systems. Care must be taken by governments to control the transfer of sensitive technologies of military significance to our countries.

THE EFFECTIVE UTILISATION OF SCIENCE AND TECHNOLOGY BY THE DEVELOPING COUNTRIES

The contribution of scientific research to developing countries has been spectacular in a number of fields. In health, for example, years of international research has resulted in smallpox being practically eliminated. In agriculture, innovation has brought new varities of high-yielding wheat and rice which have markedly increased the world food supplies.

The world economy as a whole can benefit from healthy non-inflationary economic growth among the developing countries. But the model of industrialisation and economic development which our countries have followed is not necessarily the one which the developing countries should adopt. It is for the developing countries themselves to establish their priorities and their policies, since it has to be recognised that simplistic and mechanical transfers of new technologies to these countries can create, at least in the short term, serious social as well as economic imbalances.

The greater part of the world's scientific resources are to be found in our own countries. There are substantial differences among developing countries, and hence, there is a need for many different forms of technology transfer. Many substantial programmes are already in place while recently some new and imaginative mechanisms have been developed by some of our countries. One key element of these mechanisms is the training of researchers to enable them to work on applied research problems within their own scientific institutions in accordance with the priorities set by their own governments.

Nevertheless, much remains to be done to harness the resources of science to the needs of the developing countries. We should continue our efforts to make training opportunities available to scientists and engineers from the developing countries in our universitites, government laboratories and industries. In our universities and laboratories, there are already hundreds of thousands of students and post-doctoral candidates from the developing world taking advantage of these opportunities.

The question of ensuring favourable conditions for the return of these researchers to their countries of origin and their re-insertion into their countries' professional life must be given very careful attention by the developing countries as well as by ourselves. It is important that the developing countries create their own scientific and technological capacities so that each can determine its own socio-economic and cultural path.

While governments have a central responsibility for all these activities, it must be stressed that private firms, including multinational corporations, have major achievements in this field. In particular, it should be acknowledged that an increasing number of companies have adopted codes of conduct that reconcile the benefits of an active technology transfer with the need to respect the priorities established in the developing countries by their governments, and the cultural values of the countries concerned.

Science and technology are not panaceas. They are only one of the means of promoting development. It is the responsibility of the developing countries themselves to make their choices and the necessary adaptations to the technologies they create or import. But increased efforts are needed by our governments to understand the problems faced by developing countries in the development and exploitation of technology.

Science and technology can be applied to many of the problems faced by the developing world. As developing countries create infrastructures in science and technology, our own countries should recognise the constructive role which they are able to play, mindful that it is the responsibility of the developing countries, as sovereign nations, to establish their national policies and priorities.

4. THE ROLE OF GOVERNMENTS AND THE PUBLIC AND PRIVATE SECTORS IN SHAPING THE SOCIAL AND ECONOMIC CONDITIONS FOR OPTIMUM IMPACT OF INNOVATION ON GROWTH AND EMPLOYMENT

PRIMARY RESPONSIBILITIES OF GOVERNMENTS AND THE PUBLIC AND PRIVATE SECTORS*

The long-term health of our economies revolves round the ability of our governments to encourage innovation in the public sector, private industry and in our scientific research communities.

The public sector's responsibility for shaping the social and economic framework for innovation and growth is beyond dispute. Governments, or their agencies, can determine the regulatory, economic, and commercial environment within which the private sector can develop.

But governments should recognise the role of competition and of the private sector in the development of near term commercial technologies. In general, this competition in the innovation process helps to bring the best products to the consumer at the lowest price. Remembering that innovation is inherently risky, governments should help to create an environment which on the

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* For all countries the phrase "public sector" refers to governments, in some, it also extends to other activities under public ownership.

one hand provides a predictable regulatory framework, low inflation and interest rates and a fiscal structure which rewards enterprise, and on the other hand facilitates the acceptance of new technologies in the work place and by the public more generally.

It is also important to recognise the respective contributions which the different sectors can make to the actual process of innovation. To the private sector falls the task of identifying opportunities for the productive uses of new technologies and matching applications of technology to market needs. Governments, for their part, have specific responsibilities which include the sponsorship of basic research, and research of far-reaching but uncertain applicability, whose social benefits may not be matched by immediate commercial returns.

The demarcation of the sectors' respective roles is not easy and depends on the individual situations in our countries: this is, in any case, less important than the establishment of workable mechanisms and a suitable climate which allows both sectors to function together in an optimal manner.

The market introduction of new technologies is primarily the task of the industrial and commercial sectors. A competitive atmosphere is essential for this type of innovation since it creates a continuous evolution of technological progress and, thereby, long-term economic growth. Governments should support fundamental science and long term, high-risk research and development activities.

GOVERNMENTS' OVERALL ECONOMIC POLICIES

The overall stance of an economic policy is decisive in shaping the conditions for innovation to have a favourable impact on sustainable economic growth and the creation of jobs in competitive industries. Uncertain expectations regarding rates of inflation, exchange rates and the level of interest rates make it more difficult for investors to interpret the market signals represented by changes in relative prices while expectations of increasing labour costs are likely to favour expenditure designed to save labour.

The innovation process is helped by a stable, low inflationary, environment with predictable government policies. Consistency and continuity of policy measures and confidence in the future encourage medium and long-term investment programmes. It is this kind of environment with mobile labour forces and capital, and with a flexible response to changes in demand, technology or prices which enables an economy to be kept more easily on a path of macro-economic equilibrium and orderly expansion.

Government policies should therefore be geared to increasing micro-economic flexibility rather than hampering it, and to promoting growth through balanced macro-economic policies thereby inducing confidence to all those involved in the process of innovation.

Under present economic conditions, technological collaboration in areas which are promising at the scientific research level can be hampered by increasingly defensive strategies aimed at protecting market shares. The implementation of a programme of international collaboration in the field of science and technology can contribute to, and benefit from, the restoration of expansionary non-inflationary conditions: both technical progress and employment could be favourably influenced.

Thus, while each of our governments must continue to have national responsibility for the choice of appropriate demand and supply policy mixes, greater collaboration on policies affecting innovation will hasten the return to growth.

Governments need to generate and support the framework conditions for workable competition and provide incentives for innovation through the encouragment of invention and investment in innovation.

REGULATORY, PATENT, TAX AND TRADE POLICIES

Governments possess a variety of instruments through which they can create a positive environment for technological innovation.

A predictable regulatory environment can promote innovation. While regulations are necessary in order to protect the rights, health and welfare of the public, a constant review of the regulatory structure is necessary in order to balance the costs and benefits.

All our governments use the patent system to give protection to innovators in pursuing and marketing their ideas. The incentive for the private sector to develop new products and processes would be diminished without such protection. But many patents arise from work under government research contracts in universities, government laboratories and industry. It is important to ensure that those who develop patentable ideas in collaboration with government, do so on the basis of clearly understood patent rights which do not impede the introduction of the new technologies into the market place.

Many countries, in addition to allowing research and development expenditure as a tax deduction, have developed special tax incentives and other forms of government assistance for innovation, due to the inherent high risk nature of research and development and its anticipated social benefits. This special assistance for the innovation process is to be welcomed.

High technology industries may pose special problems for the functioning of the world trading system, in part because of the rapidity with which changes are taking place. Government policies can stimulate the development of a competitive world market and the expansion of world trade in new technologies. For example, the development of common standards on new products will allow them to be marketed more widely. Government policies should, however, seek to avoid the creation of conditions that might lead to distortions and impediments to free and open trade flows.

The high efficiency and other beneficial effects which have emanated from the open multilateral trading system as it has developed since the Second World War could be endangered if government resources were used unfairly in a way which distorts normal international competitive activities in the development of products and processes.

Governments should therefore carefully explore ways to facilitate adjustments which seek to enhance the overall strength of their economies.

Governments, collectively and individually, have a responsibility to minimise distortions and encourage international trade in new technology, including products and services.

National policies in areas such as regulatory standards, tax, patent and trade all influence our ability to innovate and to reap the full benefits of innovation. The Group recognises and endorses the efforts of the OECD to resolve some of the problems we faced in this area. We reaffirm our commitment to removing barriers to an open multilateral trading system, to strengthing the rules in this connection, and to promoting the development of trade in new technologies, particularly for creating new employment, and therefore, shall seek to intensify our contacts bilateraly and in all relevant fora. In this regard, the Group takes note that discussions of these items will be pursued in the GATT Council.

NATIONAL POLICIES FOR THE PROMOTION OF SCIENCE AND TECHNOLOGY AND INTERNATIONAL CONSULTATIONS ON THESE

Science and technology are vital components of economic activity and of society; these in turn create the conditions in which science and technology can either flourish or wither.

It is important for governments to consider policies for:

- the promotion of science and the pursuit of knowledge for its own sake;
- the application of science and the development of technology;
- the integration of science and technology into economic and social policies; and
- international cooperation in science and technology, their application and their role in economic and social policies.

The promotion of science includes support for the acquisition of fresh knowledge and of new scientific skills, for the education and training of young people and the retraining of older people in new skills, for the dissemination of scientific knowledge to the scientific community and the education of the general public in science. A healthy climate for basic research in all sciences is an essential element in any free, industralised country: it is not possible to predict from which part of the spectrum of todays' basic research tomorrows' technological wonders will emerge.

The application of science and the development of technology involves the generation of an economic and social climate which encourages the growth of new technologies and the regeneration of old industries through the application of new techniques. Timing is crucial in both cases and it is important to recognise that assistance may be necessary to allow major change to take place smoothly and with due regard to the human problems caused by change.

The integration of science and technology into economic and social policies is essential if science and technology are to develop in a context which is acceptable to society and if science and technology are to be allowed to make their unique contribution to the solution of economic, social and cultural problems. Only in this way can the general public recognise and welcome the beneficial effects of science and technology and overcome their natural fear of technical change.

It is neither sensible nor necessary for these policies to be developed purely on a national basis. Science itself is, and always has been, international in nature. Even when international communications have been difficult, scientists corresponded with each other, exchanged research results, and debated ideas and hypotheses. This tradition among scientists has been a mainspring of scientific progress through the ages as well as a glowing example of peaceful and constructive competition to humanity as a whole. Science is now inextricably linked to technology, and hence, to economic and social progress. International trade and world travel have meant that no free country can develop economic and social policies in isolation from the world environment. Our countries are interdependent with respect to economic policies, employment levels and the diffusion and uses of science and technology. This interdependence can be beneficial or a cause of conflict and hence a source of strength or weakness in the future.

Taking the progress of science as our example, we believe that interdependence is more likely to lead to strength and vitality if our countries cooperate in appropriate areas of science and technology and in their applications to economic and social activity. Whilst periodic consultations have taken place in the past in bilateral and multilateral meetings, we believe that these have sometimes been less effective because they failed to take sufficient account of the growing interface between technical activity and the socio-politico-economic environment.

Accordingly, a new thrust and fresh political will is needed from the highest level of government if international cooperation is to take its place alongside fair competition in helping science and technology to play their unique role in the solution of the problems which currently beset the world.

Science and technology are a source of national and international strength and can provide immense opportunities for revitalisation and growth of the world economy. They should therefore be given due consideration in all policy decisions for national development and international cooperation.

5. INTERNATIONAL COOPERATION IN SCIENCE AND TECHNOLOGY

PRESENT SITUATION

A large amount of cooperation in science and technology already exists between our countries: each country participates in bilateral and multilateral arrangements in a way which is too extensive to recount here in any detail, and a few examples must suffice.

The International Council of Scientific Unions (ICSU) has organised projects like the International Geophysical Year (IGU) and the International Biological Programme (IBP). Following the success of the IGY in 1958, 26 nations became parties to the Antarctic Treaty, which has amongst its objectives the encouragement of cooperation in scientific research. This has led to major advances in the sciences of climatology, oceanography, biology and geology. In the field of medicine, the World Health Organisation has stimulated cooperation in many fields of research including infectious diseases and carcinogens.

In some cases, cooperation in fundamental science has led to unexpected technological developments which have proved of great economic and social value to mankind. For example, the high degree of safety enjoyed by the millions of people travelling the globe by air and sea owes much to fundamental research in climatology and meteorology. Research on very accurate measurements of terrestrial distances from satellites has begun to show promise for the early prediction of earthquakes. The International Phase of Ocean

Drilling of the deep sea drilling project was designed to answer fundamental scientific questions on the structure of the earths' crust but has also provided information of real value to deep sea exploration. Work on high energy physics at CERN had led to such contrasting developments as improved theodolites for tunnel construction and a positron camera for medical tomography.

These examples demonstrate how international scientific cooperation is advancing science today and how mankind has benefitted from this in fields as diverse as medicine, travel, enginering, agriculture, energy and safety. Individual research workers, scientific societies, non-government institutions and government itself have all played key roles. The future environment for scientific collaboration will depend on a continuation of their complementary activities.

In the private sector of industry, cooperation naturally tends to be more technological than scientific; collaborative agreements or joint ventures need to take into account the rules of domestic and international trade. Scientific or technological information is often proprietary and companies cooperate through licensing and cross-licensing arrangements in order to advance their technological base.

Finally, mention should be made of cooperation between the private sector and universities, an historical link in some of our countries, but one which has new force today, and has played a major role in the development of fields such as biotechnology. This collaboration will be increasingly important in the future as a stimulant for industrial innovation.

International cooperation in science and technology has demonstrated its value. Governments should continue to support cooperation, including the international scientific organisations.

THE SPECIAL RELEVANCE OF INTERNATIONAL COLLABORATION TODAY

In the present difficult economic circumstances that we are all experiencing, institutions responsible for scientific and technological research could be tempted to give more attention to their own science and technology activities to the detriment of international collaboration.

This risk should be recognised: with the present worldwide economic and social problems, there is a special and growing significance for international cooperation in the fields of science and technology, because only by such cooperation is it possible to:

- increase the effectiveness of national research work by rationalising it and reducing its cost;

- take into account the international character of certain research projects;

- create a climate which permits research to be tailored to the new situations in the international market-place;

- resolve jointly certain common problems and thus avoid useless duplication and promote a diversity of approach;

- cope with factors such as the expanding scale of technology, the increase in development costs, and the ever greater challenges of research and development; and

- enhance growth and employment.

With current economic difficulties and with national budgets subject to greater constraints, it makes even more sense to cooperate internationally, in particular, in long term, high-risk research and development projects.

GOVERNMENT POLICIES ON SCIENCE AND TECHNOLOGY

To meet the needs for international cooperation in science and technology, governments should incorporate within their policies, the following specific objectives:

- to encourage international science and technology exchange and the dissemination of knowledge;

- to encourage international collaboration at all levels where this is appropriate; and

- to seek cooperation in, and in certain cases joint operation of, large scientific research installations, the cost of which is prohibitive for a single government but which are nonetheless indispensible for the advancement of science.

In order to achieve these objectives, our governments should consider:

- enhancing the appropriate conditions for exchanges of knowledge (via scientific publications, for example) and of researchers. In the latter case, governments should generate conditions which will increase their mobility and allow eventual reinstatement upon their return.

- giving increased emphasis to the education and training, not only of the scientists themselves, but of the population as a whole, to encourage the practical application of new technologies; and

- undertaking a regular evaluation of the results of scientific research in order to assess whether the planned goals have been attained and, if not, the appropriate course for future action.

Already existing international cooperation in science and technology should be continued and, where appropriate, enlarged. An effective exchange of idea and researchers must be strongly encouraged.

POTENTIAL AREAS FOR COOPERATION

The Working Group has determined that it is in our common interest not only to endorse existing international cooperation, but also to refocus or to change its scope. In addition, a number of specific areas for cooperation in science and technology were examined by groups of experts. The topics for cooperation were selected with the following objectives in mind:

- to stimulate conditions for growth;
- to encourage education and training at all levels;
- to improve living and employment conditions; and
- to protect the environment.

In order to achieve these objectives, the Group agreed on four criteria to be used for the selection of collaborative projects. They should:

- benefit from international cooperation and involve several countries in the Working Group.

- be within the public sector or within the clear responsibility of governments;

- represent a potentially major step forward in science or technology if successful;

- involve possible interest by the developing world.

As a result of the examination, the Group has proposed to governments a number of cooperative research projects which are listed at the end of this report.

The cooperation begun under the auspices of this Working Group forms a solid base for future action and should continue in the relevant fora.

Finally, we recommend to our Heads of State and Government that, bearing in mind the role that science and technology can play in improving economic growth and employment, and in stimulating culture and eduction, they take science and technology into account in their policy decisions and continue to include the subject on their agenda at future Summit meetings.

PROPOSALS FOR COOPERATION

The identification of projects which meet all economic and social needs and are agreed upon by all participants would have required a much longer exercise than was possible for the Working Group. The choice of projects therefore does not reflect the priorities of all delegations to the Working Group, let alone the priorities of other countries. Nevertheless, the Working Group is unanimous in its belief that these projects constitute a solid base of cooperation.

The Working Group has reviewed a number of scientific and technological issues with a view towards determining where additional international collaboration could best contribute to increased understanding and improved social and economic conditions, not only for our own people, but for all the world.

In this process, we noted that a wide range of cooperation is already under way in the following important and wide spread areas:

- Conquest of space
- Renewable sources of energy
- Safety research on light water reactors
- Deep ocean drilling

We appreciate this effort and encourage its development using existing multilateral and bilateral frameworks.

Taking these considerations into account, the Group agreed to propose to governments a number of cooperative reserch projects along the following lines.

STIMULATION OF THE CONDITIONS FOR GROWTH BY BETTER MANAGEMENT OF ENERGY RESOURCES BY:

Photovoltaic Solar Energy (ITALY-JAPAN)*

The possibility of utilising photovoltaic technology for large scale energy supply depends mainly on future innovation related to higher quality and mass production of solar cells and related systems. This technology can make a helpful contribution to energy supply.

The objective of the project is to establish international collaboration among governmental research and development activities and to make the best use of government research facilities such as the Japanese solar simulator, EC Joint Research Centre, and the international research center which Italy is setting up.
The aim is to accelerate the application of photovoltaics and to establish adequate standards in order to ensure reliability.

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*Countries responsible for the organisation of the project.

Cooperative activities will include the following:

- holding joint meetings on topics such as the review of existing cooperative programs, and new cooperative activities which include the participation of both developed and developing countries;

- exchange of researchers and study missions especially on basic research;

- the development of common evaluation methods and standards;

- on-site joint study at research institutes and/or experimental photovoltaic installations.

Controlled Thermonuclear Fusion (EC-USA)

The final objective of research and development work on controlled thermonuclear fusion is to bring to fruition a new energy source using fuels which are practically inexhaustible and which possess potential advantages from an environmental point of view. The development of this new energy source will take some decades and require a considerable financial effort of the order of tens of billions of dollars.

The fusion research and development programmes currently in progress in the United States, Europe and Japan are all aimed at a demonstration fusion reactor. Coordination of the three programmes on the conceptual design of the next generation facilities would be desireable. It might lead to the possible construction of a joint facility. Because of the time scale involved, it is not too soon to begin discussions on this project and to promote collaboration based on existing activities.

Collaboration could be developed along the following lines:

- Access of partners to facilities already existing or under construction, such as TFTR in the U.S., JET in Europe and JT-60 in Japan.

- Sharing of development programmes, in particular the pursuit of alternative lines of development.

- Development and joint use of costly equipment, such as the large coil facility, where duplication would be unnecessary.

- Coordination of development programmes for a demonstration reactor and next generation machines.

<u>Photosynthesis</u> (JAPAN)

Photosynthesis may be an increasingly important source of energy in the future because it is a natural process which converts abundant and everlasting sunlight into chemical and electrical energy. International cooperation can further basic research on photosynthesis and photoconversion, including the development of artificial photosynthetic systems.

This research program could contribute to the supply of energy in the 21st century and thereby have great effects on future economic activity. The participating countries wish to encourage cooperative activities among their scientific communities by using the existing framework for international cooperation.

The forms of cooperation will include the following:

- cooperative research through exchange of scientists;
- collaborative use of facilities and equipment;
- information exchange through international seminars and symposia.

Fast Breeder Reactors (FRANCE-USA)

All our countries believe that nuclear power will play an essential role in meeting their prospective demands for electricity. The current generation of thermal reactors plays its part in meeting present demands. But in the long run, fast breeder reactors, which utilise an essentially inexhaustible energy source, offer great potential. At present, breeder costs are not competitive with coal or thermal reactors, but further progress in research and development could make the breeder economically attractive in the next few decades. From a technical standpoint, the breeder is much further advanced in development than other "renewable" energy technologies such as fusion and solar energy.

International collaboration in fast breeder reactor research and development can make a key contribution to making this technology economically viable. A great deal of collaboration is already taking place among our countries; but more can be done in areas such as design, safety, safeguards and fuel cycle facilities. Discussions are currently under way among our countries to expand cooperation in these areas and those efforts should be pursued vigorously.

BETTER MANAGEMENT OF FOOD RESOURCES BY:

Food Technology (FRANCE-UK)

There has been major progress in agricultural technology in the past two decades in our countries, but more attention should now be paid to food and food technology. While there is still scope for improving agricultural productivity and utilisation of agricultural raw materials in the developing countries, there is also a need to increase the efficiency and quality of food production in OECD countries. In addition, more attention is being paid to the safety of food additives and to novel foods; and present initiatives should be supported.

Three aspects of the topic are identified as worthy of collaboration: food processing, safety evaluation and developing countries aspects. For food processing, there is scope for collaboration on food research programmes and for the application of existing research knowledge. In safety evaluation, there are many international initiatives in food laboratory practice, harmonising testing guidelines for food additives and novel foods, which need continuing support. There is also scope for coordination of fundamental research programmes aimed at the validation of alternative testing systems and on developing and understanding mechanisms of toxicity. Developing countries aspects can best be satisfied by closer collaboration in research and training, increased processing yields, improved utilisation of raw materials, improved storage of agricultural produce and avoidance of food wastage. The initiatives should be pursued largely through existing mechanisms.

Aquaculture (CANADA)

The sciences basic to food production are being applied increasingly to the culture of aquatic organisms, with numerous aquaculture systems being on the threshold of significant expansion. Such development is encouraged by the special need for employment opportunities in rural areas, by the demand for new and appropriate technologies in fisheries, and by the evidence that natural fish resources are now being exploited to their limits.

Expansion of aquaculture systems in both developed and developing countries seeking greater self-sufficiency in food supplies could also create indirect benefits such as an improved investment climate.

Objectives of this project are to develop and adapt to cool water environment technologies for intensifying the production of fish, shellfish (including crustaceans), and marine plants. It involves the use of existing institutions, and the establishment of a research and development planning group.

IMPROVEMENT OF LIVING CONDITIONS, EMPLOYMENT,

AND PROTECTION OF THE ENVIRONMENT, THROUGH:

Remote Sensing from Space (USA)

Satellite remote sensing is an important tool in monitoring and understanding environmental phenomena, including those influenced by human activity. Because many of these phenomena are global, international cooperation is essential and is already well developed. Data from remote sensing satellites in orbit are also used extensively by many countries. Our countries are coordinating their efforts to achieve compatibility of remote sensing data. We envisage a succession of earth observation satellites developed individually or cooperatively as well as the provision of training opportunities, particularly for developing countries. To facilitate use of data from different satellite systems, informal multilateral groups have been formed for technical coordination among operators of national systems.

Through various bilateral arrangements, our countries have cooperated in space activities, in some cases, contributing instruments to each other's satellite systems. Such arrangements provide both cost-savings and coordination of data systems. Expanded cooperation should be pursued in the area of national and existing multinational remote sensing activities in support of such international environmental programs as the World Climate Program. In addition, increased emphasis should be placed on cooperation in the areas of polar orbiting meteorological satellites, ocean remote sensing, geostationary meteorological satellites, land remote sensing products and archives, and coordinated flights of remote sensing instruments.

High Speed Trains (FRG-FRANCE)

In recent years modern high speed wheel-on-rail systems have been successfully introduced by Japan (Shinkansen) and later by France (TGV), with significant effects on rail transport and on the economy in general. In the United Kingdom (APT) and the Federal Republic of Germany (ICE), similar systems are under development. In parallel, next-generation systems based on magnetic levitation are being developed in Germany and in Japan. The German "Transrapid 06" designed for speeds up to 400 km/h and carrying 200 passengers, will begin tests runs on a 21 km track in 1983; smaller Japanese test vehicle in 1979 achieved a top speed of more than 500 km/'

Based on these developments, the following proposals are made:

- Enhance cooperation between those countries which work on and have an interest in the future development of high speed ground transport systems and encourage the exchange of scientific, technical, and economic data and other information on such systems.

- Feasibility studies for high speed ground transport networks, (including their socio-economic aspects), focusing on Western Europe, and, if appropriate, North America and Japan. These studies may provide a basis for investment decisions having strong political and economic impacts.

Housing and Urban Planning for Developing Countries (FRANCE)

This project relates to one of the major problems of the latter part of this century: the explosive growth of towns and cities in the developing countries.

At the beginning of the 21st century, the world population will have reached 6 billion, half of whom will be living in towns. Forty conglomerations of the developing world will each have over 5 million inhabitants. The construction of many millions of relatively inexpensive dwellings in developing countries is imperative if the living conditions of the urban and rural populations are to be improved.

The project is not aimed at creating a new aid organisation, but at improved efficiency of existing national and international organisations.

Three approaches have been proposed:

- Exchange of information on programmes and projects;

- Coordination of technical training programmes for the habitat in developing countries. The first steps would be to evaluate training programmes available in the industrialised countries, and to improve the links of such programmes with the research sector, and their application;

- A research programme and experiments on relatively inexpensive dwellings in the developing world.

Advanced Robotics (FRANCE-JAPAN)

The industrial sectors in our countries are increasingly developing and utilising robots. Our governments support more basic and long-term research in these areas. Among the areas particularly appropriate for governmental action and cooperation are advanced robot systems that avoid the need for people to work in difficult or dangerous conditions or environments.

Development of advanced robot systems to work in such conditions or environments will require new technologies which are far more advanced than those embodied in today's industrial robots. International cooperation among developed countries to develop such technologies is highly desirable.

Cooperative activities would be flexible and carried out in phases in the following ways:

- discussion, in a joint coordinating group, of possible subjects for cooperation such as effective international collaboration, appropriate intellectual property protection, and possible technology transfer.

- Exchange of data, information, researchers and study missions;

- Examination of suggestions for common standards, establishment of common criteria for evaluation, and joint evaluation and experiments.

<u>Impact of New Technologies on Mature Industries</u> (FRANCE-ITALY)

One of the important aspects of new technologies, and notably of microelectronics, informatics, robotics, new materials and new energies, is their horizontal diffusion into many production activities. The introduction of these new technologies provides an excellent opportunity to modernise and rejuvenate traditional sectors at the production, management and marketing level.

This complicated process of technological modernisation requires a systematic interdisciplinary approach. Moreover, it needs to take into account international factors such as the structural adjustments occuring in the related industries in those developed and developing countries.

Individual governments are pursuing systematic efforts in this direction. Italy, for example, is currently studying the impact of the introduction of micro-electronics and information technology in several branches of the textile industry. In the FRG, a similar government-sponsored project has been undertaken in the printing industry.

At the international level, for instance, OECD has established a programme to analyse periodicaly the structural adjustments occurring in several different mature industrial sectors such as textiles, steel, shipbuilding, automobile, pulp and paper, aluminium, machine tools; and to evaluate the opportunities offered by some advanced technologies such as robotics and information technology.

It is important that the findings of these national and international efforts be taken into consideration when tackling specific projects on this subject. Related aspects such as social acceptance of technological change, cultural tradition and training needs should also be considered. Comparison of as many case studies as possible built on field experiments in different areas and countries can contribute to the definition of a common methodological approach.

Biotechnology (FRANCE-UK)

Biotechnology will have significant economic and social impacts on both developed and developing nations. It is already currently the subject of some commercial activity. At this stage, the commercial benefits of some biotechnological processes are far from clear and probably unlikely to be realised in the short term. Many of our governments have national programs which concentrate on basic research in this field. It is therefore appropriate to consider international cooperation so that limited national resources are not wasted by unnecessary duplication. If managed carefully, such collaboration should accelerate the development of some aspects of biotechnology, thus increasing economic activity and employment. The commercialisation of biotechnology could also be of significant interest to developing countries in the upgrading of raw materials.

The aims of the project are to obtain essential information on enabling technology at a lower cost than through purely national programmes; and at the same time, assist in the training of biotechnologists for the needs of developed and developing countries.

A network is proposed to link existing training centres and any new centres which may be established by individual countries to serve the needs of developing and developed countries and be coordinated through a Committee.

The rate of commercialisation is affected by the regulatory processes in each country particularly for health and food products. Representatives of the participating governments should meet to develop common guidelines for codes of practice for safety evaluation of new products arising from biotechnological processes.

Another aspect of the proposal concerns "orphan drugs". An international network of advanced biotechnology units with a specific interest in basic research needed for the development of drugs for diseases hitherto not amenable to pharmacotherapeutic control would be established to allow a coordinated approach in our countries to development of drugs of this type.

This work should be implemented with the full knowledge and continuing cooperation of the International Federation of Pharmaceutical Manufacturers Associations, and in consultation with the World Health Organisation.

Advanced Materials and Standards (UK-USA)

We all recognise the critical importance of the materials used in mechnanical, constructional and electronic engineering. The availability of suitable materials with advanced properties and performance will determine the rate of introduction of many new technologies and new industries.

The objective of the present proposal is to encourage the setting up of codes of practice and specifications for advanced materials on an internationally coordinated basis. Such codes create the conditions for the rapid adoption of materials by industry. New materials enlarge technological perspectives and catalyse innovation.

The provision of advanced materials standards depends on a number of factors: the enabling technologies, advanced testing, predictive and investigative techniques, data bases and the use of large centralised test equipment. Specific projects will be aimed at the development of standards on new materials (such as composites or engineering ceramics) and also on improvement of existing materials and processes (such as materials produced by recycling and joining technologies).

The intention is to establish an international research collaboration for the preparation of codes of practice and standards on advanced materials. This will be conducted on a flexible basis, with each participating member using existing resources. Recommendations arising from this collaboration would be submitted to the International Standards Organisation as a basis for standards having international status.

New Technologies Applied to Education, Vocational Training and Culture (CANADA-FRANCE)

The aim of this project is the coordination of basic and long-term work aimed at improved access to information and at the effectiveness of training. The achievement of this aim would contribute to better employment opportunities and hence to economic growth. New technologies to be applied to education, vocational training and culture will include basic research on computer assisted learning, the future electronic image (advanced computer animation and interactive imaging), information access technology in future systems (computer-assisted translation and technology links) and telesoftware.

An important objective of the project is to encourage collaboration between different governmental working groups in participating countries in order to improve appropriate transferability and exchange of these technologies. It is proposed that the organisations participating in this project may, after review of existing international coordinating mechanisms, define appropriate joint activities including information exchange, organisation of symposia and workshops, and launching of common pilot projects.

Public Acceptance of New Technologies (UK)

Public acceptance conditions the environment in which all new technologies operate and therefore has an important bearing on growth and employment. If technologies are regarded as unacceptably risky or threatening to the environment or to jobs, they can be, and frequently are, resisted.

It is possible to distinguish between different publics and different dimensions of the public acceptance problem. For example, the same individual can respond enthusiastically to new technologies as a consumer but negatively in the workplace, where technlogies are frequently seen as threatening to jobs, status and skills. The roots of opposition to new technologies may sometimes go beyond technical considerations, for example, they may be more concerned with political grievances about values or democratic processes.

A number of general lessons can be drawn from experience with the introduction of new technologies. In view of the importance and complexity of the subject, and the lack of understanding about it, a programme of studies should be undertaken encompassing the following themes:

--General background studies, which would draw lessons from the history of the introduction of new technologies and indicate the role which cultural differences play in determining public acceptance.

--Studies to focus on the way organisational changes need to be made to accommodate new technologies and on ways of involving the public in decisions.

--Assessments of the future impact of new technologies.

GENERAL INCREASES IN BASIC SCIENTIFIC KNOWLEDGE, PARTICULARLY IN:

Biological Sciences (EC)

Biological sciences have made enormous progress in recent years and this momemtum needs to be maintained. Knowledge of the basic structures of living systems and their functions --including the fast developing areas of cell adaptation and communication-- provide a powerful basis for the development of a wide range of applications in agriculture, health care, environmental control and other growth sectors of the world economy.

The complexity of modern biology (with its increasing need for expensive instrumentation, computing facilities, special laboratories and world-wide field surveys) points to the need for increased international collaboration. Further, modern biology has a major requirement for the collection, processing, retrieval and interpretation of huge quantities of data and information.

There is a need for continuing discussions between scientists in our countries on cooperation on biological banks covering, for example, plant and animal preservation material, nucleic acid and protein sequence data, micro-organism strain collections, and seed banks.

There is also a need for improved collaboration on the use of some of the important new tools in modern biology and medicine: synchrotron radiation facilities, cyclotrons, electron microscopes, neutron sources and nuclear magnetic resonance equipment, and space and deep ocean laboratories. Some biological phénomena, such as the evolution of ecosystems, desertification, and transborder pollution have a world-wide dimension which can best be tackled by international collaboration.

High Energy Physics (USA)

High energy physics is an important basic research activity which addresses the most fundamental questions of the nature of matter. This field has had many spinoffs of direct application to other areas of science and technology. Experimental research in high energy physics requires the use of a limited number of expensive particle accelerators and colliding beam facilities which have been constructed with government support.

A few large and costly machines are being constructed in different regions of the world to meet future needs. It is anticipated that scientists from each region will continue to be able to participate in experiments at these large facilities on the basis of the scientific merit of their proposals. Such international collaboration avoids unnecessary duplication of costly facilities.

In the mid-1990's further progress will probably require a new generation of very high energy accelerators costing huge sums of money. Such facilities are likely to exceed the financial capabilities of any single nation or region. An international cooperative programme should therefore be considered. The decade of effort required for definition, design and construction indicates that these discussions should begin in the near future.

Solar System Exploration (USA)

Scientific interest in the sun, planets, comets and asteroids lies in the expectation that their investigation will contribute greatly towards our understanding of the earth, the origin and evolution of the solar system and the origin of life in the solar system. In the last two decades, new and far more powerful scientific and engineering tools have revolutionised the exploration of the solar system. There is a long history of fruitful international cooperation in solar system research resulting from the realisation that by pooling capabilities and resources, the parties involved gain scientific, technical, and financial benefits.

Our countries endorse and encourage solar system exploration. We emphasize the need for a continuation and expansion of the various methods of cooperation and for planning to develop more cost-effective means of solar system exploration.