10 DOWNING STREET

From the Private Secretary

MR R.B. NICHOLSON
CABINET OFFICE

VERSAILLES WORKING GROUP ON TECHNOLOGY, GROWTH AND EMPLOYMENT

The Prime Minister has noted the contents of your minute of 14 January.

A.J. COLES

17 January, 1983

(2)

Prime Minister

This is largely for information.

A.J.C. 14/1

W.021

PRIME MINISTER

VERSAILLES WORKING GROUP ON TECHNOLOGY, GROWTH AND EMPLOYMENT

Sir Robert Armstrong minuted you on the status of the Versailles Working Group discussions on 20 December. The final meeting of the Group is due to take place on 24, 25 and 26 January in Paris, after which it is anticipated that President Mitterrand will communicate the Working Group's report to Heads of State and Government.

2. The report will consist of an Executive Summary (draft attached, Flag A) which will conclude with a list of projects (draft attached as Flag B) and, possibly, an indication of which countries are leading and participating in each project (draft attached, Flag C). The main body of the report (draft attached, Flag D) will follow and will conclude either with a list of projects as extended abstracts or with the project papers themselves as an Annex. The projects which are asterisked in the lists flagged B and C are those where the Working Group is simply endorsing existing collaboration, and it is likely that these will appear in title only as in the last paragraph on page 4 of the Executive Summary.

3. The draft report has been circulated to Departments and the project papers circulated to relevant Departments. Clearance at Ministerial level has been obtained in most Departments. In some, clearance at Permanent Secretary level has been regarded as sufficient. Departments have had few comments on the draft report beyond saying that it is rather bland and optimistic. Lead Departments for each project have been responsible for deciding whether or not the United Kingdom would wish to participate in a project.

4. All the projects in which the United Kingdom has been involved as leader or co-leader have been discussed with enthusiasm at the meetings of the Working Group. The position on each of them is given in the Annex.

5. I believe we have been successful in achieving the objectives set out in my minute to you of 8 October. The bulk of the report is concerned with the theme of the harnessing of technology for economic growth and employment, leaving international collaboration in science and technology as just one aspect of this. The more ridiculous and harmful proposals in President Mitterrand's Versailles paper find no place in the report and the strongly French flavour has been effectively eliminated. Whilst the UK delegation has certainly played its part in removing French national interests from the report, we have also managed to maintain an excellent relationship with the French Chairman and the delegation who probably feel that we have been the most constructive of all the delegations. The projects which we have suggested or taken co-leadership in have all been very well received. None of them requires major new resources for implementation but each of them could make a contribution to the better harnessing of technology for economic growth. On developing countries we have played a part in restricting the references to these to the bare minimum but have managed to avoid publicly taking a negative attitude. Finally, together with the United States and Germany, we have been able to ensure that the report makes plenty of reference to the primary role of the private sector in scientific and technological innovation, so that the role of governments and the public sector are kept in perspective.

6. Admittedly the report can be correctly criticised as bland, anodyne and optimistic. However, I believe that the conditions of setting up the Working Group and the very short time it had to prepare its report make it unrealistic to expect the report to contain original wisdom. More important than the detailed content of the report is the fact that it has appeared as the result of a debate on science and technology and what they have to offer, conducted by Heads of Government in the Summit countries. If one believes that many of the

economic and social problems in the world have part of their origin in science and technology, and yet, apparently paradoxically, the solutions to these problems lie, again in part, in the better use of science and technology in the future, then it is surely right for science and technology to appear as a regular item on the agenda of future Summits. There is plenty of opportunity for constructive discussion and for new ideas. The present report should be seen as just a first and rather faltering step in this direction.

7. When you receive the report formally from President Mitterrand he will also raise the question of publication (mentioned in Sir Robert Armstrong's minute of 20 December) and distribution of the report to non-Summit countries. Following your earlier instructions on publication, the United Kingdom delegation will continue to take the line that the report should first be considered by Heads of State and Government. I will minute you further on the question of publication and on distribution to non-Summit countries when I have seen the French proposals in this area.

RBN.

ROBIN B NICHOLSON
Chief Scientist

Cabinet Office
14 January 1983

cc: Sir Robert Armstrong (with flagged material)
Mr Sparrow
Mr Gregson

A. Renewable Energy Sources

This project, led by the Department of Energy, examined the state of international research and development on renewable sources such as wind, waves, geothermal, and concluded that existing international collaboration was adequate for the current technical and commercial prospects for these technologies. The project is therefore likely to appear by title only but it has been valuable exercise in the sense that it allowed us to resist French attempts to take the responsibility for collaboration away from organisations like the IEA and set up French institutions to do essentially the same work.

B. Food Technology

This project, led by MAFF, has the objective of improving collaboration in research on safety evaluation and harmonisation of test methods, food processing, and technology transfer to the developing countries. We have proposed that the first two of these subjects be pursued through more effective use of the EEC R & D resources in this area and that the developing countries' work be done through FAO. At the meeting of the Working Group just before Christmas, the French asked for co-leadership of this project, which we granted them. I believe that we have a firm grip on the project and this request is unlikely to lead to any significant change in the work proposed. Again, I believe that the MAFF initiative effectively pre-empted a French initiative which would have been aimed at French national objectives.

C. Advanced Materials and Standards

This project has been led by the Department of Industry and the United States has been a co-leader but content to play a very secondary role. The project has an objective of improving co-ordinated research activity to provide an appropriate research base for the development of improved codes of practice and standards in the field of advanced materials. Materials technology is an enabling technology for many other areas of research and improved utilisation and trade in new materials will enhance the rate of development of several new technologies. A small Secretariat for this new international activity will be based at the NPL.

D. Biotechnology

This project was originally proposed by the French in a form which was unsatisfactory to the UK, and indeed to several other countries. We requested co-leadership and have been successful in totally reorienting the project so that it is consistent with UK interests and with our substantial reputation in this field. Instead of a broadly-based and very French-oriented project the proposed work is now confined to specific areas of biotechnology and the activity involving technology transfer to the developing countries will be carried out by a network of centres in each of the Summit countries.

E. Public Acceptance of New Technology

This project arose from your own comments at the Versailles Summit and has been led by the Department of Industry. The topic features strongly in the Main Report (paragraph 2.3) but is also the subject of this separate project. Three areas have emerged as worthy of further study: first, there has been little historical analysis of the factors which have influenced public acceptance of new technology in the past and the way this has varied from one country to another; secondly, different countries have a variety of organisations, institutions and methods for educating and informing the public on new technology. There has been little comparison of these and the results from them. Thirdly, there is considerable scope for prediction of the benefits and problems from future new technologies and hence for planning for maximum public acceptance of these.

A

Versailles Working Group on Technology, Growth and Employment

DRAFT FINAL REPORT - PROPOSED ENGLISH TEXT

EXECUTIVE SUMMARY

"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 France a Working Group of Representatives of Seven Heads of State and Government and the Representatives of the European Community 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 political 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.

In this report the word Government is also taken to include the European Community

The Group has completed its task, and its report contains 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 (1.1).

Fundamental scientific research is the source of technological achievement in industry and should be given special support by Government (1.2).

Special training programmes are necessary to promote flexibility, mobility and adaptability, especially amongst scientific and technical personnel (2.1).

The educational programmes of nations should prepare their citizens for living and participating in a society of an increasingly technical nature (2.2).

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 (2.3).

Special attention should be paid to the rejuventation of mature industries through the use of science and technology (2.4).

Industrial innovation is best exploited through a balance of increased productivity and increased employment (3.1).

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 to avoid the transfer of sensitive technologies of military significance to our countries (3.2).

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 (3.3).

The market introduction of new technologies is primarily the task of the industrial and commercial sector. 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 (4.1).

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 (4.2).

National policies in areas such as regulatory standards, tax, patent, and trade influence our ability to innovate and to reap the full benefits of innovation. We recognise and endorse the efforts of the OECD to resolve some of the problems we face in this area (4.3).

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 (4.4).

International cooperation in science and technology has demonstrated its value. Governments should continue to support cooperation, including the international scientific organisations (5.1).

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 (5.2).

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 (5.3).

The cooperation begun under the auspices of this Working Group forms a solid base for future action and should continue in other relevant fora. We also recommend to our Heads of State and Governments 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 (5.4).

Finally the Working Group has reviewed a broad spectrum of scientific and technological issues with a view toward 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 underway in such important and wide-spread areas as the conquest of space, the safety of lightwater reactors, renewable sources of energy, and deep ocean drilling.

We appreciate this work and encourage its continuation under presently existing multilateral and bilateral arrangements.

We have also proposed to our Governments the following collaborative projects which are either new or incorporate significant re-focussing.

Groupe de Travail
- Technologie, Croissance, Emploi -
constitué par décision des
Chefs d'Etat et de Gouvernement
réunis au sommet de Versailles

Le Secrétaire Général

Paris, le 20 Décembre 1982.

* SAFETY OF LIGHT WATER REACTOR.

The objective is to encourage research on the safety of Light Water Reactor through holding of periodic workshops and collaboration on the research programmes on thermo-hydraulics and fuel behaviour.

* RADIOACTIVE WASTE DISPOSAL.

The objective is to encourage research on the environmental impact of radioactive waste disposal through setting up an international working group as a forum for collaboration for the research programmes of participants.

SOLAR CELL.

The objective is to accelerate the R & D of advanced solar cells through the exchange of information and researchers and through the development of common evaluation methods etc. with a view to realize the early application of photovoltaics

* RENEWABLE ENERGIES.

The proposal concluded that there have been substantial international collaborative research and development activities in this field by various international agencies ; and that these existing international mechanisms were satisfactory.

...

5, rue Descartes, 75005 Paris - tél. 634-33-78

* CONTROLLED THERMONUCLEAR FUSION

The final objective of research and development work on controlled thermonuclear fusion is to bring to fruition a new energy source using practically inexhaustible universally available fuels and pos sing potential advantages from the environmental point of view. Th interest of this long term objective for the growth of world econom is obvious and the responsibility which the developed countries mus assume in this area is particularly important.

The long and expensive path leading to this objective will probably be the same for the three fusion programmes presently in progress i the United States, in the European Community and in Japan. From the technical point of view a substantial increase of cooperation betwe these three programmes whould be desirable and it is time to start discussions on this subject.

For the setting up of such a cooperation, politival determination and support from the highest political level would be essential.

FOOD TECHNOLOGY.

There is scope for research on improving the efficiency and quality of food production in OECD countries ; for research and training in Third World countries on the utilisation of raw materials, storage of agricultural produce and food wastage ; and for coordinating research on food safety.

AQUACULTURE.

A project for planning consulting and developing technologies for increased aquacultural production in cool water environment.

PHOTOSYNTHESIS.

The objective is to promote basic research on photosynthesis and photoconversion to develop artificial photosinthetic systems and to improve photosynthetic efficiency through implementation of exchange on information and researcher and promotion of mutual utilization of facilities and equipment.

HABITAT AND URBAN PLANNING IN DEVELOPING COUNTRIES.

Aim : to take into consideration problems of urban planning in developing countries.

Cooperation would concentrate on training Urban Planning Offices to enable them to apprehend technical, social and cultural problems encountered in developing countries.

FAST TRAINS.

Development of high-speed ground transportation systems utilizing both whell-on-rail and magnetic levitation technologies have reached a stage where more effective international cooperation and, especially, the preparation of first international connections are recommended.

IMPACT OF NEW TECHNOLOGIES ON MATURE INDUSTRIAL SECTORS

The project proposes a series of comparative studies of the process of rejuvenation of traditional sectors induced by new technologies.

The aim is to acquire a defined and common methodology of analysis and evaluation in terms of competitiveness and employment of this delicate process.

ADVANCED ROBOTICS.

The objective is to develop advanced robot systems, which can liberate human work from difficult activities in harsh, demanding or dangerous conditions or environments by integrating advanced new technologies.

ADVANCED MATERIALS AND STANDARDS.

The proposal aims at coordinated research activity to provide the necessary research basis for the preparation of codes and practice and standards in the field of advanced materials and in new applications of existing materials. The results of the research would be fed into the International Standards Organisation.

BIOTECHNOLOGY.

There is a need for collaborative R& D : selection of priority projects will emerge from expert meetings. There is also a need for establishing and coordinating a network of new and existing training centres to serve the needs of developing and developed countries.

ORPHAN DRUGS.

As part of the proposal for biotechnology it is proposed to promote the development of commercially non-viable pharmaceuticals.

NEW TECHNOLOGIES APPLIED TO CULTURE, EDUCATION AND VOCATIONAL TRAINING.

The project will contribute to the development of culture, education and vocational training by seeking to encourage the transferability and portability of new technologies.

It is also proposed that a collaborative program be set up for the production of didactic material for computer training and retraining of personnel.

PUBLIC ACCEPTANCE OF NEW TECHNOLOGY.

People react to new technologies in ways which reflect their attitudes and values. Relatively little is known about the factors involved, including the role of cultural differences. International co-operative studies and exchange of experience are proposed.

The following synopses have been prepared by the UK Secretariat.

FAST BREEDER REACTOR CO-OPERATION.

Considerable international collaboration is already under way, aimed at improving the commercial prospects for this technology. More can be done however, and it is recommended that Summit countries consider ways of expanding this co-operation through existing channels.

* SCIENTIFIC OCEAN DRILLING.

The study of the oceanic crust has long term implications, which are currently the subject of an international co-operative programme (IPOD). Because of the potential international benefit, broader participation of scientists from other countries is recommended, together with a wider sharing of costs where possible.

* HIGH ENERGY PHYSICS.

Experimental research into high energy physics involves extremely expensive facilities, which are likely to exceed the financial capabilities of a single nation. Thus an international co-operative programme should be considered, leading to the definition, design and construction of appropriate facilities.

* SOLAR SYSTEM EXPLORATION.

The Summit countries endorse and encourage solar system exploration, emphasising the continuation and expansion of international co-operation in this field. A prime objective

is to enhance collaborative planning aimed at the development of more cost-effective methods of conducting solar system exploration.

REMOTE SENSING FROM SPACE.

The global nature of satellite development has led to substantial international collaboration in this field. The Summit countries have demonstrated their commitment to the use of satellites for remote sensing through a number of co-operative programmes. Nevertheless, further work needs to be done, particularly in such areas as ocean sensing, meteorology and world climate, land sensing and the development of remote sensing instruments.

VERSAILLES WORKING GROUP - TECHNOLOGY, GROWTH AND EMPLOYMENT

SUMMARY OF PROJECT SUPPORT

PROJECT \ COUNTRY	CANADA	EEC	FRANCE	GERMANY	ITALY	JAPAN	UK	US
* Light water reactors		L	I		I	L	I	
* Radioactive Waste		L			L	I		
Solar Cells		I		I	L	L	I	
* Renewable energy	I	I	I	I	I	I	L	
* Nuclear fusion	I	L	I	I	I	I	I	L
Food technology	I	I	L		I	I	L	
Aquaculture	L		I	I		I	I	
Photosynthesis		I	I	I	I	L	I	I
Urban planning		I	L		I	I	I	
Fast trains		I	L	L	I	I	I	I
New Technology on mature industry	I	I	L	I	L		I	
Advanced robotics	I		L	I	I	L	I	I
Materials	I	I	I	I	I	I	L	L
Biotechnology	I	I			I	I	L	L
Orphan drugs	L	I	I		I		I	
Technology applied to education	L	I	L		I		I	
Public acceptance of technology	I	I	I	I	I	I	L	I
Fast breeder reactors		I	L	I	I	I	I	L

COUNTRY / PROJECT	CANADA	EEC	FRANCE	GERMANY	ITALY	JAPAN	UK	US
* Deep ocean drilling	I		I	I	I	I	I	L
* High energy physics	I	I	I	I		I	I	L
* Solar system explorations		I	I	I	I	I	I	L
Remote sensing	I	I	I	I	I	I	I	L

Notes:-

a) L indicates Leader or Co-Leader

b) I indicates a willingness to participate in the next stage of the project (where appropriate)

UK Secretariat

5 January 1982

D

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

Consistent with this instruction, and at the initiative of the PRESIDENT OF FRANCE a Working Group of Respresentatives of the European Community 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 20, 1982.

Operating on the basis of concensus the Working Group has produced this report which is essentially political 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 hereby presents its report.

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* In this report the word Government is also taken to include the European Community.

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

1.1 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 countryside, our systems of transport were all transformed. The introduction of the railway, the steamboat, and the telegraph stimulated our economies. Later, the internal combustion engine the automobile, the aeroplane, the telephone, electricity, and the chemicals industry began to change the quality and style of our lives.

This process of transformation and change stemmed from a conviction that scientific inquiry and advance is central to progress. This confidence in science, which, since the Renaissance, was popular in intellectual circles, was to spread gradually to many disciplines sich 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 a result of the spin-off from scientific research. The progress which resulted was substantial in the agricultural, industrial, service and public health sectors.

While science and technology were modifying our methods 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 different ways, science and technology have 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 muclei, 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 industrialization 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, some of which have suffered from severe economic strain.

Thus, despite all mankind's achievements many problems confront the industrialized and the less developed 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.

1.2 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 optimal use of human and material resources. Incorporation of microprocessors into existing technologies can produce a generation of new products of improved performance.

Robotics can improve the productivity of industry and free workers from hazardous and repetitive labour. The same technology can be applied to the problems of the physically handicapped to produce artificial limbs and other devices that may enable them to lead fulfilling lives.

Remote sensing can improve our capacity to live in harmony with our environment, develop our natural resources, and predict out 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 the source of technological achievement in industry and should be given special support by Government.

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

2.1 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 layoffs 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 by the concomitant job creation, a growth conducive micro- and macro-economic environment is essential. The existence of a stock of promising but unrealised innovations 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 condifence in future growth and stability is low.

Special training programmes are necessary to promote flexibility, mobility and adaptability, especially amongst scientific and technical personnel.

2.2 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 mundane 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 increse the level of employment and encourage growth, but create a more human environment for the individual.

Such changes present a challenge to society which demands an effective response. First, there should be a relation between the types of technology developed and perceived social and cultural needs as well as purely economic ones - hence the need for public debate in science and technology. Second,

education and training are necessary to prepare people for technological change. Third, 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 weakest segments of the labour force, such as women and older workers.

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

The educational programmes of nations should prepare their citizens for living and participating in a society of an increasingly technical nature.

2.3 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 minority groups. 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.

2.4 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 centres 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, can not 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

3.1 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.

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

- Third 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, it is desirable that productivity gains must not be entirely distributed in the form of higher labour costs. It is also desirable that productivity gains be associated with a simultaneous increase in aggregate demand. Providing a proper distributional balance is achieved productivity gains could not only improve the overall economic outlook, but also the employment situation.

Industrial innovation is best exploited through a balance of increased productivity and increased employment.

3.2 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 organised, others occur by chance. But the result is a flow that has encouraged the birth and growth of new technologies. At government level numerous formal cooperative arrangements serve to facilitate 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 technology, important for the national security of 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 the partners who, nevertheless respect each others 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.

We reaffirm our commitment to removing barriers to an open multilateral trading system and to promoting the development of trade in new technologies, especially for their role in creating new employment. We therefore seek to intensify our bilateral contacts and our multilateral contacts in all relevant fora.

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

3.2 Conditions for the Effective Utilization of Science and Technology by the Developing Countries

The contributions 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 varieties of high-yielding wheat and rice which have markedly increase 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 the 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 universities, 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 govenments 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 IN SHAPING THE SOCIAL AND ECONOMIC CONDITIONS FOR OPTIMUM IMPACT OF INNOVATION ON GROWTH AND EMPLOYMENT

4.1. 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

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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. For all countries the phrase private sector refers to private industry and commerce, in some the role of the private sector is also shared with parts of the public sector.

inherently risky, governments should help to create an environment which on the 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 recognize 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 includeed 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 sector. 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.

4.2 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 low inflation, stable environment with predictable government policies. Stability, continuity of policy measures and confidence in the future encourages 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 peconomic 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 encouragement of invention and investment in innovation.

4.3 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 deducation, 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 it 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.

[A world trade system in which governments, using the resources of their tax payers compete with each other instead of allowing independent private sector firms to do so, would undoubtedly put an end to the high efficiency and other beneficial effects which have emanated from the open multilateral trading system as it has developed since World War II.]

[Notwithstanding this general philosophy, where market forces are proved to be inadequate, for example where excessive barriers to change exist, governments should carefully explore ways to facilitate adjustments, while seeking always to enhance the overall strength of their economies.]

Governments, collectively and individually, therefore have a responsibility to minimize distortions and encourage international trade in high technology products and services

[Both the OECD and the GATT are launching work programmes to examine the trade issues which may arise in high technology products. We endorse those efforts to develop a better understanding of these issues.]

National policies in areas such as regulatory standards, tax, patents and trade all influence our ability to innovate and to reap the full benefits of innovation. We recognise and endorse the efforts of the OECD to resolve some of the problems we face in this area.

4.4 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
- intenational relations 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 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, industrialised country: it is not possible to predict from which part of the spectrum of today's basic research tomorrow's 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 crucial and 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 propose 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 application to economic and social activity. Whilst periodic consultations have taken place in the past in bilateral and multilateral meetings (for example the United Nations, OECD) we believe that these have sometimes been less effective because they failed to take 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 souce of national and international strength and can provide immense opportunities for revitilization 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

5.1 Present situation

A very 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.

Following the success of the International Geophysical Year in 1958, 30 nations signed the Antarctica Treaty which has amongst its objectives the encouragement of cooperation in scientific research in Antarctica. °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 measurement 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 earth's crust but has also provided information of real value to deep sea exploration. Work on high energy physics at CERN has 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, engineering, 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 account of 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 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.

5.2 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.

That attitude should be challenged: 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 rationalizing it and reducing its costs

- take account of 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

- enhance growth and employment.

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.

5.3 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

- to seek cooperation in, and in certain cases joint operation of large scientific research installations, the cost of which is prohibitive for a single state 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 mobility and allow eventual reinstatement on return.

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

- 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 ideas and researchers must be strongly encouraged.

5.4 Potential areas for cooperation

The working group has determined that it is in our common interest not only to endorse existing international cooperation undertaken, but also to refocus it in some instances to widen or change its scope.

In addition, a number of specific areas for cooperation in science and technology were examined by groups of experts, whose conclusions are included in an annex to this report. The topics for scientific and technical cooperation were selected with the following objectives in mind:

- to stimulate conditions for growth
- to encourage training and education at all levels
- to improve living and employment conditions

In order to achieve these objectives the group agreed on four criteria to be used for the selection of collaborative projects in such areas. They should

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

- be within the public sector or within the clear responsiblility of Governments;

- represent a 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 in Section 6.

The identification of projects to adequately meet all economic and social needs and to be agreed by everybody would have required a much longer exercise than was possible for the Working Group. The choice of projects cannot therefore reflect the priorities of all delegations to the Working Group, let alone the priorities of the other countries of the world.

The cooperation begun under the auspices of this Working Group forms a solid base for future action and should continue in other relevant fora. We also recommend to our Heads of State and Governments 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.

6. COLLABORATIVE PROJECTS

The Working Group has reviewed a broad spectrum of scientific and technological issues with a view toward determining where additional international collaboration could best contribute to increased undestanding 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 underway in such important and wide-spread areas as the conquest of space, the safety of light water reactors, renewable sources of energy, and deep ocean drilling. We appreciate this work and encourage its continuation under presently existing multilateral and bilateral arrangements.

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