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TOWARDS A EUROPEAN STRATEGIC PROGRAMME FOR RESEARCH AND DEVELOPMENT IN INFORMATION TECHNOLOGIES

(Communication from the Commission to the Council)

Towards a European Strategic Programme for Research and Development in Information Technologies

A. INTRODUCTION

1. Concurrently, with the present economic crisis, Europe is suffering from declining competitiveness in its industry. This has resulted in an increasing loss of markets and in a consequent rise in unemployment. Increasing competition from Europe's major industrial competitors is being experienced even more in the high technology industries which are key to Europe's future growth.

2. It is urgent to reverse this unfavourable trend. The Commission has given priority - in the context of the 30th May Mandate - to adapting the whole range of Community policies to respond to the present situation and to contribute to solutions.

3. Information technologies affect the entire fabric of the economy. Their rapid application offers the key to increased competitiveness in virtually all main sectors both in manufacturing industry and in the service sectors.

4. Not only is information technology a key to competitiveness, but it is also a major growth sector. The world market for information technology products is growing at 10% annually - even in the present recession. Annual world sales are perhaps 100 billion ECU and 30% of this market is within Europe.

5. The Commission has recognised the importance of increased efforts in the information technology sector as being a major component of any industrial or research strategy. For example, the Commission's Communication on community Industry Strategy (1) (which highlights the need to promote high-technology high-skill activities), the Communication on Scientific and Technical Research (2) (which draws attention to the urgent need to implement a Community R and D programme in information technologies) and the Communication on Industrial Innovation (3).

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(1) A Community Strategy to develop European Industry, COM(81)639
(2) Scientific and Technical Research in the Eurppean Community, proposals for the 1980s - COM(81) 574
(3) A policy for industrial innovation - strategic lines of a Community approach, COM(81) 620.

B. CHARACTERISTICS OF THE INFORMATION TECHNOLOGY SECTOR (I.T.)

6. A dynamic, fast-moving high technology sector, the I.T. industry, by rapid continuing generation of new advanced technology products is now a key factor in promoting economic and social development. This rate of technological change is so great that around half the products that are on the market today did not exist three years ago. In the I.T. sector, technology is the key to competitiveness.

7. This rate of change shows no sign of slowing down. All technological indicators show that this trend will continue beyond the foreseeable future. New microelectronic technologies are making possible increases in circuit speed and chip densities that will reduce even further the cost of memory devices and so as to produce ever more cost effective and widely acceptable products in the years ahead.

8. A continuously growing range of I.T. products is spreading into every aspect of daily life bringing to all sectors of commerce and industry an immediate and striking improvement in efficiency and productivity. This is the key to the profitable competitivity needed to capture markets and create wealth.

9. Also, in an industry which is moving at that pace, investments are extremely heavy : in fact, the I.T. industry has become the "heaviest" industry where the ratio of investment to turnover is now higher than any other industry.

Reasons :

- rapid obsolescence
- the necessity to pursue several R&D approaches in parallel, sometimes well into the development stage, as technology predictions are very difficult in such a fast moving environment.

10. The I.T. industry is at present dominated by the U.S.A.. This position is supported by close links between industry and universities (cf. Stanford; MIT), as well as the scale and nature of Department of Defense sponsored programmes such as VHSIC (Very High Speed Integrated Circuits).

The U.S. position is now being seriously challenged by Japan. The Japanese employ effective, co-ordinated industrial strategies based on government sponsored industrial research. The latest example is the fifth-generation computer technology programme.

Any European attempt to match competitive developments in these countries requires expenditure on a concerted basis at least on a comparable scale (see Section I. below.)

C. THE EUROPEAN INFORMATION TECHNOLOGY INDUSTRIES

11. Despite certain strengths in each country, during the past three years the situation of the European Information Technology industries has worsened. The financial position of most of the companies is weak compared with their Japanese and American competitors, and their information technology products are not yet making a major contribution to their profitability.

12. The overall balance of trade for Europe in the I.T. Sector is negative. Studies show that there is also a negative balance in patents, which is evidence that European industry is losing the race to create the technology base.

13. Without this technology base the European I.T. industry is increasingly dependent on foreign technology. However, this technology comes from companies who are its own competitors. In an area where success depends on having a technical lead, the European industry frequently lags in the introduction of the latest technologies because it does not have access to them at source.

14. The result of this weakness in technology exploitation is that only 40% of the European domestic market and 10% of the world market is held by European industry itself.

15. In several key areas foreign competition has strengthened its position :

- in microelectronic components, both manufacture and design of integrated circuits is dominated by the Japanese and USA
- in mainframe computers IBM continues to be dominant, the turnover of IBM Europe exceeding that of the ten largest European companies together
- in smaller computers the main company successes have been in the USA

- in consumer electronics such as TV picture tubes, TV receivers, audio equipment and electronic games the Japanese dominate world markets and European companies have suffered noticeably
- in telecommunications no European company approaches the strength of ATT, and the Japanese manufacturers pose an increasing threat with the speed to their introduction of new technology.

16. European industry therefore finds itself in a position where not only is the domestic European market characterised by fragmentation perpetuated by national standards or local variations of international standards, with the result of increased costs and lower competitivity in export markets, but a situation in Japan and the USA of increasing rate of new technology creation.

17. Most of the major European companies are therefore at a crossroads. Either they must increasingly rely on imported basic technology with the consequent risks of vulnerability to embargo, or they must opt out of the race to be in the forefront of high technology and fall back on lower technology products. However, many of the world's largest growth markets are in high technology, and Europe cannot afford to surrender these since they are to a considerable extent its own domestic market.

D. TOWARDS A EUROPEAN RESPONSE

18. Europe must create a long-term strategy for its I.T. industries whose aim must be to place them in a position of technological equality with their competitors. Only in this way can its industries hope to become competitive with the USA and Japan.

19. This European strategy should enable the European industry to attain eventually a world market share comparable to the relative size of the European I.T. market itself, e.g., 30% of the world market.

20. The main responses of Member States to the continued external threat to their I.T. industries have so far been national responses. There exist a whole series of national support schemes all designed to strengthen national industry. In response to new research programmes being announced and undertaken in the USA and

Japan and to the continued loss of markets, Member States are preparing a new series of national responses, and national strategies.

21. However, national strategies cannot address the root of the problem. This is that all technology options must be pursued and developed, since it is not predictable which in the long term will be the key ones. Companies, and even individual countries, do not have the resources to pursue the full range of technology options.

22. A European strategy must re-inforce the existing efforts of national authorities, encouraging cooperation between European firms and increasing the direct Community contribution to this joint effort.

23. European industry has indicated that if such a goal is to be achieved within the next ten years, a major cooperative long-term R&D effort must be launched at the Community level in addition to and reinforced by those other measures indicated in I. below.

24. Such an effort (which could be called the European Strategic Research Programme in Information Technology - the ESPRIT) should have three objectives :

- it must be aimed at pre-competitive technology,

- it must be concerted with national activities,

- it must be of substantial scale, adequate to catch up with and match the equivalent efforts of Japan and the USA.

25. Other important aspects are that it must draw on all the available skills by involving public research institutes and universities; industry throughout the Community must benefit both through as wide a participation as possible and through wide dissemination of the results.

26. Given the situation much of European industry is now in, and the revision of national strategies, it is important that this effort be launched as rapidly as possible, to ensure that the companies involved in the I.T. industry are not forced to give up the possibility of a European option.

E. EUROPEAN STRATEGIC PROGRAMME OF RESEARCH AND DEVELOPMENT IN INFORMATION TECHNOLOGY ESPRIT

27. A number of major European companies in the I.T. field have, together with the Commission, entered into an exercise to define a programme of cooperative long-term research capable of being carried out by industry and research bodies in cooperation.

28. They have used as a basis for discussion studies which were carried out by the Commission with consultants on the long-lead-time research needs of European industry. The consultants in question reviewed potential areas of technology with a view to identifying those which were :

1. Necessary for the competitivity of the industry,
2. Suitable for a European effort rather than a national one.

29. They concluded that there were five major areas of information technology which, with a properly focussed effort at a European level, offered the possibility for European industry to close the technological gap with its competitors and to have immediately available the ability to apply these technologies to other sectors without dependence on foreign sources of supply.

30. The companies accepted the broad conclusions of these studies. Within the framework of the Commission, working to an accelerated timescale, and deploying considerable resources in terms of key engineers the companies have created working groups to study each of the key sub-sectors identified in the studies and for which a new body of science and technology is required within the new five to ten years in order to develop a new generation of products and systems.

31. The subject areas being studied by the five groups are :

- Advanced Microelectronics,
- Advanced Information Processing,
- Software Technology,
- Office Automation,
- Computer Integrated Flexible Manufacturing.

32. This preparatory phase will result in the main lines of an overall programme which will be of a European scale.

33. The European dimension of any such programme will need to be reinforced by attention to standards, opening up of the markets and perhaps improving the financial environment. However, the starting point must be a genuinely valid technology programme. Once the main lines have been identified within the present preparatory phase it will be discussed with the European industry in general, major users, research institutions and national authorities, and these discussions have already started.

F. NATURE OF THE PROGRAMME

34. ESPRIT will build on existing Community activities. It is a logical follow-on to the Community microelectronics programme and to the existing multiannual programme which concentrates on networks, applications and software. However, because of the need for scale and the need to address all the key I.T. sectors ESPRIT will be significantly larger in scale and be a systematic, integrated approach.

35. The main lines of ESPRIT will consist of a number of long-lead-time R&D programmes of sufficient depth and variety that the results will provide an overall capability that can be exploited by the whole of the European I.T. industry to compete successfully with US and Japanese efforts in this field.

36. The following brief outline of the nature of the five areas indicates the large extent by which R&D in one area is needed for the development of a vital capability in another.

It follows therefore, that to establish a competitive European Community presence in the world markets, the R&D programmes in all five areas are very closely related from the point of view of industrial exploitation and therefore the results from all those areas should be available at roughly the same time. The great volume of very high quality, multidisciplined research and development skills that are needed to make this possible, can be obtained only by bringing together the appropriate scientific and technical resources of the whole Community.

i) Advanced Microelectronics

Microelectronics provides the common operational circuit technology on which all modern electronic systems rely in order to perform their functions. Advances in microelectronics technology are aimed at producing smaller, more reliable and more powerful devices, capable of performing more functions or operations than those in use today.

They will enable a new generation of cost-effective electronic equipment and systems to be introduced and the cost per function of existing systems to be reduced.

The successful design and manufacture of these devices depends upon the availability of new capabilities based on Advanced Information Processing, Software Technology and Computer Integrated Manufacturing technologies arising from the work programmes initiated in these areas.

The existing Community microelectronic technology programme (1) concentrates on some of the new technologies needed to design and manufacture VLSI (2) microelectronic circuits. The programme initiates cooperation at Community level between industry, research establishments and universities, in projects that are the first steps of the long-term R&D programme in advanced microelectronic technology envisaged in this communication.

ii) Advanced Information Processing (AIP)

The nature of the new generation of AIP is that they will be more directly orientated towards the needs of human, non specialist users than are the data processing systems that are available today. They will provide for new kinds of direct communication between man and machine such as pictures and speech, and their functions will be much like human thought, association and inference, rather than calculation and data storage.

AIP systems will require advanced architecture and further miniaturisation in microeelectronics, a reliability much increased beyond that which is possible today and novel ideas in information science.

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(1) Council Regulation 3744/82
(2) Very Large scale integration.

The successful implementation of the R & D programme needed to achieve these goals depends upon the availability of new capabilities in the fields of Software Technology and Computer Aided Design tools for Advanced Microelectronic Devices arising from the work programmes initiated in these areas.

iii) Software Technology

The present nature of software technology is that it is both skilled-labour intensive and barely adequate to meet current system requirements. Substantial advances and improvements on present software development and engineering techniques are necesary, in particular those needed to establish the generation of highly modular software, enabling individual modules to be "reusable" in other programmes for which the same functions are required.

This will lead to cost-effective production of the complex programmes required to control the new generation of AIP systems. Projects within this theme will develop and build upon a common set of tools and methods, to define and implement a "second generation" software engineering environment by which to achieve these goals.

iv) Systems for Office Automation and Computer Integrated Flexible Manufacturing

The nature of these systems is that they depend upon the development of an extensive range of cost-effective highly reliable sensors and transducers and the availability of the new capabilities that will be provided by the sectors described in the preceding paragraphs.

These developments and capabilities will open the way to the design and introduction of a vast range of new products and systems. It should be noted however that one key to successful commercial exploitation and use by European industry and business, is a European-scale market characterised by continental-wide adoption of appropriate, common, telecommunications - compatible standards, operating

procedures and other user rules and protocols for use in national government, company and education systems and public purchasing specifications and procedures.

R&D projects in this sector will be aimed at developing common technologies related to the definition of user and interface standards that satisfy these requirements.

G. NEED FOR PILOT PROJECTS

37. In the course of their investigations into the broad definition of ESPRIT, the working groups have identified a number of pilot projects of limited scope compared to the whole programme, but which, by their nature, are representative of the different types of activity that constitute ESPRIT.

38. The projects have a double purpose :

- to constitute concrete examples from which to develop and validate the methods and framework of cooperation,

- to maintain the momentum towards the definition and realisation of the whole programme.

39. It should be emphasised again that these projects do not constitute a comprehensive, integrated programme (as ESPRIT will) and therefore should not be judged in that light. Rather, as has been said before, they are meant to be starters for the operation.

H. TIMETABLE

40. As has been stated above the need for the above programme is urgent. Because of this, the present Communication is being submitted to the Council so that preparatory discussions can be initiated to enable decisions to be taken more rapidly later on. The main ESPRIT programme will be prepared and presented in time for discussions to begin before December 1982. In order to allow the main programme to begin in January 1984, the second half of 1983 will have to be devoted to negotiating and setting up the cooperative mechanism.

41. As has been stated earlier there is a need for pilot projects and these will be prepared much earlier and submitted to the Council before the autumn of this year, to enable them to begin in January 1983. The aims of these pilot projects have been stated in the previous section. It is envisaged that the Community contribution to this preliminary phase would be of the order of 10-12 MECU, and this sum is included by the Commission in the 1983 budget.

42. Before any proposals are presented the consultation process will be widened to include industry and national authorities on as wide a basis as practicable, and to bring in major users and scientific bodies.

I. ESPRIT IN THE WIDER CONTEXT

43. How large should the ESPRIT programme be ? As stated earlier, it must at least match comparable efforts in the U.S.A. and Japan.

44. In the U.S.A., 15.7% of the national 1981 R&D budget of $ 68.6 billion ($ 10.8) was for electronics and related technologies. Of this figure some 47% was to be provided by industry and 49% by government. (1)
Two examples of joint U.S. government/industry programmes are the VHSIC (2) programme - $ 210 million over 6 years, with an industrial contribution of at least that amount - and the ICAM (3) programme - to which the U.S. government is contributing $ 100 million over 5 years. It is also worth noting that in the U.S.A. even though many of the companies, have much greater research programmes than European ones, some of them (including IBM !) are combining to conduct research in key areas.

45. In Japan, the total figure for research appears comparable to that of Europe, but their results have been spectacularly striking in comparison. This appears to be due, amongst other things to their clear strategic objectives and the fact that research and exploitation is concentrated on a few large companies.
There are a number of programmes involving government and industry, of which well-known examples are the VLSI (4) programme which was $ 139 million ; PIPS (5) $ 82 million ; high speed computer - $ 148 million over 7 years ; operating systems - $ 148 million over 4 years, and so on.

(1) Source - Study on Long Lead Time R&D for the Commission (Phase
(2) Very High Speed Integrated Circuits
(3) Integrated Computer-Aided Manufacture
(4) Very Large Scale Integration
(5) Pattern Integration Processing Systems

46. In Europe (although it is too early) to quantify the ESPRIT programme considerable sums must be involved. Although there are a number of national European programmes on this scale there are significant differences. In particular the U.S.A. and Japanese programmes are building blocks, in that they relate to each other and lead to further programmes. For example the U.S.A. VHSIC programme will lead to the UHSIC (1) programme.
In Japan the PIPS and high speed computer are an integrated part of the push towards Artificial Intelligence Systems.

47. ESPRIT will improve the use of European R&D resources provided it is in the nature of a building block. This means there must be a dynamic approach to the programme. Projects must be added (or discarded) as technology itself evolves.

48. The ultimate success of any such programme however will only be measured by European industry increasing its share of European and world market.

49. This will only be possible if R&D is placed in the context of a wider strategy supported by national authorities and the Community. For the companies a wider strategy may imply a degree of industrial specialization. For national authorities this should mean concentration not only on R&D but increased efforts in the field of norms, standards and public procurement policies to ensure that the largest possible market exists in Europe.

50. Some existing Community activities are aimed at supporting industry and national authorities in these aims and others, like the microelectronics programme, lead into ESPRIT. Amongst the first type are :

i) The multi-annual informatics programme promulgated by Council regulation 1996/79. This concentrates on the cooperative development of a variety of software and application projects of Community interest and the creation of supportive data bases.

ii) The maintenance of a working group on standardisation (the W.G.S.) concerned with the identification of needs for Community and international standards in the field of information technology systems.

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(1) Ultra High Speed Integrated Circuits

iii) The proposal on Telecommunications to harmonise future integrated service digital networks and create an open Community market for telematic terminals. This is currently before the Council and there is an urgent need for a decision.

iv) A number of projects aimed at the definition of compatible standards and use of I.T. in office automation and information exchange systems. A Community action, INSIS (Inter-Institutional Information System), is envisaged. It is the intention to reinforce these activities.

J. CONCLUSION

51. The Commission invites the Council :

- to accept the urgent need for a European Strategic Research Programme in the information technology field.
- to agree the general outlines given in this paper.
- to approve the timescale and procedures set out in section H above.