European
Commission

Esprit Review Board 1996 report

Making progress happen
through development,
application and diffusion
of information technologies

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BRUSSELS, 1997

Almost six months have elapsed since the Report of the Esprit Review Board, which I had the honour to chair, was formally submitted. Given the pace of change in the information technologies, even half a year constitutes a reasonable time frame to take stock. In this Preface will try briefly to note intervening events and responses to the Review Board's findings in order to look further ahead.

There is no indication of any slow down in the pace of advance in IT. The trend towards convergence of the information and communications technologies in all their manifestations, including networks and content, is becoming ever more evident. Internationalisation continues apace. The resulting 'broad' ITC sector is already the major driver of the Californian economy, and its role in all advanced economies is increasing, especially in terms of value added and stock market capitalisation. The TWO agreement reached in Singapore in December 1996, due to enter into force by July 1st, 1997, implies the elimination of tariffs on about 90% of IT products. Another agreement within TWO on the liberalisation of telecommunication services has also been stipulated in Geneva in February 1997. Both agreements will give a further boost to ITC.

That this ferment has yet to translate into a positive impact on employment is not something which should surprise us. The comparison between today's information-led revolution and the industrial revolution of the 19th Century may be overworked,

but it makes sense nevertheless. A technological paradigm shift of the scale we are experiencing will inevitably overturn existing certainties. The labour market resulting from earlier industrialisation is being forced to adapt. Employment rebound is most rapid in economies which have responded with the greatest flexibility. After initial and often sustained shock arising out of restructuring, these economies are now finding a new equilibrium and there are definite signs of job generation taking place in some sectors, if side by side with ongoing job losses in others still candidates for restructuring. Overall, however, in the European Union the perspective remains clouded by labour market rigidity, high unemployment rates and low investment.

The combination of the economic downturn and the adherence to the Maastricht criteria, is compelling European governments to attempt the task of convincing electorates that it is not possible to spend our way out of a structural crisis. With flexibility, it is possible, however, to *invest* our way out of it - and that means, public-private investment in technologies, in infrastructure, in skills, above all in people. It means investment in the information and communications technologies, in research, but perhaps -at this stage of our economic life- above all in their diffusion and uptake, in extending their use, multiplying the number of people with mastery of the technologies and their applications. It also means implementing the Information Society in a changing world marked by liberalisation and globalisation. For all these, Esprit has crucial and growing importance.

The Review Board's conclusions are striking. At first drafting they seemed at times even controversial. But it is heartening to note that they are shared by others charged with covering similar ground in different contexts. There is significant consonance of ideas between the Review Board and the subsequent 5-Year Assessment of the IT Programme (panel chaired by Prof. Carneiro) and the 5-Year Assessment of the

overall European Community RTD Framework Programmes (panel chaired by Viscount E. Davignon). A number of their recommendations, both strategic and operational, have been based on the findings of this Report. In subsequent presentations to members of the College of Commissioners and to the European Parliament, substantial agreement with the Review Board's diagnosis and with the gist of its proposals has been apparent. This consensus would argue that it should be possible to commence implementation of many of the changes proposed as from now, before the beginning of Framework Programme V.

Specifically, the Review Board's proposal to bring Esprit, ACTS and Telematics under the same programme umbrella finds broad support. The recommendation now finds echo in the Commission's desire for the removal of artificial barriers in the Union programmes to create a common coherent and well balanced single programme integrating R&D with take-up actions such as pilots, demonstrations, first users and best practice actions. This should take form in the V Framework Programme.

The Board's strong call for further streamlining in administrative and financial matters of Esprit, but particularly upstream in the Framework Programme proper, is also seconded by others. Drastic change - outsourcing, spinning off tasks, etc. - must be made to the present system if it is to fulfil its role. In similar vein, the other panels call for a massive effort of re-engineering. There is a need for a change in culture and attitudes particularly within the Commission's legal and financial services. This is not a minor aspect: it is unfair and unworkable to rely on the dedication of hard pressed Commission staff in Esprit, and in the other RTD programmes, to combat the unacceptable delays and time-wasting procedures imposed by bureaucracy.

The Review Board views Esprit's attention and commitment to the SME sector as important. This sector is the biggest provider of job opportunities, and it has been shown that its dynamism can add zest to an economy. But changes are needed in order to enable Europe's successful small companies also to grow out of their SME status. In a message also subsequently taken up elsewhere, this Report calls for far-reaching re-examination of the place of venture capital in the Union-sponsored RTD effort.

The Review Board findings indicated that 39% of Esprit funding has been converted into commercial products and services within two years and 68% within five years. This is commendable, but not enough: a bigger effort in diffusion and commercialisation is required. For the economy as a whole, it is essential to make sure that today's new products are used today. Esprit's accompanying measures are a step in the right direction. This Report places further emphasis on users, on applications and on the market. Wide use of user-supplier partnerships has been pioneered in Esprit, they are the key to innovation in the technological chain.

In IT, fundamental research is important to generate the products of tomorrow. Therefore, it is necessary to give to it the priority it deserves. The Review Board report thus argues for continued support to long term research, and a new flexibility toward novel thinking. The Davignon Report rightly makes the case for scientific excellence and for relevance to socio-economic criteria as pillars for the Union's Framework Programme. We also should keep firmly in our minds that, in IT - a sector of enormous strategic significance with highly abbreviated product cycles - the role of pre-competitiveness must be limited. IT is an area which greatly benefits from having within it a sizeable effort in fundamental research, but that meanwhile must tilt toward applications and the user. For obvious reasons, this is particularly true

where the SMEs are concerned and it is to them the Board looks with confidence for innovative applications, flexibility, fresh ideas - and jobs.

This Report has been fortunate in its submission during the course of preparatory work for Framework Programme V. It has contributed to reinforce the pretty general conviction that IT must remain at the centre of the Union effort in science and technology. In fact, Information Society Technology is proposed to be one of the three thematic programmes in Framework Programme V (1998-2002), a driving force for all actions. The Commission's Rolling Action Plan for 'Europe at the Forefront of the Global Information Society'[1] identifies the lines along which to proceed. Implementation of the Review Board's recommendations will greatly facilitate their achievement. This is true in terms of social acceptability, skill acquisition and learning, and of improving the business environment, with particular attention to electronic commerce, acceptance of which will give a truly explosive new impetus to the impact of ITC on everyday life. There is thus an opportunity to extend and deepen Esprit's contribution, not only to competitiveness, but also to the Information Society conceived as a new technological facility of benefit to the economy and to the quality of life of European citizens.

All in all, therefore, the climate is changing. Awareness of European deficiencies is no longer a passive response to changes generated elsewhere. Benchmarking is starting to have an effect. We are coming to terms with our weaknesses, expanding our strengths and identifying where we must concentrate our efforts to position ourselves as protagonists in ITC and its applications in the new century. An innovation culture is springing up, and this must immediately be nurtured. The new climate is also evidenced in the emphasis on Information Society issues at the 1997

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[1] COM (96) 607

World Economic Forum in Davos, in the outcome of revision of the Structural Funds, the Commission Communication "Cohesion and the Information Society"[2] and at the conference on "Regions and the Information Society"[3].

Esprit, and the other IT-related programmes, are set to continue to be a major element in Europe's future-oriented strategy. Whatever their new guise, it can rely upon the remarkable community of experience and commitment which Esprit has built up across the whole of Europe over the years. In commending what has been done so far, this Report aims to project the Union's IT Programme into making a still bigger contribution to Europe's economic future and, through that, to the well-being of its citizens and its standing in the world.

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[2] COM (97) 7 final

[3] Brussels January 30/31 1997

ESPRIT REVIEW BOARD 1996

REPORT

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EXECUTIVE SUMMARY

This Report covers the evaluation of Esprit III, the Community's specific programme for research and technological development, including demonstration, in the field of Information Technologies (IT) 1990-1994. Given the rolling nature of the Union's IT effort, the Board also considers the initial stages of the new IT Programme. Based on Esprit III with significant changes in orientation, content, administration and execution, this got under way in 1995. On-going commitment to adaptation has permitted a seamless transition from Esprit III to its successor, even with the challenging expectations of the emerging Information Society. The Board sees this as a matter for congratulation. ʻ

Esprit is a multi-sectoral cross-disciplinary, industrially-oriented, RTD programme in an area underpinning the competitiveness of the whole European economic fabric; a programme contributing to the creation of an advanced skill base and helping to pave the way for Europe's advent into the Information Society. It has been very successful as an expression of R&D policy. It is also an enabler for other Community actions. The Programme's contributions to wider policy need to be seen in their strategic light, with a clearer picture of what the Union wants from its R&D effort. However, for the Union's effort in IT to impact decisively on competitiveness, and thus long term employment, now demands solutions which range across the whole of the Framework Programme, and beyond. Several of the Board's main recommendations are thus aimed specifically at the wider audience of policy makers within Commission, Council and Parliament.

With regard to the Programme, the Board supports the strategic management of Esprit, the Programme's breadth and its value to industry. Rather than by criticism, its recommendations for improvement are often motivated by the need to reinforce changes already taking place or to highlight shifts which the Board can perceive, but of which some participants and policy makers may as yet be unaware. The Recommendations aim to go beyond fine tuning, to reposition the Programme as it makes its contribution to the Union's strategy to raise competitiveness and ensure employment. Overall, therefore, the Board seeks to inject still greater flexibility, to further reduce response times to changes in technologies and markets and to enhance the Programme's ability to target and succour new ideas. The guidance for this should come from a significantly reinforced programme steering committee.

The Board recommends moving to a headings-only structure designed to facilitate adjustment, retargeting and reallocation of resources, thus abolishing the Work Programme as currently conceived. Headings should be arrived at through ongoing consultation of all those at the leading edge in IT, in Europe and outside, taking into account particular European needs and strengths. They should not have a set allocation or percentage of funding assigned to them. Retention of headings should be judged by results. Except in strictly basic research domains, proposals should justify their exploitation potential. Each proposal would compete against all others for funding.

Continuing today's emphasis on user involvement, closer attention could be paid to electronic systems builders and the IT user companies. In terms of structure, the Board would like to see a base of macro domains - Microelectronics, Software Technologies, Applications - with what the Report calls sub-macro domains linking all the various IT-oriented Union efforts in particular areas, wherever they currently take place within the Commission. These would rely for strategic co-ordination on the IT Programme, applying an interdisciplinary, cross-DG approach.

The pillars of this phase of the Union IT effort should be networking, exploring social demand and media synergies, exploiting telecoms liberalisation, exploiting dual use technologies. Best practice, training and diffusion efforts should be further enhanced. In Microelectronics, a strategy should be developed to target cluster technologies for microelectronics competitiveness and competence. Microelectronics is the crucial infrastructure of our time: to facilitate its spread throughout the Union, links between RTD funding and structural funds should be substantially extended. Building on European excellence in Software, attention should be paid to improving the marketing capability of producers and their export orientation. In Applications, Europe must build on niches, not be confined to them. Applications software, integration issues, customisation, need to be targeted. Enormous commercial potential exists in the Applications area, specifically in the areas of industrial competitiveness, socio-economic demand, agriculture, public administration and the commercial and industrial opportunities of the networked society. Solutions must not be Euro-centric. A global market in Applications is already emerging. It must be captured while still in its infancy.

In fact, to enhance the competitive impact of the Programme, the Board wants a more commercial approach to participation in general. Strong encouragement should be given to universities and research institutes to adopt legal forms and company structures permitting them to interface more readily with the fast-moving IT market place. The Programme should also encourage start-ups and knowledge based spin offs, originating in academia and in the corporate sector. SME representation in the advisory structure should be improved to reflect both the role of IT SMEs in innovation and, in general, the SME contribution to employment in Europe.

Administrative issues need to be tackled. At selection, projects with smaller number of partners and more focused consortia should be the rule. There should be the possibility to fund competing consortia in areas in which competition will drive innovation. In evaluation, besides excellence, value for money criteria should be adopted in proposal evaluation, and the merits of moving to a flat labour rate from today's assigned rates in costs statements should be analysed. To improve the flow of information, greater use should be made of electronic communications and the INTERNET.

The Union's IT programme has an industrial policy function. This justifies a certain emphasis on breakthrough concepts. For these, the global market impact of eventual success should be of key relevance in evaluation, assessed in terms of both the size of the potential market and the scale and impact of the potential breakthrough.

In this highly fluid area, more high risk proposals should be funded. To overcome a handicap affecting in particular innovative SMEs, links should be established to Europe's venture capital community active in the IT area. Upstream of this, the Board recommends that a special, speedy mechanism be created to permit the sccd funding of highly innovatory, novel ideas.

In a crucial reform for the Union's RTD effort as support for our competitive future, the Board calls for the programmes in information and communications technologies to be unified, or the present legal distinction between them to be ended. A programme "umbrella" serving as a strategic integration platform matching the various Union efforts is needed, linking today's Esprit, ACTS and Telematics, with the manufacturing results of these programmes as they mature, passed to IMT. The umbrella would rest on a common base: Long Term Research, Training, Diffusion and Dissemination of Results. The shared underpinning areas would be the macro domains Microelectronics, Software Technologies and Applications.

Whether this reform should then be extended to include combining these programmes into a single mega-programme in information and communications technologies, or placing them into some kind of single allocations envelope to facilitate reshuffling of moneys, is a matter to be decided in the run-up to future Framework Programmes.

Finally, the Board indicates several issues which, in its view, have diminished the performance and level of satisfaction of Esprit III, and if not rectified, could well cloud the possibilities of success of the new IT Programme. These centre on the deleterious effects of Commission procedures which are not specific to Esprit and over which the Programme's management has no control. The Commission financial arrangements under which both Esprit III and the IT Programme are administered need drastic reform. There should be a move to a cost system based on deliverables in technology development and application projects, except for long term research. Financial control should be decentralised to programme management teams, in line with current business practice throughout the modern world. In a similar move to adopt now tried and tested cost-efficient practices, far greater recourse must be made to the outsourcing of operational management tasks. Big savings could be achieved. These reforms would also dramatically reduce administrative burdens and speed up the payments system, helping both the Services and the participants. The Board urges the Commission, the Council and the European Parliament to act. The current situation is undermining the Union's RTD effort, European competitiveness and long term job creation. The Board's intention is to help bring what is becoming an intolerable situation to an end.

Until something can be done, the Commission should accept liability to pay interest on delayed payments. In contracts, the simplification process that is already underway should be carried through. A bankruptcy contingency fund should be set up. This would enable participants to continue work in projects in which the co-ordinator has gone bankrupt, probably now a natural and potentially not infrequent event in such a dynamic

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sector. In parallel with these changes, the Board recommends that a cross-service Standing Group be set up to simplify all the financial and legal matters affecting the Programme, with a wide brief.

The creativity and energy of Europe's IT community is well matched by the dedication and imagination of the Esprit staff. Yet Esprit III and its successor perform their job so well despite, not because, of overly rigid Commission-imposed procedures and practices originating outside the Programme. Given its size, impact and objectives, it is right that the IT Programme should blaze the trail for customer-oriented reform of the Union RTD effort in the run up to the Fifth Framework Programme.

I. THE MEMBERS OF THE INFORMATION TECHNOLOGIES REVIEW BOARD

Chairman:

Umberto Colombo

Former Minister of Science and Technology & the Universities

Government of Italy

Rome, Italy

John Forrest

Chairman, Brewton Group Ltd

Deputy Chairman, National Transcommunications Ltd

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Geneva, Switzerland

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II. TERMS OF REFERENCE

The Information Technologies Review Board was established by the European Commission to evaluate the 1991-1994 phase of Esprit, the European Union's Information Technologies Programme. Its overall aim is to assess to what extent the Esprit Programme met its objectives during this period and to make recommendations to the Commission for the future orientation and management of Union activities in this field.

III. METHODOLOGY

The Board conducted interviews in all fifteen Member States of the European Union. It here wishes to thank all who participated in these interviews, as well as the Esprit contact persons in the Member States who were of great help in introduction and organisation. It held a series of plenary meetings, in Brussels at the Commission premises and in several other major European cities, and circulated papers and drafts for discussion. Board members informal contacts with leading figures and commentators in IT in many countries also outside Europe provided valuable insight and placed the Union-sponsored effort in context.

The Board interviewed members of the Commission Services, in DG III and beyond. It wishes to express its gratitude for the informative and helpful way its questions were answered.

A Questionnaire was sent to all participants in Esprit III, as well as to newcomers applying to the new IT Programme. The analysis of the four hundred almost universally comprehensive replies is found in Appendix One. The results of the Questionnaire also provided a basis for many of the Board's interviews and again the Board thanks all who took the time to complete a quite complex document.

Appendix Two gives statistics concerning Esprit III and the new IT Programme as well as in the context of the relevant Framework Programmes.

In this Report, abbreviations have been kept to a minimum. Besides IT (information technologies) and ICT (information and communications technologies), other abbreviations refer to Esprit domains, a list of which can be found in Appendix Three.

Bullet points at the end of a section give the Board's recommendations in that area. The cases cited in the boxes are illustrative of arguments the Board makes in the body of the text.

IV. ACKNOWLEDGEMENTS

SECTION ONE: INTRODUCTION

1.1   The starting point

1.1.1   Esprit III, the Community's specific programme for research and technological development, including demonstration, in the field of Information Technologies (IT) 1990-1994, was agreed by Council Decision 91/394/EEC of 8th July 1991. The Council Decision itself is a useful guide to the Board's approach to evaluation. It makes the following key points:

-    IT increasingly underpins the competitiveness of all industry and services;

-    maximum user involvement in the various stages of Research and Technological Development (RTD) projects is to be sought;

-    Small and medium sized enterprises should be involved through technology stimulation measures;

-    close co-ordination is needed with research programmes in advanced communications technologies and services (ACTS) and telematics applications (Telematics).

These points also retain their validity in the context of the new Information Technologies Programme in the fourth Framework Programme.

1.1.2   The ruling concept is that of IT as a generic technology, an essential basis on which the European economic system must ground its global competitiveness. This is the most radical departure from earlier Community-sponsored efforts in IT dating from 1984 onwards and it colours all else.

1.1.3   At their beginning, the Community's IT programmes were designed to assist the European IT industry itself develop increasing competitiveness in global markets. From the initial technology-push, supply-side approach, the emphasis has shifted from the early 1990s onwards to identifying *application and applicability* of IT, rather than its development and production, as the single most important objective in the Community's IT strategy in the run up to the Information Society. In fact, today IT is embedded in almost all RTD and non-RTD Union programmes and funding activities. In this shift away from addressing solely the IT industry towards greater involvement of the users in the wider economy, the Programme inevitably changes character. Research and development remain points of departure and important pillars, but programme orientation is not only the acquisition of knowledge, nor the maintenance of a given manufacturing capability in Europe. It is more mastery of the technologies in order to ensure the vitality, indeed viability, of the whole economic and productive system through anticipating market demand in innovative IT products and new services, and providing valid solutions

1.2   Differing targets

1.2.1   In fact, it is not so simple a move toward the market as the description given above suggests. There is a new orientation, though attitudes and even work plans indicate that there are still in fact four quite distinct

targets for the Union's action perceived at varying times by the European Commission and by the various participants in the Work Programme. These can overlap, complement each other and even sometimes clash.

1.2.2   The first is the view of the Programme as aiming to boost the position of Europe's IT industry. When Esprit started, the Commission was concerned by its low market share and the effects of under-investment and an unclear strategy. In line with the original conception of the early 1980s, in this view Esprit exercises an industrial policy role. Accordingly, evaluation should not centre merely on excellence of the research, but also on economic results, many of which likely to be hard to quantify and difficult to ascribe directly to the Programme.

1.2.3   The second sees Esprit as an R&D programme in information technologies, thus guided by research objectives and to be evaluated above all on the quality of the work achieved. This view remains prevalent among many long-standing participants in the Esprit exercise and especially in academia. Many participants working in the big IT companies' research departments support this: Esprit for them has always offered a way to conduct far from the market research over a longer time frame than is usual for industrial firms.

1.2.4   The third view is of Esprit as a multi-sectoral cross-disciplinary, industrially-oriented, RTD programme in an area underpinning the competitiveness of the whole European economic fabric. The Dekker Report *A Spectrum of Opportunities* (June 1992, republished with preface December 1993), and Esprit III as it evolved (even more so the new IT Programme in Framework IV) favour this view. RTD excellence is in this case to be demonstrated by relevance to competitiveness, seen as a comparative and global concept. Evaluation is thus a broader task, looking for direct, indirect and fall-out effects which can be ascribed to the action of the Programme. A growing applications focus - embracing also best practice, diffusion, training etc. - is an essential, rather than merely marginal, aspect as hitherto in most Community-sponsored research programmes. For the first time, Esprit's impact on the European IT industry is seen primarily as creating demand pull.

1.2.5   The fourth view, which is gaining ground to complement or even supersede the third, is of Esprit as paving the way for Europe's advent into the Information Society. The new Programme also focuses on the emerging IT infrastructure and services providing the basis for the Information Society. Competitiveness of industry is of importance, but beyond that Esprit is to be seen as helping to generate across the board socio-economic impacts facilitating penetration of IT in so pervasive a way as to ease emergence of the true Information Society anticipated for the first decade of the next century. Activities thus stress access to, and use and usability of, the information technologies along with best practice. Given the importance of the overall objective, this fourth view embodies the strategic significance of Esprit for Community policy.

1.2.6   It is obvious that each of the above carries within it a series of core concepts, most of which related to the weight to be ascribed in each to the RTD element or to the industrial (or socio-economic) policy element. These then determine the fairness of criteria to be adopted in evaluation. Esprit's overall objectives have changed significantly over time. The improved information flow between the Commission Services and both

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the participants and the contact points in the Member States should generate better awareness of the Programme's evolution as it responds to technological advance and Union policy priorities.

1.3   The transition to the new IT Programme

1.3.1   After completion in 1993 of the ten year Esprit (European Strategic Programme of Research in Information Technologies), a new Union programme in IT was launched in 1994. Its aim is the timely development and take-up of information technologies by European industry and society in general. It is thus not sector specific. It views IT as generic, underpinning technologies - building blocks for Europe's future prosperity.

1.3.2   The present Board's objective is to evaluate Esprit III. Clearly, however, it has to bear in mind the intervening changes which have led to adoption of the new Programme. The evaluation exercise has therefore been rendered somewhat more complicated by the fact that there is necessarily overlap between the two phases of the Union effort in IT. While the Board is compiling its Report, Esprit III projects are still running, especially those launched in 1993. Meanwhile, the first projects under the Union's new IT Programme kicked off in late 1995.

1.3.3   Many participants in Esprit III have already had their first contact with the new Programme. They often refer to the new Programme as Esprit IV. This is in fact a misnomer. The new IT Programme is based on Esprit III but significant changes have been introduced in orientation, content, administration and execution. These pick up on ideas coming from a wide variety of sources, including past reviews, experience outside the Europe, consultation with industry and trade associations, input from the Commission's own Services and from external experts. The process of change has not been easy and indeed can be said to be on-going, given the commitment to constant adaptation and greater all round responsiveness. The fact that the transition from Esprit III to its successor is so seamless, even under the challenging expectations of the emerging Information Society, is a matter for congratulation.

1.4   A basis from which to judge

1.4.1   The Board has been established to review a programme which is designed for, and primarily intended to be, an expression of R&D policy. Esprit has been very successful in this regard. As noted in section 1.2, the Programme has over time acquired expectations of making a major contribution to industry and competitiveness, and to Information Society policies. The Board sees these expectations as justified, and their acceptance as a valuable recognition of the worth of the Programme. Esprit is to be seen as an enabler also for other Community actions. It is right that R&D policy should make a high value contribution to other

Community policies. The Board considers that there is a need to organise the Programme's contributions better and to disentangle the various strands in what the Union wants from its R&D effort. Esprit exercises an industrial policy function. It also boosts excellence in IT R&D and this is how it is defined in the Council Decision. Still, Esprit III, and even more so the new IT Programme, has to recognise diverse and expanding expectations. As a general principle, the Board sees the third and fourth of the interpretations outlined in section 1.2 above as more consonant with what the Union requires from its IT effort today - a generic, industrially-oriented, RTD programme in an area underpinning the competitiveness of the whole European economic fabric; a programme contributing to the creation of an advanced skill base and helping to pave the way for Europe's advent into the Information Society. Neither compromises the contribution to industrial policy or the commitment to R&D excellence. Both in fact complement the whole.

1.4.2   Esprit is just one small, though catalytically important, element in the European IT scene. The ongoing globalisation process compels industrial policy to measure competitiveness against global standards. This being particularly acute in IT, now the success of European IT companies can only be defined by their ability to act on the global stage and not be obliged to adopt the standards that have been developed elsewhere without their active contribution. IT markets have become global, so has the technology. IT research is a global asset; a country's or region's reservoir of IT skills and competence likewise. The long term health of its economic system is destined to rest on Europe's ability to use such assets. While the relationship between technological innovation and economic growth is not always linear, lack of innovative capability is a clear recipe for economic decline. In a similar fashion, though an economic system may not be able to identify with certainty the specific benefit of a given investment in R&D, systematic under-investment in knowledge will generate economic disadvantage.

1.4.3   This, then, is the context in which the Programme must now function. For the Union's effort in IT, as an RTD programme, to fulfil the task of raising competitiveness and guaranteeing long term employment now demands solutions which range across the whole of the Framework Programme, and beyond. For these reasons, the Board has examined the Programme in different contexts and from different angles, including for example its relationship with venture capital, Europe's requirements in IT seen as an infrastructure for the future, as well as the financial aspect of the Programme. Its recommendations in these areas are directed at a wider audience than the Esprit management.

1.4.4   Esprit has to be seen as a *strategic* industrial RTD programme. This cannot be reduced to mere sponsorship of IT research with greater attention to applications. With a contribution from Esprit, Europe's over-riding aim in IT must be to possess and diffuse mastery of the key information technologies. The Board believes that this requires capability in research matched by capability in development, product design and manufacturing. It also requires an adequate pool of qualified human resources and access to leading edge competence in technology foresight to ensure that Europe is neither unwittingly left behind nor deliberately excluded from markets by developments taking place elsewhere. In areas in which currently Europe lags

behind, at least a watching brief must be maintained in order to permit future return to such markets, taking advantage of technology leap-frogging.

1.4.5   This being said, the Board acknowledges the relatively small scale of the Union RTD effort in IT. At 2 billion ECU over a four year period, the Esprit spend is approximately the same as the Thomson R&D budget, 12% of that of IBM, 8% of that of Siemens. There is then, of course, a multiplier. Commission funding is matched by participants so that actual investment in IT RTD targeted with the Esprit label is almost twice as great as the Programme's budget. Currently, under Framework IV, Esprit comprises just 1% of the total spending for R&D in the Member States of the Union. Disturbingly, and despite its acknowledged and over-riding importance for the future of Europe, Esprit amounts to only 2% of the revised annual budget for support to agriculture. The Board believes that it is vital that EC funds be used in a future-oriented highly strategic manner, assisting development of initiatives which are then further funded by industry to generate wealth.

1.4.6   Previous evaluations of Esprit had to describe the failure of an industrial policy then aiming to sustain IT manufacturing in Europe. This is only part of the story. Esprit has now moved away from traditional IT domains towards a broader use of IT in industry. As a reference, statistics show that, in 1987, Europe had a 13% world share in IT in general, including services, by 1995 this had risen to 30%. But it is true that Europe's market share in the principal IT sectors has obstinately refused to grow and, in some cases, has declined. For these same years, in microelectronics the figure was 11%, dropping in 1995 to 8%. Looking at global IT market shares over a shorter, more recent period corresponding to Framework Programme III, 1992-1995, for Europe, the United States, Japan and the so called East Asian Tigers, Europe rose from 130 billion ECU to 147 billion ECU, while the figures for the US are 124 billion ECU and 197 billion ECU respectively; for Japan, 61 billion ECU and 75 billion; for the four Tigers (South Korea, Taiwan, Hong Kong and Singapore), 4 billion ECU and 14 billion; for the rest of the world, 31 billion ECU and 50 billion. The most dramatic changes in ranking are among the Asian economies. These countries followed a top down, investment dominated strategy, on top of a strong R&D effort - not just one based, as in the Community, on research and that initially further weakened by excessive insistence on pre-competitiveness.

1.4.7   It is a basic tenet of first Community and now Union RTD programmes that they should add value to national activities and not be interpreted as a substitute for public support to research at the national level. This remains the remit of national governments. Inevitably, limitations are imposed by the international collaborative nature of any work to be funded. These factors moderate the Programme's ambitions. The accumulation of objectives still ascribed to Esprit is, to a certain extent, also due to the already noted fact that the changes intervening since its foundation have not been fully understood. Thus, to give two examples, the big IT companies still believe they should have the right to determine the Programme's strategy and orientation; academia believes it can use the Programme as a replacement source of funding for research, irrespective of industrial relevance. For the Board, while representing valuable input, these expectations are not in line with the evolution of Esprit III and now of the new Esprit. More effort should be made to make this evolution clearer, so as to ensure better appreciation of the new strategy and orientation on the part of these participants.

1.4.8   A necessary distinction has to be borne in mind between basic/blue sky research (science and technology push), strategically oriented research (for common goals, for instance the Task Forces) and market driven industrial research. Esprit covers a broad domain which is in constant creative ferment. Clearly, all three of these aspects have their place, though we must be aware that they make different demands on programme management. In the end, attainment of objectives depends heavily on the appropriateness of management. How far management is able flexibly to modulate its response to suit these demands is thus a topic for evaluation.

1.4.9   In its brief history, the IT industry has undergone a series of evolutions. Few, if any, of these originated in Europe, yet each of them influenced the standpoint from which the Community IT Programme could be judged. This is true today. Starting from the 1960s and 1970s, the framework for evaluation could be described in terms of categories (for instance, components, consumer and professional electronics) or by the nature of the respective industries (computers, telecommunications, defence, and so on). Some of these distinctions remain conceptually valid and others are maintained primarily by inertia, yet the Board believes that all can still be traced in the present Esprit. They too could be reviewed, allowing the Programme better to express the new logic of the industry as it emerges globally.

1.5   Past and present reviews

1.5.1   The present review is the third in the series of evaluations of the Community effort in information technologies. Its predecessors appeared in May 1989 and June 1992. Progress with implementation of their respective recommendations was good and their influence can be traced in the Programme's evolution down to this day.

1.5.2   The first evaluation was chaired by Dr A.E. Pannenborg and covered Esprit I, 1984 - 1988. The report, entitled *The Review of Esprit*, dealt exclusively with the information technologies and centred on the following domains: microelectronics; software technology; advanced information processing; office systems; computer-integrated manufacturing. The Esprit Review Board made a total of fifteen recommendations, divided into two groups - strategic and tactical. With certain omissions - for instance, the Board's call for closer collaboration between national and European R&D programmes, which has yet to be achieved - implementation has been comprehensive.

1.5.3   The second evaluation was chaired by Dr Wisse Dekker. A significantly more complex operation, it covered the Community's three major programmes in the information and communications technologies (ICT), namely Esprit II (1988 - 1992), RACE (Research and development programme in Advanced Communications technologies for Europe) and DRIVE (Dedicated Road Infrastructure for Vehicle safety in Europe), under the research and development Framework Programme II. The ICT Review Board reviewed all aspects of the three

programmes: policy and strategy, management and budget, programme achievements and results. Its report was entitled *A Spectrum of Opportunities*. In the information technologies, it dealt with the domains microelectronics, including the OMI initiative; advanced business and home systems; information processing, including software, the embryonic ESSI Programme and parallel computing; computer-integrated manufacturing; basic research.

1.5.4   The ICT Review Board made a total of thirty nine recommendations. Out of the thirty-eight of relevance to Esprit, the Commission managed substantially to incorporate the Dekker philosophy even though the suggested recasting of the ICT effort at Community level into three completely new programmes did not prove feasible. The driver for the Dekker Board's recommendation was the paramount need to unite the Community effort in information and communications technologies. The present Board reiterates this. Ideas in *A Spectrum of Opportunities* can be traced in Esprit III, but it is above all in the new IT Programme that they are finding expression. Three other recommendations made by its predecessor which the present Review Board also addresses in its Report are a link between regional and structural funds and the R&D effort; the role of venture capital and encouragement to start ups and SMEs; a more collaborative approach linking DGs, Member States and regional administrations. These require broader reconsideration of the relations between the Framework Programme and other Community policies for their implementation.

1.5.5   The present review board is the first to be reporting after the launch of the Information Society by the European Commission as a global concept. The Report of the High Level Group of Experts set up by Commissioner Bangemann in 1994, and the Commission and Council response, has considerably expanded the context in which the Union effort in IT operates. IT is no longer solely an R&D matter: it is central to European competitiveness and also to the evolution of society and the maintenance of the European quality of life. For these reasons, over and above the evaluation of Esprit III, in this Report the Board inevitably explores areas of great relevance to the Union, at a transitional time for its R&D policy and for the future of its research programmes.

2.1   Trends

2.1.1   Over the past decade, new global leaders have established themselves in the IT, electronics and related industries. These include Microsoft, Oracle, EDS, Sony, Nintendo. Others are bursting onto the scene, such as Netscape. Traditional giants, like IBM, DEC, Hewlett Packard, have totally re-engineered and almost reinvented themselves to retain prominence. Europe has to recognise that European players do not figure in any of these big player lists. SAP and, to a lesser extent, Baan are emerging as leaders in applications software, and there are other examples of solid performance, but true market dominance is missing. Sizeable European actors, like Bull or CAP Gemini, are little known outside of Europe. European success stories, of which there are several enjoying dominant world market shares in their areas of activity, tend to be in niches. This uncomfortable reality has to be faced. Industrial and R&D policy has to be built on acknowledgement of the strengths and weaknesses of the specific actors - and not just more diplomatically of the areas or domains. Only by applying an impartial assessment of players also at a policy level can the right orientation be achieved.

2.1.2   The 1980s and 1990s are a period in which many areas in information and communications technologies deregulate, such as telecommunications, while others deconcentrate at the equipment level, such as computers, and others again become ever more global so as to acquire a new competitive profile, an example here being defence electronics. On present world market trends, for the later 1990s and beyond, competition and non-regulatory systems will increasingly condition the basic dynamic of the IT industry at the global level, as well as its technological choices, its pricing and the strategy of the actors. An instance of this crucial change is telecommunications which is rapidly assuming the guise of an infrastructure for different types of IT service delivered through a variety of media and terminals. Operators will thus offer functionality via IT not devices, or offer bundled services via communications technologies.

2.1.3   As elsewhere in the modern economy, competition is gradually transferring the power of conditioning the nature of an industry to its end users, taking it away from the technology, the producers, the intermediaries. In IT, the process started with open systems. It is accelerating with worldwide deregulation and technological advance. Even in the ICTs there appears to be now some European preference for re-regulation, rather than deregulation - that is for the replacement of an outdated regulatory framework with one believed more consonant with today's requirements. This can have social and political justifications, particularly the worthwhile desire to protect Europe's very high standards of social welfare. In areas dominated by the global impact of advanced technologies, however, it carries within it the risk of becoming a brake on achievement of competitiveness, leaving Europe behind in a dynamically deregulated world. This is because re-regulation tends to freeze what often are transitional situations and thus by necessity implies catching up. In the context of IT, this could even imply stepping back and inventing ever more complex provisions to cover untested situations, in

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real time, as they are developing. It is a labour of Sisyphus - with the chance that any new regulatory framework might reveal itself more oppressive than its predecessor once its bases are again left behind by an acceleration of change. In terms of IT, the Union's most deregulated market - that of the United Kingdom - is also its most dynamic, with the highest investment and the highest number of jobs created. If competition and deregulation is determining the evolution of the world IT market, it will inevitably also determine that in Europe. We will either participate in the process, or passively suffer its consequences.

2.2   New IT categories and convergences

2.2.1   Globally, the IT industry, and specifically the IT end-user market, is evolving in four broad categories of activities, each of which, in turn, divided in several sub-categories. This new categorisation extends far beyond the mere convergence of telecommunications and computing and it has significant policy implications. Thus digitalisation of all types of signals (voice, data, audio, video) is creating the convergence of many different types of content also with the advent of multimediality. Infrastructure and devices are also converging, along with their respective industries.

2.2.2   The categories can be seen as:
- 1. Infrastructure
This area includes all the telecoms infrastructure: wire and wireless, cable and broadcast TV and radio, terrestrial or satellite. Convergence of these hitherto distinct and separate areas is proceeding to the point of fusion, to form the networked infrastructure of the Information Society of the future.
- 2. Terminals
As networks extend, devices such as telephones, TVs, PCs etc., will become terminals, input and output devices of the networks. They may operate in varying degrees of autonomy most of the time and will have differing degrees of incorporated intelligence. This leads to a blurring of demarcation in the electronics industry, with the end of the distinction between consumer and professional electronics, between working and leisure tools. Consumer electronics will also enter telecommunications (as mobile telephony already demonstrates). Underlying these changes are hardware components and systems. Traditionally a focus of policy attention also in Esprit, this area is not however decreasing in importance. It is instead passing through a transition with wider differences between commodity producers and high value-added ones. The transition from generic devices, such as PCs, to an articulated specialised market also brings about fragmentation of the value chain, ranging from microprocessor supply to CD-ROMs. With miniaturisation and the need to save power, many components are becoming complete systems. The LCD is passing from being a component to become an element around which a system is built. It will become the system itself.
- 3. Information tools and software
This is becoming the most strategic area and includes critical components such as data bases, new types of object-oriented operating systems, horizontal tools for network navigation, vertical tools for on-line

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services. Software components are becoming more critical than hardware. Competitive advantage in specific software components is more resilient than in hardware, as the latter is more easily replaceable. The area is set to generate higher margins and sustained revenues unconditioned by short technology cycles.

- 4. Content

The distinction between content and device will blur. Currently this change is most evident in games, but as the economics and the performance of processors, memory capacity and display quality increase, there will be more and more programmable dedicated devices, such as educational machines. As the modularity of systems expands with improved economics and the quality of networks, content will become more critical and in many cases virtually indistinguishable from information tools and software.

2.2.3 Mechanisms driving these changes, all evident in advanced areas of the global IT scene of today, are the following:

- convergence of infrastructures, operating systems, languages and content;
- multiplication of terminal devices which define the industry by functionality rather than by the nature of the device, per se;
- new forms of dis-intermediation and intermediation permitted by the networks, which accelerate a new generation of technologies and applications propelling an ever faster shift in the industry paradigm;
- the all pervasiveness of microelectronics, the basic underpinning technology of the Information Society.

2.2.4 Trends in this area are in constant flux and the Board is well aware of the need for caution in making forecasts. Certain probable future outlines are, however, becoming clearer. As a consequence of all the above, a massive process of integration of systems is taking place through the mechanism of networks, both public and private. This can be seen as a frontier of evolution, most strikingly in the impact of the World Wide Web. It is likely to be here that many of the needs, demand and value-added is to be found for the years to come. New areas of critical development, of great technical challenge and of competitive quest for commercial success are the integration of components into systems and the integration of systems. This, rather than the mere creation and production of individual components, is now the area of greatest promise. In fact, hardware and software components can no longer be straightforwardly defined as the building blocks for the IT based economy. In both, distribution via marketing, rather than production, now gives the value-added. It is also their strength in marketing that gives American players such an edge. We see the emergence of *de facto* standard commodities and utility products. The future will rest on other, more distributed and diversified, bases.

SECTION THREE: FINDINGS - THE BUILDING BLOCKS

3.1 The Work Programme

3.1.1   The Esprit Work Programme is a complex document with so many origins that identification of the decisive influence becomes uncertain. Though all those making input to the process of drafting that takes place within the Commission are known, the weight ascribed to the various ideas and proposals for areas is less evident. The Services put up suggestions, and these can derive not only in-house from Esprit, but also from elsewhere in the Commission. These latter sources should be further encouraged and an ongoing dialogue established. Much of the external input upon which the Commission rightly puts emphasis for the orientation of the Programme comes essentially from a subset of the (present and eventual) proposers. It has to be borne in mind that this input could be coloured by the desire of particular proposers to ensure that an area in which they have already identified a potential project finds a sufficiently prominent place to justify its subsequent funding.

3.1.2   The detail in which the Work Programme has always been drafted amounts almost to an attempt to second guess the direction not only of technological development, but also of market opportunities. Historically, comparing past Work Programmes and later global shifts in IT, this second guessing cannot be regarded as particularly successful on either front. If novel ideas emerge, the Work Programme has been "mined" to try to find a way to include them. Proposals coming forward at any one time should reflect advanced thinking of the moment: they have had to be squeezed to fit into last year's mould. There have been cases when even this proves impossible and an idea is too innovative for Esprit. To the Board, each time this occurred represents a failure. Once defined, initially or at mid-term revision, the Work Programme then governed Esprit III for the next two years, constituting a further element of rigidity in a dynamically changing situation. The new Programme should be monitored to ensure that these problems are now overcome.

3.1.3   The Board notes the distributed structure of the advisory boards in Esprit which does not lend itself to co-ordination. It recommends reconstitution of a strategic steering committee or the radical reinforcement of the role and function of SIAG (the Strategy and Infrastructure Advisory Group), with a higher profile. There is need for a body charged with a visionary reassessment of programme orientation and ambitions - once a year, using global criteria. This reassessment should feed into definition of the rolling Work Programme which the Board recommends be structured by headings only. The headings should be arrived at through ongoing consultation of all those at the leading edge in IT, in Europe and outside, taking into account particular European needs and strengths. They should not have a set allocation or percentage of funding assigned to them. Retention of headings should be judged by results. Except in strictly basic research domains, proposals should justify their exploitation potential. Each proposal would compete against all others for funding. The intention is to increase the flexibility of the Programme, and the ability of the Programme management to identify trends and quickly to act on them, with any fine tuning required as a useful task for the steering committee.

3.1.4　By this change, today's mere conformity to a specific subsection of a given heading would no longer have relevance in selection: the coupling merit plus impact must be the determinant consideration. If all areas of potential interest are not covered all the time, nothing is lost. It is more important to obtain flexibility in the allocation of funds to the most promising, most dynamic, areas. At present, areas of reduced interest end up having more funding available per proposal than those in which demand - and opportunity - is high. This paradox must be ended. The change will provide real time response to breakthroughs and new market opportunities. It will moreover be cheaper and simpler to administer.

3.1.5　The Board believes that the rolling, headings-only, Work Programme should be implemented speedily. It appreciates that this change would require a more imaginative initial response to proposals. Greater flexibility would also be demanded of the Services and the evaluators. The Board is convinced that not only will both rise to the challenge, they will also better appreciate the task. After a possible first rush, the Board is confident that the Programme will not be swamped with too many - and too cranky - proposals. The change will further raise Esprit standards of selection and increase its relevance. It will constitute one more step away from Esprit's origins as a straightforward R&D programme toward a strategic industrial programme that is more responsive to what Europe can really do, through innovation, to underpin its competitiveness.

　　　　o　　*reinforce the function of a strategic programme steering committee*

　　　　　　o　　*rapidly implement a headings only Work Programme*

3.2　User involvement

3.2.1　Esprit III already saw user involvement as an objective; in the new IT Programme, it has become central. Technology take-up is now seen as best ensured through user-supplier interaction. A further justification for Community action is that, through the workings of the Single Market, user-supplier combinations are not supposed to respect national boundaries. A major complication - and opportunity - for the new approach is that IT users are not a single category. They range from large corporations to SMEs and start ups, from high tech firms to companies operating in traditional sectors, from public sector organisations to academia. Moreover, firms in IT are increasingly at the same time users and suppliers.

3.2.2　Furthermore, users often carry out little or no RTD in IT and, with some justification, can have minimal interest in where their IT comes from. This is particularly true of users whose products do not actually incorporate microelectronics and software. Yet even these sectors - for example, financial services and

insurance, health care and pharmaceuticals, retailing - are now often developing their own tools or using IT radically to expand their business area.

TESCO

All major commercial enterprises are reappraising their businesses, their strengths and their weaknesses. Increasingly they seek to expand into areas which may not be traditional for them, but in which they can operate strongly by using particular assets, such as a customer base or IT infrastructure, in new ways. A revolutionary example of this is the recent action of the large supermarket chain Tesco in the UK. It has launched a loyalty card for shoppers, which pays a high rate of interest on credit balances. Together with the existing facility to draw cash at the checkout tills, this action effectively makes Tesco a bank for its customers. Further expansion into other financial services may well be expected. This development has sent tremors through the conventional banking world in the UK. Tesco's strong IT infrastructure, allied to loyalty card use, gives major competitive advantage in understanding customer shopping patterns and profiles, allowing targeting of advanced services promotions and special offers.

3.2.3   Community interest in this highly variegated group of user companies is to head off emergence of competitive disadvantage, as well as to encourage - where possible - import substitution of the technologies concerned. It is a new challenge to obtain active participation in Programme definition and direction from these companies.

3.2.4   A different class of users are those whose products are systems with sophisticated IT contained within them. These user sectors include telecommunications equipment, automotive electronics, avionics, medical electronics manufacturers, consumer electronics. To be globally competitive, they are aware that they need strategic relationships with their suppliers to ensure they incorporate the very best IT, particularly microelectronics, into their systems. Given the strategic handicap constituted by the present overwhelming reliance on non-European sources for this essential technology the health of world class European suppliers, large and small, able to sustain their competitiveness is absolutely vital for such users. They are now ready to co-operate in finding solutions.

3.2.5   Practical difficulties in participation in Esprit particularly affect users for whom IT is an external input. This is a target group to which, currently, the Programme pays close attention: industrial users, general manufacturing. The Board recommends enhanced Programme focus on users for whom IT is an essential component, specifically on Europe's electronic system builders. IT supplier and user couplings can act as a strong driving force in innovation. For instance, couplings between microelectronics companies and the electronic systems builders reflects the continuing trend toward added value in systems being embedded within

the microelectronics. Europe has an array of electronic systems builders, many active in sectors in which it remains globally competitive. These are companies which engage in RTD in IT, are active at the leading edge, have world class potential and represent a class of users capable of intervening in the formation, orientation and direction of Community programmes in IT. Subsequent spill over to the rest of the economy should then be relatively automatic.

3.2.6   The Board welcomes the increased presence of IT user companies in Esprit and recommends a role in the Programme that better reflects their commercial importance for Europe.

> *More attention to Europe's electronic system builders*
> *More attention to IT user companies*

3.3   *The universities and research institutes*

3.3.1   The participation of Europe's universities and research institutes in the Esprit Programme has long been greatly valued and it is still very high, given the evolution of the Programme. In most fields of knowledge, the wealth of talent and originality to be found in European academia is perhaps only rivalled by that across the Atlantic. There is a need to ensure that this tradition of excellence is maintained throughout the Union in all areas of the information technologies. In some regions, in particular but not only in the periphery, there is less attention paid to teaching and research in IT than in other competing economies. This generally mirrors the local situation, often in part as a result of still inadequate infrastructural support.

3.3.2   Universities have the responsibility to prepare young scientists and engineers so that, in their working lives, they can solve problems relevant to the economy and society, and specifically to industry. Participation in Esprit can assist academia in fulfilling this commitment. Beyond university syllabuses, more IT training is needed throughout Europe. Besides training at the specialist and technical levels, in which Esprit makes a contribution, the Board would like to see a concerted, practical programme to facilitate access to, and use of, IT across the Union, involving young and old alike. Though organised in close co-operation with Esprit and the academic community, this ongoing effort should be separately funded using the Union budgets for education and social affairs. It is fair to say that a long over due cultural change is taking place in both academia and industry towards training. This will be extremely important in the information technologies, where the need for training across the board, from users to production workers is constant and never ending. All concepts of life long learning, to which the Union is committed, rely on IT as both carrier and teaching tool. In the new programme, training is an important element. One of its aims should be to support the Member States in their own, more extensive, IT training efforts by sharing experience, ventilating new ideas.

3.3.3   In terms of the role of academic institutions in the Programme, there has been a move away from an indiscriminate invitation to participate toward a more targeted approach. This has taken place in parallel to the shift towards a more industrially-oriented programme. It is a fact that difficulties can arise in marrying the market-driven time scales of industry to the research driven ones of academics. The R&D activities undertaken by companies are aimed at markets three to five years hence. Though Union-sponsored research must prepare for the future, it also has to take into account shorter marketing lead times. There is also still a tendency for some European academics to view applications-oriented research as somehow inferior to basic, or pure, research. This elitist attitude, besides being wrong in itself, can be a serious irritant to other partners. Many industrial participants especially resent what they have seen in the past as the enforced participation of academics in projects. Understandably, friction can arise on many fronts. Negative sentiment is, however, by no means universal. The Board has heard warm testimonials by some industrial participants in support of the university and research institute presence in Esprit.

3.3.4   The Board would like to see the issue tackled of how best to manage academic participation in the new IT Programme. It is easier to involve universities from certain Member States than from others. In fact, Europe's academic institutions have very different room for manoeuvre. In some countries, faculties and individual researchers are encouraged to act almost as entrepreneurs; in others they are bound by regulations which stifle initiative. For the latter group, at least, full participation in industrially-oriented projects can be problematic. In order to ensure a smoothly running partnership, this is something which has to be considered when consortia are being formed.

3.3.5   The Board suggests that university departments and institutes examine how constraints have been eluded by counterparts elsewhere. An example is Austria. There is a real need for university-linked research companies in Europe, such as IMC in Sweden, able to propagate more efficiently the results of university research and, at the same time, to feed industrial needs in research and development back to the universities.

3.3.6   Esprit has supported some fundamental and far-from-the-market research in IT since its inception. In Esprit III, this was in Basic Research. In the new IT Programme, with a budget of 10% of the total funding, the domain is called Long Term Research. The Board supports this commitment. It is right that the Programme funds, and obtains access to, leading edge research, including that with no immediate commercial potential. Outside the confines of the basic research component in the Programme, however, Europe's universities, research institutes and academic institutions should appreciate that it is unreasonable to expect a strategic industrially-oriented RTD programme to view their contribution as more than the provision of building blocks upon which others must work. Esprit is not a programme to support Europe's universities, however much their presence is valued. The current spate of cuts in spending on advanced education and training at the Member State level cannot be offset by reliance on Esprit funding. Universities and research

institutes active in the IT area should not expect to replace declining national government allocations with what they can receive from Esprit.

<p style="text-align: center;">o   more IT training</p>

<p style="text-align: center;">o   encourage university linked research companies</p>

3.4 SMEs

3.4.1   A real effort has been made in Esprit III, and even more determinedly in the new Programme, to promote the presence of SMEs. The upward trend in participation has not been maintained, however. At the end of the first year of the new IT Programme, the participation of SMEs is still only equivalent to that of universities and research institutes (28% and 29%, respectively, of total funding in the first three calls). All statistics show that the SMEs constitute the most important sector for job creation in Europe. Employment opportunities are expected to remain healthy for the foreseeable future. Growth in the SME sector is strong, with a high rate of start ups and failures. The Board thus wants more to be done.

3.4.2   European IT SMEs represent a vibrant sector in terms of innovation. Company spin-offs from university research, while still below United States figures, are increasing in some Member States. They remain too few: the marriage between excellence and entrepreneurship is often lacking here compared to the US. The Board recommends that Esprit actively encourage and foster start-ups, and also the rash of knowledge-based spin-offs from larger companies turning to outsourcing for their R&D needs.

3.4.3   A distinction has to be made between SMEs in high tech sectors, where they can be in the avant-guard, and the rest. Furthermore, for Esprit, high tech SMEs can be users or suppliers. Down-sizing and outsourcing are swelling their numbers. SMEs resulting from this process are very attentive to the requirements of their principal clients in selling their knowledge capability. In terms of employment, one million Europeans work in IT, only 300,000 of these are in large companies with over 1,000 employees. There are thus good reasons for Esprit to encourage especially high tech SME participation.

3.4.4   For the great mass of Europe's smaller companies, however, the Board looks to greater effort through Best Practice and dissemination activities to encourage utilisation of research and upgrade systems, in particular through involvement of representative companies, co-operatives and associations. But the Board argues that this effort cannot be conducted efficiently through a technology development programme like Esprit itself. Another impediment to IT diffusion and use in most of the Union - and one not only affecting SMEs - is the high cost of telecoms linkages as a result of lack of competition. To give one example, a small German company was quoted DM2000 per month for a single ISDN leased line. Its sister company in California leased

a T1 line with 32 times that bandwidth for a mere $800. Though liberalisation is imminent, there are insufficient guarantees that, by itself, this will rapidly bring down telecoms costs to internationally comparable levels.

3.4.5   Other considerations affect this picture.   Despite the policy of SME inclusion, in the Board's view *de facto* the Programme retains some of the imprint of its big company-big project origins. Established procedures and practices can still hamper full SME participation.   Ways should also be found to boost the representation of SMEs in the advisory structure of the Programme, perhaps through the involvement of more SME associations and other groupings. The Board also looks to increasing results for SMEs from the Exploratory Awards scheme, which needs added edge, and from Special/Accompanying Actions.

3.4.6   Meanwhile, CORDIS should be revamped and improved. Specifically, it should offer a better service to SMEs. These are the firms which most require access to information and assistance with contacts. A special section or electronic page dedicated to SME partner search might be considered.

3.4.7   Other valuable help could come from taking Esprit Information Days and SME-specific IT events and awareness campaigns to a wider audience outside Brussels and the major centres in the Member States. Any additional cost of this extended diffusion effort could be offset by sponsorship from local and regional governments, chambers of trade, etc.. As part of a more intensive public relations effort to alter the perception of Esprit and explain its significance to a wider audience, the Board would like to see the Commission approach the Member States to encourage them to be more energetic in their support.

3.4.8   Ensuring greater involvement of SMEs demands radical changes in management and procedures. This is, the Board stresses, beyond the possibilities of Esprit itself - demanding action at the level of the Framework Programme. Concern in this area is reinforced by a re-reading of the *Special Report concerning the European Research and Development Programmes in the Field of Information Technology* of the European Court of Auditors of February 1994. There many of the issues raised in the present Report were already aired. The responsibility for introducing most of the changes recommended lies outside the specific programme and some of the Commission's replies to the Court published with the Report have yet to be acted upon. This leads the Board to wonder whether a new approach for SMEs may not now be desirable.

3.4.9   The current time-consuming procedures can act as a drag on the creativity and innovation of start-up firms and highly innovative and fast growing SMEs in rapidly evolving leading edge sectors, both prime targets for Union encouragement and support. The Board would like to see a marriage between technology development and venture capital to offer one-shot, no ties, assistance to such firms, but that is beyond present possibilities. It can only hope that the high level Standing Group recommended in section 6.2.3 and comprising

the Esprit management and representatives of Legal Services and Financial Services will come up with a workable solution.

3.4.10   Otherwise, but outside the Framework Programme, it hopes that the many contacts Esprit has with enlightened capitalists in Europe can be turned to good use in helping such new companies. This will not be enough but, in the Board's view, the Programme cannot itself act as a substitute for venture capital. For this reason, the Report treats venture capital in relation to industrial policy, in section 7.2. Esprit lacks any capacity to fulfil the true role of the venture capitalist - that is, investing in risk. At their best, venture capitalists specialise in quite narrow fields, accumulating experience which enables them to gauge this risk better than others and so to profit by it. They provide not just finance, but crucially a pool of specialist management skills, including legal advice, marketing, small company financial and taxation advice, which allows the start up or expanding company to concentrate on what it knows best - its own core business. Relieving entrepreneurs of these sort of headaches allows many companies to flourish which otherwise could have ended in bankruptcy. Venture capitalists are networkers *par excellence*. They congregate in particularly favourable areas, taking advantage of regulations and tax regimes to service an entrepreneurial environment. In IT, the classic case is California, around Silicon Valley; in Europe, only the United Kingdom has a perhaps potentially similar situation. There, a small entrepreneur in need of capital is an opportunity; regretfully, in the rest of Europe, he still tends to be seen as a risk.

BLACK SUN INTERACTIVE

Black Sun Interactive is a highly dynamic software start-up with two offices, in Munich and San Francisco. Founded in August 1995, the company envisions a world in which people meet, work and play in cyberspace as normally as they do in the real world. It has developed a three-dimensional multi-server NET browser and aims to provide ever more sophisticated support for interaction on the World Wide Web. Given the risk aversion of the banking community in Germany, Black Sun had to seek venture capital in the US where investors appreciate the opportunities of high tech financial reward and are not put off by the significant possibility of failure. Black Sun's activities are driven by the extraordinary speed of innovation in NET services. At this pace, better is not best: best is speed to market coupled with acceptable functionality, so as to establish market dominance followed by rapid upgrades as generations succeed each other. Black Sun dismissed after a brief examination the possibility of participating in Esprit. The Programme's time scales are far out of line with those of its market. At the frontiers of IT, for companies like Black Sun the pace of the market renders concerns such as a pre-ordained work programme and protection of intellectual property almost meaningless. Involvement in Esprit would have inevitably slowed down Black Sun's rapid development.

3.4.11   The Board believes that, in IT as in too much of European industry, two crucial elements in the competitiveness equation are lacking; they are, first, acceptance of risk and, second, the willingness - and ability - to face failure. For the success of fast moving innovative companies, Europe has to adopt a totally different attitude to risk and to failure. Risk aversion in Europe is not restricted to the banking community unfortunately. It is widely diffused and intimately linked to the European approach to failure and to the stigma automatically placed on bankruptcy (see section 6.2.2). There is a readiness to attach blame to failure, to castigate those who try and do not succeed. Yet the humus of success is failure. The willingness to risk failure, to learn from it rather than to be disheartened, is typical of American high tech and the whiz-kids who abound in it. Their European equivalents rarely take these sort of gambles. They do the research, but then are often mentally and culturally blocked from turning their R&D advances into commercial breakthroughs. This is one of the prime reasons for the Framework Programme's repeated disappointments in the effort in diffusion and dissemination. It has to be challenged. In fast evolving advanced technology areas, the market is by its nature fickle and unpredictable. The rewards, both for the successful individual innovator and entrepreneur and for the economy, are correspondingly large. The new IT Programme's culture and approach should aim to stimulate a change in attitude.

- *encourage start ups and knowledge based spin-offs*
- *boost SME representation in the advisory structure*
- *revamp CORDIS plus SME awareness measures*
- *encourage a risk-taking, entrepreneurial attitude*

3.5   The IT suppliers

3.5.1   In spite of their vitality, no world region or country can afford to base its position in IT on SMEs. As well as strong in-house RTD capability, only big corporations have the investment potential required to maintain truly global reach, especially for instance in sectors such as chip production. Thus it is vital that Europe's big IT supplier companies remain competitive on the world stage.

3.5.2   The Board stresses here, however, that the continuing problems of Europe's big IT companies are beyond the scope of Esprit to solve. In the global marketplace, competitiveness is to be judged by the ability to expand market share and profit over a given time. Technological change is a *sine qua non* for maintaining competitive advantage. To realise the benefits of RTD, successful innovation and commercialisation are necessary. Ideas have to be translated into commercially successful products and processes, achieving market penetration by establishing a sound customer base. This process demands a series of complementary inputs, such as management skills, investment acumen, marketing expertise, excellence in design. There are indications that Europe's IT industry is weaker in these latter areas than in its access to advanced knowledge and invention.

3.5.3   Large companies often appear to use Esprit funding for research which is not central to their core business. RTD done internally by a dedicated team is more efficient and controllable than a collaborative pan-European effort, and so they try to keep core research close to the firm. Such companies are also reluctant to share knowledge and know-how in the areas of their core competence. They are therefore willing to engage in Esprit more for collaborative standardisation work, longer term, far from the market topics, building and keeping human resources, rather than in the quantifiable product implementation which the Programme's new orientation should imply. At its worst, Esprit money is used for marginal work, with welcome but not determinant spin-off in terms of improved training, personnel relations and contacts. At its best, it can accelerate the timing of longer term projects and make possible others which the company otherwise might not have been able to tackle. Judging Esprit from the standpoint of generation of marketable results, it may be that the performance of the large companies actually rates lower than that of the medium and smaller ones which are more willing to engage in core business research with partners.

3.5.4   In the run up to the new Programme, valuable departures in terms of wider consultation, including the important innovation of industrial advisory panels and groups, has still not entirely dispelled the aura of residual influence which big IT companies possess. The role of the large companies in the Programme is still criticised by many smaller and medium sized participants. The Board believes balance is being attained but it suggests that more information is needed in this area to reassure all participants.

SECTION 4: FINDINGS - THE DOMAINS AND IMPACT.

4.1   Evolution and general comment

4.1.1   Esprit III had almost the same themes as Esprit II though some were upgraded and enhanced to constitute entire domains, managed by separate or new units. Examples of this are HPCN, out of Software Engineering and Information Processing Systems, and Multimedia, from Advanced Business and Home Systems. Basic Research (now Long Term Research in the new Programme) also underwent major restructuring to become more open and flexible so as to accommodate novel ideas. Already in Esprit III, Basic Research was not seen as a far from industry, nor as a fundamental research, domain.   The names of the other Esprit "areas" (in ESPRIT III terminology, "domains" in the new Programme) have slightly changed over time to reflect current trends, notably in Software Technologies, Microelectronics and Computer Integrated Manufacturing and Engineering (CIME). Between Esprit II and the so-called Esprit IV of the new IT Programme, only one entirely new domain has been introduced, namely Technologies for Business Processes (TBP) in the new Programme, and none has been dropped.   Despite similarities in names, both content and orientation have been adjusted to take into account intervening developments in technology and, increasingly, shifts in the IT market.

4.1.2   There has been a significant increase in Accompanying Measures since ESPRIT II. These include working groups, networks of excellence, special interest groups, user-driven large scale initiatives, as well as special actions for certain Member States (Portugal, Spain, Greece, Ireland) and international collaboration activities. Examples of horizontal user-led initiatives include a major integration platform project in the software area and projects in advanced design and manufacturing for the automotive and aerospace industries in CIME. More user reference groups have been established in the new Programme, covering user IT requirements in the maritime, textile, oil and construction industries.

4.1.3   The Board acknowledges with satisfaction that a wide variety of topics of considerable industrial interest have been addressed by Esprit III and now by its successor, making a real contribution to meeting the needs of industry. A long list of attractive innovative and forefront themes (methodologies, implementations and networks) were also supported in Basic Research. Microelectronics gave support to projects ranging from design (CAD) to manufacturing and applications. As early as 1990, enterprise-related communications, hypermedia and parallel architectures were accommodated in Esprit; these areas have all received added emphasis.

4.1.4   The projects selected in the Esprit III areas were not intended to be exhaustive and it was accepted that the selection of projects could have left gaps. It is noticeable that some areas, while present in Esprit III, did

not receive the same level of attention as they did in the United States, others as they did in Asia. In part this reflects the European capability in certain sectors of R&D, in part European industrial preferences. Close watch must be maintained, however, that gaps are not the result of oversight or miscalculation.

4.1.5   In Esprit III, projects funded constituted isolated activities, as in previous Esprit Programmes. Early attempts to cluster projects to generate synergy took place, notably in OMI, CIME (IiM) and HPCN. Clustering is central to the new Programme, taking the form of "focused clusters" or informal groupings of related projects. This has been a very positive development. The Board supports the extension of clustering at a strategic and operational level, though not excluding recourse to single projects where appropriate or when specifically requested by a consortium. With regard to the interaction between project teams, the Board recognises that there are confidentiality issues involved in bringing project teams close together. Dissemination of early results to interested parties is essential and involves IPR issues. Currently, it can take far too long to negotiate the necessary agreements between participants.

4.1.6   There have been times when similar projects have been undertaken in more than one ESPRIT domain with insufficient co-ordination between them. Beside the risk of confusing applicants, this can significantly reduce potential impact. The Board argues that cross-domain work should be encouraged, and indeed makes a recommendation elsewhere (section 6.3.4) in favour of competing projects in certain cases, but this demands that co-ordination be significantly improved. Thus, although it is clear in the Work Programme where the cross-domain topics are, the specific emphasis and core orientation of the individual domains attract and favour each individual domain's mainstream proposers and, apparently, systematic internal ESPRIT cross-domain co-ordination to pick up proposals falling between stools is absent. Examples of this abound above all in the application areas and include simulation, IT support for environmental technologies, intelligent sensors, control systems, concurrent engineering, decision support and integration platforms. On the one hand, applications are present in all domains, definitely a positive sign, but an underpinning or enabling technology domain can also look like a focused cluster. Good co-ordination can bring together the different strands, effectively manage overlaps between domains and create synergies from cross-domain interaction. The new Programme is starting to show that this can be achieved.

4.1.7   In recommending abolition of the Work Programme as currently formulated for the reasons indicated in section 3.1.3, the Board is arguing for a macro approach to define future domains. Though today's Work Programme does explicitly allow for multi-disciplinary proposals, in practice the domain boundaries have always discouraged them. The need now is for a more coherent and co-ordinated IT applications area, aiming to maximise flexibility. The Board envisages a structure based on over-arching *macro domains* in which funding and other resources can be more easily shifted between projects and themes, as needs evolve. In putting its proposal forward, the Board sees it as one configuration, illustrative of reorganisation of the IT Programme using a macro domains approach. Indicatively, there could be three such macro domains: Microelectronics,

Software, Applications. Of the three macro domains, two - Microelectronics and Software - are the enabling technologies providing a generic foundation for IT in Europe. The Third, Applications, is more thematic. In fact, given the strong user orientation of the new Programme, it would then be principally the Applications macro domain that would generate *submacro domains* providing across the board, multisectoral, linkages in prioritised themes and objectives. The latter could themselves fall into one of several categories: i.e. sectoral applications (for example, health, aerospace, education, etc.); functional applications (simulation, logistics, controls, etc.); business applications (quality, enterprise communications, re-engineering, corporate knowledge, information society interfaces etc.). Implementation would build upon co-ordination of the existing programme structure, rather than any novel departure: the Board sees this as an evolutionary process, not a revolutionary one. Joint calls in the various submacro domains would extend beyond the IT Programme to encompass IT aspects of activities in other programmes, drawing on expressed requirements and anticipated demand, with effective inter-programme and inter-DG co-ordination. The experience acquired with the focused clusters in the new IT Programme should provide valuable input.

4.1.8   In its support to manufacturing - primarily CIME, but also to a lesser extent Software Technologies, OMI and HPCN - Esprit is considered upstream of BRITE-EURAM (in Framework IV, called IMT) activities. There are, however, cases in which the distinction is difficult to make. Thus, for example, Esprit projects in the field of validation need the development of industrial demonstrators for methods or systems and increasingly BRITE-EURAM itself needs IT, especially for process technology development, design and clean manufacturing. In Esprit III, potentially related Esprit-BRITE-EURAM projects, which could have been accepted in either programme, were few. The trend in the new Programme is now upward. As the linkages deepen, the Board favours more joint calls and shared projects.

4.1.9   More co-ordination is promised in the Work Programme, especially in the Esprit domains Microsystems (TCS) and CIME. Examples exist here too of fragmentation of the European effort, with the result of inadequate cover over all. The Board notes the crucial area of sensors, in which Europe is currently too weak. The already small effort is split between Esprit and IMT, with no strategic targeting of the area. This deficiency must be remedied.

INTELLIGENT SENSORS

Sensors, actuators, micro sensors, microactuators and microsystems have been identified as promising devices for a long time. World-wide, considerable interdisciplinary research is taking place. In terms of products, the area is dominated by non-European, primarily Japanese, firms. European industry is slow to adopt the technology. Sensors, actuators and microsystems are strategic in a growing number of applications areas. Of the many which fall into the strategic category, the Board offers here by way of example four fields of particular economic, social and environmental interest:

1. medicine - the development of intelligent sensing devices offers improvements in diagnosis and, therapy with significant cost reduction. The cheap 'laboratory on a chip', routinely used by general practitioners in their offices without the need to consult hospital departments, is one attractive example.

2. automotive systems - progress in car manufacture relies on electronics, centred on sensors as interfaces to mechanical systems. Car safety (ABS, air bags, speed control etc.), reduction of fuel consumption by electronic engine management, pollution control, and other functions require high reliability sensors. Frequently, the performance of a system does not depend on the type of computer used but rather on the quality of the sensors and actuators.

3. biotechnology - this is one field among others in which intelligent and high reliability sensors offer a way to move from costly batch type production to continuous computer controlled fabrication.

4. environmental monitoring and control - a good example here of high economic and environmental value added to a system is a sensor for monitoring carbon in fly ash. Excessive amounts of residual carbon in the fly ash of coal fired power stations represents a significant loss of energy and makes disposal of the ash both difficult and expensive. Fly ash is a valuable raw material for the production of cement if carbon levels are correctly monitored.

Other applications include food processing, industrial control systems, robotics and mechatronics and home systems - all important for the competitiveness of the European economy.

The role of intelligent sensors is destined to increase as costs fall. The area is synergic with microelectronics and signal processing needing new dedicated integrated electronic architectures. Moreover, it presents many opportunities for innovative SMEs. Growth forecasts for the 1990s were about 7% per annum - now seen as a conservative estimate.

4.1.10   Over and above ad hoc arrangements, long term co-ordination issues remain unresolved and the Board recommends that, in recasting the Union's IT effort, as results of the manufacturing oriented technologies developed in the IT programme materialise, they should be taken up by IMT. The Board proposes that this be achieved in a seamless on-going process, by which the IT requirements of IMT are passed up stream to the IT Programme and successful identification of IT solutions in Esprit then leads to their development in IMT. It

envisages the links between the two programmes becoming more intimate, so as to assume a quasi-permanent basis in this interchange.

- *move to a macro approach to define future domains*
- *pass on the results of the manufacturing oriented effort in IT for development in IMT*
- *manage overlaps between domains, create synergies from cross-domain interaction*

4.2 The Domains

This analysis is based primarily on the results of the Questionnaire and interviews conducted by the Board in the Member States, and draws on recently published technology trends and foresight reports. The analysis is an assessment of performance and impact of Esprit III in its key technologies, using the terminology as it had developed by its last phase. The following text in *italics* represents the Board's comments.

Domain 1: Design and engineering of software intensive systems
(Software technologies in the new IT programme)

For the majority of IT-based systems, software is the major cost component and increasingly a source of added value. Against this background, the overall objective of the domain is to ensure that in all sectors of the economy Europe's software developers continue to have the skills, capabilities and key technologies that are needed to provide software intensive systems of outstanding quality and relevance. Themes addressed are:

Software Intensive Systems
Objectives in the Work Programme
To ensure that European professional software developers in both vendor and user organisations have the world class skills and tools necessary to build the increasingly complex and varied systems required by the market place.
As an objective, this seems perhaps too general. Its achievement is thus unmeasurable. The work done under this umbrella appears to include a wide array of topics - formal methods, requirements definition, systems architectures, development process improvement, software quality techniques, software re-use, and the evolution of legacy systems. These themes continued into the new IT programme, with more emphasis on development methods and quality issues.

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Emerging Software Technologies in the new Programme

Objectives in the Work Programme

To widen the spectrum of IT supported applications by developing new software technologies and associated tools, techniques and standards.

The tasks under this objective relate to knowledge modelling and management, active decision support, control and optimisation techniques for complex and possibly safety critical systems, techniques for visualising complex statistical data. All of these can be defined as poorly supported significant problems. Objectives also cover, however, 'techniques and tools to enable more intelligence to be added to products and services in a wide variety of application domains'. This seems an improbable task to meet the stated objective. The Board wonders whether there is sufficient selectiveness and rigour in the thematic definitions within this domain.

Distributed Systems and Database Technology

Objectives in the Work Programme

Tasks under Distributed Systems aim to improve both the effective and efficient development of, and migration to, systems in which functions and data are increasingly distributed. The prime objective in database systems is to develop new technologies and methodologies and to help those in existence to reach maturity. A further objective, in the new IT programme, is to contribute to the development of the Information Infrastructure for the Information Society.

The starting point is a reasonably well contained and defined objective which the Board supports. The themes around database technologies evolved from the outset of ESPRIT III (called information servers) and on to the new IT programme. This thematic area could become the heart of a software macro domain, addressing and guiding more focused generic software issues. This correction is perhaps necessary, however the Programme is reordered.

Support for Human Activities

(Human Comfort and Security in the new IT programme)

Objectives in the Work Programme

To make future systems more user friendly, attractive and acceptable to the user. These systems range from sophisticated electronic entertainment to major command and control systems set in both business and industrial contexts. The advanced approaches developed and demonstrated by activities in this sub domain will subsequently be applied across a wide spectrum of industrial and

service sectors, in particular through development in the Industrial and Materials Technologies, Telematics Applications and Transport programmes.

The latter represent another group of applications and the Board wonders to what extent software engineering can now be carried out by industrial users with what is approaching mature technology. R&D on new technology is still needed in some areas. In the main, it should, however, be the province of academics, and a very few users and software companies. The budget for such work need not be large. In this area, the Board argues that the competitiveness of European industry, both large and small, can best be increased through actions designed to raise software standards, so that a much higher proportion of companies use the latest proven technology. Only relatively few firms have the capability - and inclination - to engage themselves with unproven new techniques.

Accompanying Measures

Software Best Practice

Objectives in the Work Programme

To promote best practice and to improve the software development process in industry, through the take-up of well founded and established but insufficiently deployed technological support

The Board supports this action (notably ESSI). It would welcome further actions to meet the objective.

Technology Transfer

Objectives in the Work Programme

To foster the adoption of leading-edge software technologies by demonstrating their suitability and viability to build real domain applications for which these technologies, although potentially suitable, still present some level of risk.

The Board regards this action as very worthwhile.

Results from Domain 1 Software Technologies

The Board is supportive of the Programme's activity in Software. There appears to be a paradox, but one which can be explained. There seem few results which have a solid market impact. Even in results affecting the wider market, the actual technology is often only of value in a small minority of situations. Many

results are used by their developers but do not appear to disseminate more widely. Whilst for the majority of IT-based systems, software is the major cost component and a source of increasing added value, it is a fact that the majority of software is developed within the companies which are going to apply it inside their products. Therefore when an Esprit project makes a technological advance in software, there is no natural process for the advance to spread to them. There are not the software suppliers to take this advance to other users, for the supplier is so often inside the user company where the development occurred. It is not entirely surprising that so many projects in the Software Technologies domain - whilst producing interesting results of value to their developers - do not have obvious nor rapid impact on the market viewed as a whole. The Board would be interested to see whether this situation can change. With regard to Software Technologies, the Board would prefer a stronger emphasis on the Accompanying Measures and a lesser, more tightly focused, emphasis on technology development. As far as applications are concerned, closer co-ordination with other Esprit domains dealing with applications - CIME, HPCN, MMS - is essential.

Domain 2: Microelectronics

(Technologies for components and subsystems in the new IT programme)

Semiconductor components and Applications

Objectives in the Work Programme

To stimulate product innovation with emphasis on communications, automotive, consumer electronics, and industrial applications.

A sound objective, though the emphasis could be thought somewhat predictable.

To improve competencies in advanced design, manufacturing and equipment, and testing, with demonstrable impact on time to market, functionality and cost per electronic function.

Important for this domain and beyond.

To prepare for the longer term through advanced industrial process technology development.

In supporting this activity, the Board points to the possibility of overlap with the basic research component of the Programme. This needs to be watched carefully.

The components addressed are based on silicon in the first place and, where necessary or appropriate, e.g. for high frequency or optoelectronic applications, compound semiconductors (e.g. GaAs, InP, SiGe).

The work must be in the mainstream of world market demand (CMOS) with a 'where necessary and advantageous' approach to the specialised parts of the market. Esprit must not make the mistake of supporting European niches and forgetting the mainstream marketplace.

Microsystems

Objectives in the Work Programme

To expand the application potential of Microsystems technologies.

This is the second objective, see the Board's next comment.

To overcome the high entry cost currently associated with the design, manufacturing and use of microsystems.

This is the key objective and is valid in all three of its components. Expanding the application potential will follow, once this objective is properly achieved. This should be borne clearly in mind.

To contribute to the establishment of an industrially oriented microsystem supply base.

The Board agrees with the sentiment, but wonders whether the task is really one for Esprit.

The Board is concerned whether everyone appreciates exactly how Microsystems relate to the Open Microprocessor Initiative Domain. It is not really very clear. OMI seems to be focused upon microsystems with embedded microprocessors. It could be argued that that is quite a high proportion of all microsystems. The question arises whether OMI and Microsystems should not eventually be merged into one domain, or be integrated in a more straightforward manner. This might eliminate a potential source of confusion affecting participants and interested parties. Such a solution might also reduce overlap and intra-Commission competition.

Peripherals (in Esprit III, a sub domain of **ABHS-P**)

Objectives in the Work Programme

To create new, or to enhance existing, European capabilities to produce selected peripheral components and subsystems needed to meet large market requirements in the professional and consumer markets

In practise, the funds from this activity have been spent upon three topics: mass storage devices (disc drives), where small European companies have emerged to compete on the world stage (a surprise to the Board and a success for Esprit); flat panel displays, where a serious European world market presence continues to be awaited; home systems and home systems integration. Whilst in general approving of these topics, the Board sees little need for the detailed actions specified in the work programme, in a sense second guessing what R&D topics should be pursued best to achieve the objectives. Each proposal for funds should spell out the anticipated contribution to one or more of the thematic objectives and be evaluated on this anticipated contribution, as well as on the other evaluation criteria. (see also comments in page 51 - Peripherals)

Accompanying Measures

Best practice, co-operative R&D and technology assessment

Objectives in the Work Programme

To spread best practice and to establish effective links between technology users and suppliers.

Basic services and first user actions

Objectives in the Work Programme

To facilitate access to, and demonstration of, new technologies and relevant know-how.

The Board sees the competitiveness of European companies, and especially of the SMEs, being enhanced notably by the second of these Accompanying Measures. In particular, and in company with many respondents, it has found both Europractise and FUSE to have been effective and worth emulating.

Results from Domain 2: Microelectronics

The Board has been impressed with the results achieved in this domain. Examples include a wafer stepper for 0.35 microns, CMOS processes for 0.5 micron ASICs, simulation and verification of complex mixed signal ICs, very small clean room technology, file size reduction technology speeding up CAD processes, contamination control in silicon wafers improving yields etc..

Consideration of this domain would not be complete without mentioning JESSI in the past, and MEDEA for the future. Esprit funds have supported this - the largest of the Eureka projects. With the contribution of funding has also gone a degree of control and management by the Esprit microelectronics staff, notably

in the area of microelectronics core manufacturing technology. Strong linkage has gone a considerable way to ensuring that overlap, duplication and rivalry has not developed to any great extent between the two programmes. The microelectronics domain is the major hardware related area in the Programme. It should play a guiding role in the applications, as well as support for similar areas such as OMI and CIME.

Domain 3: Multimedia Systems
(in Esprit III a sub-domain of **ABHS-P**)

Multimedia Technology
Objectives in the Work Programme
To develop and integrate technologies to allow the creation, manipulation, display, access and storage of multimedia information (high quality image, text, motion-video animation and high fidelity sound). The work covers both multimedia software tools and multimedia systems. The second objective is to develop, integrate and apply technologies with a view to building an appropriate open environment for distribution, trading and use of digital multimedia objects. Such an environment should enable wide and easy access to and use of digital material while, at the same time, providing an appropriate protection of Intellectual Property Rights.

Multimedia has become something of a catchword in IT, with all the advantages and disadvantages that stem from such a label. Nevertheless, the Board is pleased to see a domain focused upon this area of leading edge technology development. The work being done is important. The potential overlaps with other areas within Esprit and with other programmes are, however, very considerable. It is the Board's view that the present levels of demarcation and of inter-programme co-operation are far from ideal. Much of the technology developed will, in the near future, be built into microelectronic chips. The MEDEA Eureka programme actually has a major segment devoted to just this topic. Many of the software problems to be solved could be described at the top level by the words to be found within the emerging software technologies objectives. In the applications of multimedia technology being developed, the potential overlaps with the Telematics programme are evident. All these aspects need to be addressed in the new Programme.

The second objective is well defined, aimed at solving one of today's particularly thorny problems. The Board questions, however, whether the search for a solution to it should be left to the inevitably rather slow moving vehicle of Esprit, rather than to market forces.

Accompanying Measures

Objectives in the Work Programme

To integrate advanced technologies and standards into multimedia systems solutions with a view to stimulating their uptake in the information infrastructure.

In other domains, users are involved in R&D projects many of which are expected and indeed do end with a system pilot. The Board wonders why the Multimedia domain is different. Multimedia pilots, of which the Board is in favour, should emerge from some of the R&D projects initiated under Multimedia technology. This activity could be seen as an unnecessary segmentation of the Programme. The problems which potentially could arise with the Telematics Programme is evident looking the tasks defined to be carried out under this heading. Pilots are sought for business or the home and for authoring systems, where education is mentioned; but not multimedia systems for education or for medical applications etc. which would be treading too closely on the toes of Telematics. The Board urges the Commission to recognise that these demarcations are neither of interest, nor are they helpful, to industry. Less fragmentation would represent a significant improvement.

Multimedia Support Networks

Objectives in the Work Programme

To set up and provide support networks to provide a range of services that support identified and quantifiable needs of European organisations producing multimedia systems, multimedia content and/or multimedia applications on a continuing basis.

The Board is somewhat unimpressed with the definition of this activity and even wonders whether it is really necessary. The case for such support networks in one technology area is not well reasoned.

Results from Domain 3: Multimedia

Many of the results already seen from this domain are highly relevant to important areas of the market place and to advanced activities. Results considered include new electronic cash terminals, multimedia shopping, electronic service manuals, low cost document management, interactive holiday brochures, tools for multimedia authoring and a method of copyright management applicable to films, music and books in digital form. Given the acknowledged market potential, this is an area in which the Board believes Esprit's actual commercial impact should be measured against what could reasonably be expected of it, to serve as a test of the Programme's real effectiveness. Meanwhile, joint and co-ordinated activities with other programmes are highly recommended. Consultation with other programmes active in the multimedia area should be the rule upstream of commencement of planned activities.

Domain 4: Basic Research
(**Long Term Research** in the new IT programme)

Activities and proposals are sought for innovative RTD in any IT-related area; for work in areas complementary to what is addressed within other domains of the programme; towards microelectronics technologies that are likely to shape the markets of the next decade; and towards novel interfaces to heterogeneous information systems which may enable access on the part of the broadest community of users to the global information infrastructure.

This domain is often perceived as the domain for the universities and academics, among whom it is very popular. The Board supports its strategy and thrust. It sees Basic Research/Long Term Research as an important domain and one not to be restricted to a limited audience. As it is defined, the domain is truly catholic in its coverage. There is now also a welcome near- blue sky element, which the Board would like to see flanked by the possibility of one-shot financing of radically novel ideas.. It makes a recommendation in this regard.

The Board regrets that there is currently such a lack of long term speculative research in industry that responsibility for what is really quite strategic work should fall essentially upon the academic community. Nevertheless, it appears to be increasingly a fact of life. The domain management does a good job in co-ordinating a dispersed effort, giving it some strategic coherence. The Board also supports the domain's awareness of industrial requirements, distant and ill expressed as they tend to be so far from the market. It believes that the

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courtship is under way between what leading edge research in Europe can do today and what European industry will want at some time in the future.

Results from Domain 4: Basic Research/Long Term Research

Judging by levels of appreciation, Esprit long term research enjoys considerable success. It is obviously difficult to have a true feel for the actual results of this domain. By its nature, they are still far from the marketplace. Normally such research would be judged, as is other academic work, by the number of papers produced and by patents stemming from it. The Board has not seen any data of this type. It would be an interesting exercise to gather and collate it.

Domain 5: Open Microprocessor Systems Initiative

The OMI domain addresses the design and development of microprocessor and microcontroller based systems, hardware and software, with emphasis on embedded applications.

Systems Technology

Objectives in the Work Programme

To promote innovation in the components of embedded microprocessor systems, including software, tools and methodology. Inter-operability and re-usability of the components play a major role in the OMI open systems approach. Future IT based systems will increasingly make use of 'systems on chip'.

The Board welcomes the focus brought to this important topic by the existence of this particular domain in the Programme. The existence of a microsystems theme within the technologies for components and subsystems domain may seem to indicate a lack of clarity and purpose in establishing the detailed structure of the overall Esprit programme. The difference needs to be spelled out.

Systems Integration and Applications

Objectives in the Work Programme

To provide a "vertical" integration chain of technology suppliers and users and demonstrate the benefits of the application of open microprocessor systems technologies in systems industries.

This is a clear and focused objective of which the Board fully approves.

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Accompanying Measures

These comprise Small Demonstrator Projects for SMEs, a Management Organisation and a User Support Network.

The Board believes it is very worthwhile to spend part of the budget on these topics given that the openness of the developed technology has to be proven and sustained in the early days, particularly for the smaller users.

Results from Domain 5: OMI

Results have been very specific to the domain - tool kits to facilitate writing embedded applications, a standardised interface bus to which elements of a microsystem connect, a software tool kit relevant to this standard, technology to embed a range of processors for high volume markets are all examples. The OMI concept has not yet reached market maturity so the value of these results is difficult to assess. The Board notes that, unlike elsewhere in the programme, the number of proposals is not increasing in this area and acceptance rates are therefore higher here. This can be ascribed to the definite and targeted focus of the domain, which circumscribes proposers to those who have something specific to put forward. Or it can presage a decline in interest. The Programme should ensure it has established which is in fact the case.

Domain 6 : High Performance Computing and its Applications
(High Performance Computing and Networking in the new IT programme)

High performance computing goes beyond what was often referred to as 'super computing'. It includes scaleable, distributed, parallel computing, Massively Parallel Processing systems, Shared Memory Processing systems, as well as high performance workstation clusters, computer networks, and heterogeneous architectures with multiple processors. Despite the similarity in name, there were quite substantial changes in sub-themes between Esprit III and the new Programme, reflecting user requirements.

Simulation
Objectives in the Work Programme

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To expand the application of HPCN in simulation aiming to achieve increased quality and/or efficiency in design, shorter time to market, and reduced development costs.

High Performance Computing has reached the point where simulation of many functions which in the past were evaluated experimentally has become viable. This objective is well formulated. It has been followed through with a focused cluster of projects all aimed at making simulation of some application area a reality. The Board considers this area to have been a success.

Embedded Systems

Objectives in the Work Programme

To expand the application of HPCN embedded systems to a wide range of products and processes, where HPCN enables real-time processing of large volumes of data to achieve new levels of functionality, usability, intelligence and therefore added value.

The tasks in this area include large data throughput requirements, such as real time image processing and medical imaging. This is not to be confused with multimedia applications. They also include time and safety critical applications. The latter not to be confused with emerging software technology applications to be found in the Software technologies domain. While for those working in the domains the need for such distinctions may be very real, for those outside - the Board, but possibly also proposers - they tend to be a source of disorientation.

Information Management and Decision Support

Objectives in the Work Programme

To expand the application of HPCN in information management and decision support

Here the Board is concerned that these same applications appear also to be found in the emerging technologies domain.

The Board emphasises that this domain is well managed and its content is basically sound. Nevertheless, a decision seems overdue to tackle the repeated apparent duplications, with other programmes but even within the one programme. The Board acknowledges that stripping out unnecessary and wasteful duplications, while leaving those which add to the richness of cover, will not be an easy task. The present situation has not arisen out of inertia, but as a response to conflicting demands. Restoring some order, of benefit both to

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the Programme managers and to its customers, will require an attention to detail which cannot be expected of outsiders.

Networked Multi-site Applications

Objectives in the Work Programme

To facilitate and accelerate the application of HPCN in industry at large, by exploiting the potential of using advanced networking services.

Development and Execution Environments

Objectives in the Work Programme

To enhance and expand the HPCN software and systems technology base as identified by applications requirements.

The Board sees both the above as worthy components in a multi-faceted effort in high performance computing.

Accompanying Measures include

- demonstrating the use of HPCN technologies and advanced networking services   to lower the risk for early adopters;

- raising the awareness of and promoting the use of HPCN in industry;

- assessing the potential gains of HPCN use, especially amongst first time users;

- transferring mature and proven HPCN applications and practices into new environments under real working conditions, in particular, from large enterprises to SMEs;

- establishing Technology Transfer Nodes for the provision of services which are of common interest and use to participants in a cluster.

The Board evaluates these actions as well conceived and evidence of a clearly thought through strategy. The aim is to expand the base of European users of high performance computing technology. This is currently far too low. Broadening the applications and stimulating uptake of this technology will significantly boost competitiveness. On an ever expanding number of fronts, high performance computing is generating a new paradigm, with new quality criteria, new levels of efficiency and cost control. The Board commends this area.

Results from Domain 6: High Performance Computing

Results are numerous. Many represent incremental steps rather than novel breakthroughs and inventions, but they are none the less relevant and valuable for that. Results considered include car crash simulation, neural networks for energy forecasting, software with a potential market in computer animation and special effects, 80 software packages transferred to parallel environments enabling for example the simulation of the life cycle of a new generation of roller bearings, networked collaborative working in the aerospace industry and compilers for parallel systems.

It is expected that High Performance Computing will become a central technology for many industrial sectors in the near future. This is already happening outside Europe. There is a need for a higher European profile in this technology, from research to manufacture, and on to applications and diffusion. High Performance Computing is destined to penetrate other domains and also other programmes, such as IMT. The Board expects the new IT programme to play a leading role in guiding the research and stimulating applications and uptake in association with industry across the Union.

Domain 7: Technologies for Business Processes (introduced in the new IT programme)

Business Best Practice Pilots

Objectives in the Work Programme

To demonstrate the effective transformation of one or more business processes at user sites, from existing to new industrial paradigms.

To demonstrate Electronic Commerce both within Europe and between Europe and its current and emerging global trading partners.

The Board finds this a somewhat surprising R&D theme. It is certainly important, but most of these pilots are likely to use established technologies and protocols. The focus is thus probably on demonstration rather than development. The Board agrees that the second theme, electronic commerce, needs to be explored in close conjunction with sectors and DGs already actually engaged in commerce, following countries outside Europe where it is already taking off. It is no longer to be seen as an area for study. Electronic commerce is poised to explode in importance and when it does the market will take the lead in determining the success of the variants in technology and the practicalities of their management and regulation. Theoretical work, or work planned with too

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leisurely time scales, will be overtaken, and the resources dedicated to it largely wasted.

Enterprise Systems Integration

Objectives in the Work Programme

To apply, integrate and adapt the next generation of technologies to sophisticated enterprise systems in support of existing and new industrial paradigms. This includes Computer Supported Co-operative Working, Groupware, case handling and work flow management. Also document handling systems, Electronic Data Interchange and electronic commerce technologies all in distributed, multilingual, multimedia environments.

The Board supports the range of activities under this heading. There is some degree of overlap with CIME, however, and this should be considered.

Accompanying Measures

Business Best Practice Networks

Objectives in the Work Programme

To set up a network of support centres, established in existing organisations such as business schools, to gather and disseminate widely the state of the art in business best practice, IT products, services and systems and the results of national programmes.

This is an important and interesting activity. The network is a network on a network, and this is a concept which could be emulated elsewhere. If Europe is to rectify lags in promoting what is already available, even more than what is to come, the diffusion and awareness building effort in IT has to be increased. This applies to decision-makers perhaps even more than to others. The Board is glad that in TBP this extra effort is recognised.

Results from Domain 7: Technologies for Business Processes

It is too early to have real results from TBP. Not too early, however, for the Board to have gained an idea of the value this work can have for the new IT programme's wider goals. The Board supports this domain and finds it well structured and well targeted. In terms of management, it comes under the same head of unit as does OMI. The Board wonders how great the synergies are

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between the two to justify this organisationally. As an administrative choice, it does not seem to the Board to be particularly customer (i.e. industry) oriented.

Domain 8: Computer Integrated Manufacturing and Engineering
(Integration in Manufacturing in the new IT programme)

The term manufacturing is used to cover the full life-cycle of products from design ·to recycling and refers not only to discrete manufactured products but also, for example, to large scale engineering projects and the process and other related industries. The overall goal is to enable the transition from traditional to concurrent engineering environments within European manufacturing industries.

Information Technology for Product and Process Data Modelling
Objectives in the Work Programme
To ensure that manufacturing and process industries have access to inter-operable building blocks for their future IT systems, taking into account ongoing developments in the field of standardisation.

Manufacturing is very often involved with IT products and manufacturing equipment from many vendors. Standards are essential to progress and to the facilitation of change without making existing equipment obsolete. The Board feels comfortable with this objective. There, has, however, been substantial research, especially in STEP, in Member States and sectoral associations, in this area. Results need to be made more generally available, across Europe. The Union-sponsored effort in the new IT Programme should be carefully defined in the future.

Logistics in the Virtual Enterprise
(appearing in the new IT Programme)
Objectives in the Work Programme
To enable global co-operation in production activities in a volatile business environment; to provide IT support for management of enterprise change, total quality management, systems for distributed management, and provision of the IT infrastructure to support global integration of manufacturing processes.

The Board sees these as well selected topics. The many possible links to Information Society applications are a further element adding to relevance. The Board anticipates useful results from this area, which should be enhanced,

where appropriate, in wider collaboration with other programmes and also beyond the Framework Programme to involve other DGs.

Intelligent Production Systems and Equipment

Objectives in the Work Programme

To develop new IT solutions which support the rapid adaptation of production processes to rapidly changing business requirements and to provide optimal decision-support capability in a human-centred production environment with a highly developed and distributed decision-making structure and taking full account of usability considerations and the need for on-line quality monitoring.

The themes outlined here are more about the application of IT to the needs of manufacturing industry than the development of IT technology through R&D. The Board notes that it would be possible also to make a similar comment about Domain 7's concern with business (large office) processes. The Board suggests that it would make more sense to bring all the various applications of IT to particular industry/market sectors into one directorate and one programme. On the evidence presented to it, the Board believes that the overall effort would gain in focus and utility. The application of IT to the fields of health care, education and training and many aspects of transportation, which are also all important industrial market places, could more logically be handled as part of the same programme handling the application of IT to manufacturing and business processes. This moreover is the philosophy which inspires the Board's recommendation for the Applications macro domain. Furthermore, the Commission would be more efficient should this reform be actuated. Much of the confusion in the minds of industrial partners, for whom the effort is designed, would be removed. A large number of the overlaps which clearly exist both within and between programmes would also be reduced.

Accompanying Measures

Best practice in IT-based engineering and manufacturing

Objectives in the Work Programme

To promote within SMEs best practice in use of IT in the design, engineering and manufacture of products.

The Board supports the Best Practice aspects of this domain, as elsewhere in the Programme.

Results from Domain 8: CIME (IiM)

The domain has expanded beyond CAD/CAM to CAx and on towards generic issues. Strictly speaking, results from this domain do relatively little to help the IT industry, much more to help manufacturing industry. They include heavy handling robots, integrated systems to handle design changes, change management, release control, information sharing and document handling, applications and software tools based on STEP a generic standard for information interchange, an information interchange system for collaborative design of ships etc. The domain has also stimulated and supported a small number of user only requirements generation projects in late ESPRIT III. These could lead to significant commercial results if IT vendors are really committed to implement solutions.

However, the Board notes that the CIME (IiM) domain falls between different policies and programme interests. It increasingly overlaps with IMT, beyond Esprit, and internally with Software technologies, Microelectronics and TBP. More strategic co-ordination is now required to minimise the potential dispersion of effort.

Esprit III Domain 4: Advanced Business and Home Systems - Peripherals
(this domain did not continue as such into the new IT programme)

The Home Systems activity has been practically absorbed as part of the Peripherals activity, and has gone to Microelectronics (Technologies for Components and Subsystems). Advanced Business Systems, *per se*, became a completely new domain, Technologies for Business Processes, in the new IT programme.

With declining allocation, interest in Home Systems appeared to wane during the lifetime of the domain. Parts related to Multimedia can now be found in the separate Multimedia domain and in Technologies for Components and Subsystems. During the evolution of Esprit III the domain was superseded by more generic technologies and approaches. The design of the new IT Programme reflects this.

Results from Esprit III Domain 4: Advanced Business and Home Systems - Peripherals

Overall, several good results emerged, some of commercial relevance. European industry has incorporated Esprit results into products and the area is expanding. Though the domain as such was subsequently overtaken by developments and new priorities, the effort expended under Esprit III in Advanced Business and Home Systems has proven valuable.

- expand best practice accompanying measures, with special emphasis on SMEs, to all domains of the Programme
- strengthen interaction and co-ordination among those domains dealing with similar industrial themes and issues
- offer proposers a single, coherent focus for activities in topics which appear in different parts of the Programme
- continue the intensive applications activities in the simulation area, especially in High Performance Computing and Networking

SECTION 5: FINDINGS - CRUCIAL ISSUES

5.1   Microelectronics

5.1.1   Microelectronics is the main propeller of the phenomenal growth of the IT industry and telecommunications over the last 25 years. The crucial underpinning technology, it controls the development of the information infrastructure and related services which drive the implementation of the Information Society. As such, it is now to be considered as an infrastructure essential for the industrial, economic and social development of the European Union. Microelectronics today parallels the canal network during the early stages of industrialisation, the railways in the nineteenth century, the trunk roads, electricity grids and telephone system in the first half of the twentieth. The Board is convinced that, just as structural funds are allocated throughout the Union to improve these traditional infrastructures and so to encourage the development of all the regions, these funds should also now be directed to create a microelectronics infrastructure throughout Europe.

5.1.2   Over the last 25 years, electronics has become the biggest industrial sector world-wide. Since 1992, it has grown at an annual compound growth rate of 11% to stand at $800 billion, excluding related services. Over the same period, microelectronics has grown at a rate of 24%, standing today at $154 billion. The content of microelectronics in electronic systems increased from 11.6% in 1992 to 19.3% in 1995. It is expected to be about 29% by the year 2000. At this rate, into the next century, the content of microelectronics in electronic products, such as mobile telephones, will approach 50%. This leaves no doubt as to the strategic nature of this industry.

5.1.3   The consumption of microelectronics in Europe represents 19% of the world total. Regardless of where they produce, the European companies only have a world market share of 8%. These numbers do not appear to have changed over the past ten years. Worse still, the microelectronics content of European products is considerably lower than in those from Japan and the USA. There is definitely a link between these two facts. Without ready access to a local source of advanced microelectronics, electronic equipment manufacturers tend to use microelectronics less and to take less advantage of the creative potential and superior performance it offers. This constitutes a significant and growing competitive disadvantage as, in today's market, the difference between a good product and an excellent product can very often be related to the content of microelectronics.

5.1.4   The Board supports the statement in the 1995 *Microelectronics Review* that "Systems companies, which use microelectronics in their end products, collectively add more value, employ more people and are growing faster than any other industrial sector in the Community. It is vital for their future success that Europe has a world class semiconductor industry." The Cornu Report recognised the contribution made by Esprit, and by JESSI under Eureka, to raising European microelectronics to the technological level of Japan and the United

States, a consideration with which the present Board expresses full agreement. Meanwhile, and still under the Eureka label, JESSI is now giving way to MEDEA in which five European countries participate.

5.1.5   In technology, therefore, overall Europe no longer lags behind in microelectronics. This being said, the European microelectronics industry must now be stimulated to increase its market share, improve product portfolios and keep pace with technological development. In this industry, the capital requirements are staggering - any significant new investment currently involves a billion dollars plus - and the pace of technology is extremely fast. It is this industry that is driving the advent of the Information Society by digitalisation and convergence of voice, data, audio and video, miniaturisation, decentralisation of computing, systems integration and cost reduction with improved reliability. Its demands on capital and R&D are in line with this importance. R&D and investment costs actually double with every second chip generation. Investment is, in most cases, high risk. For microelectronics, as intermediate products, success depends on the success of potential systems manufacturers. Thus it is difficult to forecast. However, though subject to a cyclical business trend, the returns can be high. Universally, the industry is viewed as strategic. The Board notes that, throughout the world, various forms of support to encourage microelectronics investment are the norm, their scale and duration reflecting the comparative advantages of the respective sites.

5.1.6   For the first time ever, European semiconductor companies are not only profitable, they also have massive capital investment plans. It is expected that Europe's three major semiconductor companies - Siemens, SGS Thomson and Philips - will invest about 10 billion ECU by the year 2000 in manufacturing facilities alone. This will more than double their output, given the one-to-one ratio of investment to annual sales that characterises this industry. Siemens and SGS Thomson are the fourth and fifth fastest growing semiconductor companies in the world. After the uncertainties of the late 1980s, there is now undeniable proof of the European companies' firm commitment to microelectronics, both as a business and as a strategic part of system development. Reversing the trend of a decade and more, one of the big three at least - Siemens - is now bringing back to Europe some of the semiconductor assembly manufacturing jobs it had relocated to South East Asia, while SGS Thomson is creating thousands of new jobs in its European factories.

5.1.7   The microelectronics industry faces three challenges in the future: capital requirements, technology and software development, design capability. Today's trend is towards two types of companies, those with and those without manufacturing capability. The first type will primarily need capital resources, the latter human resources. Europe needs both, and support should be given to both. The Board recommends that a strategy be formulated at Union level to ensure that Europe will enter the next century with a strong and healthy microelectronics industry able to contribute to development of the information infrastructure and to the advent of the Information Society. The Board believes that such a strategy would reinforce future economic competitiveness and job creation in Europe.

5.1.8   Access to the latest technology is a must for European companies if they are to avoid dependence on foreign suppliers. This has happened in the past, with significant negative impact on competitiveness. In fact, the timing of introduction of new generations of components into a market is crucial for the whole supply chain and this cannot be guaranteed by a policy of buying in from outside. The dissemination and application of microelectronics must also be encouraged. Accompanying measures, such as FUSE and ESSI, have had great appeal and should be developed further. Applications areas important for Europe, such as telecommunications, transport, telematics, should also be identified and explored. The Board believes that development and use of microelectronics must go hand in hand. If not, any effort in microelectronics is directed to just one business, without taking full advantage of microelectronics' ability as an enabling technology to create new markets, generate employment opportunities and propel the advent of the Information Society.

5.1.9   It is obviously unrealistic to expect the Framework Programme to finance the capital requirements of Europe's microelectronics industry.   The Board calls on the Member States to address the issue of the higher cost of capital facing European players compared to their global competitors. Higher costs in Europe also derive from the social costs and structural rigidities inherent in the European productive system. Ways should be examined to offset the competitive disadvantage generated. Again, given the fiscal implications, this is likely to require action at the Member State level.

5.1.10   What is needed in terms of the Framework Programme, on the other hand, is a complementary, flanking effort, together with long term exploratory research in novel devices. The Board recommends specific targeting of a limited number of clusters of technologies which would, at the same time, augment Europe's microelectronics capability and competence in terms of human resources and assist in its diffusion across the Union.   The aim should be to attempt to raise the European presence in such clusters to at least the position of number two, world-wide, in both technology and market share.

FLAT PANEL DISPLAYS

Space, portability, power dissipation, size are parameters conditioning future systems in telecommunications, data processing and consumer electronics. The Information Society is based on information highways from which branch off a number of terminals to provide human-machine interfaces. These interfaces are normally visual and consist of screens with electronics around the periphery. In most instances, these screens will be flat panel displays (FPDs). Europe's research in FPDs needs refocusing. The aim must be to redress the currently unsatisfactory situation of import dependence. This is urgent, as screens are not simple add-on devices: they have become strategic to ICT development. In most systems, the cost of the screen represents over 50% of the total. Furthermore, in most instances, the screen determines the size of the system. The screen could well become the 'mother board' of the future, dominating system development.

5.1.11   Given the infrastructural aspects noted at the beginning of this section, the Union should also expand encouragement to microelectronics: linking RTD funding and the structural funds; targeting companies in Europe with a commitment to distributed manufacturing and design and development activities throughout the Union. European support to microelectronics, drawing on all the resources and the creativity available, is likely to be particularly important for the peripheral countries. Here great potential exists. This at present cannot be fully utilised, and is therefore lost to the Union, hampering development as well as the introduction of the Information Society.

> o   *a microelectronics strategy in manufacturing design and dissemination throughout Europe*
> > o   *target cluster technologies to raise microelectronics competitiveness and competence*
> > > o   *link RTD funding and structural funds*

5.2   Software Technologies

5.2.1   Software is now the principal cost of a typical IT system and the main source of added value. Software and software related activities are the dominant source of revenue in the European market. Software is not only generated in the IT industry. In fact, about 70% of all software produced is developed by IT user industries for their systems. Furthermore, a vast range of products and services have a rapidly growing software content, which constitutes an increasingly important component in competitive advantage.

5.2.2   For the operational context of software, the principal evolution in information technologies is a shift towards:
-        self-stabilising, upgradable, hardware environments;
-        by now expanding, but as yet not converging, communications systems;
-        software operating systems, tools, systems and applications with a dramatic increase in sophistication, responsiveness to end users and rising employment.
This shift is linked to support, customisation and maintenance activities. Recent statistics show that employment in software and services is rising steeply in Europe, and is currently around 800,000 of the two and half million total in the ICT sectors.

5.2.3   Software is an area of comparative European strength. European software engineering is acknowledged to be world class. European players dominate the Union's domestic market, especially in professional and processing segments. High margins and rapidly expanding business means that this is an area of increasing competition. In packaged software, the situation is less good: standard, shrink-wrapped software packages are now often global products dominated by the US vendors. Here the immensely more powerful marketing machine of the American players comes into its own to ensure that even competitive alternatives

stand little chance of winning market share. Europe does remain strong in specific niches, for example the larger, more complex, packages and new generation software tools.

5.2.4   In the software area, the role and impact of Esprit III, and now the new IT Programme, is considerable. Early targeting software and software technologies, the Programme has helped ensure that Europe's weakness in hardware has not been replicated also in this area. The Software Technologies domain has been in the forefront of Esprit's evolution from a technology-led to a user-centred programme. Recognising in early 1993 that the capability to develop software to high standards is a critical competence for all developed sectors of the economy, Software Technologies pioneéred the introduction and development of Best Practice actions with the launch of the very popular Esprit III European Systems and Software Initiative (ESSI). Other domains, namely OMI, CIME and now TBP, have been particularly effective, helping European companies to accumulate experience and grow.

5.2.5   This Esprit success is not fully recognised. The popular image of software is actually only one small part of it: a specific, off the shelf product, marketed world-wide by the dominant player Microsoft. In fact, in the shrink-wrapped segment, it has been impossible for the industry, even with Programme help, to contrast US power. Europe has to accept that in packaged software, standard software and horizontal applications packages, today's main markets are in effect lost. The one real European success story - SAP, now fifth in world rankings of software producers and integrators - is the exception which proves the rule.

5.2.6   The fragmented European market is one reason for this situation. It can be problematic for a European company with a valid product to capitalise on technical success. The large homogenised single market for software in the United States is a considerable competitive advantage, constituting a springboard to conquer world markets. In Europe, there is still no single market in IT. The huge US domestic market also permits American software houses effectively to determine standards. *De facto* standards are developing essentially by a Darwinian process of evolution, determined by the market. Adoption in the US by a major player is the fastest way for a standard to achieve global status. Being first in the market with a standard enables a company to exploit opportunities and especially to dominate its development. The World Wide Web is the best example of this: initially a European idea to link its scientists working in high energy physics, by now, through its application on the INTERNET, an American cultural, social and commercial phenomenon that is expanding globally. In their concentration on negotiated *de jure* standards, European standardisation bodies appear at times oblivious of the speed of *de facto* standard setting in the US, determined by the pace of the market. The Board urges them to adopt less bureaucratic methods and to accept market driven international standards.

5.2.7   The Board would like to see some of these aspects of the software equation addressed. It calls for an Esprit initiative designed to stimulate greater attention on the part of European software producers to marketing and product design in order to expand their market relevance and boost export potential.

5.2.8   The European software industry is largely composed of smaller (sometimes very small) players, many of which highly innovative. It operates best in niches, with a bias in favour of tools and applications software. The Board supports building on this, with an enhanced shift now toward applications software running over networks and the INTERNET. That is, the areas of applications products, systems software integration, network software and the generation of semi-finished software products able then to be adapted to different requirements by the producer and/or client. These areas represent a major commercial opportunity, in all of them, European software industry has real potential, following Esprit successes like O2, NSL, Chorus Systems, Iona, Etnoteam, ARM and Verilog.

5.2.9   Furthermore, the imminent telecommunications revolution in the Union will generate vast, potentially Europe-wide, markets in software applications to run on the newly liberalised networks. As shall be noted below (section 7.1.5), the Board looks to telecoms liberalisation as a generator of a major new strand in Esprit activity. In software particularly, this should be an area of high profitability, offering significant opportunities in terms of entrepreneurship and employment.

5.2.10   The Board argues that another area of enhanced interest should be customised software packages meeting a variety of sectoral applications, in which the American vendors of standard horizontal packages like Microsoft have fewer in-built advantages. A sizeable and growing European market exists in custom applications and especially in the new large infrastructure applications for telecoms networks, business-to-business markets, public administrations. The overdue recasting and renewal of Europe's traditional backbone of infrastructure will offer parallel opportunities for the European software developers. Infrastructure is no longer a matter of roads and rails, cables and cement: it is also complexity, multi-site/multi-modal environments, and on to the security aspects relating to protection of sensitive data. Managing all these is software. Infrastructural problems are not specific to the Union: again, producers must be encouraged to favour solutions which can have export-oriented relevance. In recognising this area, Esprit should also act to counter possible future invasion of the customised market by standard packages from abroad as the market develops. It is essential that the current European advantage be consolidated and expanded, also to take a bigger share of the emerging global market .

5.2.11   The Board is convinced that the Programme's continued emphasis on standard packages and products, a hangover from earlier Esprit ambitions, can no longer be justified. The core business of the European software industry is, in a real sense, provision of software services - and applications - not products. Esprit should more fully recognise the business model in which Europe has shown its strength - in applications. This, in the software area, implies some easing of current insistence on the generation of identifiable market products. The Board looks to the ESSI experience, both as a funding model and in its attraction to SMEs, for potential extension to the broader software area of Esprit. In addition, user funding for applications with sub-contracting

for development could be a way forward, in which it is users who are funded, so as to draw R&D out of the laboratories.

5.2.12   The trend to differentiation of software, with sectoral specialisation determined by the evolution of the technology, should be followed up in the Programme. As customer needs are differentiating, standard packages cannot cope. With adequate attention paid to systems integration, which is very custom specific, the basis exists for a healthy European software industry well into the next century. If this is coupled, as the Board wishes, with determined encouragement from the Programme to enhance marketing skills and to orient product design more to satisfy export markets, European software has the potential to become a dominant player in global IT.

> o   ***boost the marketing capability of European software producers and their export orientation***
> o   ***build on applications software and customisation***

5.3   Applications

5.3.1   Applications are an area of expanding importance for Europe. There is already considerable market activity, with high value added and a growing employment base. The potential for European IT applications to find global markets is real and the Board believes that the opportunities should be explored with determination. Europe has consolidated strengths, but these are not enough: through the Programme, European IT must build on niches, not be confined to them. Applications should aim for the widest scope. Particular European needs can still be met even with a global focus. For example, applications deriving from needs expressed by the Information Society have relevance beyond the specific Union context; the future global marketing of them should be an integral part of the effort.

5.3.2   There are a range of crucial issues to be found under the Applications heading. As noted in the Board's recommendation to establish a programme format based on macro domains (section 4.1.7), while both microelectronics and software are enablers for IT in Europe, Applications are over-arching and all pervasive. It is in the applications area that visible impact can be made across the whole of the economy and it is here that the most direct contribution can be made to the Union's competitiveness. In view of its importance, there is a vital need now to consider structures that are fully appropriate to the applications area. These structures should facilitate and indeed accelerate the introduction and diffusion of IT best practice in all sectors, and prepare them for ever more innovatory solutions. Structures derived from long experience in the management of collaborative international R&D might not be entirely suitable for a diffuse effort in applications. What could be true for structures may be even more so for procedures, which the Board feels may have to be rigorously re-examined to ensure that they match what is needed in the Applications area.

5.3.3   Much of what the Board argues under Applications builds upon the trends already emerging in the operation of the new IT Programme. Experience so far is encouraging. The enhanced user focus, an essential component if the applications area is to flourish, appears to be working well. A balance is being maintained between the often still ill-defined requests from users and the better defined technology-push proposals. This is already not as easy as it might seem.

5.3.4   As noted in section 3.2, the Board recognises the difficulty in involving users in IT development, even in applications. Many user companies, and in particular the small and medium sized ones, will find it hard to express potential needs or requirements, given their lack of awareness of the range and scale of solutions IT can now offer. In fact, one useful sideline of the Programme's new focus may be to counter the natural preference of users for well tried solutions, rather than innovation. Not all companies wish to be technology leaders, nor are they capable - financially or organisationally - of sustaining such a role. For these companies, the possibility of developing advanced solutions together with a technology supplier may be less attractive than an off the shelf, shrink wrapped package, more or less adapted to fit their current requirements. A preference to satisfy present demand through existing commercially available IT solutions - rather than to explore the potential of the technology to generate new demand which can be satisfied through advanced applications - may complicate a strategy based on user involvement. The educational and promotional aspects of the Applications area of the new Programme thus acquire real importance.

5.3.5   The Board supports the view that the significance of the applications area points to a new orientation in the overall balance of the Union's IT effort, implying a reshuffling of resources. This could mean a relatively more compact technology effort to give adequate space for a large applications area. The additional resources which the Board believes the information technologies merit in the Framework Programme should find their way primarily to Applications. As noted, the technology effort would have strong long term research and a twin focus on the enabling technologies in microelectronics and software. The Programme's user orientation would find its fullest expression in a cross-sector, interdisciplinary and inter-directorate, applications research effort. In this, it is the demand coming from the user sectors which determines the input of the different technologies. That is, the Applications area should be solutions-driven, addressing problems and responding to customer needs, rather than developing technologies and then looking around for ways to apply them.

5.3.6   The outlines of the shift to a solutions-driven focus are emerging in the passage from Esprit III to the new IT Programme. The strategic co-ordination and integrated management that is required constitutes a real challenge, and one which the Board is confident is being fully met. The general administrative aspects of an area characterised by shorter response times and a need for considerable agility and flexibility will, however, have to be monitored carefully, given the strains and rigidities all too apparent throughout the Framework Programme.

5.3.7 Applications could be potentially all encompassing. The themes centre on the application of IT to the economy's needs - as expressed by specific companies in manufacturing or services - rather than development of IT technologies through R&D. There is already considerable work done in the Framework Programme and elsewhere in the Commission in support of IT applications to particular sectors. This takes place in DGs III, VII, XII, XIII and XVII, but also further afield. The Board recommends that, as far as possible, this work be linked through to the Applications macro domain in the new IT Programme, acting as a co-ordinating mechanism. The Board is not issuing a call to centralise the entire effort inside the new IT Programme in DG III. It wishes to place the various elements in the context of a Union effort co-ordinated from DG III to expand the uses and applications of IT across the whole economic and social fabric. Thus, for example, the application of IT to the fields of health care, education and training, transport, are all important market sectors with global commercial potential. They should be co-ordinated and interfaced with synergic IT applications in manufacturing, the services and business processes in the IT Programme. The aim would be to reduce confusion outside the Commission and to enhance efficiency within it. Strategic co-ordination of the work in IT applications would also eliminate overlaps which arise between and within the various programmes and directorates general.

5.3.8 Experience gained in the extended effort in Applications can then feed back to refine and orientate activities in the two enabling macro domains. The Board sees Applications as a macro domain generating submacro domains providing across the board, multi-sectoral, linkages in prioritised themes and objectives. These could cover sectoral applications, functional applications and business applications in a configuration permitting the programme to target and tackle the priority topics for the Union over the coming decade. Many of these targets will be related to competitiveness and to achieving sustainable economic growth. A growing economy will provide employment opportunities in Europe. Some will be industry specific, dealing with product quality, design, production, the management of systems. Others will relate to the underpinning ancillary aspects of competitiveness - infrastructure, communications, transport, energy.

5.3.9 The targets are not, however, exclusively industrial. IT touches on all aspects of everyday life. Directing attention also to non-economic sectors is in line with the fact that the social dimension of the Union's R&D effort has always been a significant element in it. This is especially important in this area, as IT can impact so strongly on such sectors that they actually become generators of economic activity in their own right. Just one example of this effect is the art gallery which commercialises images from its collection on CD-ROM. Building and serving the Information Society is an instance of socio-economic demand, as are multimedia applications ranging over fields such as education, electronic commerce, teleworking, and so on. There is also IT in the service of the environment and Europe's cultural heritage. The scale of the Union's commitment to agriculture and the rural economy is often a matter for comment: developing IT applications of utility to this sector could amplify the impact of current policies as well as possibly lead to ways to achieve the Union's objectives with a more rational allocation of resources. It should be specifically targeted. Advanced IT

applications can also radically improve the individual citizen's interface with public administrations. They can simplify access to information in the public domain and inform the citizen about his or her rights and the public services that are available. They can speed up the public sector response to the individual's needs. IT can raise efficiency, while being at the same time more user-friendly - and more cost effective.

5.3.10   A special focus should be placed on networking. The rapid diffusion of networked services and the INTERNET in the United States has yet to find a parallel here. It is urgent that we remedy this before the lag becomes accepted as another part of the European landscape. For Europe, the effort required ranges from building the net, to managing it; liberalising services to commercialisation of those services. The IT Programme has an integrating and enabling role that can be maximised in concert with other Union programmes and policies. The networked society, and at this stage above all exploitation of the market possibilities of the INTERNET and the development and commercialisation of interactive services, is thus to be seen as an important target area for the Union effort in information and communications technologies. It could hold the key to generation of employment through introduction of the Information Society.

5.3.11   Throughout, the effort in Applications involves Best Practice, a strong commitment to dissemination and diffusion, a search for alliances at national level to propagate and popularise IT applications, awareness of what is happening outside the Union and a readiness to emulate it. A programme objective should be to unleash the energy and creativity inherent in many IT applications across the Union. The Board argues that IT applications will be one of the keys to restoring vigour to the European economy. It believes, however, that in all the Applications areas liberalisation of demand, further loosening up the regulatory framework which still governs networks and services, and more competition to bring down prices and lower tariffs, are required if IT applications are to create the number of jobs they potentially could in Europe. This is a matter for Union policy outside the Framework Programme. Meanwhile, the new Programme should position itself now to take advantage of these long overdue changes. Once achieved, they will again alter the context in which the IT Programme operates.

> o   *build on niches, not be confined to them*
>
> o   *more resources for IT to give a boost to solutions-driven, cross sector, interdisciplinary Applications*
>
> o   *co-ordinate from DG III the dispersed Union effort in uses and applications of IT*
>
> o   *target competitiveness, socio-economic demand, agriculture, public administration - and networking*

SECTION SIX: FINDINGS - MANAGEMENT AND ADMINISTRATION

6.1   Contentious issues - payments and reporting

6.1.1   Payments and reporting proved thorns in the side of Esprit III and they will inevitably undermine satisfaction and diminish confidence in the new IT Programme unless they can be tackled root and branch. The gravity of this pathology affects the whole Framework Programme, not just Esprit. It has perhaps not been apparent to the College of Commissioners. Any effective and lasting solution demands an exercise of political will and consensus for reform which involves not only the College, but also the European Parliament and the Council. The issues are sensitive on many fronts, but they must be faced with determination if the Union really intends to support industrially-relevant research, with its time scales and risks. The process of consensus building at the political level has to start now; the Board feels obliged to warn that, on the evidence it has seen, remedial action must be undertaken even before Framework Programme V.

6.1.2   Today's actual cost accounting system creates mountains of paperwork and excessive administrative costs. It is estimated that a move to budgeted costs or deliverable-based costs could generate several percentage point savings, substantially reducing the Programme's administrative overheads. More flexible financial arrangements, especially for smaller sums, may not pass the detailed procedures of Financial Services in DG XX. Moreover, the time-consuming complexity of the system does not spare the Commission itself. Several companies, not only SMEs, have had their overall annual budgets - and business plans - unfairly cast into disarray by Commission demands for repayment following recalculations made several years later. Nor are research institutes immune from this problem.

6.1.3   With regard to payments to experts used in Esprit (as invited evaluators, reviewers, consultants, etc., or employed on temporary task assignment contracts), in today's world of electronic accounting it is inadmissible that the Commission does not provide detailed payment statements when disbursements are made, so that a trace exists of where the experts stand financially. This is standard banking practice. An anachronism affecting the whole Commission environment and its relationship to outside advisors, it is actually quite a simple defect to remedy.

6.1.4   In terms of reporting obligations, here again much seems inherited from previous Esprit Programmes dominated by fewer large participants and fewer, larger, projects. Reporting has become a near-constant exercise, absorbing a disproportionately high portion of resources for both Commission and consortia services. For small projects, and for SMEs, the general cost of administration is a considerable problem, discouraging participation. There does not seem to have been enough improvement so far under the new Programme. Review meetings, in particular, add to travel time and costs. It is paradoxical that a programme in IT does not take the lead in use of the electronic communications systems which are now becoming generally available. The Board argues that greater use should be made of teleconferencing. When meetings are necessary, they

should be held more often at a site where work is actually done, and not only in Brussels. Furthermore, the constant reporting to the Commission should be cut to the essential. Only the co-ordinator should be required to refer back to the project officer, unless there is a specific need for a full consortium meeting.

6.1.5   Underscoring again that these issues bedevil the whole Framework Programme, the Board notes with regret the unanimity of criticism across Europe in this regard. The consequences are sometimes disturbing, with actual cases of failure and bankruptcy among participants ascribed directly to Commission procedures. The conclusion is inevitable: despite all that is written, and management good intentions notwithstanding, with the current administrative procedures Esprit, like other programmes, has problems so grave as to be practically ill-suited for instance for SME participation.

6.1.6   Prime responsibility for this truly unacceptable situation rests with the demands and formalities of the financial and legal services of the Commission. There is an incapacity, or unwillingness, to overcome self-imposed bureaucratic hurdles which is vitiating a crucial element in the Union's research policy and, moreover, in the process hampering European attempts to regain global competitiveness. In its hearings with the Services, the Board has learned that this preoccupation is shared by staff also in DG XII and DG XIII.

6.1.7   Above all small companies are particularly susceptible to cash flow problems and can be seriously damaged by late payment. The present already unacceptable delays inside the Commission can then be compounded by further bureaucratic procedures after money has left EC accounts. Six to nine months, and even more, elapse before any cash actually gets into the hands of participants. The Board fails to see why the Commission should be immune from interest on this debt, particularly as it levies it on delayed incoming payments. The Board recommends recognising Commission liability for interest in the same way, and on the same conditions, as it demands of its suppliers: at commercial rates, after any delay exceeding sixty days from the due date of payment in the case of cost statements, with interest calculated from that due date. Liability would commence five days after contract signature in the case of advance payments. Besides being a demonstration of equity, an obligation to pay interest would hopefully oblige internal reform of procedures.

6.1.8   The Board further recommends, as an immediate action, in technology development and applications projects whose targets can be well defined *ad initio,* to move away from the actual cost accounting system to a cost system based on deliverables. These deliverables should be subject to on-going review so as not to constitute a straight jacket for research. Modification of deliverables, their content and timing, should be allowed for in procedures. In areas of particularly innovatory, exploratory research, in which it is not possible to identify what is a realistic deliverable, a 'give it a try' philosophy is needed: here the Board acknowledges that greater flexibility in accounting is essential.

6.1.9   The Board recommends that reforms taking place throughout corporate structures in Europe and outside, as well as in certain Member State administrations, to downsize central financial departments and increase the accounting responsibilities of the operational units, should be adopted where possible by the

Commission. Thus, to boost both accountability and efficiency in resource allocation and use, the Board recommends that financial and related controls be decentralised to the programme management teams, with payment on signature of the project officer, leaving only financial policy matters to be handled by a small central Commission team in Financial Services. Monitoring of the progress of these reforms should be designed so as to ensure that no compensatory rise in bureaucracy takes place as a response elsewhere in the system. Given the depth of dissatisfaction, and the impact, the Board also favours increasing recourse to outsourcing operational management tasks, including and even especially the payments systems, wherever it is feasible and cost effective. Savings for the Commission budget would be very considerable indeed.

> ○ *pay interest on delayed payments*
> ○ *in technology development and application projects, move to a cost system based on deliverables*
> ○ *decentralise financial control to programme management teams*
> ○ *increase outsourcing of operational management tasks*

6.2   Other aspects of financial and legal matters: contracts and IPR

6.2.1   The Board is concerned that also in the area of legal matters changes required as a result of the evolution of the Programme have not been carried through with sufficient thoroughness. It is apparent that the legal basis upon which the Programme is founded has not evolved with its aims, objectives and ambitions. There has been an accretion of new requirements, new conditions, new criteria, without any radical rethinking of whether, given the new context, the existing set cannot be replaced. Besides intellectual property rights (IPR) issues, the Board is also aware of the continued emphasis on liability issues in consortium agreements, when the prime concern now should be with commercial uptake, as well as of contractual insistence on formalities such as rigid milestones and paper deliverables which can hamper substantial redirection of projects to follow more promising new paths.

6.2.2   A particular word must be dedicated to the case of consortia which find funding blocked because the co-ordinator has gone bankrupt. The Board recommends that the Commission establish a small contingency fund rapidly to intervene to assist unlucky participants caught in such a situation so as to allow the project to proceed.

6.2.3   Given the scale of the problems - and the size of the Programme - the Board recommends that a joint Standing Group be set up at a senior level comprising Programme management, Financial Services and Legal Services in order to iron out difficulties as they arise and undertake drastic simplification of financial and legal matters affecting Esprit. As a matter of urgency, this should be entrusted *inter alia* with excogitating the way to implement the Board's recommendations affecting these Services. Specifically, to introduce payment by deliverables, to improve the payments system, to finance the bankruptcy contingency fund, to outsource operational management, to permit disbursements on the single signature of project officers. The Standing

Group should also examine procedural matters relating to possible Esprit action to broaden the availability of venture capital to participants. Consideration should be given by the Standing Group to a new legal basis for the Programme, eliminating all those elements which derive from the pre-competitive past of Community research policy, replacing them with new forms better able to push results through into Europe's firms.

6.2.4   The Board stresses that all the above reforms should take place independently of efforts - much needed, in its view - to revise the bases of the Framework Programme proper. Full revision of Framework Programme mechanisms and objectives, including the policy issues behind restructuring of the Framework Programme itself, needs to be tackled jointly by Council and Parliament, with a wide ranging debate preceding a Commission proposal.

6.2.5   Turning now specifically to the area of IPR, the Programme's shift closer to the market has generated new problems with regard to contracts. Fundamentally this is because, if Esprit results are to have the competitive market impact now desired, they have to be confidential to their originators. Difficulties in IPR arise with user-supplier relationships in a project in which, fearing market repercussions, a supplier may not wish to give the user participants IPR over what is being jointly developed. They also arise in big company-SME relationships, in which the latter sometimes feel themselves disadvantaged in the assignation of IPR. Here there is need for Commission assistance. On another front, the corporate desire to obtain IPR protection for Esprit work can come up against the cultural barrier of academia's drive for early publication of results. Furthermore, the rapidity of market shifts and technological change in IT means that it is vital to get a return on a product from the market on a time scale that can be even faster than obtaining patent protection. Unless this can already be put in place during development, it could end up being superfluous. Overall, therefore, greater emphasis on exploitation of results means that achieving an equitable division of IPR and other related issues assume more importance. In some countries, notably Spain, additional difficulties arise as a result of national legislation and practice.

6.2.6   IPR is a very important area also in terms of maximising Union return from previous Esprit work. Liaison with past activity often seems weak. The Board recommends that IPR-mining be encouraged in order to unlock whatever valuable IPR is contained in past IT projects. It also recommends a concerted effort to update the Programme's data bases and sources of statistical information. The Board has encountered a significant lack of domain and market statistical data, with the partial exception of microelectronics, during the course of the evaluation. Some data are available in different services in the Commission but there is no easy access and no shared definition of terms or categories to facilitate comparison. In particular, and despite the huge number of EC publications, coherent information on IT sectors in Esprit, on European trends in investment, markets, employment and on company size (especially the scale of the SME presence) has been impossible to obtain. Hard data about the IT industry and its impact on economies is either American or Japanese. All too symptomatic of Europe's inability to grasp the strategic importance of IT, the data gaps must be filled.

6.2.7   In contract negotiation, the importance of the initial phase of contract drafting cannot be over-estimated. Many problems can arise downstream from imprecision here, not least in division of IPR and exploitation. The operational guidelines should be improved as currently they can generate constraints rather than certainties. The Programme management should not forget that, especially but not only for SMEs, the complexity of procedures, inevitably augmented by difficulties of language, can present an almost insurmountable obstacle to participation as well as, subsequently, greatly increase the effort required to fulfil commitments.

6.2.8   The centrality of an effective business plan for exploitation in proposals is a good departure, though this cannot be applied too rigorously in areas which, by their nature, are farther from the market such as LTR. Consortium agreements can be a bone of contention, and here there is room to explore whether more assistance could not be given both in definition and interpretation, should problems subsequently arise. Flexibility should be the key word. This is especially the case during the early stages of a proposal, covering the submission proper and the technical annex, when market perceptions can change quite fast. The existence of an agreed technical annex must not in fact condemn partners to undertake work no longer demanded by the market. More rapid renegotiation procedures are required. The consortia themselves need to be flexible in their internal arrangements, accelerating their response times especially during the preparation and amendment of technical annexes. The Board notes that further simplification of the R&D contract is under consideration, especially for IPR aspects closer to the market. It is aware that over-simplification could prove counter-productive, by lessening protection or by seeming to favour the point of view of one or other category of participant. While shared-cost contracts may be better placed, for the others there is still work to be done and the Board urges that this be undertaken expeditiously.

> *o*   *establish a bankruptcy contingency fund*
> *o*   *create a cross-service (standing) group to simplify financial and legal matters*
> *o*   *encourage IPR mining*
> *o*   *update statistics, programme data bases and information services*

6.3   The partners

6.3.1   The essence of partnerships is that they be mutually supportive and complementary. Furthermore, it is generally agreed that partnerships, to be effective, must be small. With high numbers, experience shows that overheads increase and management becomes difficult. Community competition policy states that, as a minimum, European funded research requires a collaborative basis between two partners in more than one Member State. It does not demand more than that, let alone geographical balance in individual projects as the Commission sometimes seems to believe. A reduction has been achieved and the trend is downward, but there is still an average number of six or more partners. This is probably due to the imposition of other objectives: not efficiency, not competitiveness. The Board fears that, as the number of Member States increases, so most

likely does the *number of partners* in the individual projects - rather than, as it should be, the *number of projects*. Noting the many previous calls for smaller numbers of participants in projects, the Board calls for a radical departure.

6.3.2   In the new Programme, the Board would like to see a more selective choice of partners than in Esprit III, demonstrating clear communality of interest to generate synergy, together with a narrower focus for projects. It would like the new Programme to develop a more industrially accountable partnership system. This could, for instance, envisage a single paid co-ordinator flanked by one or more industrial contractors. In this scenario, non-industrial partners - the universities, research institutes, but also smaller companies unable to act as full contractors - could then act as sub-contractors to a prime mover better able to focus their inputs, their timing and payment, and handle IPR issues. Only the few actual contractors need attend project meetings and liaise with the Commission Services, a big saving for everyone in travel time and associated costs. Again, as elsewhere in the Programme administration, greater use should be made of electronic communications. The aim of any change must be simultaneously to reduce the administrative overhead and the burden on project officers, to speed up payments to the smaller partners, to provide an industrial driving force for projects going beyond research into exploitation.

6.3.3   Partnerships are also most efficient when the relationship between members is complementary, rather than competitive and overlapping, vertical rather than horizontal. The Programme now seeks to be active along the whole technology chain and there is an increasing preference for vertical co-operation to take an idea from development to application. In a positive change from earlier programmes, in Esprit III and the new IT Programme more than 70% of partnerships are now vertical and the Board recommends continuation of selection of projects with either vertical or complementary structures.

6.3.4   Where this preference for vertical partnerships leads to difficult choices between excellent proposers active in similar areas of the same field, the Board recommends abolishing the rule which limits Community-support in any given area of activity to just one project. If we really believe that it is the market which in the end picks the winners, it is surely better for Europe to have several competing offerings available than just one. In the Board's view, competition is also essential in all challenging and highly dynamic areas where ideas and differences in approach can be critical to success. Moreover, competition between projects working in parallel in an area of importance for Europe should prove healthy, especially as breakthroughs achieved by one project automatically imply rediscussion of the future of the other. This is a better corrective to unnecessary duplication than the present arm-twisting to bring about mergers. Some examples of competing projects already exist in LTR. The practice should be extended, where appropriate, to the rest of the Programme.

> o   *smaller numbers of partners per project*
> o   *more focused consortia*
> o   *fund competing projects*

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6.4   Proposal Evaluation

6.4.1   The generally high quality of evaluation upon which the Programme rests should not blind us to the fact that some problems exist and that these are set to become worse unless significant changes are implemented. Notice is often too short for the evaluators to make their arrangements. In Esprit III, the process took two weeks. While it may be possible for some academics and researchers to be available for such a period, for many senior experts a long spell as an evaluator is difficult to organise. It is moreover extremely improbable that an active industrialist can dedicate this amount of time. Evaluation can end up without the full benefit of industrial input. This might explain some decisions reported to the Board, in which industrial logic would suggest a positive response to a proposal and yet the evaluators applied other priorities leading to rejection. More frequent calls in the new Programme could ease some of these problems. Nevertheless, with more and more small projects, the evaluation load is increasing and the pool of competent and impartial people available to the Programme may not be enough. Quality could suffer, along with consistency and coherence. The problem is already acute in narrow niche areas, in which Europe is insufficiently represented and human resources scarce.

6.4.2   For the new IT Programme, the Board favours the adoption of more streamlined and decentralised procedures in evaluation, including greater use of teleconferencing to reduce travelling and facilitate an active industrial presence. Preparatory and ancillary work should be outsourced wherever possible, a practice adopted in several Directorates General. Rather than being an added on task for the Services, an Esprit management team specifically charged with the actual co-ordination of proposal evaluation might be considered.

6.4.3   If the cost statement system is retained, the Board recommends that proposals be assessed also on value for money terms. Equivalent work of the same standard can cost significantly less in certain parts of the Union than in others. This comparative advantage, often in favour of countries of the periphery as well as those with more efficient research systems, should not be unfairly eliminated. It can act as a spur to the expansion of efficient R&D support structures. For Esprit, the savings made can then be applied to fund other work. Also for this reason, the Board has considered recommendation of a flat labour rate, in view of the criticism levelled in many European countries at the assigned rate system of today. Participants wishing to receive a rate higher than the flat rate might then, for example, be asked to provide the relative documentary support justifying their request, to be assessed at the time of evaluation. Meanwhile, all others would automatically receive the flat labour rate. It therefore here recommends the Commission to set up an in-depth analysis of the pros and cons of these two alternatives.

6.4.4   After the evaluation process proper, decisions reached by the evaluators are sometimes called into question following pressure by interested parties. The management committee and ITC may find it impossible to resist this pressure. Many proposers fear proposals are retrieved. Total funding then becomes insufficient and good proposals may be cut down, modified, even merged. Yet a proposal evaluated as good at the

requested funding may not be worth undertaking at a reduced level. The Board is aware of the concern and believes that it is mostly greater transparency that is required. Esprit's fair and impartial evaluation criteria just need to be seen to govern all aspects of the selection process.

> o *value for money criteria in proposal evaluation*
> o *analyse the merits of moving to a flat labour rate from today's assigned rates in cost statements*

6.5   The flow of information

6.5.1   Though the initial availability of information about Esprit is generally good, many participants report they encounter subsequent difficulties in accessing specific information. In a recurrent complaint, it is said that the information flow is good until one gets to the practical level - for instance, exactly how to fill out a cost statement - when the system fails to provide adequately detailed support. Participants often end up in the frustrating position of not appreciating whether they just don't understand, or whether crucial information is lacking. This seems to affect all stages of the Programme, from proposal submission to reporting, from payments to partner selection, etc.. The Services realise that participants can feel daunted by the various levels of bureaucracy and need a guiding hand. The Board hopes that they can have more time to extend this.

6.5.2   If for successful proposals the project officers do their best, even though they are seriously over worked, a special word must be reserved for proposals which are rejected. There are too many complaints about the scanty information given at rejection. A lot of effort is required for a submission and not knowing what went wrong is particularly galling for those who reached the final stages. Furthermore, by being left in the dark, no learning process can result from failure. Today's standard letters should be replaced by a more personalised contact: a member of the services charged to communicate the results of the evaluation and able to pass on requests from failed proposers for additional information and possible feed-back.

6.5.3   Information flow could also be speeded by an extended use of electronic forms and e-mail, building on the experience of other Union-sponsored programmes. This experience needs to be fully evaluated in order to improve procedures to avoid some of the dissatisfaction reported elsewhere. An electronic Esprit Forum also designed to facilitate informal contacts should be considered, perhaps with systematic use of the INTERNET. Finally, as noted in section 3.4.6, CORDIS should be further improved.

> o *faster feed back to proposers*
> o *better information to rejected proposers*
> o *greater use of electronic forms and the INTERNET*

6.6.1   In strategic thinking, Esprit overall shows great open-mindedness coupled with a good international perspective. There appears not to be strategic areas in IT that, somewhere, in some form, are not covered in the Programme, without dispersion of resources. Esprit's limitations, in the Board's view, are due to the rules of the game of any international collaborative programme, and to its funding levels, not to the quality of its strategic management.

6.6.2   The need for agreed rules of procedure is a prerequisite for transparency in any operation as complex as Esprit. The Board recommends that Esprit management exercise still greater flexibility in the new Programme, for instance in the redistribution of funds between areas and units, without which the response to changes in demand from participants, to shifts in the market, to developments in technology, can be hampered. This was a problem especially in Esprit III. In the fast moving world of IT, shifts in technology in particular can be rapid and unexpected. OMI and Home Systems are examples where lower numbers of applicants have not been taken into account in a reallocation of resources; in LTR, higher numbers suffer the same fate. Flexibility is not of course merely a matter of shifting financial allocations. In facing the challenge of IT, there is also need for operational flexibility.

6.6.3   In terms of operational flexibility, further improvements are required. In the move out of DG XIII decided in 1993 into DG III, a Directorate General historically mainly concerned with regulation, accommodating Esprit (a future-oriented programme which accounts for 75% of the DG's budget) was recognised as a challenge. In vastly increasing its responsibilities, Esprit changed the hitherto control-oriented character of DG III. Today, with the Directorate General strongly promoting industrial competitiveness, the strategic value of this internationally recognised IT programme, and in fact Esprit's centrality to all the Directorate's responsibilities, will enable DG III better to explore the expanding opportunities for synergies among relevant activities and policies.

6.6.4   All in all, then, Esprit administration has to undergo a drastic exercise in simplification. Over time, it has become too complex. Necessarily dependent on procedures and formalities in order to allow it to work, the risks is of becoming too bureaucratic. The problem is especially serious for new entrants, who can easily find themselves lost. This gives an in-built advantage to the 'regulars'. They have personal contacts and can use them as guides through the system. The present complexity is not the fault of the Programme management, nor does it benefit them. They have as much to gain as the participants in trying to bring about change. These first phases of the new Programme offer an opportunity that must be seized.

> *о*   *greater flexibility in funding reallocations*
>
> *о*   *greater strategic and operational flexibility*
>
> *о*   *simplify administration*

SECTION SEVEN: ESPRIT RESPONSES TO TRENDS IN THE IT INDUSTRY

7.1   The challenge of integration

7.1.1   The implications of global changes in the IT industry on Esprit are significant. Traditionally, the Programme's efforts have been focused on individual technologies and specific solutions, though often under a thematic focus. So far, there has been little complete system design, despite the fact that much of the value-added of the future will be in the mortar binding the bricks, not just in the bricks themselves.

7.1.2   In the Board's view, one focus of Esprit's attention should reflect this change and look forward to Europe's requirements in complete system design, the array of technologies relating to it, and the complexity of integration of systems and interconnectivity. Based on major advances in microelectronics, this implies quantum leaps in software complexity and speed, and in the reliability of systems. It is an effort which cannot be divorced from the users - be they public sector or private.

7.1.3   Following this logic, the institutional implications for the Programme and its contribution to the needs of Europe should be considered, in the light of Framework V and, potentially, of the Task Force approach. In large scale system design and integration, it is possible to focus on a given problem by bringing in an array of companies and academic institutions. It is already understood that a Union-sponsored effort targeting specific problem areas of Pan-European interest - strategic common good objectives for Europe - would rely on shared direction and management involving several DGs of the Commission and draw heavily on other budget lines besides those specific to R&D. By way of example, the Board refers to environmental monitoring, advanced transport systems, advanced educational software, advanced health care. The Board notes that, given the resources required, majority funding for Union sponsored problem-oriented integration will obviously have to come from the specific areas involved, not from the IT Programme, though calling upon co-ordinated Esprit technological input.

7.1.4   In the Board's view, any such effort, and the proposed solutions in IT, must not be Euro-centric. A global market exists also for problem solving on this scale of magnitude of these issues. Any Union endeavour must be oriented to placing European enterprises in a position to capture this market in its infancy.

7.1.5   In the Union's IT effort, the Board anticipates greater attention to network and to integration issues. It recommends enhanced co-ordination between projects and programmes also in order to facilitate this new focus. The WWW underpins the extraordinary success of the INTERNET, the fastest single, and most significant, development since publication of the last Esprit Review. The Board feels that more attention should be dedicated to advanced work on post-INTERNET networking issues as well as on the radically different

commercial and industrial opportunities the networked society of tomorrow will offer. Another area of opportunity - and of concern - centres on the emerging synergies between very large and powerful sectors hitherto individually more or less confined to differentiated sections of a broad, ill-defined, 'media' playing field. These include games suppliers, publishers and broadcasters, multimedia information services, content owners and distributors, advanced communications providers. WFS, the Web For Schools initiative in the new Programme, is one pointer to many areas of social demand which should be addressed. The Board also looks forward to the imminent deregulation of the telecommunications systems and markets in the Union to stimulate an outpouring of enterprise - in products and services, from large companies and small - which the Programme should aim to sustain with novel technology, software applications and solutions tailored to the new reality. This is not a matter of telecoms applications for providers, the preserve of ACTS, it is again seeding new IT markets exploiting this newly liberalised infrastructure in sectors across the whole economy. Finally, a concerted effort should be dedicated to unlocking the European potential in defence to civil dual use technologies. The European defence industry is a major world player. Its beyond the state of the art IT capability, hitherto covered by military secrecy, can now be exploited for civil uses, in line with what is happening in the United States.

7.1.6   Much of this work will be affected by developments in the field of end-user protection. This will be a key factor facilitating take-off of consumer markets. Privacy and confidentiality are crucial issues not just for the NET. They have significant ramifications throughout the Information Society and will have to be tackled internationally. The Board is confident that the IT Programme will also be adequately represented in Union and international fora negotiating protocols in this area.

<blockquote>
o   **target networking and integration issues**

o   **exploit the commercial and industrial opportunities of the networked society**

o   **explore media synergies**

o   **explore areas of social demand**

o   **take advantage of telecoms liberalisation**

o   **exploit dual use technologies**
</blockquote>

7.2   *Industrial policy and venture capital*

7.2.1   The Union's industrial RTD programmes are moulded by the requirements of industry. Its time scales must match those of industry, respecting the accelerating innovation cycle in industrial products and processes (which are exploding with new applications across all sectors). 78% of the revenue of data processing industry comes from products which have been on the market for two years or less. Furthermore, in shifting the focus from the IT suppliers to include the IT users, the Programme has to respond to a host of potentially conflicting

demands. For instance, the time scales of the one are not necessarily the same as the other. Medium-term objectives which can serve the needs of some parts of IT can be too long for others at the leading edge. Long term research needs support, yet long term applications oriented research is up till now a concept which is proven difficult to define. Moreover, curiosity-driven research, per se, should normally be carried out by the Member States. Only when there is an industrial finality, or when a critical mass of trans-national co-operation can complement national activities, should it be carried out at the Union level. The Board stresses that the attempt to attain such critical mass cannot be a permanent exercise in a competitive industrial context: it risks becoming a pretext for subsidising research which otherwise would not be undertaken in more appropriate fora.

7.2.2   Significant importance rests, however, with the role of Esprit in nurturing IT in Europe, both in terms of technologies and companies. As noted in section 3.4.11, a major part of the programme's contribution can actually come from stimulating a change in attitude by researchers and IT entrepreneurs to risk and failure, two inevitable ingredients in an exploding market like that for the information technologies. The recommended encouragement to prefer the use of company status to handle research institute and academic participation in the Programme could help. Moreover, given the rudimentary nature of venture capital in most of the Union, the Board acknowledges that, in several cases, Esprit has provided enough funding at just the right time to ensure that work is carried on to success, or a company survives to get products to market. As section 3.4.10 points out, where a healthy venture capital market exists, there are other, more efficient, means to achieve both. In much of Europe, however, sometimes in IT the task can fall to Esprit. It is not easy to assess this aspect of Esprit. Its importance, however, further underlines the Board's concerns regarding flexibility and promptness in the handling of payments.

7.2.3   The Board nevertheless recommends the new IT Programme to fund more high risk proposals. Specifically, the hint of conservatism in selection of research topics needs to be corrected.   The need to safeguard public moneys and rigour in evaluation need not, in the Board's view, automatically translate into somewhat unimaginative choices, several examples of which can be found in Esprit III. This is especially true given that alternative sources of support to scientific creativity in Europe are drying up due to cuts in public funds for blue-sky research, the well-known risk aversion of European firms even in R&D, and the already noted lack of a Europe-wide venture capital industry to finance start-ups exploiting eventual results. The new Programme's closer consultation with industry and associations, the search for novel input sources and greater openness all point in the right direction.

7.2.4   Tangible exploitation potential is a valuable yard-stick by which to judge proposals. However, the market in advanced IT is volatile, a fact that should be borne in mind. Absolute guarantees cannot be given, especially for the more daring advances. Esprit III's evaluation system may well have stifled some of the more adventurous ideas by too restrictive an interpretation of the exploitation potential criterion. The risks exists that peer review may end up ensuring that only mainstream thinking gets funded. This should be challenged. There

is room for adventurous ideas and innovative approaches. The Board recommends that the new Programme target breakthrough concepts in IT which, if successful, could have significant market relevance. The size of the potential market, the scale and impact of the potential breakthrough, would both be considered in selection.

7.2.5   As stated in section 3.4.10, in accepting more high risks proposals and targeting breakthroughs, the Board does not expect the new Programme to get into the parallel activities which characterise venture capital. Nevertheless, it would be a valuable exercise to identify through the Programme's consultation process the fiscal and other changes, including specifically more modern legal and social attitudes to bankruptcy, that are required to free European entrepreneurship in IT. The Board suggests the Programme management should then take hard information to the relevant Services of the Commission and see what can be done. Meanwhile, it recommends closer, perhaps even more structured, links between the Programme and the European venture capitalists specialising in the IT field.

> *fund more high risk proposals*
> *target breakthrough concepts*
> *link through to Europe's venture capital community*

SECTION EIGHT: TOWARD THE FUTURE

8.1   The case for an ICT Programme

8.1.1   It was the Dekker Report which recommended in 1993 that the programmes in information and communications technologies be moved under the wing of the Directorate General for Industry. The recommendation was only partially adopted as RTD in telecommunications remains in a separate DG. The Report argued that the importance of information and communications technologies (ICT) for the strategic future and competitiveness of European industry was such that the move was inevitable. Introduction of advanced information and communications technologies across the Union is estimated to add 3.5% to GDP growth between now and 2010, generating directly and indirectly six million new jobs. In supporting this logic, this Review Board regrets the separation between IT and advanced communications technologies in the present structure of the Framework Programme.

8.1.2   Convergence between the technologies underpinning the Esprit, ACTS and Telematics Programmes is proceeding rapidly and there are increasing areas of application in which demarcation is virtually impossible. Multimedia is perhaps the most obvious of these. Relations between these programmes are generally good, though there is a lack of clear co-ordination between Directorates General. There is some liaison and joint calls are being experimented with in order to reduce a degree of overlap which is readily acknowledged. To handle difficulties that have emerged, there are now transversal proposals across the programmes, with some pooling of resources and limited joint management. The programmes do, of course, serve different user markets: private sector markets dominate both Esprit and ACTS, procurement markets Telematics (which leads to questions as to why, the way the programme is currently conceived, the Community research budget should be the latter's source of funds). Moreover, the fact that Esprit in DG III and ACTS and Telematics in DG XIII are both under the same Commissioner is regarded by the Board as a major advantage, not to be lost in any hypothetical reorganisation.

8.1.3   Difficulties, however, do arise from the fact that there are different specific programmes and different eligibility criteria. This makes it significantly harder for proposers to apply. It encourages shopping around, by which proposals rejected in one programme are summarily rewritten in order to be submitted to another. A lack of consistency in evaluation criteria across the programmes is evident. One part of a co-ordinated proposal can be rejected by one side while the complementary research is accepted by the other. There are also cases of valid cross-sector proposals being rejected by both sides for lack of a comprehensive vision of the issues. Joint calls and joint management of projects involving, for instance, two programmes require two different teams administering moneys and dealing with contracts, as formally the programmes are distinct legal entities and are

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financially individually accountable, each via their own procedures. Besides overlaps, there may also be areas which fail between the stools or which end up being only partially covered - a bit in one, a bit in another. An example cited here is the smart card, in which Europe has had a lead. The public sector data aspects of work on smart cards (health, taxation, social security, etc.) is ACTS and Telematics, the commercially vital financial data (credit and charge card, banking) in Esprit. Meanwhile, the lead is evaporating. Thus, more adequate mechanisms must be found to ensure better ongoing communication between the two.

8.1.4   The Esprit Review Board has no brief to discuss the future of either ACTS or Telematics. Nevertheless, it does argue that these three programmes should be seen as a coherent whole. Today's *de facto* convergence may not be enough. The Board therefore recommends that the legal distinction between them be ended. The need is to develop a programme "umbrella" serving as a strategic integration platform matching the various Union efforts. Whether reform should then be extended to include combining them into a single mega-programme in information and communications technologies - with the political disadvantage that this might imply during negotiations in Council - or placing them into some kind of single allocations envelope to facilitate reshuffling of moneys, is a matter to be decided in the run-up to future Framework Programmes.

8.1.5   Should the Board's recommendation to establish a single programme umbrella for Esprit, ACTS and Telematics be accepted, the results of the manufacturing oriented parts of Esprit - and of the other programmes, ACTS and Telematics - should be passed on for development in IMT, as part of the ongoing interchange between the programmes noted in sections 4.1.8-10.

8.1.6   To sum up, the Board's recommendation for the strategic future of the Union's effort in information technologies, therefore, envisages a single programme umbrella linking today's Esprit, ACTS and Telematics, with development of results in the manufacturing area taking place in IMT. It would rest on a common base of three domains: Long Term Research, Training, Diffusion and Dissemination of Results. The shared underpinning areas would be the recommended macro domains, Microelectronics, Software Technologies and targeted Applications (see section 4.1.7). All three current programmes would gain from this linkage. The information technologies effort proper would benefit from an enlarged customer and user base, and a broader social focus. The Union effort in telecommunications in Telematics would be synergetically enhanced through software and hardware developments in Esprit. Likewise, the present ACTS and its diverse applications in the environment, health, transport, etc. would be enhanced by Esprit and Telematics domains to generate unified Applications. The Applications would build on structural concepts deriving from overarching applications-oriented domains pioneered in TBP and CIME (IiM). The whole umbrella would take as a point of departure effective implementation of the Information Society. In this, it would link through to economic and social studies on the use of IT to stimulate competitiveness and employment in Europe. For the Commission, significant administrative benefits are anticipated, with sizeable savings in overheads, by minimising overlaps and speeding up procedures. For participants, and the wider economy, the advantages should be very plain,

with a more coherent programme umbrella to ensure that the convergences taking place in the real world find full expression in the Union's strategic effort with faster, slimmer, procedures bringing this effort closer to its target customers.

end the separation between IT and communications technologies.

8.2   Out of the mainstream - new ideas and approaches

8.2.1   Besides the call to accept more high risk proposals and target breakthroughs in section 7.2, the Board would like to address the upstream issue of more creative thinking in information technologies, and how to foster it. Imaginative ideas in fast moving areas of IT should not be excluded from consideration by the new Programmes because they are still only partially formed. Current procedures necessarily make it difficult for one-shot, even odd-ball, ideas of great originality to survive the selection process. The Board would like to see a special track - limited in scale and specific in scope - dedicated to such ideas.

8.2.2   Already it is clear that the speed of advance in IT is such that Esprit III's average one year lag between submission of a proposal and initial contract is far too long. For the highly creative concepts that the Board would like the new Programme also to explore, it is obviously unacceptable. A way must be found promptly to assist researchers to follow up novel ideas showing real originality, and perfect them for fast track submission, without having to undergo the lengthy formalities required for normal participation - let alone having to share them with others at a stage still unprotected from imitation. In its thinking here, the Board draws upon and extends the 'open' scheme of the LTR domain of the IT Programme and the continuous Accompanying Measures already in use.

8.2.3   Without prejudice to the overall equilibrium established between a user/applications general thrust and a supporting LTR role, the Board proposes an open guichet for bright new ideas at a stage in their development requiring initial support and testing. The money required to finance this essentially preparatory work is likely to be small, the time scale short and results quickly visible, thus permitting innovation in management. For success of the new ideas scheme, the Board envisages greatly simplified procedures and full flexibility in allocation, without imposition of any administrative overhead on the originator. The Board recommends that, say, five million ECU per year be set aside to a special fund to be drawn down by the Directorate for such a purpose. Following rapid in-house evaluation assisted by outside expert advice as necessary, allocations would have a duration of three to six months, up-front payment by single instalment of the small sums intended. Applications for this seed funding of new ideas needs to be by open guichet, across the whole of the IT spectrum.

8.2.4   In this recommendation, the Board aims to succour truly innovative ideas when they are at the stage requiring fleshing out before they can even be presented as full proposals. For this reason, the Board expects single applicants to be funded for the elaboration of an idea, implementation of which would then require co-operation at the European level. Fleshing out could thus count as the first step in the two-step evaluation process for a proposal, assisting in partner selection and further accelerating the passage from idea to invention, from invention to innovation - and on to growth.

o   *establish a special/speedy mechanism for the seed funding of new ideas*

8.3   An industrial or a research programme? The Social Dimension

8.3.1   In the present phase of the IT Programme, and looking forward to Framework V, it becomes essential to focus still further the objectives and scope of the Programme on industrial targets and the coming Information Society. Accepting the mandate that the Union's RTD policy must frame and implement also other Union policies, the Board believes that the effort in IT should be judged explicitly in the context of just two of these: namely, competitiveness of European industry and employment. Its impact on the others should be beneficial, but not determinant for the Programme's organisation or management, nor for establishing criteria for its evaluation.

8.3.2   The Board thus argues that, for example, in raising the quality of life of Europe's citizens and improving environmental quality, the Programme's contribution comes from the clean technologies a healthy and expanding European IT sector as a whole will generate - not directly, however, financed by Esprit itself. New environmental technologies will perforce rely heavily on IT. The same can be said of the Esprit added-value to sectors such as energy and transport, where new, resource-saving and clean technologies are all IT dependent.

8.3.3   Esprit is not a regional aid programme. It can best aid cohesion by acting in alliance with investment from the Structural Funds to finance the commercial exploitation of results generated by peripheral country participation. The Board is aware that for lately industrialising countries in the periphery, Esprit performs a highly appreciated function in generating knowledge and expertise. However, positive outcome from Esprit participation, including improved R&D infrastructure and human resource development, all too often withers on the vine for lack of commercial expression. This is a waste of resources. Trying to achieve competitiveness and cohesion through an effort in research is an uneconomic use of resources, especially in countries in which the underlying conditions for transforming research results into innovative activities is not present. To better serve the periphery, Esprit should be closely integrated with capital investment programmes and training. Esprit III's few ties to the structural funds had success; they should be expanded and made a matter of Union policy in the

new IT Programme. The initiatives in training should be maintained and, where necessary, reinforced and integrated into Union-sponsored training activities carried out elsewhere.

8.3.4   In terms of the anticipated boost to competitiveness, Europe has to be aware that comparative advantages resulting from technology applied to business, like those stemming from regional specialisation, are much more fragile than traditional forms of comparative advantage based on factor endowments, labour and capital. In a technologically-determined market situation like today's, lasting competitive advantage can only be maintained through a continual process of renewal. The positive side is that, with application, Europe still has the potential to leap-frog from a rearguard position and challenge current leaders - provided it can turn invention into innovation and tangible economic value. In going well beyond a straightforward RTD effort to application and diffusion, preparation for this leap-frogging is certainly a prime task for the new Programme.

8.3.5   In terms of employment, IT is the principal mover in the current technological revolution, underpinning the generation of new products, new services, new jobs. IT will displace many jobs and destroy others, as in the previous shift to a new production paradigm in which mechanisation revolutionised industry and destroyed the employment base of agriculture. Early stages of this effect have been felt over the past two decades by blue-collar workers. In this phase, it is about to affect white-collar workers. In both cases, essentially repetitive, non-creative, non-autonomous, tasks are being replaced. There is a definite link, however, between high-technology uptake and net job creation as this feeds high-growth, expanding markets. Moreover, IT can rejuvenate traditional sectors, safeguarding European employment in the sectors concerned, which otherwise might migrate to lower cost locations elsewhere.

8.3.6   Efforts are already underway to monitor the ongoing impact of technological change on employment. Links between these efforts, the technology foresight groups and leading edge research into the information technologies and advanced process technologies need to be ensured. European policy makers will have to plan for difficult times ahead. Esprit's input will be relevant to all sides of the innovation-employment equation. The insights which such links should generate will prove invaluable in attempts to manage an unprecedented transition.

> o   *judge the IT effort in terms of its impact on competitiveness and employment.*
> o   *use IT excellence to forge new clean technologies for all sectors of the European economy*

RECOMMENDATIONS OF THE 1996 ESPRIT REVIEW BOARD

Respond to the need to reshape:

1. The Work Programme

o   *reinforce the functions of a strategic programme steering committee*

o   *rapidly implement a headings only' Work Programme*

2. Programme evolution

o   *pass on the results of the manufacturing oriented effort in IT for development in IMT*

3. The need for flexibility in a high flux, high technology, area

o   *greater flexibility in funding reallocations across domains*

o   *move to a macro approach to define future domains*

o   *manage overlaps between domains*

4. The challenge of integration

o   *target networking and integration issues*

o   *exploit the commercial opportunities of the networked society*

o   *explore media synergies*

o   *explore areas of social demand*

o   *take advantage of telecoms liberalisation*

o   *exploit dual use technologies*

5. The case for an ICT Programme

o   *end the separation between IT and communications technologies*

Develop specific macro-domain strategies:

6. Microelectronics

o   *a strategy to target cluster technologies for microelectronics competitiveness and competence*

o   *link RTD funding and structural funds wherever possible*

7. Software technologies

o   *boost the marketing capability of European software producers and their export orientation*

o   *build on applications software and customisation*

8.   *Applications*

,   *build on niches, not be confined to them, in solutions-driven, cross sector, interdisciplinary Applications*

o   *co-ordinate from DG III the dispersed Union effort in uses and applications of IT*

o   *target competitiveness, socio-economic demand, agriculture, public administration - and networking*

Reach out to the members of the IT and user communities:

9.   *User involvement*

o   *more attention to Europe's electronic system builders and the IT user companies*

10. *The universities and research institutes*

o   *more IT training*

o   *strong encouragement to university linked research companies*

11. *SMEs*

o   *assist start ups and knowledge based spin-offs*

o   *boost SME representation in the advisory structure*

Improve the "service" to the IT Programme participants:

12. *The partners*

o   *smaller number of partners per project, more focused consortia, fund competing projects*

13. *Evaluation and costing*

o   *value for money criteria in proposal evaluation*

o   *analyse the merits of moving to a flat labour rate from today's assigned rates in cost statements*

14. *The flow of information*

o   *faster, improved, feed back to proposers*

o   *greater use of electronic communications and the INTERNET*

15. *New ideas and approaches*

o   *establish a special/speedy mechanism for the seed funding of new ideas*

Work hand-in-hand with the investment community:

16. Industrial policy and venture capital

o   *fund more high risk proposals*

o   *target breakthrough concepts*

o   *link through to Europe's venture capital community*

Monitor overall effects:

17. The social dimension

o   *judge the IT effort in terms of its impact on competitiveness and employment*

o   *use IT excellence to forge new clean technologies for all sectors of the European economy*

Much desired fundamental changes demand action in Framework Programme level:

18. Management and administration

o   *pay interest on delayed payments*

o   *in technology development and application projects,move to a cost system based on deliverables*

o   *decentralise financial control to programme management teams*

o   *increase outsourcing of operational management tasks*

19. Contracts and IPR

o   *establish a bankruptcy contingency fund*

o   *create a cross-service Standing Group to simplify financial and legal matters*

APPENDIX ONE
RESULTS OF THE 1996 ESPRIT REVIEW BOARD QUESTIONNAIRE

APPENDIX TWO
PROGRAMME STATISTICS

APPENDIX THREE

A CHECK LIST OF ESPRIT DOMAINS AND THEIR ABBREVIATIONS

Introduction, methodology and response

As part of the review process, a questionnaire was constructed and sent to all organizations who had participated in ESPRIT III. The questions asked directly for an assessment of the achievement of the programmes' objectives, the structure of the work programme and project management procedures, the nature and importance of results and a number of other related issues.

The returns from the questionnaire provided the Review Board with valuable insights and evidence. These were useful in their own right but also served to reinforce findings obtained during face to face interviews.

Out of the 1.300 questionnaires sent out 378 were returned. These were distributed by country and by type of organization as shown in the following table.

Country	All Responses
Austria	3
Belgium	25
Denmark	9
Finland	8
France	41
Germany	75
Greece	23
Ireland	7
Italy	32
Luxembourg	1
Netherlands	26
Portugal	11
Spain	30
Sweden	10
United Kingdom	62
Undefined	15
Totals	**378**

SME	Large	Academia and Research Institutes	Undefined
36.9%	27.3%	25.4%	10.4%

Results obtained from the questionnaire are presented graphically in this appendix. As will be apparent from an examination of the questionnaire itself, most of the questions asked for the participants evaluation of a particular issue according to four categories. A uniform style of presentation is used in this appendix to facilitate rapid appraisal of the results.

Questions 1.6 and 1.7 requested a free format response to what other domains should be within the programme. There were many suggestions, most of which are touched upon by the programme already but not in as focused a fashion as the responders would wish. Examples include communications and the Internet, biomedical electronics and IT in health care, packaging, imaging, language engineering, optoelectronics and sensors.

The responses to question 1.7 'Could the programme have been better structured?' gave the Board the impression that the work programme is too detailed and complex and, also, that the parts of the programme with a very clear short or medium term strategic objective (such as many of the Accompanying Measures and, for instance, OMI) are well appreciated. They also brought out the dichotomy between those who seek more basic research and those calling for more on market needs and exploitation.

The free format question (6.13) asked about the importance and value of the accompanying measures (For example, ESSI, FUSE, Eurochip and Networks of Excellence). It is the focusing, the targeting of these which seems to be appreciated especially amongst the smaller companies to whom many of the measures are aimed.

IT QUESTIONNAIRE

Opinions about Objectives

1.1   Esprit aims to support European R&D in IT. To what extent do you believe that it achieves this goal?

1.2   To what extent do you believe that Esprit is helping to provide European industry with the critical technologies needed to meet the competitive requirements of the late 1990s?

1.3   To what extent do you feel that the programme's objectives are worthwhile?

1.4   To what extent do you believe that Esprit promotes European industrial co-operation in IT research?

Opinions about Objectives

Legend:
- Not at all
- Not much
- Quite a lot
- A great deal

Sme   Large   Academia
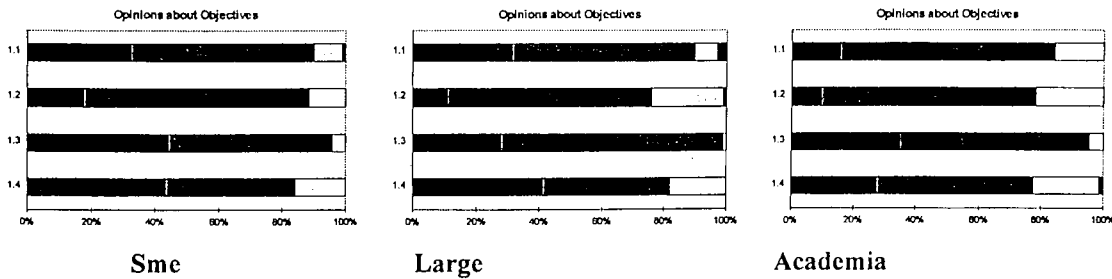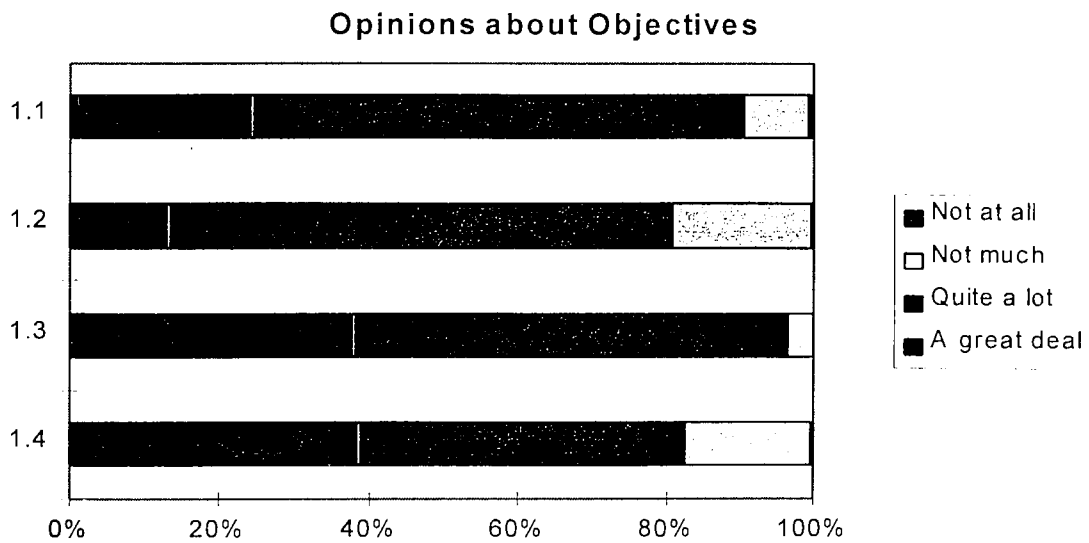
There is a broad consensus that the programme objectives are worthwhile and having a positive impact. The 20% negative opinion concerning Esprit's role in helping to provide European industry with the critical technologies to meet the competitive requirements of the late 1990s, suggests, however, that there is considerable room for improvement.

1.5   Seven domains were selected as the focal points of the Esprit III and current phase of the programme. To what extent do you believe that the respective emphasis given to these domains is justified?

a)   - Microelectronics / Technologies for Components and Subsystems
b)   - Information Processing Systems / Software Technologies
c)   - Business and Home Systems / Multimedia Systems
d)   - Basic Research / Long-Term Research
e)   - Open Microprocessor Systems Initiative
f)   - High-Performance Computing and Networking
g)   - CIME / Integration in Manufacturing

Emphasis by Topic
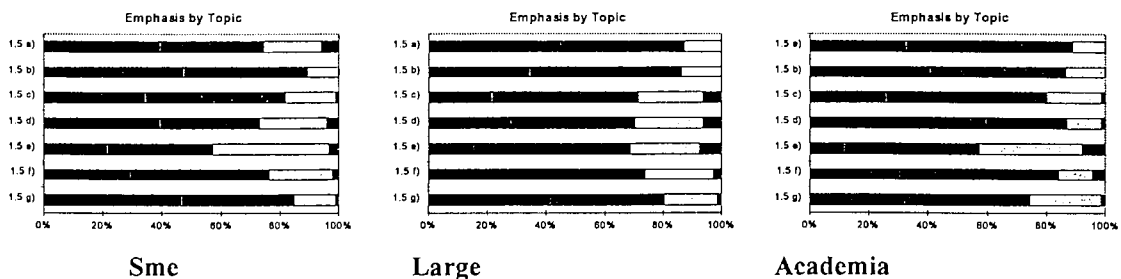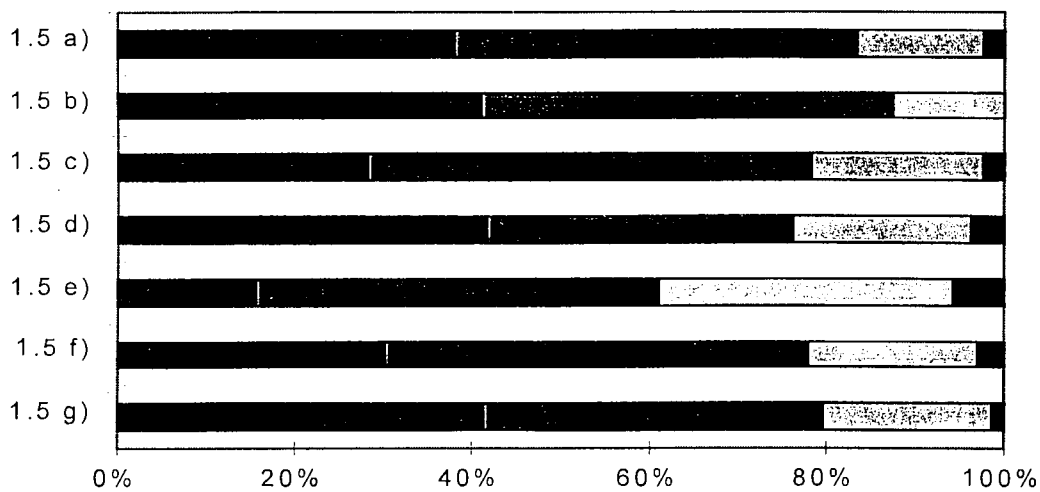
Sme   Large   Academia

Academia is strongly in favour of basic research, whilst the large companies view microelectronics and Computer Integrated manufacturing as the most important. The questionnaire itself may be somewhat suspect here since respondents will naturally favour their own interest area. At the same time it illustrates the catholicity of the interests which Esprit has been endeavouring to serve.

Competitiveness of Industry

1.8   In your view, has Esprit helped industrial sectors to improve their competitiveness through the greater use of IT?

1.9   Is Esprit contributing to improving the European IT industry's position in the world market?
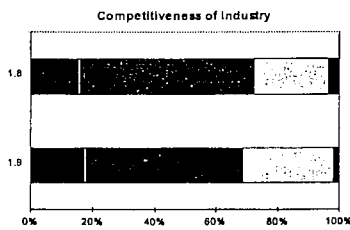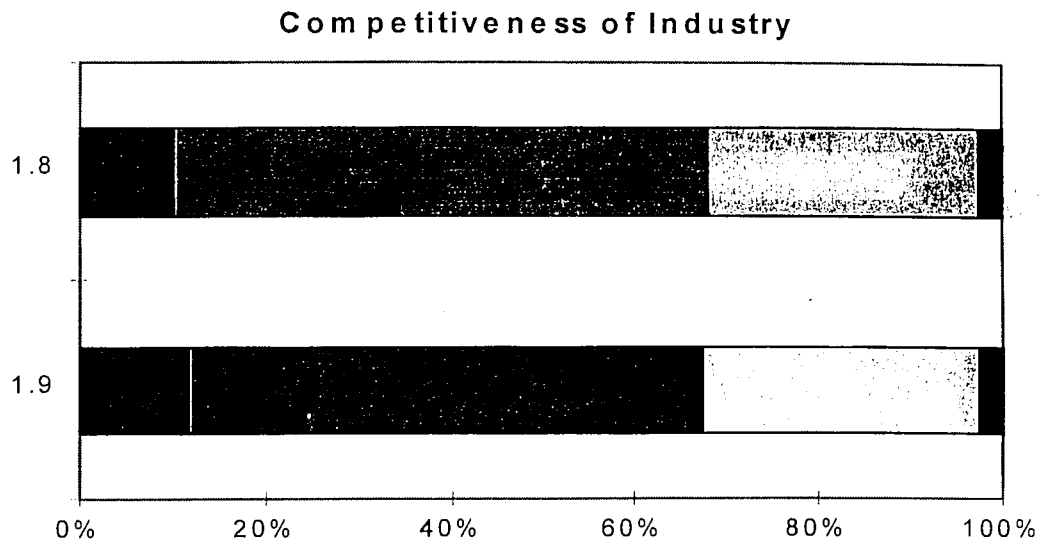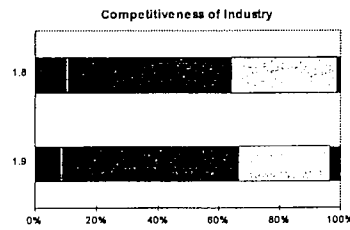
Competitiveness of Industry
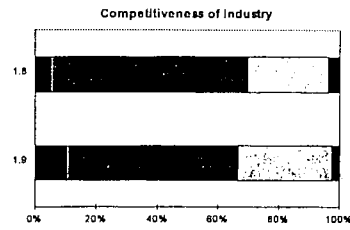
70% say Esprit has helped at least 'quite a lot' to improve industrial competitiveness.

Relationship to national/other programme

1.10 To what extent do you see the programme as supportive of or complementary to
a) - your national programmes in this area?
b) - other international programmes? (e.g. Eureka)
c) - other EU programmes (e.g. ACTS/RACE, Telematics, BRITE-EURAM/IMT, etc.)?
1.11 To what extent do you need help from regional or national bodies to support your activity within Esprit?
1.12 How much use do you make of the Esprit National Contact Points (NCPs)?

Relationship to National/other programmes

Sme   Large   Academia
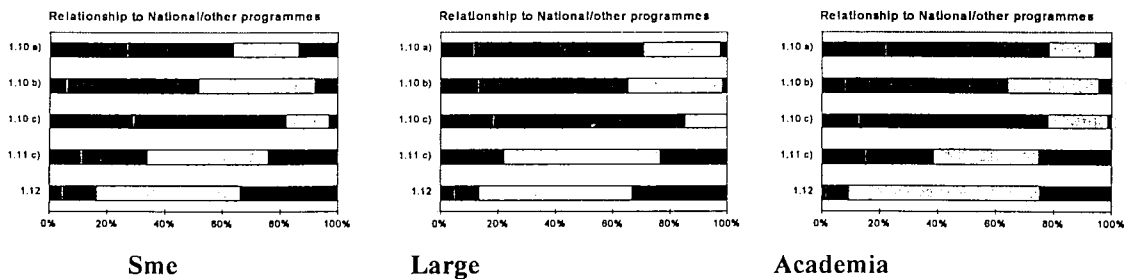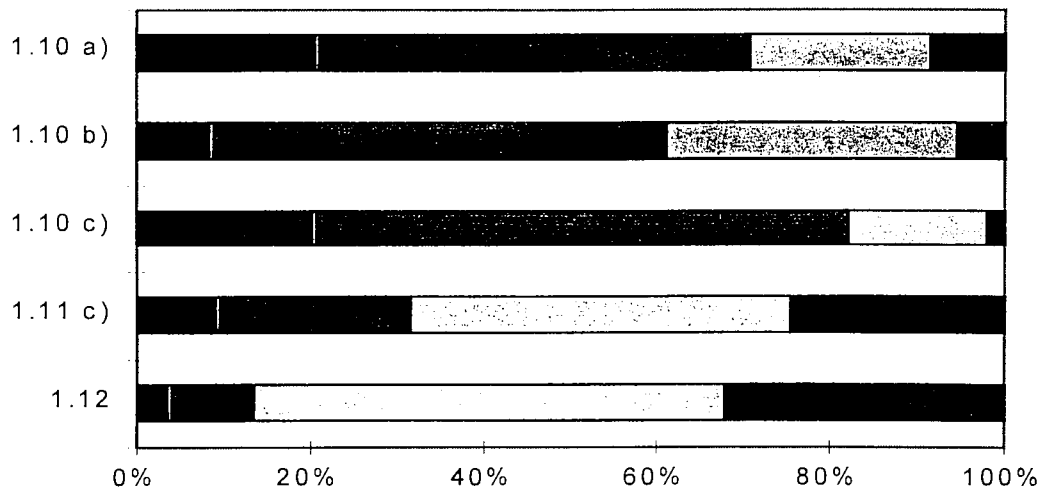
Esprit is seen as complementary to other EU programmes but less so to other international or national programmes. The fact that one third of respondents, notably SMEs, need some help to support their activity with Esprit underlines the need for some changes. The overlap between domains and between EU programmes is one area which needs to be addressed.

Quality and balance of R&D

2.1 Esprit work-programmes have emerged through consultation and involvement with industry and academia. Judging by their content, to what extent do you think this process has been effective?

2.2 Do you believe that the Esprit work-programme generates an R&D programme of world-class standard?

2.3 Industrial Advisory Panels were set up to ensure that the programme is more closely driven by market and user needs. Judging by the work-programmes, was this objective met?

2.4 Are you satisfied with the overall balance of the work-programme with respect to:

a) - fundamental research?

b) - exploratory research?

c) - technology-push R&D?

d) - market- and user-driven R&D?

Quality of R&D and Balance
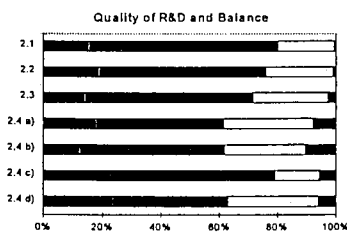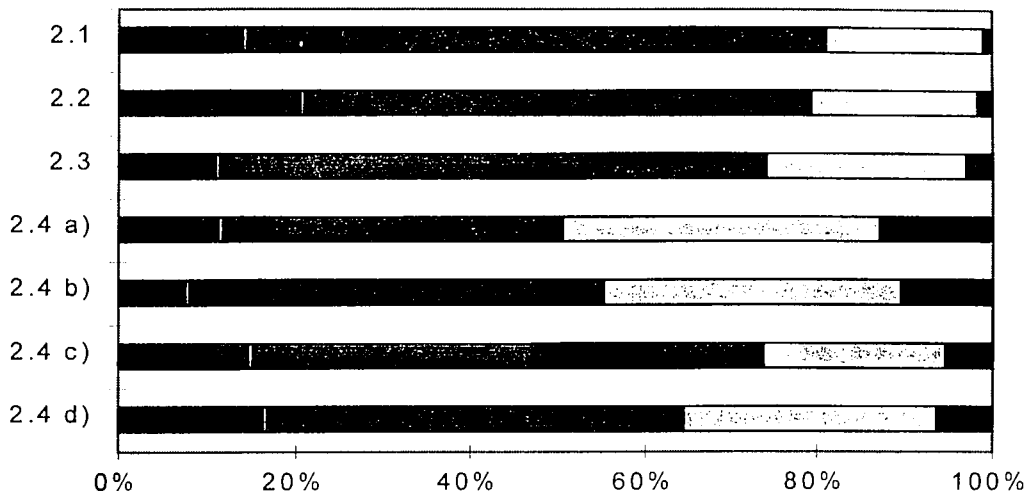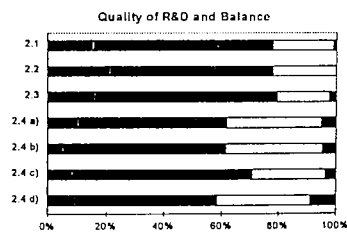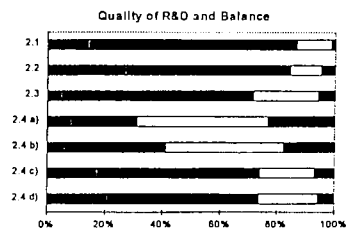
Sme   Large   Academia

Work programme creation through consultation with industry and academia is judged effective by the answers to question 2.1. However, elsewhere there is criticism of the time the process takes and the complexity of the output. It is the Review Board's view that, whilst such consultation is essential, improvements can be made in the process.

Importance of Funding

3.4   How much does the funding component enable you to justify your organisation's participation in Esprit?

Importance of Funding

Sme

Large

Academia
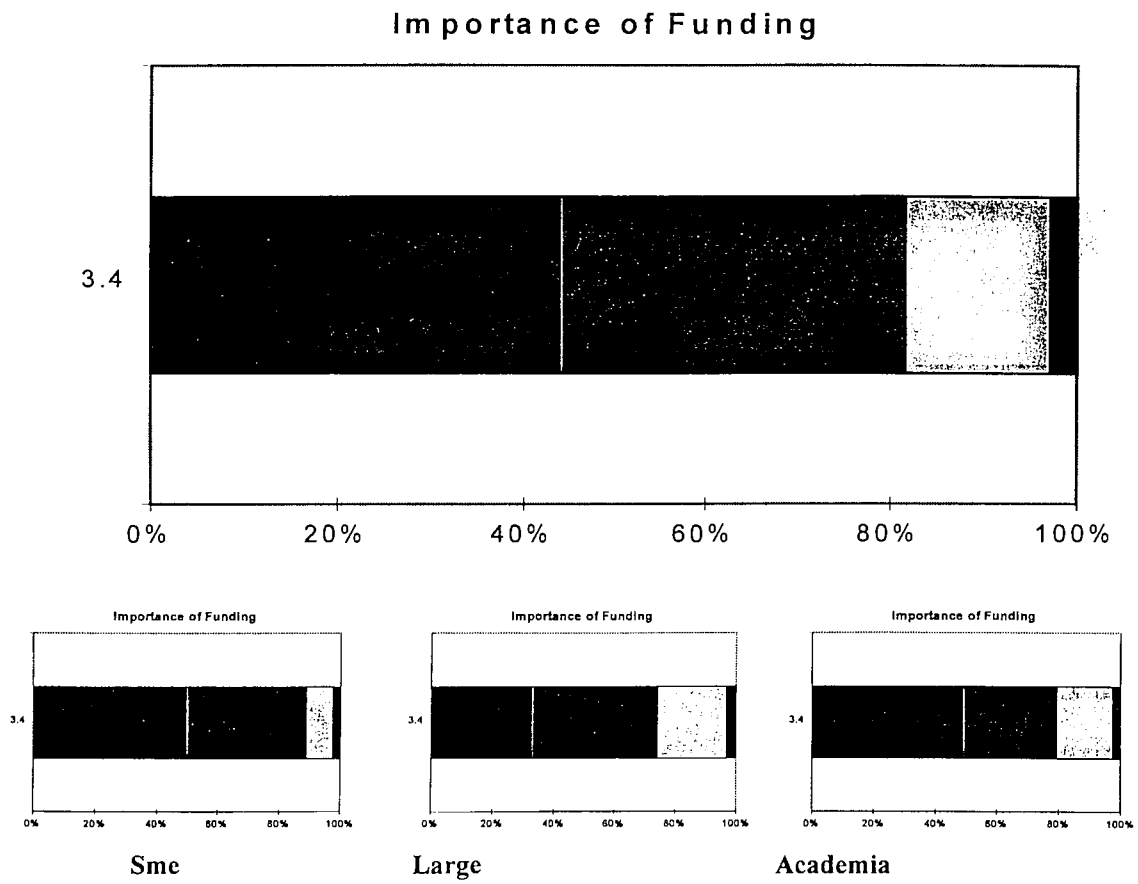
The funding component is important for all, less to large industry and most to SMEs.

Why Participate?

4.1   To what extent was your reason for participating in the programme:

a)   - to gain access to technologies that would give you a competitive advantage?

b)   - to work on advanced topics that would otherwise be beyond your resources?

c)   - to reduce R&D costs and timescales?

d)   - to increase the funds at your disposal for R&D?

e)   - to improve your opportunities to do business?

f)   - to expand your contacts with:

      - users?

      - suppliers?

      - other researchers?
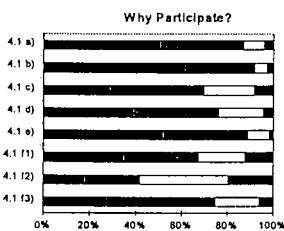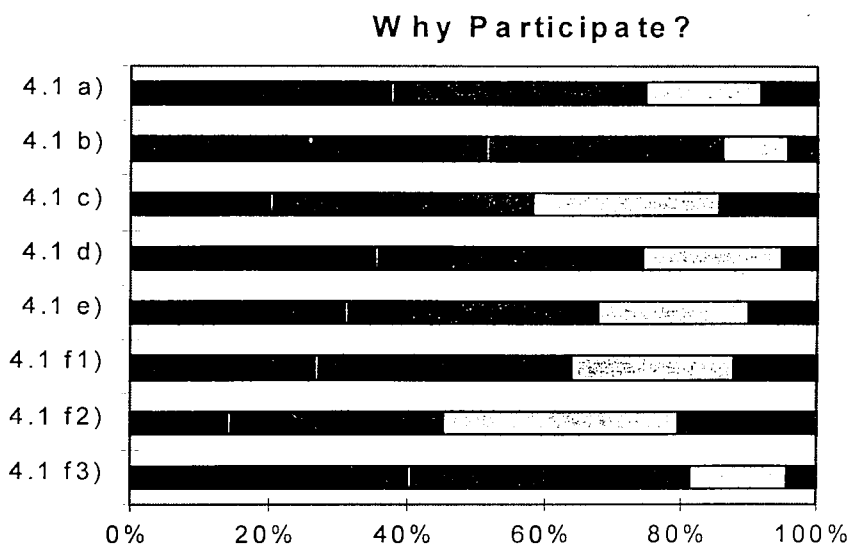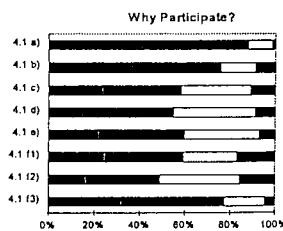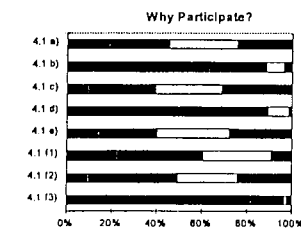
There was a considerable difference between respondent types. Large industry puts accessing competitive technology first and expanding research contacts second. SMEs put working on advanced topics otherwise beyond their resources first and improved business contacts second. Academia puts research contacts first and increased funding second. Interestingly, 20% saw reducing costs or timescales as a strong reason for participating. This probably reflects a realistic view of Esprit projects.

5.1a)   Do you regard the new approach in "Esprit IV" to programme management an improvement
          over the past?

b)   And specifically, for example, in:
          - moving from "blockbuster" calls every two years, to more frequent, focused calls?

c)   - the use of two-step evaluations and continuous calls in certain cases?

d)   - the use of a simplified contract and the speed-up of evaluation and contract-negotiation
          procedures?

e)   - the greater attention paid by the programme to SMEs?

f)   - the introduction into the programme of specific technology transfer, dissemination and
          training activities, over and above those carried out as part of individual Esprit projects?

Programme Management
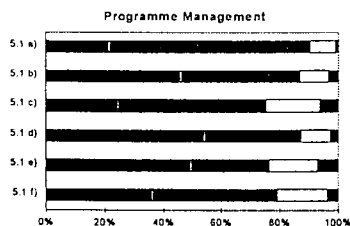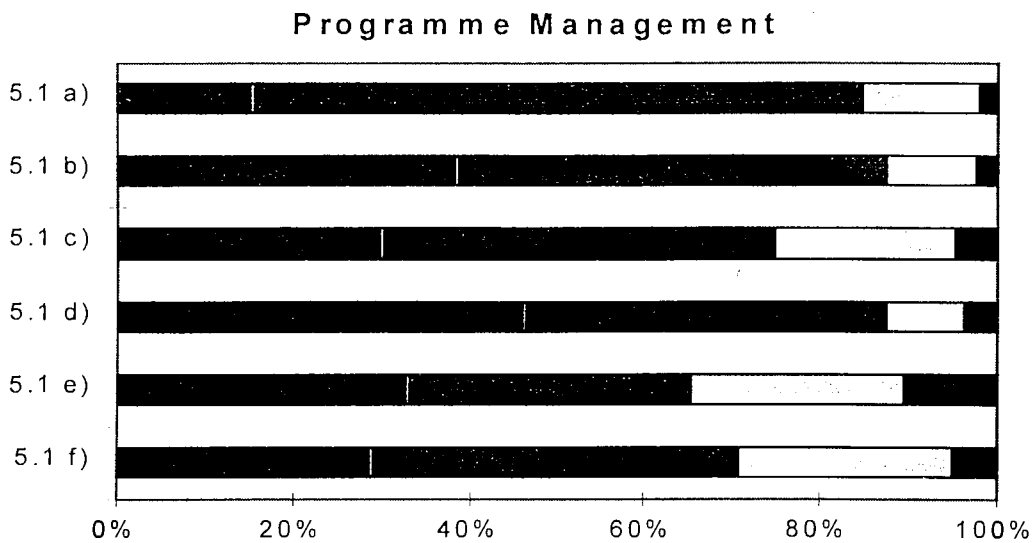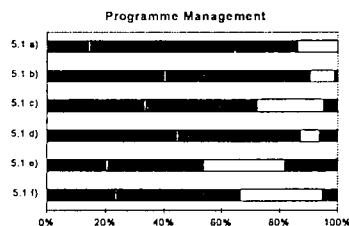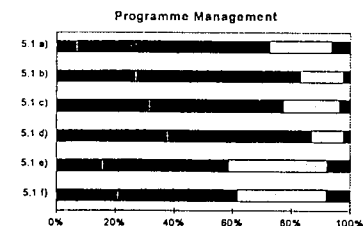
Sme   Large   Academia

More frequent focused calls are an improvement (say a 87%). A simplified contract and faster
evaluation and contract negotiations are all of considerable importance. In the free format
question (5.1.g) seeking suggestions for improvement there was a big response and many
suggestions. A number of these have found their way into the Board's recommendations.
Notably, the Board supports steps to make the evaluation process more visible through the
provision of feedback on the reasons for rejection or acceptance. Care should be taken when
considering exploitation plans from proposers with a poor track record of exploiting results in
the past. Links between Esprit and BRITE/EURAM should be strengthened. Direct submission
of proposals through e-mail should be possible. Sanctions against backsliding partners in
projects should be introduced.

Satisfaction

5.2	How satisfied are you with the requirements for submitting proposals?
5.3	How satisfied are you with the support given by the Commission to those seeking potential partners?
5.4	Would you like assistance with consortium arrangements?
5.5	How satisfied are you with the process of contract negotiation?
5.6	*If you have had a proposal rejected:* how satisfied are you with the comprehensiveness and clarity of the explanation?
5.7	Does the interval between the submission of an ultimately successful proposal and the start of the project affect the relevance òf the proposed work?
5.8	How satisfied are you with the project review process?
5.9	Do you think that the procedures for taking corrective action and reorienting a project are sufficiently rigorous?
5.10	How satisfied are you with the payment procedures?
5.11	To what extent does the Commission impose requirements on projects that increase overhead costs unnecessarily?

Satisfaction
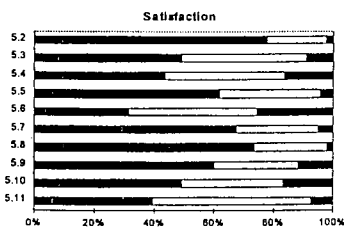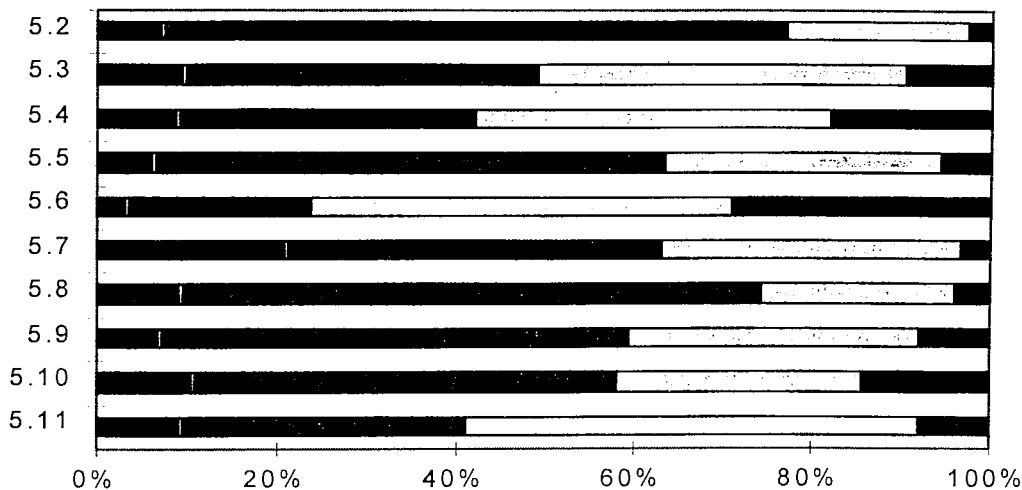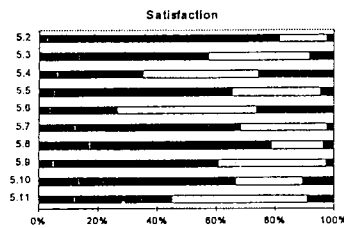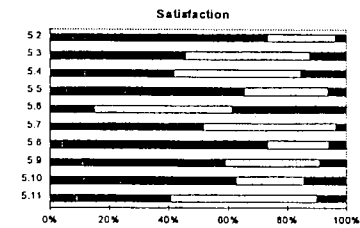
Sme   Large   Academia

The conclusion must be that there is still considerable room for improvement for which the Commission should continually search.

There are reasonable levels of satisfaction with respect to the requirements for submitting proposals and the project review process. However, a level of dissatisfaction with respect to the lack of feedback for rejected projects also exists.

Your partners/management

5.12   To what extent can EU-funded projects be managed in the same style as in-house projects of comparable duration?

5.13   How satisfied are you with the quality of project management carried out by co-ordinating partners?

5.14   Has participation in Esprit improved your organisation's ability to manage collaborative R&D projects?

5.15   Has the international dimension of Esprit projects made your participation more difficult?

5.16   Would your company or organisation benefit from advice in R&D project management skills and methods?

Your/Partners Management

Sme   Large   Academia
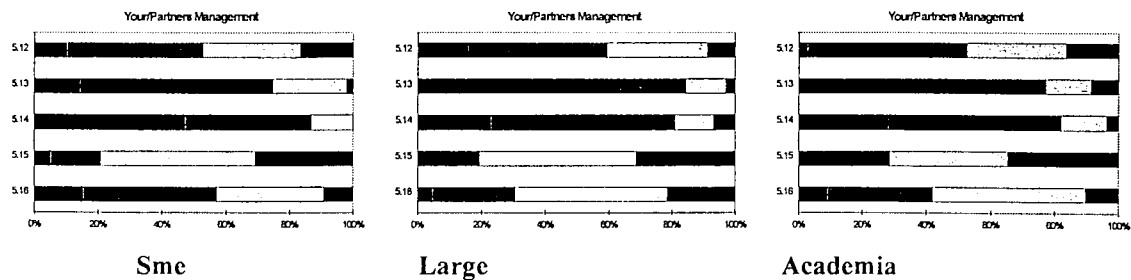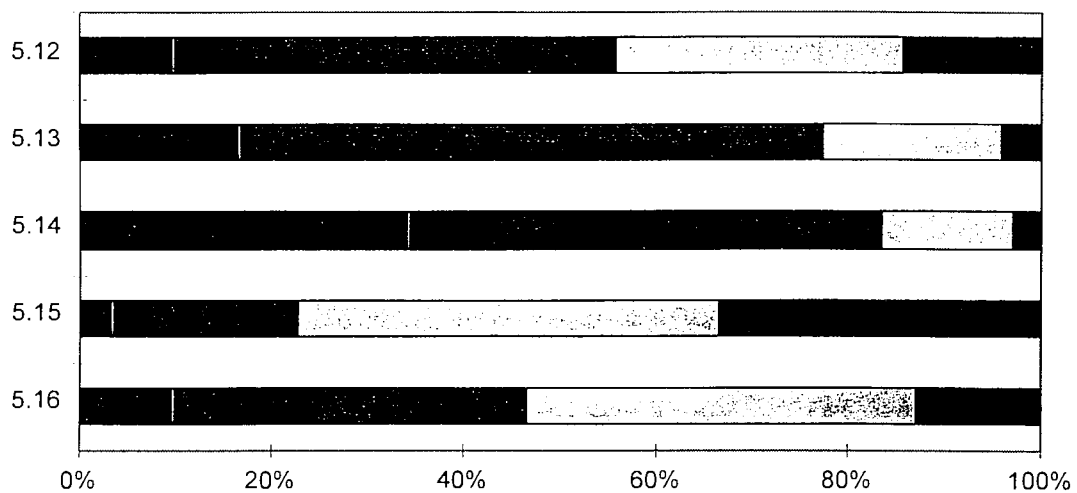
The satisfaction with the project management of co-ordinating partners is high. Furthermore, participation in Esprit has improved organisations' ability to manage such projects.

Relevance to Business Activity

3.1   To what extent are the Esprit projects or actions in which you have participated in the mainstream of your business's or organisation's activities?

6.1   To what extent do the projects in which you participate provide your organisation with results?
       - for strengthening your own technology base?
       - to increase your staff's know-how and expertise?

6.2   To what extent are the result of projects you have participated in being used in the products or services you *currently* offer?

6.3   To what extent are the results being used to create *new* products or services?

6.16   How great an impact are the results having on your company's:

a)   - productivity?

b)   - competitiveness?

Relevance to Business Activity

Sme   Large   Academia
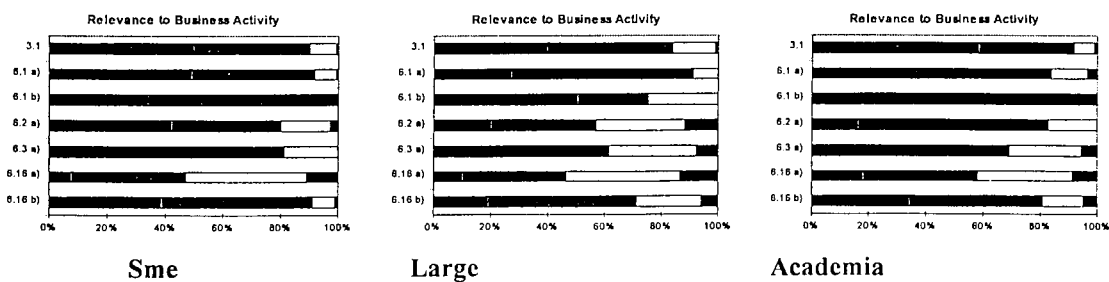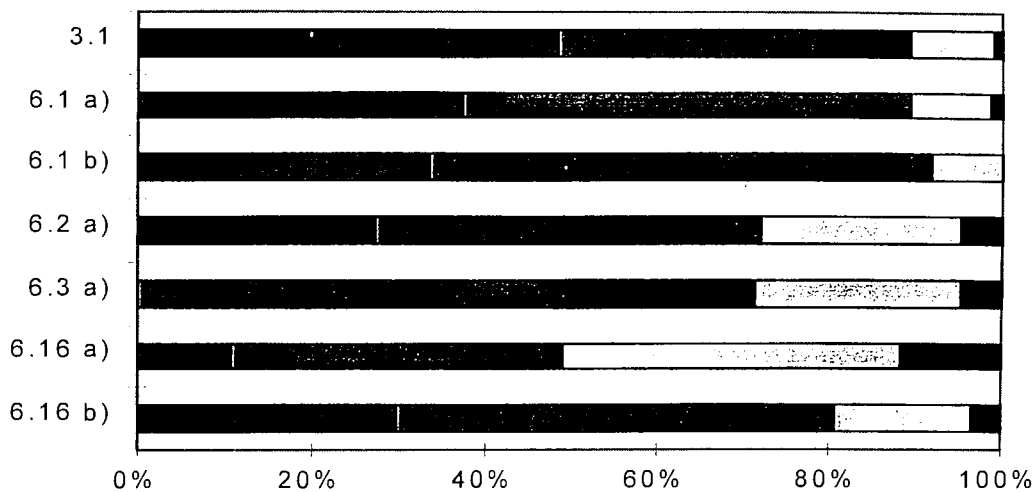
Less than 40% of large industry respondents said that their Esprit projects were in the main stream of their company business. This, one would expect. Large companies carry out their core R&D using their own resources and rely on Esprit for longer term work, higher risk projects and work where co-operation makes sense, for example on standardisation. SMEs on the other hand participate on projects which are central to their mainstream business. This colours their expectations of the programme particularly with regard to timescales.

Questions 6.2 and 6.3 called for a free format response and the provision of examples of what Esprit has achieved. The Board found that most of the examples cited had already been picked up in results publications of the Commission.

Ideas Relating to Exploitation

6.4   To what extent do you believe that access to venture capital would improve the commercialisation of the results of projects?

6.5   With respect to results, would you favour the mandatory allocation of a small percentage of a project's funding for the purposes of:

a)   - preparing a business plan for submission to venture capital and other funding sources with a view to the exploitation of eventual results?

b)   - seeking patent protection?

Ideas Relating to Exploitation

Sme   Large   Academia
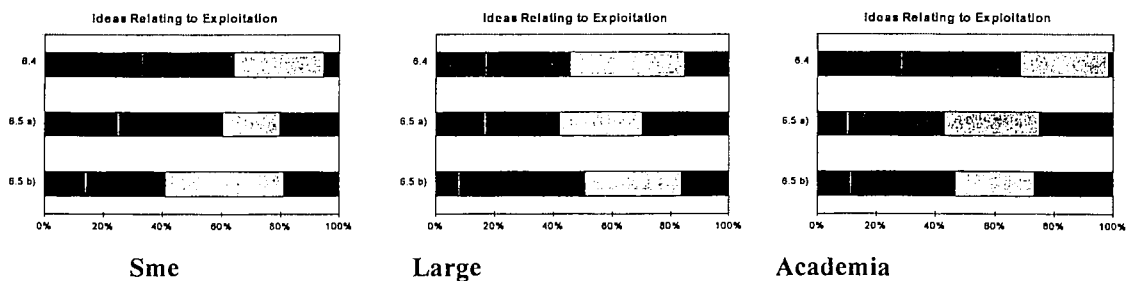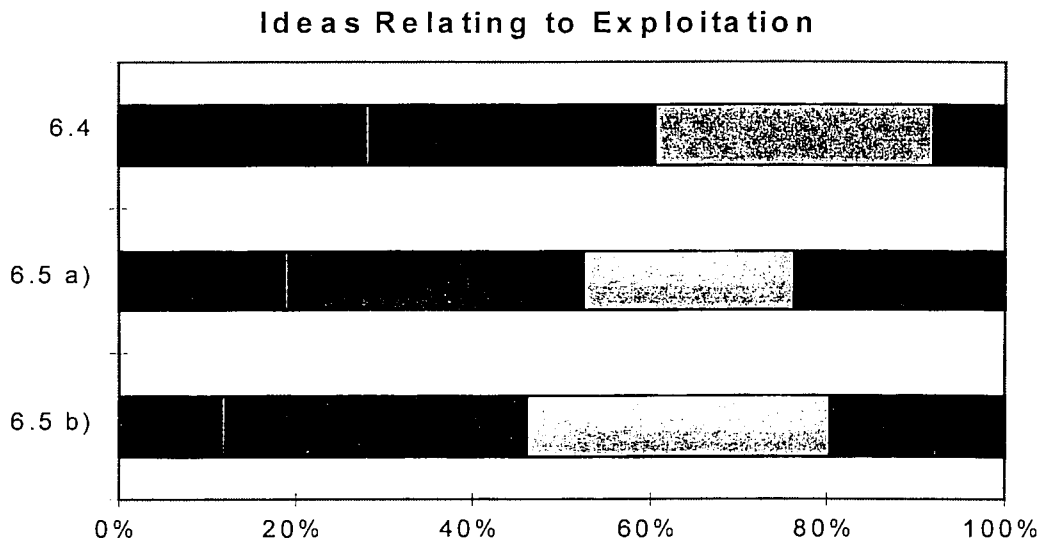
The ideas mooted in the questions in this section, namely the mandatory allocation of some funds for the preparation of business plans to submit to venture capitalists or for the preparation of patent applications did not receive sufficient support for the Board to include them in their recommendations.

Value of Partners

6.6   Please assess the contribution made to those projects in which you have participated by:

a)   - universities

b)   - research institutes

c)   - international organisations

d)   - non-EU organisations (excluding those from Iceland, Norway and Switzerland)

e)   - large companies

f)   - SMEs (small and medium-sized enterprises)

g)   - users

6.18   To what extent do you feel that the wider inclusion of non-European partners in Esprit projects
       would improve the quality of the results?

Value of Partners
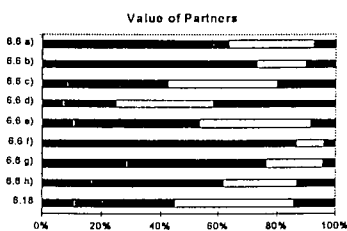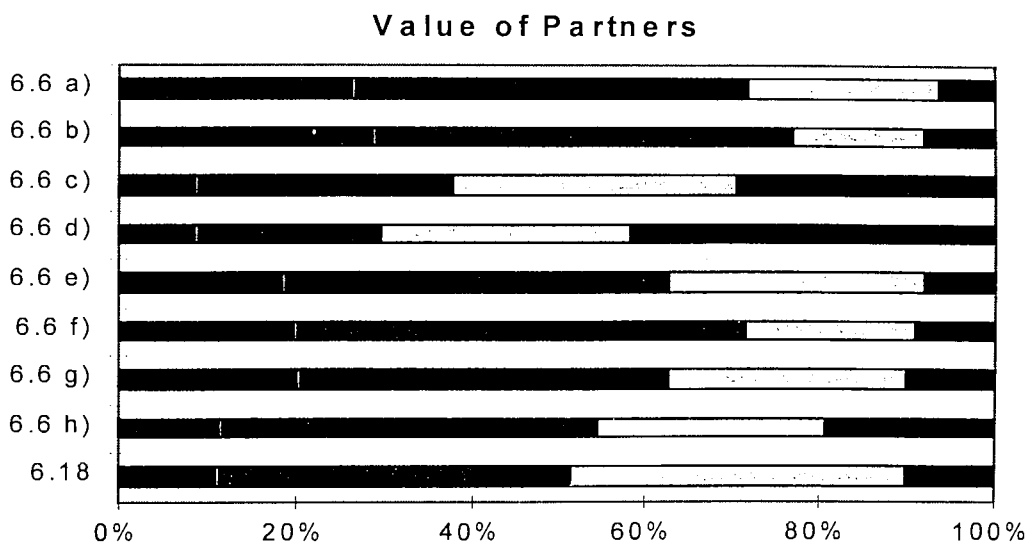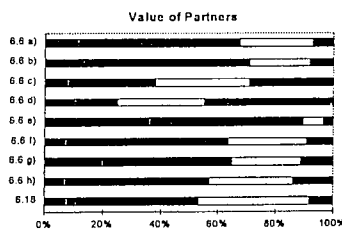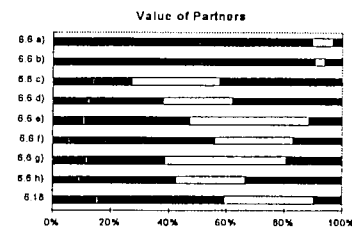
Sme   Large   Academia

In general the assessment of the contribution of other partners is higher where the assessor and the
assessed are of the same type. Universities think the contribution of other universities to be good; SMEs
think the contribution of other SMEs is particularly valuable and so on. This provides insight into the
collaborative process and suggest to the Board that a variety of project structures should be encouraged.
There is no need for an SME in every project nor for a large company.

Impact outside own Organisation

6.7 *For non-industrial participants:* how valuable do you think the results are proving to be for the industrial partners with whom you have collaborated?

6.8 To what extent do you see project results as having an impact through their publication in the scientific and technological press and their dissemination via other media?

6.9 To what extent do you feel that the Esprit programme is raising the quality of graduate and vocational education and training in IT?

6.10 To what extent is the Esprit programme augmenting the pool of IT skills available to European industry?

6.12 To what extent do you feel that Esprit projects have generated results that are of benefit to the environment?

6.14 In your view, have the various "accompanying measures" or "support actions" undertaken in Esprit increased the impact of the results achieved by the R&D projects?

Impact outside own Organisation

Smc
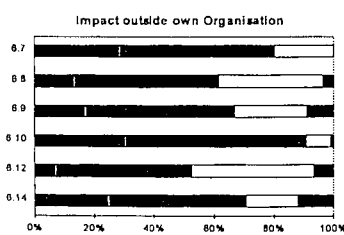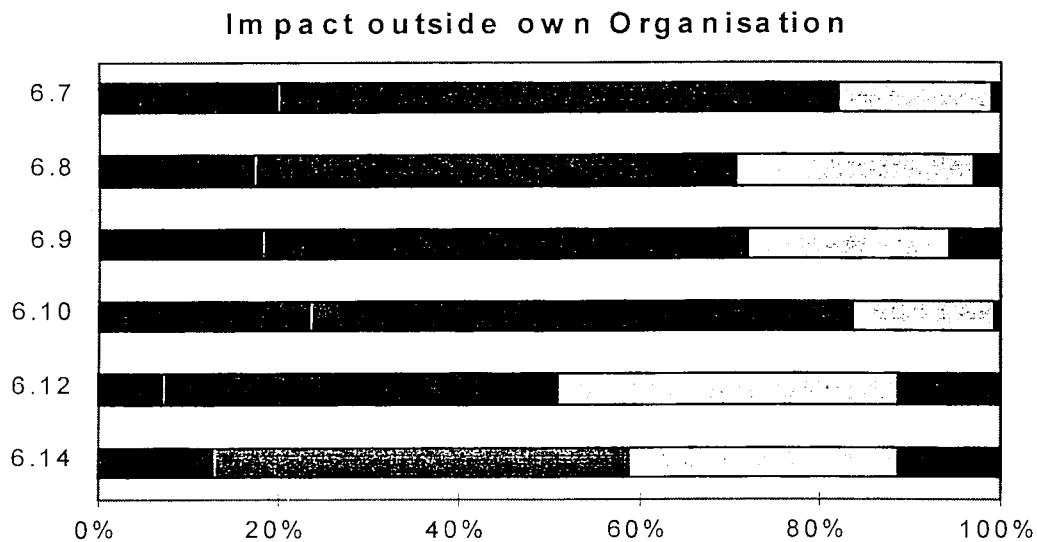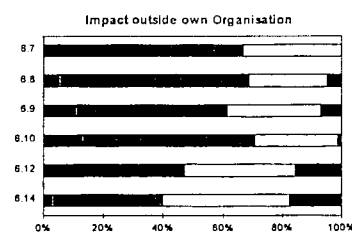
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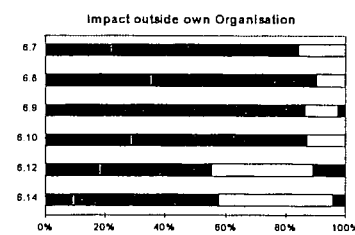
Academia

Non-industrial participants seem to think that the results are of greater benefit to the industrial partners than the industrial partners themselves think they are.

Industry is less impressed with the impact of Esprit on the pool of IT skills in Europe than is academia, who are enthusiastic. In this respect, the Board believes the academics to be closer to the truth.

Employment

6.11   To what extent have the results led to the creation of new jobs or employment opportunities:
a)   - in your own firm or organisation?
b)   - in other participants' organisations?
c)   - in other organisations known to you?
d)   - in the economy in general?

Employment

Sme   Large   Academia
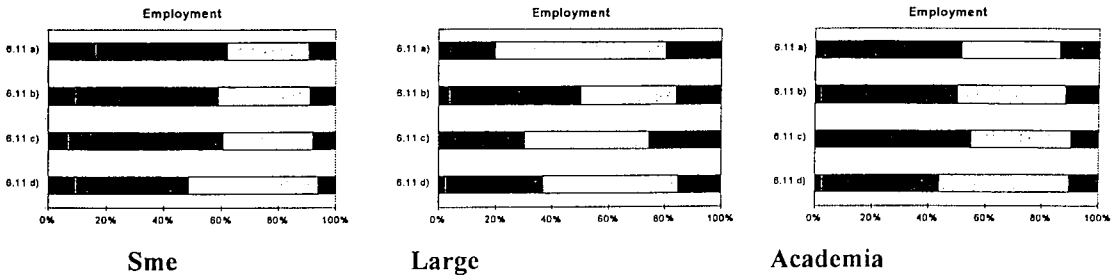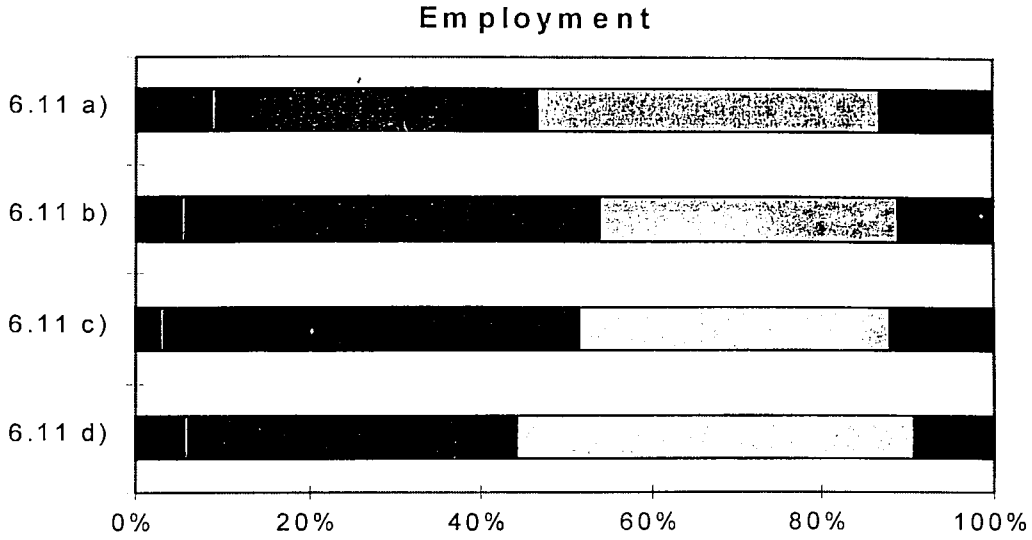
There is little evidence from the questionnaire that Esprit has a direct positive or negative impact on jobs or employment.

Internal Benefits

6.15   Are the results improving your own procedures:

a)   - in research?

b)   - in development?

c)   - in manufacturing?

d)   - in marketing?

e)   - in quality management?

f)   - in distribution?

g)   - in training?

h)   - in environmental management and protection?

6.19   Has Esprit raised the level and availability of IT skills in your home area?

Internal Benefits

	Sme	Large	Academia
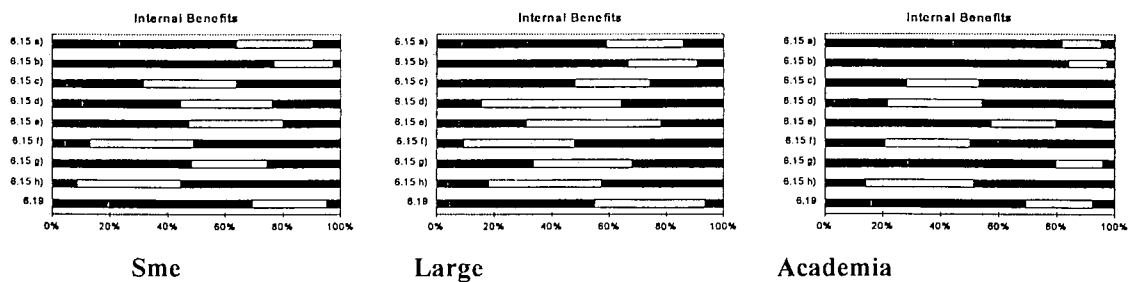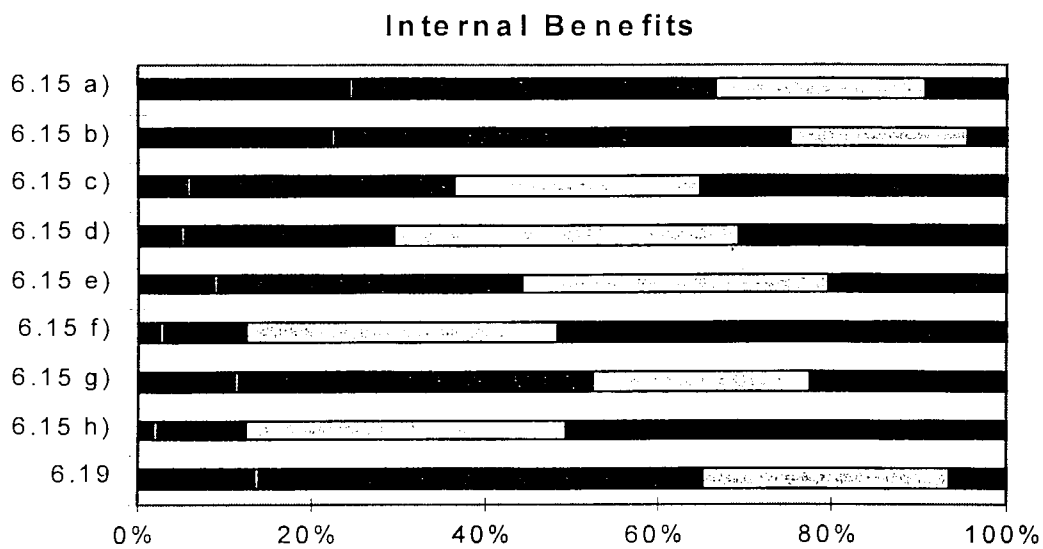
The Board was not surprised to note that the majority of 'within organisation' benefits are in the area of research and development, and for academia within training.

Co-operation

7.1   Have you benefited from results deriving from Esprit?

7.2   To what extent, to your knowledge, have other companies taking part in Esprit benefited from your results?

7.3   Has co-operation extended beyond EU-funded projects into:

a)   - joint ventures?

b)   - industrial alliances?

c)   - licensing agreements?

Cooperation
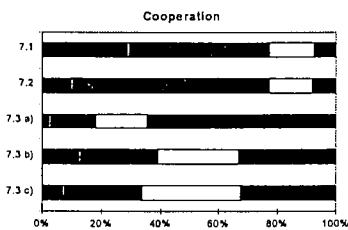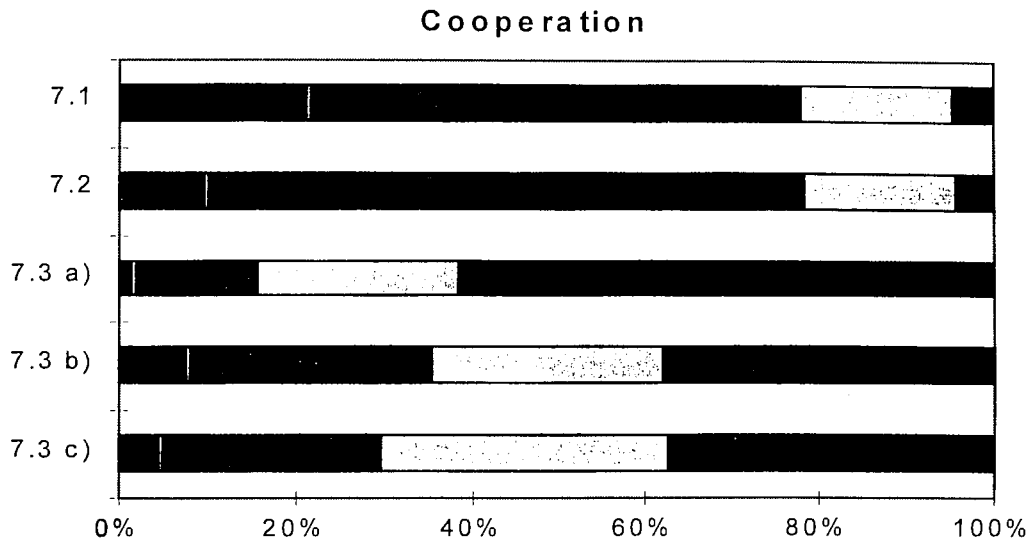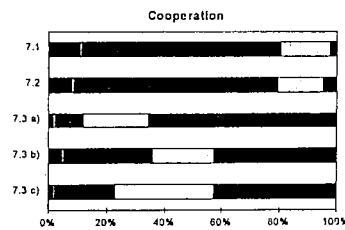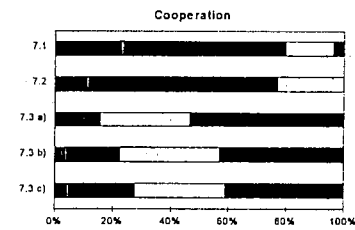
Sme   Large   Academia

Whilst participants feel that they have benefited quite strongly from the results of their participation in Esprit, there is little awareness of partner companies benefiting strongly from another partner organisation's contribution. It is rare to find examples where collaboration has extended this far. The fact that very few joint ventures have come out of Esprit confirms this point.

7.4   To what extent are you satisfied with the degree of attention paid in Esprit to IPR issues and other matters affecting the take-up of project results?

7.5   In your country, do you find the following are adequately provided?

b)   - patenting advisory service

c)   - general advice on intellectual property issues

d)   - advice on company formation and start-up finance?

IPR
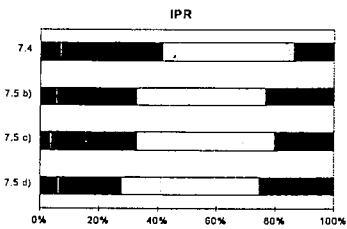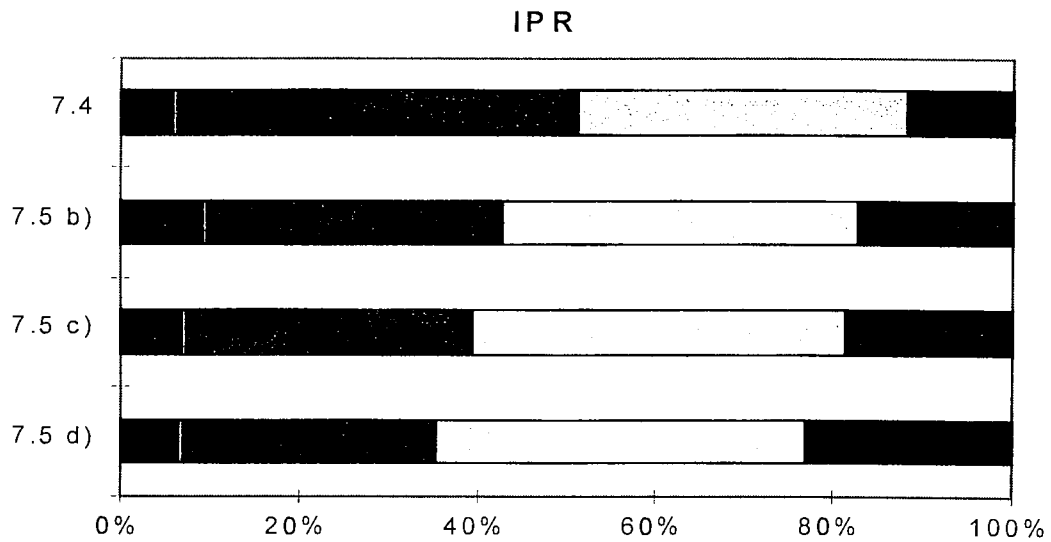
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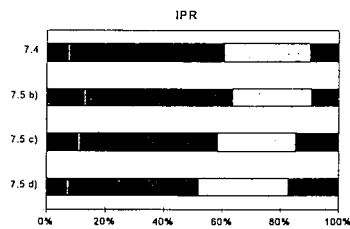
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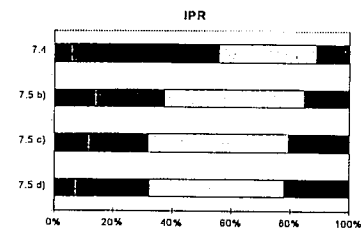
Academia

Despite the considerable attention paid to this topic in the standard contract between a participant and the Commission, most projects have to deal with IPR matters through their own consortium agreement. The Board would expect this situation to continue.

Standards

8.1   Have you worked on standards in an Esprit project?

8.2   To what extent do you feel that Esprit is contributing to the achievement of internationally
        accepted and implemented standards?

8.3   To what extent do you believe that international standardisation increases your company's
        market opportunities?

8.4   To what extent do you believe that the achievement of international standards helps European
        industry to gain a share of global markets?

8.5   To what extent do you believe that work on standards leads to lower equipment and service
        costs for users?

Standards
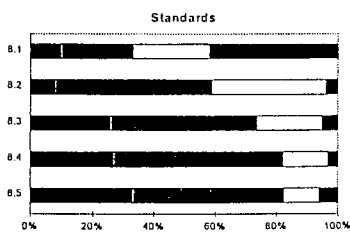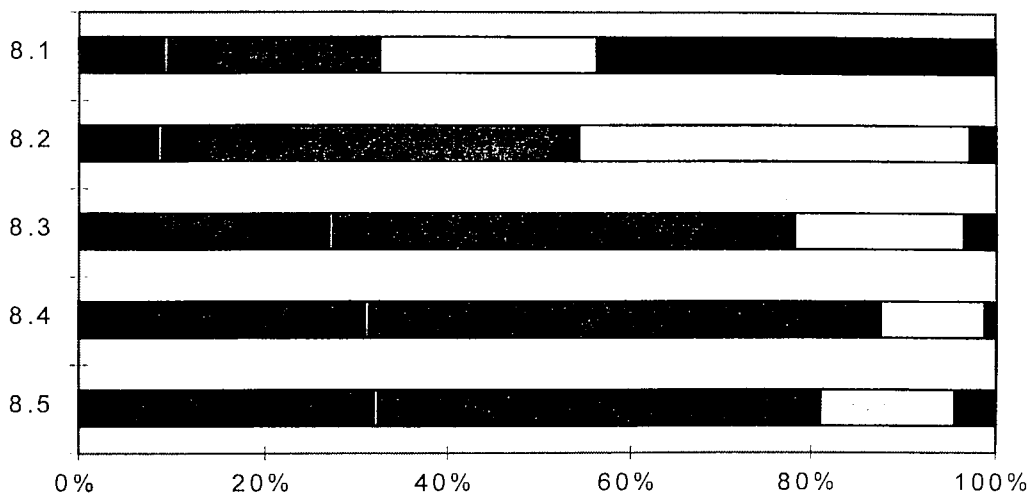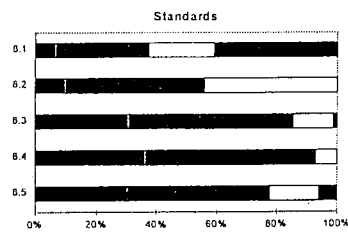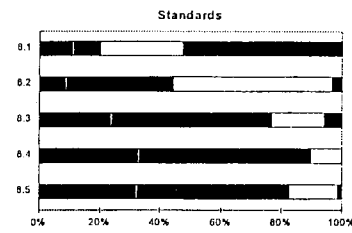
Sme   Large   Academia

There is a consensus that international standardisation is supportive towards European industry gaining
a share of global markets. The Board considers that Esprit should continue to be active in the
international standardisation arena.

Average percentage which is expected to be turned into commercial products and services in the following periods	Total R&D spend (excluding Esprit)	Esprit funding
in less than 1 year	25,08	12,44
1 to 2 years	29,68	25,97
2 to 5 years	23,07	29,27
over more than 5 years	10,43	14,86
never	10,80	12,83
	99,05	95,37

Note

Where figures were given they were not always complete, eg figures were given for Total R&D but not for Esprit, or visa versa, or the totals in one column added up to more or less than 100%

Total number of patents filed by organisations responding to the questionnaire to protect the results of Esprit work	192

Note

The above mentioned figure comes from 378 answered questionnaires, and it does not represent the total number of patents deriving from Esprit III projects. The total number of patents may therefore be higher.

The Third Framework Programme

ICT
2221 MECU

Advanced
Communications
(RACE)
489 MECU
8 %

Telematics - 380 MECU
6%

Human capital &
mobility
518 MECU
9%′

Others
3%

Esprit - 1352 MECU
(IT) 23%

Energy
814 MECU
14%

Life sciences and
technologies
741 MECU
13 %

Environment
518 MECU
9 %

Industrial and
materials technologies
888 MECU
15%

Total: 5700 MECU
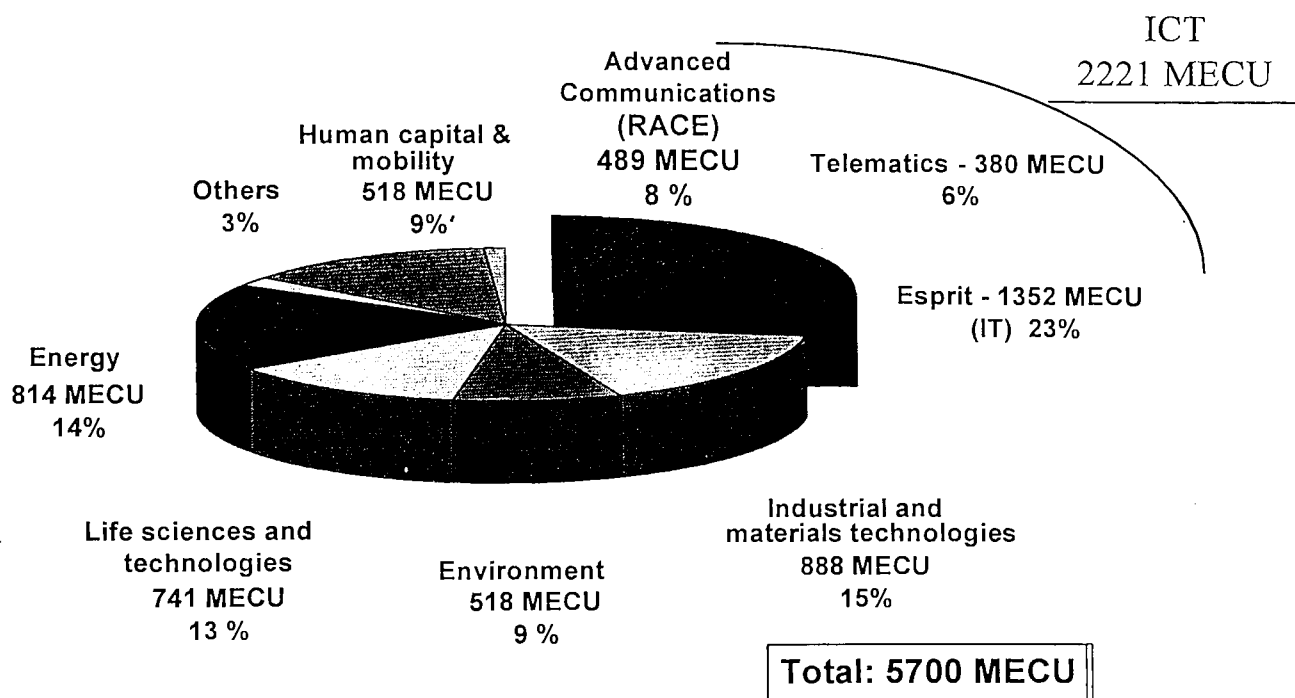
The Fourth Framework Programme
Emphasis on ICT

ICT
3626 MECU

Advanced
Communications
(ACTS)
671 MECU
5.1%

Socio-economic
research
1.1%

Telematics - 898 MECU
6.9%

Others
13%

Transport
1.9%

Esprit - 2057 MECU
(IT) 15.7%

Energy
18.3%

Life sciences and
technologies
12.8%

Environment
8.9%

Industrial and
materials technology
16.2%

Total 13000 MECU
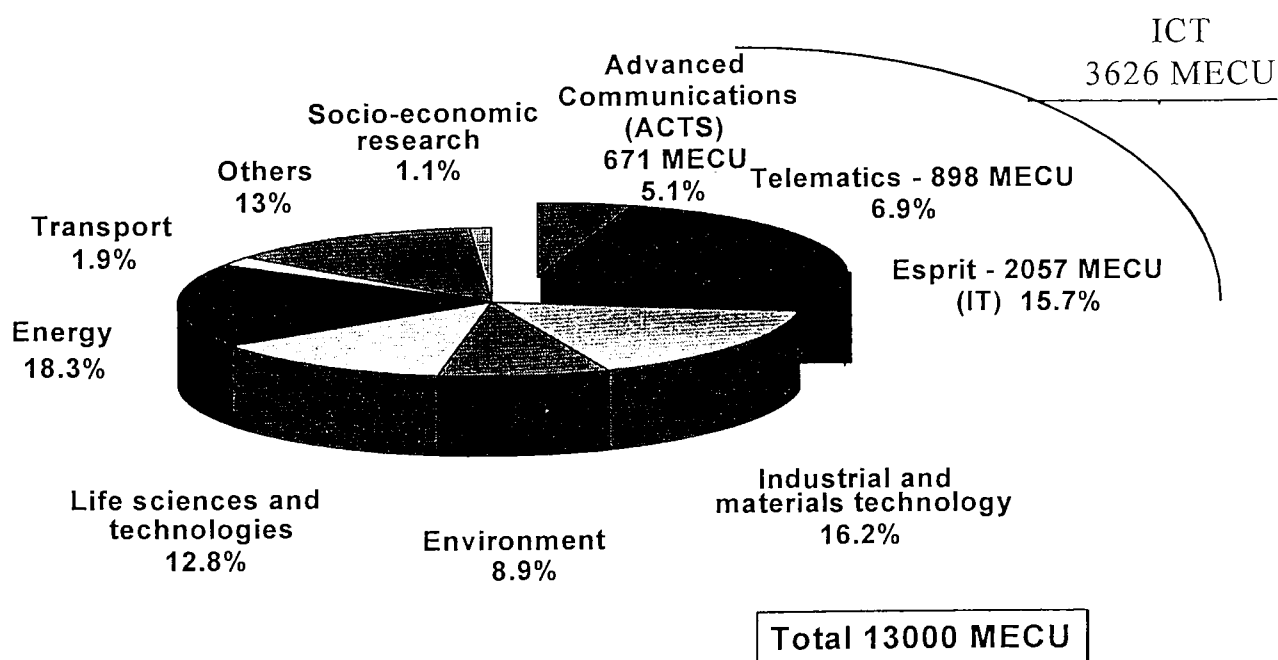
Esprit III Breakdown by Domain
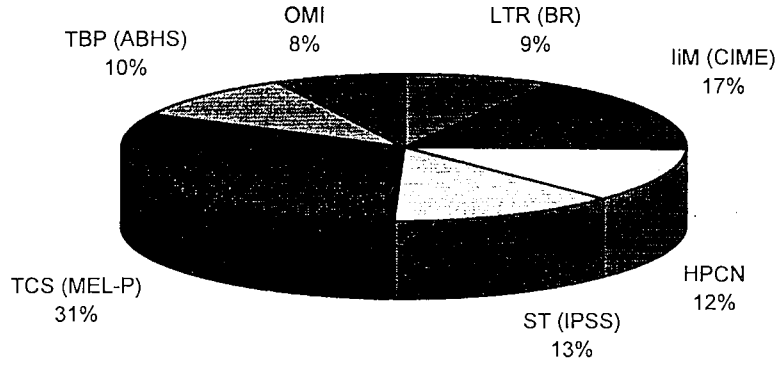
TOTAL 1352 MECU

Note: Abbreviations in brackets correspond to the area names of Esprit III

IT Programme Breakdown by Domain
Framework Programme IV
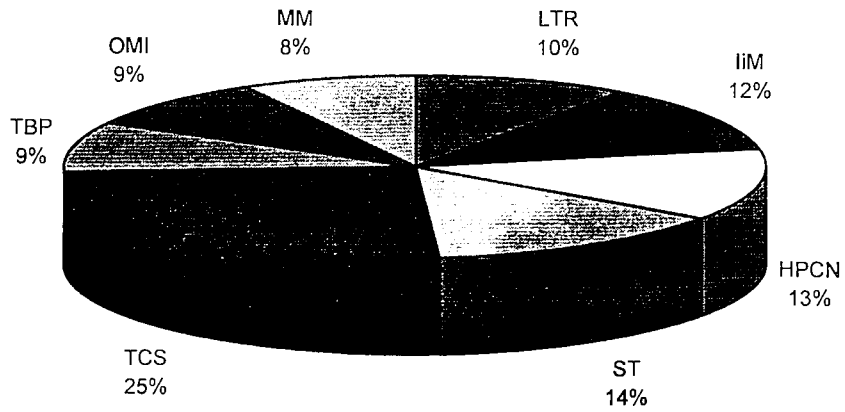
TOTAL 2057 MECU

Projects, Partners and Funding

	N° of Projects	Average Project Cost (MECU)	Average N° of Partners per Project	Total Funding (MECU)
Esprit I	225	6.35	5.37	714
Esprit II	424	6.62	9.36	1454
Esprit III	721	3.86	7.37	1491
IT Programme FWP IV	880 (on going)	1.80 (on going)	5.18 (on going)	905* (2057)**

The table above illustrates the scale of the various phases of Esprit, and the new IT Programme.

Notes:
(*) Total funding committed to projects up till 31/12/96. Note that it also includes University projects that are financed 100%.

(**) The total funding of 2057 MECU shown in FWP IV represents the total indicative funding allocated to the IT Programme until completion, and does not correspond to the number of projects shown.

Member States Participation. Esprit III

	Large	Research Institute	Sme	University
AUSTRIA	17	10	4	22
BELGIUM	55	56	52	64
DENMARK	37	21	17	37
FINLAND	23	22	9	15
FRANCE	500	222	145	136
GERMANY	389	192	151	265
GREECE	33	48	89	55
IRELAND	15	24	20	44
ITALY	291	82	115	175
LUXEMBOURG	1	1	4	0
NETHERLANDS	101	35	25	95
PORTUGAL	25	47	33	29
SPAIN	96	52	80	86
SWEDEN	35	20	9	54
UNITED KINGDOM	270	69	153	344
EFTA	40	48	21	62
OTHER	2	2	0	0

Abbreviations : General

ASICs	Application Specific Integration Circuits
Cordis	Community research and development information service
ESI	European Software Institute, Bilbao
ESPRIT	European Strategic Programme for Research in Information Technologies
ESSI	European Systems and Software Initiative (Projects)
FUSE	First User Action (Projects)
FWP	Framework Programme (at the EU), I, II, III, IV
ICT	Information and Telecommunications Technologies
IMT	Industrial and Materials Technologies
IT	Information Technologies
R & D	Research and Development
RTD	Research and Technological Development
WP	Work Programme (Document)

AREAS/DOMAINS ABBREVIATIONS		ESPRIT III	IT Programme FPW IV
ABHS-P	Advanced Business & Home Systems Peripherals	*	
BR	Basic Research	*	
CIME	Computer Integrated Manufacturing and Engineering	*	
HPCN	High Performance Computing and Networking	*	*
IiM	Integration in Manufacturing		*
IPSS	Information Processing Systems and Software	*	
LTR	Long Term Research		*
MEL-P	Microelectronics - Peripherals	*	
MMS	Multimedia Systems		*
OMI	Open Microprocessor (Systems) Initiative	*	*
ST	Software Technologies		*
TBP	Technology for Business Processes		*
TCS	Technology for Components and Subsystems		*

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