SCIENCE PARK NETWORKS

A report to the European Commission

Volume One

Segal Quince Wicksteed Limited

economic and management consultants

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EXECUTIVE SUMMARY AND KEY RECOMMENDATIONS

INTRODUCTION

1.1 This executive summary presents the main conclusions and recommendations of the SPNET study of the networking needs of science parks and related initiatives. The study was commissioned by DGXIII and DGXVI of the European Commission and was overseen by a Scientific Committee of experts from EU countries. The study encompassed science parks and also initiatives such as BICs, technopoles, teleports and technology incubators (which this report normally captures under the generic term science park) in all member states of the EU.

Study objectives

1.2 The SPNET study had four main objectives:

- to assess the needs for communication and networking in science parks at the transnational, national, regional and local levels, including analysis of existing networks
- to analyse the way telematics can support such communications and interaction at the transnational, national, regional and local levels, including both infrastructure and applications requirements
- to assess how science parks equipped with telematic applications can act as a disseminator of these applications locally
- to assess whether it is advisable to set up a specific network or to make use of existing networks to reach the objectives.

1.3 In summary, the study sought to examine how science parks and related bodies could be developed to assist in economic development through human and telematic networking at various levels. The study also had a particular emphasis on encouraging cohesion.

SURVEY FIELDWORK

1.4 A pan-European project team led by Segal Quince Wicksteed carried out the fieldwork which included:

- a postal questionnaire seeking information about science parks and their networking needs which was sent to over 380 science parks, BICs and other bodies including existing science parks and those under development (which achieved a 42% response rate)

- visits to over 60 science parks, BICs and other bodies which provided an opportunity to learn about their role, current activities and future plans. This included interviews with over 400 science park and BIC managers and representatives of tenant companies, universities, economic development bodies and other relevant organisations

- a study of technology demonstration centres including teleports and IT demonstration centres

- a review of existing networks at regional, national and EU levels

- an investigation of relevant telematic technologies and applications

- a review of the future prospects for telematic developments and their implications for science parks and other bodies

- a 'Vision' workshop which examined future telematic applications and their relevance to science parks

- presentations at various stages during the study to several international conferences and seminars to test conclusions and obtain feedback.

SURVEY RESULTS

Science Parks, BICs and other bodies in the EU

1.5 The survey identified a total of 382 science parks, BICs and related bodies in the EU of which 337 were operational and 43 were at the planning stage. The largest number of existing parks were located in Germany with 103 existing and 3 planned parks, followed by France with 64 existing and 7 planned parks. The third largest community was in the UK with 46 existing and 8 planned parks. The greatest growth in the development of new science parks was in Spain where 12 new parks were planned to add to the existing 25 science parks and related bodies.

Communications requirements

1.6 The majority of science parks provided services on a shared basis to tenants including telematic services. The level of shared provision in more advanced telematic facilities was greater on science parks in the South where 59% of responding science parks provided access to E.Mail facilities or had plans to provide access compared to 49% in the North. Similarly 41% of science parks in the South provided a telematic link to the related university or institute compared with 30% in the North. In general, the need for advice and expertise by science park managers was found to be stronger in the South (61% of respondents) than in the North (50% of respondents) and in new science parks under two years old (60%).

1.7 The survey indicated that a high proportion of science park managers would value advice, expertise and assistance from other relevant science parks in areas such as helping tenants with technology transfer (64%), obtaining finance (59%) and identifying sources of technology needed by tenant firms.

1.8 SMEs represent a high proportion of tenants on science parks with 54% of firms having less than 10 employees. In general, small firms made use of proven, widely available technologies such as fax to establish communication links appropriate to their needs. The use of modems for E.Mail and CAD/CAM data interchanges was relatively small. Larger firms, particularly subsidiaries of multi-national companies often had well established E.Mail and other telematic systems.

Demonstration Centres

1.9 The study found that many existing centres for the demonstration of new technologies were under utilised or had become outdated. The most effective demonstration of new technologies was found to be through practical applications of relevance to companies, together with mentoring and support.

Cohesion

1.10 The study identified a number of issues related to the development of new science parks in less favoured regions (LFRs). Two main approaches appear to have been taken in LFRs: science park initiatives by specific research institutions and science parks as an economic development tool. Many developments have been overambitious and there is a need to reinforce realism through the evaluation of business plans, management support and the encouragement of linkages with established initiatives.

1.11 In general, the recent creation of science parks in LFRs shows that:

- they are proliferating rapidly compared with the increase of overall RTD expenditure
- financial support is coming almost exclusively from the public budgets in various forms.

1.12 The study identified that in many LFRs (apart from those in Spain) academic institutions play a disproportionately important role. In these areas, it is therefore important to reshape the role of HEIs and at the same time increase the role of other participants, in particular regional authorities and private capital.

1.13 In order to relate parks better to economic cohesion rather than only academic interests, it is important to reinforce professional managements and shift the emphasis towards increasing linkages with bodies such as BICs but also with other organisations concerned with regional development and innovation, creating synergies and extending/valorising training, aiming ultimately to channel the RTD process towards commercialisation.

THE DEVELOPMENT OF SCIENCE PARKS

1.14 In developing the analysis of science parks and science park networks, there was a need to understand the role of science parks within the regional context in which they were situated. Science parks have developed at different times and in different ways in different parts of the EU. Science parks in the less favoured regions, mainly in the South, have developed more recently than those in the North and face particular problems in relation to the availability of an adequate research and innovation and industrial infrastructures as well as to problems of remoteness from major markets and centres of technology development. In many cases, science parks in the LFRs are still at a planning stage. Many of the more mature science parks, which are mainly in the North are developing a broader role in assisting regional economic development and in establishing wider networks.

1.15 Typically, science parks have been established in order to pursue one or more of the following objectives:

(i) establish and develop new technology based firms
(ii) encourage inward investment of public sector R&D
(iii) attract mobile private sector R&D investment
(iv) attract inward investment more broadly
(v) encourage technology transfer to local existing firms
(vi) encourage technology transfer to local new firms.

1.16 Innovative and high tech companies locate on science parks for four main reasons:

- appropriate premises
- to gain access to a high level of innovation support services and information sources
- to gain a higher market profile
- to gain advantages through linkages with complementary businesses and institutes in the same region, the same county and in other countries.

1.17 The SPRINT science park initiative which provides a centre of excellence in science park development has played a major role in the dissemination of good practice by providing consultancy assistance for studies of the feasibility of proposals for new science parks.

1.18 During the early years of a science park's development, the main focus is normally on establishing the physical infrastructure and buildings and in attracting tenants. As science parks become more established, greater emphasis is often placed on providing services to tenants and on establishing networks with other bodies regionally and more widely. As a consequence, the management skills needed at different stages in a science park's development will vary and there is consequently a continuing need for learning and exchange of experience.

1.19 The survey provided evidence of the diversity of the regional economic backgrounds, organisational structures and stages of development of different science parks and of their differing information and networking needs.

1.20 Science parks have developed throughout the European Union in a piecemeal fashion with little overall coordination or systematic cooperation between science park promoters or science park managers (with the exception of the coordinated development of BICs and the SPRINT science park consultancy scheme). There is a continuing strong interest in science park throughout the EU with many new initiatives being developed. However, the results achieved by existing parks range from excellent to lacklustre and, in many areas, the performance of science parks has been disappointing to the regional development and other promoters who had high expectations of the economic benefits which science parks might bring. Some science parks will always be constrained by the lack of underlying success conditions, but can still contribute to economic development.

1.21 The SPNET project sought to examine why some science parks have not lived up to their full potential. These relate to their abilities to provide distinctive services and networking opportunities to tenant and associated firms. In particular, the project sought to establish how regional linkages and networking between science parks and other regional organisations could be improved.

1.22 The survey found that poor linkages between some science parks and their regions militate against the delivery of innovation support and information services, while the lack of trans-national linkages between science parks limits their ability to develop a high market profile. Although some science parks have become nodal points on information networks, the information flow between most science parks is poor and this makes them less effective in the delivery of relevant information to tenant companies and associated organisations in the region.

1.23 As a consequence, science parks face a number of key problems in playing a dynamic role within their regional economies. These are summarised as follows:

Management

1.24 The experience and knowledge of science park management is variable. In some cases, individuals have no prior experience or training in science park management and in other cases they do not have the authority to make a significant impact. Many science park managers have property related skills but lack knowledge and experience in new technologies such as telematics. The best science park managers are rounded individuals combining skills in property management and marketing with skills in business support services, innovation, technology transfer and an ability to establish wide ranging networks and market contacts. Science park managers need to be able to develop new skills as their science parks develop and mature. The improvement of business planning, marketing and other management skills is a key element of the BIC network and stronger linkages between science parks and BICs where these exist could be of considerable value.

Regional impact

1.25 With a few notable exceptions, science parks do not relate well to the regions they are supposed to serve. In some cases this is because science parks have focused only on the needs of tenant companies and in other cases because there are too many discrete initiatives leading to duplication of effort, competition and inefficiency. Examples of successful regional networking initiatives demonstrated the opportunities for science parks to specialise while retaining the advantages of communications and cooperation on a wide range of issues. The development of clusters of tenant companies specialising in particular technologies or market opportunities, such as food technologies in Calabria and Cesena, or telecommunications in Rennes, strengthens the opportunities for technology transfer. The development of linkages between BICs which provide support for business planning, marketing and financial issues with

science parks and other innovation oriented organisations which are concerned with research and development, technology transfer and support for innovation can provide greater synergy and support for the small technology based firms and lead to improved regional development.

Demonstration

1.26 Science parks are centres of innovative businesses, a high proportion of which are leaders within their technological fields. Many of these businesses are often pre-disposed to the application of new technologies which can enhance their technological performance and competitiveness. Such businesses provide an important vehicle for demonstrating the benefits of new technologies through real life experiences and could therefore be used to push back the barriers to the wider introduction of new technologies and applications. Such role models are of far greater significance than pseudo-demonstrations provided in an artificial environment.

Technology

1.27 With a few notable exceptions, science parks are not making use of modern telecommunications and electronic networking technologies. This is partly due to lack of knowledge and partly to the historical lack of user friendliness of many of the systems which have been available. However, a wide range of new opportunities is developing as a result of the growth of the Internet, the greater functionality of modern telematic systems and their falling costs. There are consequently considerable opportunities for science park management teams and science park tenant companies to take advantage of modern telematic and networking technologies. There is a need to provide a source of expert advice to audit current usage and advice on future strategies.

SPECIFIC HYPOTHESES

1.28 The terms of reference for the SPNET project included eleven hypotheses on which confirmation or denial were sought through the results of the project. These hypotheses were examined during each phase of the study and therefore provide a good structure for summarising the key findings and conclusions. The evidence was not always conclusive, but the main conclusions reached about each hypothesis are discussed below.

Hypothesis 1- the number of science parks within Europe is expanding rapidly with a risk of uncoordinated development and competition between themselves that could be counter productive

1.29 The study confirmed a continuing strong interest in the development of new science parks. New proposals for science parks were identified in the industrialised areas, in Objective 1&2 regions and in the new Lander of Germany. The development of science parks is a very dynamic activity in the South. There are 12 science park proposals in Spain, 12 in Italy while all the science parks in Portugal and Greece are at a planning or development stage. In total, some 43 science park proposals were identified during the survey.

1.30 In general, there was little coordination of science parks apart from the BIC network, the SPRINT science park feasibility studies and technology transfer schemes. In some regions examples of coordinated activities had been developed, such as the Route Des Hautes Technologies, the network of Basque Country science parks and the Italian NEST initiative. These coordinated initiatives have allowed individual science parks the opportunity to concentrate on specialised technologies or on technical support relevant to the industries in the surrounding area, while gaining the advantage of communications and cooperation with a broader range of industries, technologies and opportunities.

1.31 In a few cases, particularly where science parks were heavily subsidised by public subventions, problems of competing science park initiatives were found which could lead to sub-optimal sized parks. Examples included a number of science parks in Portugal and in Greece. Further analysis of the extent to which regional science park developments might be better coordinated is likely to be provided through the Regional Innovation and Technology Transfer Scheme (RITTS) which provides funding for an audit of the regional infrastructure for technology transfer to assist the development of regional strategy to enhance innovation and competitiveness.

Hypothesis 2 - The need for exchange of experience is felt at regional, national and international levels. The implementation of human networks between park managers will help coordination of their actions, development strategies and possible specialisation and foster development of parks within the peripheral regions

1.32 The study confirmed a desire for the exchange of experience, particularly between science parks sharing a similar background , or facing common problems or regional issues. In particular, the effective networking established by EBN between BICS in different countries and regions provided a good example of what could be achieved. The importance of human networking and the establishment of a common understanding and a sense of trust was emphasised throughout the study. However, many science park managers did not have sufficient information to enable them to identify managers in other science parks (particularly in other countries) with whom they might share information. In addition, a number of established science parks were seeking to enhance their role within the regional economy through greater inter-action with other bodies. Managers of the most well established science parks were often willing to assist managers of newer science parks, but not necessarily without compensation. In general, there appeared to be a requirement for longer term guidance and assistance from managers of established parks to help those in the newly developing parks. The concept of a long term mentor or non executive director was put forward as a way of meeting this requirement.

Hypothesis 3 - It is necessary to encourage the constitution of transnational telematic networks that will allow the creation of a pan-European telematic structure. These networks should be used as vectors of communication between technopoles to encourage coherence with regard to communication standards

1.33 Transnational networks already exist and are growing at a fast pace. The most important of these networks is the Internet which provides world wide networking through a range of protocols which have become de facto standards internationally. Science park networks should seek to build on this existing infrastructure and to support the evolving standards-making process for new and existing applications.

1.34 The potential for direct point to point communications between two science parks is also being enhanced through the wide spread introduction of ISDN. The adoption of harmonised Euro-ISDN standards throughout Europe is being promoted by the European Commission which has programmes and policies for developing standards. These standards should be adopted where required within any science park network.

Hypothesis 4 - It is important to channel phenomena such as human networks to ensure harmonisation in the most developed countries and to ensure that the peripheral countries (handicapped by less developed telecommunication infrastructures) do not become marginalised.

1.35 The study highlighted the difficulties of channelling or coercing activities in a field such as networking which is dependent on human interactions and a sense of a common understanding. The study showed that the problems of peripheral regions or Objective 1 & 2 areas were not necessarily the same throughout the EU. For example, some Objective 1 areas such as Ireland had good telecommunications systems and science parks in other Objective 1 regions such as in Spain and Italy were more advanced in the use of computers and telematics than their counterparts in the North.

1.36 Problems with the availability of telecommunications infrastructure were apparent in parts of Greece, Spain and Portugal, in particular through the slower implementation of ISDN in these areas. However, a problem of potentially greater significance is the wide disparity in telecommunications pricing between different parts of the EU which could inhibit the competitiveness of companies dependent on intensive telecommunications usage. This problem is particularly relevant to LFRs in the South. The high price of telecommunications in Europe generally, and the wide disparities between countries' prices points to a need to encourage the provision of extensive local points of presence for access to the Internet so that users are not required to pay excessive long distance telecommunications charges. Such local points of presence could be provided through science parks and could allow users to gain access to the Internet at local charge rates.

Hypothesis 5 - Fostering the development of human and telematic networking of science parks would be of particular importance to the peripheral regions by giving science park managers access to the know how of their colleagues in more developed regions through telematic techniques

1.37 The study found that effective transfer of technology and management systems and knowledge is dependent on the establishment of effective human networking and the establishment of trust. The availability of electronic or computer based systems provides a mechanism to increase the efficiency and reduce the costs of such networking once it has been established. In addition the costs of advanced telematic systems is falling dramatically and as a consequence the potential savings from substitution of telematic systems such as desk top video conferencing for travel and

face to face human inter-action are increasing. There is consequently a growing opportunity for existing human networks to be upgraded to make them more effective through the use of telematics. The study identified a need for networking not only between North and South, but also a need for networking between parks with similar backgrounds in different regions of the South.

1.38 One of the current constraints on the use of these systems is the lack of a critical mass of science parks or other bodies equipped with them. This reduces the value to an individual science park of acquiring telematic systems. There is consequently a need to foster groups of users of telematic tools particularly during the early phase of their introduction to encourage the use of advanced telematic systems and to provide assistance for their rapid and effective uptake.

Hypothesis 6 - The ISDN will provide a reliable and quick access to telematic resources available within the networks of research centres of the most developed European countries and possibilities of cooperation.

1.39 The study found that the availability of ISDN varied throughout the EU with the greatest availability in the North, but that there were plans in all areas for increasing availability over the next five years. However, the study found that the uptake on science parks was relatively small with the greatest usage of ISDN in areas such as the graphic arts industry. The adoption of Euro ISDN standards is thought likely to facilitate networking between different countries and to speed up the installation of ISDN networks. Opportunities for the use of ISDN for cheap desk top video conferencing appear to provide a significant opportunity to enhance networking and reduce costs.

1.40 However, the study also found that the more advanced forms of networking such as those requiring high bandwidth for interactive full motion video would require more advanced networks involving fibre optics. Examples of such advanced networking are beginning to be implemented through the national (and international) academic and research networks, but these are unlikely to become generally available in the near future.

Hypothesis 7 - The networks will make full advantage of the IXI and COSINE networks and take advantage of the investments deployed in STAR and TELEMATIQUE

1.41 The study identified the improvements made to national telematic infrastructures in a number of countries such as Ireland, Spain and Portugal through the investments made under the STAR and Telematique programmes. The study also examined the wide spread availability of the academic and research networks and the increasing provision being made by the European Research network organisation 'DANTE' which links together the relevant national academic and research networks into a pan - European netw ork. Dante is currently enhancing the Europanet to provide higher bandwidth communications and greater functionality to facilitate communications between researchers throughout Europe (the IXI network referred to in the hypothesis, which previously linked the European academic networks, has been replaced by the Europanet).

1.42 Academic and research networks are funded by the public sector with the objective of facilitating communications between researchers and providing access to the applications and opportunities of the world wide Internet. However, because these networks are state supported, there are consequently limitations on their usage for commercial purposes. Since most science parks and tenant firms are by definition commercial undertakings, the number of firms linked to these networks and through them to the world wide Internet is limited. The survey identified a few science parks and tenant companies which were linked to the relevant national research network, particularly in Denmark and Greece. However, the widespread linkage of commercial unde.takings to academic and research networks is likely to raise questions about charging and usage policies.

1.43 During the study, the opportunities for science parks, BICs and other bodies to gain access to the Internet through commercial Internet service providers such as EUnet were also explored. There would appear to be opportunities for science parks and tenant companies to gain access to the Internet in order to obtain information, communicate with other organisations and undertake research and marketing activities. In addition, there are opportunities for science park management teams or tenant companies to act as local champions providing user support and information services to tenant companies through specialised searches of the information on the Internet. Existing networks such as those linking the BICs and those linking members

of national associations might be integrated into a broader system to encourage and facilitate communication and technology transfer.

Hypothesis 8 - The networks will give parks in the least developed regions access to European telematic resources and accelerate the exchange of data and information of a commercial and technological nature between regions

1.44 The study found that a wide range of new easy to use applications were becoming available on the Internet. The availability of applications to search for relevant information such as Mosaic on the World Wide Web could provide access for the least developed regions to the telematic resources of Europe and of the world. The use of telematic networks opens up a wide range of possibilities. However, assistance, training and guidance are likely to be required at a local level to encourage a widespread uptake by small firms on science parks.

Hypothesis 9 - For businesses located on Parks the availability of quick, reliable and cheap means of communicating will allow them to get better integrated with the European industrial fabric including EDI.

1.45 In general, large industrial companies and their suppliers are the main users of EDI. The study found that many of the firms on science parks were suppliers of specialist items of equipment, usually produced in low volumes. They were not suppliers of large volumes of components or other products to other firms or industrial buyers. Integration into EDI systems did not appear to be a priority for the majority of firms interviewed at the present time although the use of telematics for exchange of CAD drawings was of interest to some companies.

1.46 However, the 'Vision' workshop indicated that the Internet is likely to develop to allow user friendly and secure forms of trading which might extend the use of EDI and transactions over the Internet. As a consequence there will clearly be a need for companies to monitor developments as EDI becomes more pervasive on the Internet.

1.47 The availability of better telematic networks provides a range of other opportunities for companies which would allow better integration of companies for a range of purposes such as:

- the formation of specialised consortia, or virtual companies, for particular contracts. This could be of particular importance to SMEs which need to put

together a consortium at short notice to meet particular pan European opportunities

- the interchange of information about specialised areas of research and the identification of partners for collaborative research projects

- cheap and simple communications for technology transfer, marketing, customer support, distribution, servicing and other purposes.

1.48 As a consequence, the opportunities for networks between science parks and related organisations would appear to be good. Familiarisation with the use of telematic networks such as the Internet and access to a point of presence are likely to become increasingly important issues.

Hypothesis 10 - Networks could be a decisive advantage in attracting subsidiaries of large multi-national firms who are used to a tight network linking together their various operations

1.49 The study found that large multi-national firms are unlikely to be attracted to a particular science park because of its networking capabilities, although the lack of an adequate telecommunications system in a region could be a disincentive to the establishment or location of multinational companies.

1.50 In general, large multinational companies have their own E. Mail and other communications networks and are capable of installing leased lines, virtual private networks, ground to satellite communications or whatever technology is most cost effective for their purposes. In general, such companies have sophisticated systems for analysing and optimising their communications and telecommunications systems to provide the greatest cost benefits to the firm. In addition, large multinational firms are often concerned about data security and are likely to need to be convinced about security and protection systems on any third party network.

1.51 The study showed that the greatest problems in relation to telecommunications and networking opportunities were likely to lie at the other end of the spectrum, where small firms do not have the knowledge or capability to analyse the true costs of their telecommunications activities and where there is a need for assistance in the form of telecommunications audits. Such audits could demonstrate the true costs of current telecommunications systems such as telephone and fax and use of modems, the

potential savings which might be made through the use of E. Mail, ISDN etc and the opportunities for new ways of conducting business through telematic networks. In this way SMEs on science parks and in their vicinity could become more efficient and effective.

Hypothesis 11 - Confronted by the frequent reluctance of SMEs to employ modern management tools such as IT, it appears highly desirable to promote them by implementing such techniques in the companies established in science parks and establishing a show case. This would improve the competitiveness of SMEs in general and especially those in Objectives 1 & 2.

1.52 The study of existing demonstration centres found that the benefits of demonstration and show casing technology were likely to be greatest when companies were provided with practical applications and mentoring support and assistance to enable them to identify the advantages of particular courses of action to their specific circumstances. The mere demonstration of technology does not, in general, provide an effective use of public funds. In a number of cases, demonstration facilities which merely provided examples of particular technologies had become obsolete and were under utilised.

1.53 In addition, there is a need to support groups of companies with common interests rather than single companies only, to build familiarity with new ways of working such as E.Mail and to establish a critical mass of users.

NETWORK DEVELOPMENT

1.54 The development of telematic networks needs to take into account a number of general issues in order to maximise the chances of success:

- networks should be developed on the basis of the need for useful applications
- users of networks will generally make evolutionary changes and revolutionary changes in working practices should not be expected
- there is usually a need for a local champion for networking who will lead, encourage and support others
- there is usually a need for practical support for networking at the local level within a Local Area Network

- the value of a network increases in relation to the number of those connected and a critical mass is usually required to make networks cost effective

- existing infrastructures, networks, standards and applications are likely to provide the most cost effective starting point for networking.

1.55 The proposed strategy for implementing a network for science parks is therefore to enhance existing networks, facilitate the creation of new networks and to make the greatest use of existing proven technologies including:

- existing LANs within science parks

- existing Internet connection

- World Wide Web

- ISDN.

1.56 There is likely to be insufficient demand for telecommunications traffic within a science park network to justify a dedicated backbone between science parks based on leased lines such as the backbone which exists for the academic and research community within the Europanet system. However, there may be opportunities for some science parks to gain access to the Internet through connections to their national research network as well as through commercial providers.

1.57 The proposed network development strategy is therefore based on an incremental approach which seeks to build communities of interest and a critical mass of users for applications which have real value added. In particular, the proposed strategy is designed to enable science parks, tenant companies and associated companies to gain access to a range of applications at the minimum cost and to gain experience. This will be particularly significant in many Objective 1&2 regions where telecommunications costs are high. Where necessary, the implementation strategy seeks to support local users in the provision of equipment, training, customer support and investment in technology.

1.58 The strategy also recognises the potential interests of telecoms operators and other players such as cable companies, non - traditional telecoms operators and network access providers which have an interest in developing new forms of business through

computer networking. The proposed strategy seeks to enable science parks to maximise their inherent advantages by negotiating to becoming nodes within existing networks and promoting applications within their regional economies.

1.59 As a consequence, science parks should be in a strong position to negotiate linkages to existing networks particularly when there are EC support programmes which will increase the overall size of the market and extend networks into new geographic and market areas.

1.60 The proposed network development strategy therefore seeks to speed the development of networks through EC funds to:

- develop communities of interest
- provide professional assistance to science parks in negotiating agreements with network service providers
- provide funds to encourage the development of critical masses of users for example of video conferencing using ISDN.
- fund incremental infrastructure investments to facilitate these developments.

NEW SPNET INITIATIVES

1.61 On the basis of this analysis, a range of initiatives were developed and tested through wider consultations and workshops. These initiatives were designed to unlock the potential of science parks and allow them to become more effective players in regional development, innovation and cohesiveness by meeting three sets of inter-related needs:

A. the professional development of science park managers
B. support for specific telematic developments and pilot projects
C. support for the development of networks.

The initiatives proposed for each of these areas are discussed below.

A. The professional development of Science Park Managers

1.62 One of the key requirements for improving the effectiveness of science parks is the need to enhance professional development by spreading good practice techniques more widely. Two possible initiatives are proposed to meet the differing needs of science parks and other bodies throughout the EU.

Science Park Management Programme

Background

1.63 The survey found that one of the key factors in the success of science parks was the quality of management and that there was a need for dissemination of good practice to managers of science parks, BICs etc on a long term basis, particularly those in LFRs. There is a need for continuing professional development and training and a need to ensure that good practice is as widely disseminated as possible. A range of opportunities for short courses as well as longer term mentoring and distance learning opportunities need to be made available and easily accessible. On order to achieve this, a number of proposals for new initiatives have been brought together to ensure the greatest synergy between them.

Recommendation

1.64 A new programme should be created to provide research and training in science park administration and regional development. The programme should provide opportunities for :

- the development and dissemination of best practice throughout Europe using long term mentoring and other techniques
- new modular courses such as an MBA in science park administration
- training in accessing information and the use of databases in the most cost effective way
- disseminating knowledge about telematic applications and developments of potential use to science parks, BICs and other bodies

- provide training and user support in the use of telematic tools such as E.Mail and accessing information through the Internet

- open and flexible learning opportunities for learning using modern technologies such as CD-ROM, teletraining, distance learning etc as appropriate

- research into the development of science parks, BICs and other bodies and linkages between them in Europe and throughout the world

- a guidebook which includes advice to promoters as well as managers.

1.65 Such a new programme would be initiated by the European Commission by seeking bids to organise and run elements of the programme from individual bodes and from consortia of bodies such as universities, companies and others who would be expected to make a significant contribution to the development costs.

Budget

1.66 The programme would be created by inviting bids for a series of initiatives from existing organisations (or consortia). In order to make this attractive to organisations such as universities, associations etc significant support would be necessary. However, the project would be implemented building on existing infrastructure rather than creating new facilities and would eventually generate fee income. An EC contribution of 500,000 ECU per annum for a period of five years is proposed.

Mentoring

Background

1.67 Consultancy assistance for the development of science parks is currently available through SPRINT. However, this provides advice from a group of science park experts for a limited period of time and the study identified a need for longer term advice and mentoring for science park managers to facilitate:

- the transfer of experience

- the development of new skills

- advice on new projects and initiatives

- membership of the science park board where relevant.

Recommendation

1.68 The Commission should develop a scheme to provide assistance to science park management teams in identifying relevant mentors and in meeting the costs of time, travel and other communications. Assistance should be provided for 50% of the costs incurred during the first year.

1.69 In order to ensure the effectiveness of the scheme the Commission should develop a list of approved mentors and establish a managing agent for the scheme who would be chosen by competitive tender.

1.70 In those LFR areas where science park schemes are still at a development stage and where the majority of companies are in traditional industries, priority should be given to new initiatives related to demonstration and training for these companies or for groups of companies. In addition, the Commission should encourage the use of telematic methods for the provision of mentoring by assisting in the acquisition of the relevant E.Mail and/or Desk Top Video Conferencing systems. Such assistance would be provided as an alternative to travel costs and would therefore not involve any additional budget requirements.

Budget

1.71 The mentoring scheme for science park management teams would involve two main activities:

- a managing agent to provide the focus for applications and to develop, promote and manage the scheme. A sum of 150,000 ECU per annum might be required for this activity

- support for individual mentoring projects. One the assumption that 50 projects might be supported at a cost of 10,000 ECU each for one year the annual cost would be 500,000 ECU.

B. Support for specific telematic developments

1.72 The usage of modern telematic technologies varied considerably in science parks in different countries of the EU. There is a need to build communities of common interest and to support the introduction of proven technologies to support networking. Six possible initiatives are suggested which are designed to meet the differing needs of different science parks throughout the EU.

Telecoms Audits

Background

1.73 Science park managers and tenant companies are utilising a variety of technologies for communications purposes which are often not the most appropriate technologies for their current and future needs. The study showed that many science park managers and tenants were using only basic telematic tools such as phone, fax and occasionally modems. In addition, new technologies such as ISDN, computer networking and desk top video conferencing are falling in price and provide opportunities which are likely to have particular relevance to SMEs on science parks. However, many small firms on science parks are unlikely to have the time or resources to undertake a detailed study of their current and future telematic needs or of the opportunities opened up by new technologies.

Recommendation

1.74 The Commission should support a scheme to provide audits of the telecommunications systems and future communications needs of science park companies leading to improved communications strategies, demonstration sites and case studies. The Commission should:

- appoint a managing agent for the scheme
- develop an approved list of consultants
- provide support for 50% of the cost of an audit (2/3 in Objective 1, 2 and 5b regions) up to a maximum contribution of 2,500 ECU per firm.

Budget

1.75 The audit of the telematic needs of science parks and tenant companies would require two main budget lines

- a managing agent to develop, promote and manage the scheme. A sum of 150,000 ECU per annum is likely to be required for this activity

- support for individual audits. On the assumption that 200 audits costing 2,500 ECU each were supported each year the cost of support would be 500,000 ECU.

Science park Internet service provision

Background

1.76 In many areas, science parks are a natural focus for technology transfer and SME development. They can also act as an important node within a network of other organisations such as regional development bodies, research institutes etc. At present, access to the world wide Internet is available to some researchers, particularly those in academia, but access is less widely available for other groups. In addition, many science parks have existing local area networks which are frequently under utilised.

1.77 In order to gain access to the applications and facilities on the Internet, any potential user has to establish telematic contact with a local point of presence and needs support and assistance while they explore the full range of opportunities open to them. This requires a local point of presence to minimise the cost of telephone calls and to provide a source of assistance to hand locally. This is particularly important in areas where telecommunications costs are high, including many LFRs.

1.78 The commercial Internet Service Providers such as EUnet expand their operations to meet the growth in demand. When demand increases in a region they seek to install a new point of presence (POP) often through a contract with other organisations which provide secure premises and relevant technical back up for their computer equipment. In exchange, these service providers are often willing to negotiate reduced cost access to the network.

1.79 Science parks could provide suitable sites for the provision of an Internet service facility (POP) since they are frequently situated in areas adjacent to a concentration of business activity. The equipment could be located within the science park management premises (or within a tenant company). The science park provider could then:

- negotiate a contract with the relevant network provider such as EUnet
- provide access to tenants either through an existing local area network or through modem connections
- sell access to the Internet tenants to other bodies in the region
- provide technical and training support to users locally to encourage take up
- provide an information service for tenant companies and associated organisations
- provide a focus for the demonstration of the benefits of computer networking at a local level.

This suggestion was particularly well received by science park managers at the IASP conference at Bordeaux in September 1994.

Recommendation

1.80 In order to allow science parks, BICs and other bodies to develop this initiative, the EC should:

- provide a source of guidance and assistance to science parks, BICs etc to explore the options available to them, to help in preparing a proposal to establish an Internet local point of presence and to assist in negotiations with the commercial Internet provider
- provide initial support for the investment required to establish the local point of presence and support over the first year

- arrange for all EC databases and other information to be provided as servers on the Internet system rather than as direct dial up to Brussels or Luxembourg and publicise this in literature and advertisements

- ensure that science park feasibility studies and plans take into account the need to provide adequate ducting for cables.

1.81 The costs of enabling a science park or tenant company to become an access node on the Internet might range up to 25,000 ECU per annum for leased line access at 256k.bits/sec depending upon the agreement negotiated. In order to encourage science parks to negotiate the most attractive agreement with an Internet service provider, the Commission should provide the following assistance:

- professional help and guidance to science parks in developing a specific business plan for their particular science park taking into account the opportunities for selling services from the Internet

- assistance towards the first year costs of capital and running costs

- assistance towards the costs of training

- assistance with the costs of installing local area networks around the science park

- assistance with the development and marketing of services to firms in the regional economy during the first two years of operations.

Budget

1.82 Assistance should be limited to 20,000 ECU for proposals covering all the above areas and be limited to say twenty five science parks per annum. Such an approach would encourage science parks to prepare costed business and marketing plans using professional help and to negotiate effective agreements with Internet Service providers. The total cost of this initiative would therefore be 500,000 ECU per annum.

Gaining Internet Access

1.83 For science parks or tenant companies which do not have sufficient potential demand to justify becoming an Internet node (POP) but which still wish to gain access to

information, E.Mail and provide a local information service, the possibilities of dial up access using a modem may be viable. This approach would enable the science park to participate in a wide range of applications and services and gain experience and provide demonstrations. Such access might cost in the region of 1,250 ECU per annum plus the one-off capital costs of a PC and modem (1500 ECU). In order to encourage uptake and usage of the full Internet applications and to build a critical mass of users, the Commission might:

- provide funding for half the costs of Internet access during the first year including equipment and service charges

- provide assistance towards the costs of training, support etc.

1.84 Assistance would be limited to 2000 ECU for proposals which included both the elements outlined above and would be limited to 100 science parks submitting valid proposals in each year. The total costs of this initiative would therefore be 200,000 ECU per annum.

SPNET World Wide Web server

Background

1.85 Science parks and tenant companies throughout the EU have an interest in marketing their products and in identifying other companies who might be potential research or distribution collaborators. However information about the technologies, products and services of companies on science parks is not readily available. In addition, information can rapidly become obsolete.

1.86 The availability of information on science parks, tenant companies, products and services through the World Wide Web would provide companies with a unique marketing opportunity. However, such a system would need to be updated regularly by the companies themselves or their agents. Such a system could transmit text, graphics and video clips of products or services and greatly enhance opportunities for technology transfer or for other areas of business.

1.87 The development of such a system would be dependent on companies and science parks already having full connection to the Internet. However, the provision of such information would be of potential interest to a wide range of people whether they

were located on science parks or not. Consequently, a wide range of companies may wish to market their products, services or capabilities through this system.

1.88 In order to provide possibilities for demonstration of this new technology within science parks and tenant companies, assistance might be provided in a number of areas:

- assistance in the deployment of a dedicated WWW server (or portion of a server) for science park related information
- assistance to companies and science park managers in creating hypertext documents describing their services for use on the system
- assistance for the initial running costs of the system.

1.89 A World Wide Web server for science parks in which hypertext information on specific companies could be updated by those companies themselves would have several advantages:

- companies would have a vested interest in keeping information up to date since this would provide them with greater technological or marketing opportunities
- companies could make use of the World Wide Web to create a series of 'hypertext' pages with linkages to provide greater information on specific topic areas
- companies would become familiar with the use of the W.W.W system and would use it to find collaborators in other countries.

Recommendation

1.90 The European Commission should commission a project to design a World Wide Web server which would be accessible to companies on science parks. The server would be based at a science park or other organisation chosen by competitive tender. The Commission should meet the costs of:

- system design and specification
- the costs of equipment, software and communications linkages

- the initial costs of loading existing information onto the system.

- support for companies to develop hypertext pages to describe their products and technologies and install the information on the system.

1.91 A single organisation or consortium chosen by a competitive tender should be asked to prepare a comprehensive project to meet these requirements.

Budget

1.92 An initial contract might be let by competitive tender to an organisation capable of providing assistance in each of the above areas. Such a contract might be based on support on a per company basis. Assistance of some 1000 ECU per company might be provided up to a maximum of 500 companies per annum, leading to an initial cost of 500,000 ECU. Support for the scheme might be provided for a period of 5 years.

Desk top video conferencing

Background

1.93 There are major developments taking place in Desk Top Video Conferencing (DTVC) technologies. The study identified a few science parks such as Merseyside Innovation Centre which had established pilot DTVC links to assist technology transfer and innovation. In addition, the 'Vision' workshop on future telematic technologies identified exciting opportunities to extend the role of science parks through the development of telematic or 'virtual' technologies using video conferencing, multi-media application and networking. The costs of equipment are falling and the availability of ISDN lines is growing throughout the EU. At present, the technology can support a medium quality video image together with a shared application such as a word processing package or database. There are consequently growing opportunities for improved inter-action and networking between science parks and other organisations using this equipment. However, before such systems become widespread, there will inevitably be a hiatus before a sufficiently large critical mass has been achieved.

Recommendation

1.94 The Commission should fund a series of pilot projects linking science parks and other organisations throughout the EU. The Commission should:

- fund the costs of hardware, software and ISDN lines to allow video conferencing between a number of selected science parks

- select science parks and other bodies for funding on the basis of a competition for a limited number of proposals based on defined criteria which would give priority to networking within regions, between regions and between countries

- develop a directory of all video conferencing participants which would be available on the Internet. This directory should eventually include facilities for multi media images of the participants in the video conferencing system to be displayed and point and click connections

- utilise desk top video conferencing for its own communications purposes as an alternative to travel costs within projects which the EC funds.

Budget

1.95 The minimum costs to enable a science park to use desk top video conferencing using Euro-ISDN might be in the region of 2500 ECU plus the costs of a PC (1500 ECU) although these costs are likely to fall rapidly. Networking using this technology will require a critical mass of users to make the system viable. Assistance might be provided for:

- the costs of installing ISDN lines

- the costs of the video conferencing card, camera and software

- initial support and training.

1.96 Assistance might be limited to 2000 ECU per applicant with a maximum of 100 applications being funded per annum (more than one application might be considered from companies and managements on a particular science park). The total cost of this initiative would therefore be 200,000 ECU.

1.97 Where science parks were participating in the mentoring scheme described previously, a desk top video conferencing system might be installed as part of the project cost to encourage mentors to provide assistance to science parks in LFRs without the costs of travel. In such cases, the whole costs of the video conferencing system could be provided. This would not lead to increased budget requirements since travel and subsistence cost savings would be made.

Local Area Networks

Background

1.98 Some science parks are already equipped with local area networks which extend around the park, but which may not be equipped for Internet access. Other science parks do not have local area networks. The fast pace of telematic developments is likely to lead to increasing opportunities for science parks to exploit advantages through the provision of information through local area networks. Parks which are not able to provide effective local area networks are increasingly likely to be at a disadvantage.

Recommendation

1.99 The Commission should therefore:

- ensure that science park feasibility studies take into account the need for cabling ducts for LANs. This would not require any additional funding

- provide support to enable science parks with existing LANs to modernise and update their technology to enable these to be used to provide Internet services. This assistance would only be provided where a science park had become a full Internet service provider by establishing an on - site access node.

Budget

1.100 Assistance should be included as part of the support already described for establishing a node.

Broad band high speed networks

Background

1.101 A number of experiments and demonstration facilities using broad band high speed networks are being funded in Europe. At present, the involvement of science parks in these initiatives is small. However, high speed networks are being linked to institutions close to science parks such as universities and research institutes. Where science parks or tenant companies have relevant projects or interest, there may be opportunities for them to join such initiatives and gain experience of new applications and technologies. Such links could be established through links to Metropolitan Area Networks (MANs). Proposals for the establishment of MANs linking universities, research centres and science parks have been made in cities such as Manchester.

Recommendation

1.102 The Commission should take a positive attitude towards applications for linkages to MANs and encourage a limited number of initiatives to establish such linkages which might be supported through the Structural Funds or other programmes.

Budget

1.103 The possibility of linking science parks to existing high speed network initiatives is likely to vary considerably depending upon the type of network under consideration and the distance of the science park from the nearest node. In some cases proposals for MANs may include possibilities for science parks to join the network, or to provide facilities for housing servers etc. The Commission should consider proposals for linking science parks to such networks on a case by case basis. It is unlikely that more than one such proposal would be made per annum from each country and the Commission should be prepared to contribute to such linkages from regional funds or other budgets as appropriate. No additional costs are proposed under the SPNET project.

C. Support for the development of networks

1.104 A variety of networks between science parks, BICs etc already exists. However, there are considerable opportunities for new network initiatives and for the enhancement of existing networks. This will require the provision of information about potential

network partners as well as support for the development of specific networks. Four possible initiatives are suggested to meet the needs of different networking opportunities.

Information for networking

Background

1.105 Although many science park managers recognise the need to enhance their contacts with other science park management teams throughout Europe, there is no easily available source of information to enable them to locate management teams on other science parks with relevant interests. The survey found that many science park managers wished to establish contact with parks in other countries but did not have the necessary information to enable them to identify suitable partners. Existing reference directories produced by IASP, ADT, EBN, UKSPA and others present a number of difficulties including:

- partial and fragmented information
- information provided at different times
- language difficulties
- differences in format and terminology

In order to overcome these problems, a new information service is proposed.

Recommendation

1.106 There is a need for a directory which would provide information about science parks throughout the EU in an easily accessible form. Information should include the background and objectives of the science park and the regional context in which the science park is situated together with some information about tenant companies, their

technologies, markets and interests. The Directory would aim to provide information about science parks rather than detailed information about companies. It would be distributed using various media including paper, CD.ROM, electronic mail and Internet.

1.107 A database of all science parks and similar organisations would require a significant amount of administration to gain the initial detailed information on science parks and their tenant companies together with an annual cost for holding and updating the information. A starting point for the creation of the database would be the information gained through the SPNET project which includes information on just under half of all science parks. However, more detailed information would be needed to make an effective database. To create a directory as a stand alone project would therefore be expensive and would lead to a continuing expense for updating the information.

1.108 It is therefore proposed that the development of the database should be undertaken in stages by discussions with existing publishers of science park directories and that funding should be provided to meet the additional costs of producing a single unified directory. If agreement could be reached, funding might be provided to:

- develop an agreed classification system for science parks within the EU
- define the format for collecting data
- design the database system
- test and prototype
- obtain information
- analyse create a document capable of publication in printed and computer media formats and on the Internet.

Such a project would also require ongoing funding for updating and republishing. No particular sum is proposed for funding at this stage. The amount provided should relate to the outcome of the discussions.

Budget

1.109 If agreement could not be reached, the Commission might consider a project to create a new directory which would be let by competitive tender to a single organisation with an annual sum for updating. An initial sum of 100,000 ECU to create the directory followed by 50,000 in each of the following four years might be required.

Project legacies

Background

1.110 The EC funds a wide range of projects and programmes each of which involves travel and other costs. Such costs can be considerable and an alternative approach of funding the equipment and networking costs for E.Mail or Desk Top Video Conferencing would provide opportunities for a growing number of organisations to become familiar with modern telematic technologies. One of the objectives of all EC projects should therefore be to leave behind a legacy of infrastructure including investment, experience and knowledge which will enable the participating bodies to enhance their competitive position.

Recommendation

1.111 The Commission should allow project participants to install E.mail, Internet access or desk top video conferencing in all EC projects in place of travel or subsistence costs.

Budget

1.112 The proposal for EC projects to fund infrastructure developments such as desk top video conferencing would result in a transfer of funds from one activity to another and would not therefore entail any additional cost.

Specific Pilot Projects

Background

1.113 There is a wide range of opportunities for science parks and BICS to develop specific networks which might be based on:

- intra-regional linkages between science parks, BIC and other organisations within one particular region

- inter-regional linkages of science parks, BICS and other organisations in different regions or countries

- thematic linkages between science parks, BICS and other bodies throughout the EU which show a common interest or identity such as common technologies, supplier chain linkages or complementary marketing interests.

Recommendation

1.114 There is a variety of models on which this scheme could be based, but it is envisaged that support would be provided in stages. Initially, ideas for possible new networks might be put forward from a variety of bodies including science parks, regional development bodies, consultants, national governments etc.

Budget

1.115 During the second stage, it is suggested that 10 of these ideas should be selected each year with funding of 10,000 ECU being provided for the preparation of a more detailed proposal to identify the roles of all the participants in the network, the objectives, the respective contributions and the likely benefits. This would involve detailed discussions among the possible co-operating organisations. The third stage would involve the preparation of a detailed development plan and feasibility study and it is suggested that five proposed networks should be supported with 40,000 ECU each at this stage. In the final stage three networks would go forward for implementation with support of some 100,000 ECU each to cover the costs of implementation including hardware, software, training, first year operational costs and travel.

OVERALL BUDGET PROJECTION

1.116 The overall cost of implementing the initiatives will depend on:

- the rate of uptake of different schemes
- the choices made by science parks and other bodies between the various options
- the proportion of projects which were located in Objectives 1,2 & 5b attracting higher funding.

1.117 In order to provide an overall maximum budget profile, the costs of each initiative have been summarised in Table 1. In practice, the expenditure profile is likely to be lower than this maximum figure.

Table 1: Maximum cost projections (KECU)

Initiative	Year 1	Year 2	Year 3	Year 4	Year 5
The professional development of science park managers					
Science Park Management Programme	500	500	500	500	500
Mentoring	650	650	650	650	650
Support for specific telematic developments					
Telecoms Audits	650	650	650	650	650
Internet Provision					
• node provision	500	500	500	500	500
• access	200	200	200	200	200
WWW server	500	500	500	500	500
Desk top video conference	200	200	200	200	200
Local area networks	0	0	0	0	0
Broad band high speed networks	0	0	0	0	0
Support for the development of networks					
Information for networking	100	50	50	50	50
Project legacies	0	0	0	0	0
Specific networks	300	600	600	600	600
Total	3,600	3,850	3,850	3,850	3,850

Chapter 2

THE SPNET PROJECT

2.1 This report presents the findings of the Science Park Networks (SPNET) feasibility study which was commissioned jointly by DGXIII and DGXVI of the European Commission. This chapter describes the background and objectives of the project, the participants in the study and the timing and methodology of the fieldwork. The report then presents the results and conclusions leading to recommendations for initiatives to enhance networking.

Background

2.2 Science parks and related bodies have developed at different times and in different styles in all countries of the EU. Science parks have traditionally found benefits in the exchange of information and experience with other members of the science park community. Such exchanges have historically included meetings, workshops and conferences organised by regional , national and international associations. These exchanges have involved primarily science park managements and promoters. In addition, many science parks and related bodies have been involved in other national and transnational networks established for specific purposes such as the SPRINT inter firm networks for technology transfer and the EBN network for BICs.

2.3 Interest in networking among science parks has increased and greater emphasis has been placed on the potential applications of telematic technologies to assist and complement human networking. In some cases national associations have developed telematic networks for their members and a number of transnational networks have been formed, in some cases with the assistance of the European Commission. In addition, many recent proposals for new science parks identify networking within the region and with other science parks as an explicit objective.

2.4 Against this background, the SP-NET project was developed to provide a study of the feasibility of enhancing networks between science parks within EU member states in order to improve their contribution to economic performance. The study included science parks and related organisations such as technopoles, innovation centres, incubators, technology parks, BICs and teleports. (Throughout this report the term 'Science Park' has been used as short-hand to refer to all of these various initiatives).

Objectives

2.5 The SP-NET study had four main objectives:

- to assess the needs for communication and the actual practice of human networks in science parks at the transnational, national, regional and local levels including analysis of existing networks and criteria for different types of networks

- to analyse the way telematics can support such communications and interaction needs at the transnational, national, regional and local levels including both the infrastructure and applications requirements

- to assess how science parks equipped with telematics applications can act as a disseminator of these applications locally

- to assess whether it is advisable to set up a specific network or to make use of existing networks to reach the objectives.

2.6 Throughout the study there was also a need to take into account other requirements and priorities such as the need to enhance cohesion between member states including the potential for linkages between science parks in Objective 1 and Objective 2 regions with those in more developed areas, the need to identify and build on existing good practice in networking and the need to consider the requirements for technology diffusion in relation to current and future telematic systems. The influence of these other requirements and priorities provided a continuing stimulus which enhanced the scope and relevance of the study.

2.7 In addition, it became obvious at an early stage that the capabilities of telematic systems were improving rapidly and that the costs of equipment and network systems were likely to continue to fall dramatically. As a consequence, a study of the needs of science parks based on the requirements for current telematic technologies was likely to become rapidly obsolescent. The need to understand the future path of telematics technologies and their potential use in science park networks was therefore an important feature of the study.

2.8 The outputs from the SP-NET study are intended to provide not only recommendations and guidance for the European Commission (DGXIII and DGXVI) which sponsored the study, but also more general information and guidance to other relevant bodies such as national and international science park associations, managers of science parks, regional development organisations and other bodies concerned with encouraging innovation, technology transfer and business development.

Participants

2.9 The SP-NET project was carried out by an international team lead by Segal Quince Wicksteed which acted as project leader. Individual team participants were responsible for specific aspects of the work programme as set out below.

2.10 Segal Quince Wicksteed was responsible for overall project management, the final report and for the country studies in the UK, Germany, Ireland, Portugal, Denmark and the Netherlands. Centrale Management were responsible for the fieldwork in France, Belgium and Luxembourg and for a separate study of telematic demonstration centres throughout the EU. Fred Bennetts was responsible for the fieldwork in Spain, Professor Piero Formica of HITEC and Annaflavia Bianchi of ASTER were responsible for the fieldwork in Italy and Professor Lena Tsipouri was responsible for the country study in Greece. The telematic aspects of the project were assisted by INESC of Portugal and Analysys of the UK. The section of the report on cohesion (Chapter 5) was prepared by Lena Tsipouri with support from all the team members who carried out work in LFRs.

2.11 In addition to the project team, the study benefitted from the advice and assistance of a Scientific Committee of experts drawn from member states, who met on three occasions during the study and made important contributions to the direction of the project. The project also benefitted from the advice and guidance of Officials of the European Commission in DGXIII and DGXVI.

Methodology and Timing

2.12 The project involved several streams of work including a large scale survey of science parks in every member state and in-depth discussions with a sample of the various actors involved in science parks including managers, companies, universities or research institutes and regional development organisations. In addition, existing networks and technology demonstration centres were surveyed. The project was divided into phases to allow feedback to the client group and to the Scientific Committee after each stage so that the direction of the project could be amended in the light of the experience gained. These project phases included an inception phase, a fieldwork phase and a dissemination phase. The main tasks during each of these phases are outlined below.

Inception phase

2.13 The initial Inception phase began in October 1993 and focused on developing a better understanding of the most significant factors which should be examined during the fieldwork phase and on preparing the detailed fieldwork plan and the database of science parks necessary for the fieldwork to be successful. These activities included:

- discussions with EC officials to examine policies and initiatives relevant to different countries, and to the various EC technology programmes and initiatives likely to affect networking

- meetings with organisations managing existing networks such as EBN, TII and BCNET

- developing an inventory of telematic applications of possible relevance to networks,

- developing a database of all science parks, BICs, innovation centres, technopoles etc, together with a proposed sample and draft questionnaires for a postal survey and aide memoirs for the face to face interview programme.

2.14 An important part of the Inception stage was the need to develop an understanding of the many different types of science park which have been developed in different countries and the objectives which they are seeking to achieve. This was achieved through a workshop held by the project team at which science park experts developed

a typology of science parks to assist in the classification system to be used in the survey. There was also a need to develop a better understanding of the potential roles of human and telematic initiatives in networking between science parks and consequently discussions were held to learn from the experience of science parks which were already participating in pan European and local networks. About thirty interviews were undertaken during the Inception Phase of the project.

2.15 At the end of the Inception phase, in November 1993, a meeting was held with the Scientific Committee to discuss the proposed plans for the fieldwork. As a result of this meeting a number of significant amendments to the project were agreed including:

- the sample of science parks and other bodies to be visited would be weighted more strongly towards those in Southern European and Objective one areas with greater emphasis on BICS and teleports than originally suggested.

- the postal questionnaire should seek to cover all science parks and related bodies in the EU rather than a sample. Planned science parks would also be included in the survey

- the interview programme would seek not only to understand the networking needs of the science parks, BICS etc, but also to understand the roles of these bodies within the regional context in which they were situated

- the potential for building on existing networks would be examined wherever possible

- the role of teleservices would be included in the study

Fieldwork phase

2.16 During the fieldwork phase which began in January 1994 the following activities were undertaken: .

- detailed questionnaires were developed and translated into the languages of each of the countries in the EU. These questionnaires were mailed to named managers of science parks and other bodies between December 1993 and January 1994.

- interviews were undertaken with a sample of science park managers, companies located on the science parks, companies located off the science parks and with significant local and regional actors such as universities, research institutes, city authorities, development agencies, government offices etc.

- a study of existing telematic demonstration centres such as teleports and IT demonstration centres was undertaken

- a review of reports and literature on developments in telematics and networking technologies was undertaken

2.17 Reports were prepared on the visits and interviews undertaken to provide a description of the networking needs of the individual science parks visited as well as the needs of companies on them. The reports examined the role of the science park within its regional context, the roles of the other important economic actors and the economic and the policy context for the country as a whole within which science parks were developing. For each country an executive summary was prepared to provide the main conclusions and proposals for initiatives. These Executive summaries are given in the appendices to this report. The full country reports are available as separate documents.

2.18 Towards the end of the Fieldwork Phase a number of activities were undertaken to draw out the conclusions for the study as a whole including:

- a one day seminar for the country contractors to distil the key messages and conclusions of the work. At this meeting draft recommendations and ideas for initiatives were developed which formed the background to the development of a draft report.

- presentation of the work carried out and interim conclusions at conferences such as the science park conference at Rennes

- discussions of ideas and concepts with a wider group of those knowledgable about science parks and telematics in order to test ideas for possible systems and their likely future costs

Vision Workshop

2.19 In order to ensure that any recommendations from the SPNET project were robust to changes in technology, a workshop was organised at which experts in telematics technologies were asked to consider the future development of these technologies and their implications for networking. This workshop provided a basis for developing an understanding of the growth of existing networks such as Internet and the developments in telematic technologies such as ISDN and broad band cable.

Reporting and dissemination phase

2.20 The final phase of the project involved discussion of the draft report with the Scientific Committee and wider dissemination and discussion of the recommendations for initiatives through a series of workshops.

The development of the database and interview sample

2.21 During the course of the study several different approaches were used to obtain information and to seek views on the development of science park networks. One of the key approaches was the postal survey of all science parks and related bodies which provided a wide ranging structured examination of the factors involved. This survey covered all types of science parks and related organisations as well as those which were currently under development or being planned. This required the development of a structured database of all science parks, technopoles, BICS etc for all EU member states.

2.22 A database of all known science parks and other bodies in the EU was therefore created using a variety of sources including published directories, national associations and journal references. However, much of the data was found to be partial and incomplete and did not provide a firm foundation for classifying science parks or developing a reliable database. As a consequence, a considerable amount of work was required to follow up references to science parks and to obtain names and addresses.

2.23 As a result of this project, a database covering all science parks in the EU has been developed for the first time. This will form a unique deliverable from the project and should provide an on-going source of information for DGXIII and DGXVI. However, names and addresses rapidly become out of date and an annual updating of the records would enable a more complete picture to be developed of the development of science parks as well as a view of recent trends.

2.24 In addition to the postal questionnaire survey, the database was used to identify science parks and BICs etc where face to face interviews should be undertaken. Over 60 science parks were visited with the sample being weighted in favour of Southern countries and Objective 1 areas. In total, over 380 face to face interviews were undertaken with respondents in science parks, companies and other relevant organisations across all EU countries.

2.25 A study of demonstration centres throughout the Community was carried out by Centrale Management which includes visits to a range of teleports and other bodies and an Executive Summary of their report is provided in the appendices. The full report is available as a separate Annex.

2.26 The conclusions drawn from the data obtained during the fieldwork phase of the project formed the basis for the development of the rest of this report. The detailed results of the fieldwork phase in each country are given in the Annexes. The total number of face to face interviews undertaken for this study, including the study of demonstration centres and the inception phase interviews, was therefore well over 400.

Chapter 3

THE DEVELOPMENT OF SCIENCE PARKS IN EUROPE

3.1 Within each of the different member states, science parks and related bodies have developed in different ways and at different times and consequently have different characteristics. To achieve the objectives of the SP-NET study there was a need to understand:

- the different types of science parks in Europe and their role in economic development
- the economic and structural differences of the regions in which science parks are located and how this affects the contributions they are able to make to development
- the differences in the objectives and strategies of science parks which determine their networking requirements.

Cohesion aspects of science park development

3.2 The development of science parks in the less favoured regions (LFRs) has, in general, taken place at a later stage then that of science parks in more developed parts of the Community. As a consequence, science parks in the less developed regions tend to be newer than those in the developed areas and in many cases are incomplete or still at the planning stage. Very often these parks in less developed areas rely to a greater extent on public subventions and have greater difficulty in finding tenants. In some cases the role of public research institutes in taking space on these science parks is particularly significant.

3.3 In the LFRs, science parks are seen as having a particularly significant role in economic development and in fostering innovation and the introduction of new industries. In many such areas, science parks have a higher profile in economic development strategies than equivalent science parks in the more developed areas where a greater variety of other initiatives and institutions are in place for fostering innovation. High technology based firms in LFRs are more likely to be concentrated on science parks, but are also more likely to be remote from major technology markets and from sources of technical expertise than their counterparts in more developed areas. There are also concerns that science parks are developing too quickly in the some LFRs without reference to one another. As a consequence, the significance of any policies towards science park development or demonstration facilities is likely to be greater for the parks in LFRs than in more developed regions. The main conclusions of the fieldwork programme in relation to the role of science parks in LFRs are set out in Chapter 5.

3.4 In order to obtain data on these and other factors, science parks were classified broadly into two groups: science parks in less developed regions (Portugal, Spain, Greece, Ireland and the Southern half of Italy) which we have termed Southern science parks and parks in more developed regions which we have broadly classified as Northern parks. A more detailed typology of Science Parks was also developed to classify some of the main differences between parks so that their effects could be explored during the fieldwork phase. Some of the factors which were taken into account in the typology are discussed below.

Functional differences

3.5 To assist data collection and analysis we considered a number of different functional classifications of science parks including: single site science parks, multi site science parks or technopoles, incubators, innovation centres, teleports and Business Innovations Centres (BICS). Each of these categories normally involves a property element, but there is also a range of bodies such as Innovation Centres or BICS which do not include a property element and which rely either on public assistance or contract income from consultancy projects rather than property income for their funding.

3.6 Some science parks include several of the above functions, for example, a science park may include an incubator building or a BIC or may consider itself as a teleport. Many science parks in the south, for example, incorporate a BIC within the development. However, the extent to which a science park is primarily concerned with the needs of the tenants on its own site, or takes a more outward looking approach to assist companies in the wider economy is an important factor in relation to its ability to network within the wider economy. In some instances, science parks which functioned through a mainly internally oriented approach in their early years have developed to a stage where they are able broaden their role and are seeking to develop greater links within the regional economy.

Locational characteristics

3.7 Science parks have been developed in very different physical environments which may affect their ability to attract tenants and to expand. These include:

- parks developed in green field sites in an attractive natural environment where there is room to expand such as Sophia Antipolis.

- parks developed in inner city sites which are designed to improve a poor or derelict existing environment such as Aston or Dortmund

- parks developed in urban sites where space is limited such as Lisbon or Dublin.

Regional economic and S&T characteristics

3.8 Science parks are being developed in regions of Europe which have very different characteristics. These include:

- regions with an existing high level of scientific and technological infrastructure such as Heidelberg or Cambridge

- regions with a declining traditional industrial base or where there are problems of restructuring such as Porto, Manchester or Turin

- regions which do not have either a strong S&T infrastructure or a traditional manufacturing base and where S&T is being introduced for the first time such as Malaga.

- regions which are information rich where firms have access to a wide range of institutions and agencies which can provide market or technology information and assistance such as Baden Wurrtemberg

- regions which are peripheral and information poor and do not have easy access to markets or to technology information such as regions in Portugal

The role of regional and local actors

3.9 Regional and city economic development bodies have a widely different influence on the development of science parks in different regions of the EU. In some areas, some science parks have been developed entirely by a single private organisation such as a university or major company using their own resources. In other cases science parks have been seen as a major vehicle for economic regeneration and have been developed as an initiative of local, regional government or national bodies. In some areas of the Community these bodies have far greater funding, patronage and power than in others which they can bring bear to stimulate development.

3.10 The role of public funding in the development of science parks can have a significant effect on their ability to undertake non-commercial activities such as technology demonstration, technology transfer or assistance with developing SMEs. In some cases, several organisations are involved in the promotion and direction of science park schemes while in others only one or two organisations may be involved.

3.11 In addition, in some areas such as Lisbon, the significant number of science parks being developed over the same period by different sponsor groups of local and national actors is likely to exceed the volume of potential demand for space arising from target companies in the short to medium term, given the weak infrastrcuture of technology based business in Portugal. In the long run, it is hoped that these science parks will be able to encourage the generation of new technology based firms. This role as an actively supportive environment has been an important objective in many new proposals for science parks.

3.12 The various regions can be classified very broadly into three main types:

- those with powerful regional administrative structures (eg as in Spain, France, Scotland and Italy) where a high proportion of economic development activity derives from a single, central regional activity and where, in general, the structure of economic development is well planned and coherent

- those regions where there is no strong regional authority (eg as in England and Greece) and where a wide range of organisations establish (often overlapping and competing) schemes.

- regions where strong national authorities work with local or municipal authorities such as in Portugal

3.13 The potential needs for networking at a local or regional level are different in each of these areas since, in general, the first type is already much better networked than the latter by virtue of the powerful funding role of the regional organisation and because the boundaries between different types of initiatives are clearer. In the second and third types of region, networking can provide a vehicle through which the multitude of initiatives can learn of each others' activities, develop greater focus and reduce duplication. In some areas of the EU where regional structures are weak, the central government has begun to invest considerable effort in the formation of formal networks as a means of overcoming deficiencies in economic development, working with city authorities or others as in the third case above.

3.14 As a consequence of these differences in roles, there was a need to develop a classification of science parks both by defining their functions and characteristics and by classifying the objectives they were seeking to achieve. How this classification system was used to examine the networking needs of science parks is discussed in the following section.

Classification of strategies

3.15 A classification of science parks by their key strategies was an important element of the study and these are set out below:

(i) Establish and develop new technology based firms
(ii) Encourage inward investment of public sector R&D
(iii) Attract mobile private sector R&D investment
(iv) Attract inward investment more broadly
(v) Encourage technology transfer to local existing firms
(vi) Encourage technology transfer to local new firms

3.16 Strategies (i), (v) and (vi) are sometimes termed 'endogenous' since they aim to exploit existing resources and capabilities for development purposes, while (ii), (iii) and (iv) are termed 'exogenous' strategies since they seek to attract economic development from elsewhere. However it was recognised that, in practice, many science parks were likely to have multiple strategies.

Science park populations in the EU

3.17 The final database created in order to undertake the survey included a total of 382 science parks and related bodies of which 337 were existing science parks and 43 were at the planning stage. The distribution of science parks in different countries is shown in figure 1. The largest number were located in Germany which had 103 existing science park organisations and three at the planning stage (equivalent to over a quarter of all the science park organisations in the EU). Many of these German bodies could best be described as Innovation centres or incubators which have the creation and support of new technology based firms as their main objective.

3.18 The next largest community were in France where 64 existing and 7 planned organisations were identified (equivalent to 19% of the science parks in the EU). This includes the majority of the Technopoles in the EU (20 out of 23) as well as 20 single site science parks and 15 BICs

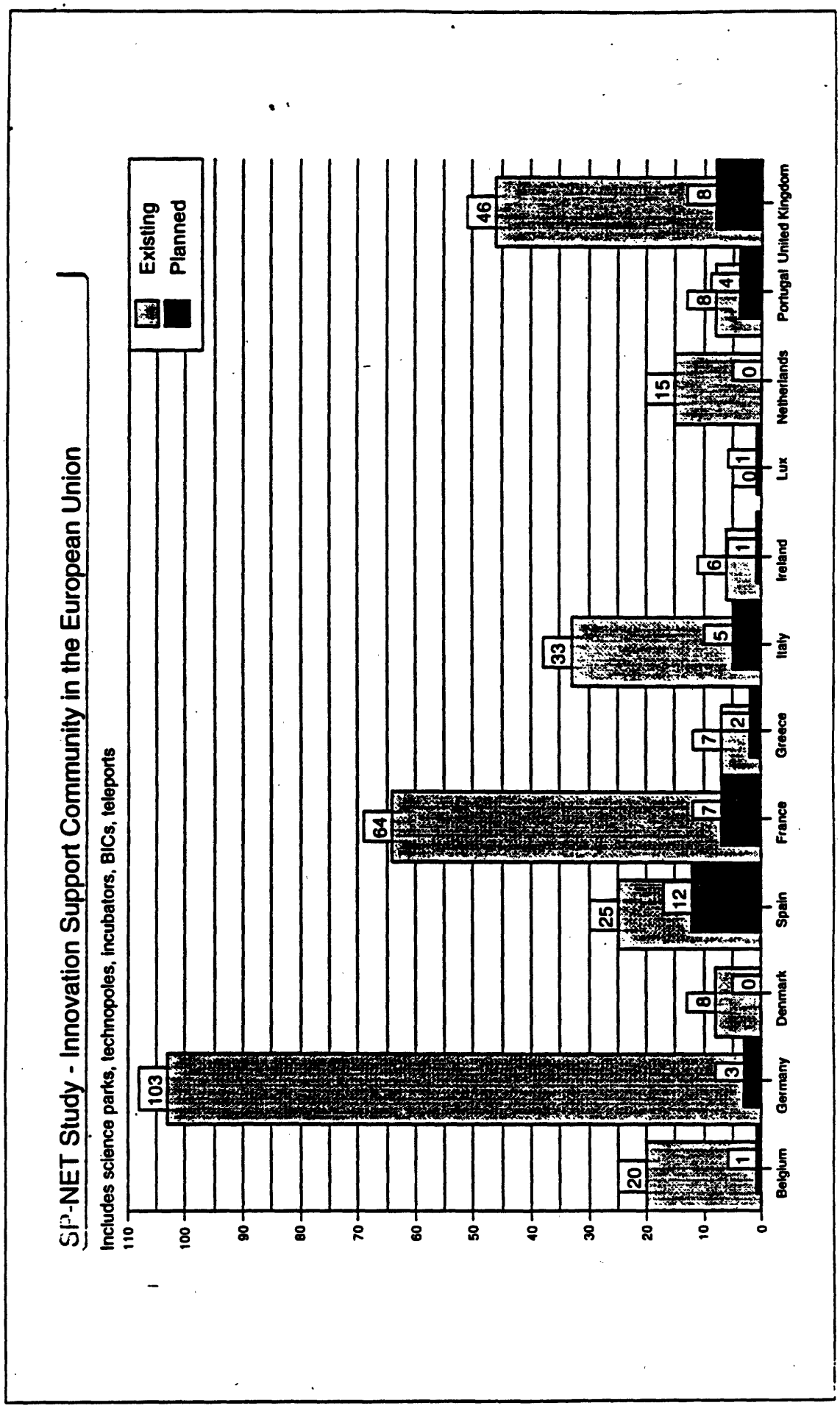
3.19 The third largest community was in the UK with 44 existing and 8 planned science parks. The majority of these (42) could be described as single site science parks with a small number of BICs and incubators.

3.20 The largest number of BICs was in Spain (17) Italy (18) and France (15) but it is also significant to note that BICs were virtually non-existent in countries such as Denmark and Germany with only a small number in the Netherlands, Belgium, Portugal and the UK.

3.21 The development of new science parks is a very dynamic activity especially in the South. Since undertaking the postal survey, a large number of proposals for new science parks have been developed or come to light, the greatest number being in Spain (12) and Italy (12) but there are also new proposals in the UK (8) and France (7).

Response rates

3.22 The postal questionnaire was sent to 382 organisations and the final response rate was some 42 per cent. Figure 2 shows the number of science parks and other bodies in each country which responsed to the survey. This response rate is good for a survey of this kind and we believe that it provides a sound basis on which to draw conclusions. The following sections reflect the findings from the fieldwork and the postal survey.


SP-NET Study - Innovation Support Community in the European Union
Includes science parks, technopoles, incubators, BICs, teleports
Existing
Planned
110
100
90
80
70
60
50
40
30
20
10
0
Belgium
Germany
Denmark
Spain
France
Greece
Italy
Ireland
Lux
Netherlands
Portugal
United Kingdom
20
1
103
3
8
0
25
12
64
7
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2
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8

Figure 1

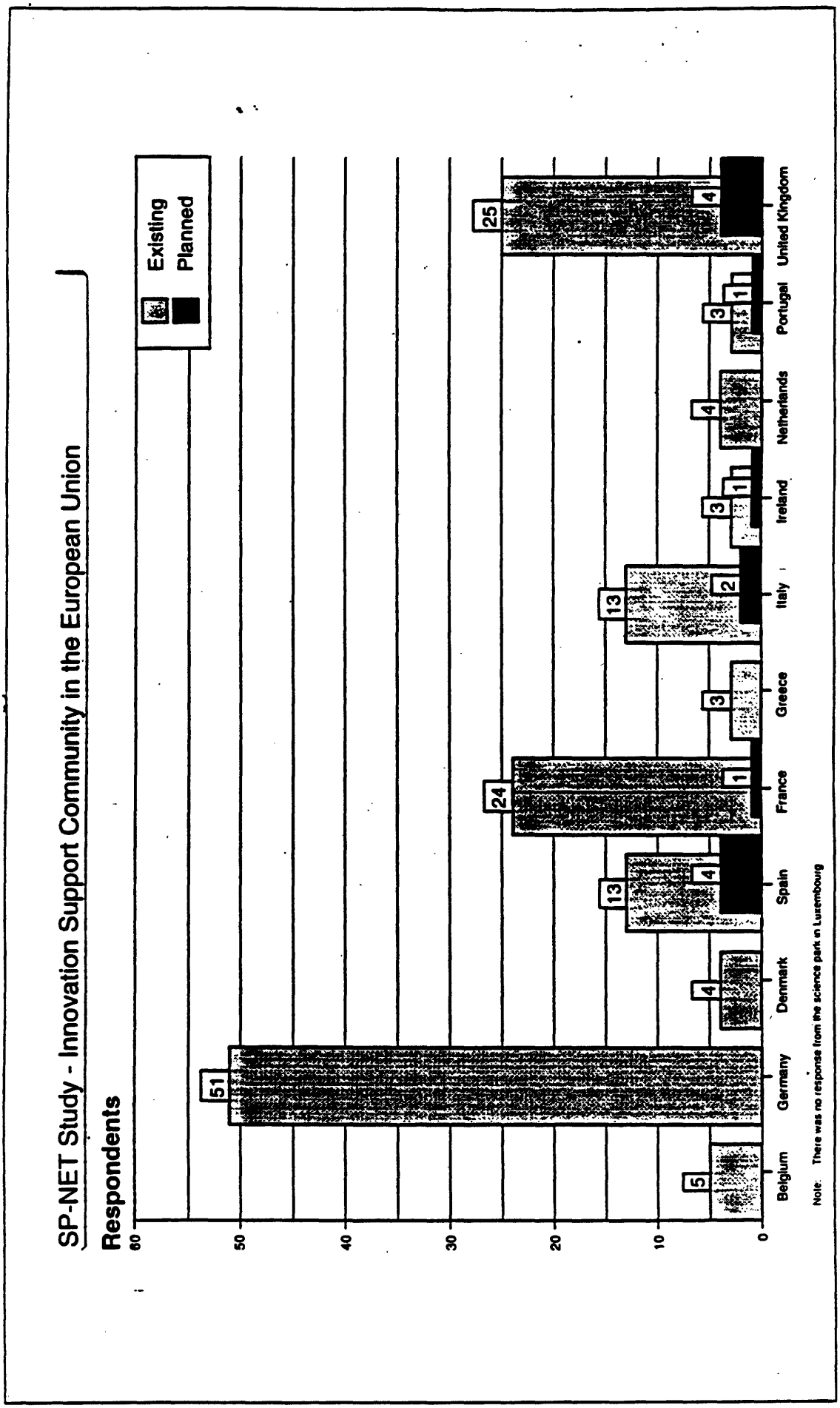
SP-NET Study - Innovation Support Community in the European Union
Respondents
Existing
Planned
60
50
40
30
20
10
0
5
51
4
13
4
24
1
3
13
2
3
1
1
4
3
1
1
25
4
Belgium
Germany
Denmark
Spain
France
Greece
Italy
Ireland
Netherlands
Portugal
United Kingdom
Note: There was no response from the science park in Luxembourg

Figure 2

Summary

3.23 In summary, science parks have developed in very different ways in different parts of the Community and from very different regional backgrounds. There are significant differences in the functional characteristics of science parks and in their strategies for development. In particular, science parks in the LFRs face particular difficulties related to remoteness and the lack of science and technology and industrial infrastructures.

Chapter 4

THE CHARACTERISATION OF SCIENCE PARKS

4.1 The process of categorising science parks for the survey demonstrated the confusion which surrounds the definition of the various terms such as science park, technopole and innovation centre. This confusion is partly caused by the fact that science parks have developed at different times and in different ways in each of the member states. In addition, the majority of science parks fulfil more than one function, for example, a science park may begin as a single site property based scheme but at a later stage develop an incubator or additional sites. The terminology used to describe a scheme in one country may be the same as the terminology used in a different country, but the science park schemes may themselves be very different. Even within the same country it is often difficult to be clear about the type of scheme under discussion.

4.2 The question of definitions is more than a matter of semantics since effective networking between science parks will require clarity about the organisational types and characteristics of different science parks to allow those seeking to develop networks to choose the most effective partners.

4.3 For the purposes of the postal survey, we defined a number of different science park categories and allowed respondents to apportion the most appropriate weighting to each of these categories which would best describe their science park. To a large extent the findings described in this Chapter are based on the results from the postal survey.

4.4 Across the EU as a whole, the largest category was 'single site science parks' to which 27 % of respondents classified themselves, followed by incubators (23%) and innovation centres(17%) with 12% classifying themselves as multi-site science parks. However, these figures disguise a wide variation between countries with a third of all multi site science parks being in France and a third in Germany but with only 13% in the UK.

4.5 The definition of science parks by their function was also confused by the fact that some BICS involved a property element which provided funding for the BIC activities as well as a client base of small companies with whom the BIC worked, while in other cases BICs had no property income and were reliant either on public subventions from regional or local economic development bodies or from consultancy services which were sold in the marketplace.

Stage of development

4.6 Science parks within the EU as a whole are at a relatively early stage in their development. A high proportion of the science parks which responded to our survey had been in existence for under two years (39%) with over 60% of science parks being in operation for less than 5 years. In general, science parks in the south of Europe have a higher proportion (50%) of respondents in schemes which were under two years old or were still in development. The North contains a larger share of mature science parks with 36% of parks responding to the survey being over six years old compared with only 16 per cent of Southern parks. This relative newness of science parks in Europe reflects the explosion of interest in science park developments which occurred in the late 1980s and which is continuing. As a consequence, many science park schemes do not have a substantial track record or history of development and many are at stage where they are seeking to define the best strategy for their future development.

Higher education linkages

4.7 Linkages to specific universities or institutes are, by definition, an important feature of science parks and the postal survey showed that over 70% of respondents had linkages with a specific university or institute. Linkages were strongest in the Southern science parks (81% of Southern respondents) and in single site science parks and incubators. This indicates the relative importance of universities and research institutes in the development of these science parks but the survey also illustrates the difficulties which multi-site science parks and BICs have in developing linkages where only 63 % of respondents had linkages with organisations. Organisations whose objectives were primarily concerned with technology transfer had the least well developed linkages with academic or research institutes.

4.8 The importance of linkages with academic institutes was also reflected in the composition of the management boards of science parks where 53% of respondents to the postal survey had a representative from a university or research institute on the management board. Other important representation on the management boards of science parks included regional development bodies (42% of science parks) which were far more important in the Southern science parks (69% of parks) than in the North. City councils were represented on the boards of 39% of science parks and local companies on 24% of science park boards.

Objectives

4.9 Science parks and related organisations may have several objectives and these can vary over time. The single most important objective identified by the postal survey was the development of New Technology Based Firms (NTBF) which was identified by 49% of respondents. This objective was more important for Northern science parks (51% of respondents). Many science parks had not been in existence long enough to comment on whether their objectives had changed, but the majority of science parks (55%) had not changed their objectives. Those which had changed their objectives were predominantly the older science parks, multi site science parks and science parks in the North. The majority of those which had changed their objectives (nearly 70%) had broadened or relaxed their entry criteria. A number of science parks felt that it was too early to tell whether objectives had been reached, including some science parks which had been in existence for nearly 10 years. This raises interesting questions about when it is appropriate to evaluate science parks against their objectives.

Tenant mix

4.10 The majority of respondents (86%) had tenants on site but the mixture of tenant companies within different types of science park varied considerably. As might be expected science parks which had only recently been developed were less likely to have tenants. The average number of tenants on science parks was 43 with a higher average number in the North than in the South reflecting the increasing age of science parks in the North. Domestic tenants made up the majority of the tenant population (on average 81%), but this proportion is lower in the South (70%) than in the North(85%). There were, in general, a higher number foreign tenants on multi-site science parks. Public sector organisations made up a relatively small proportion of the tenant mix.

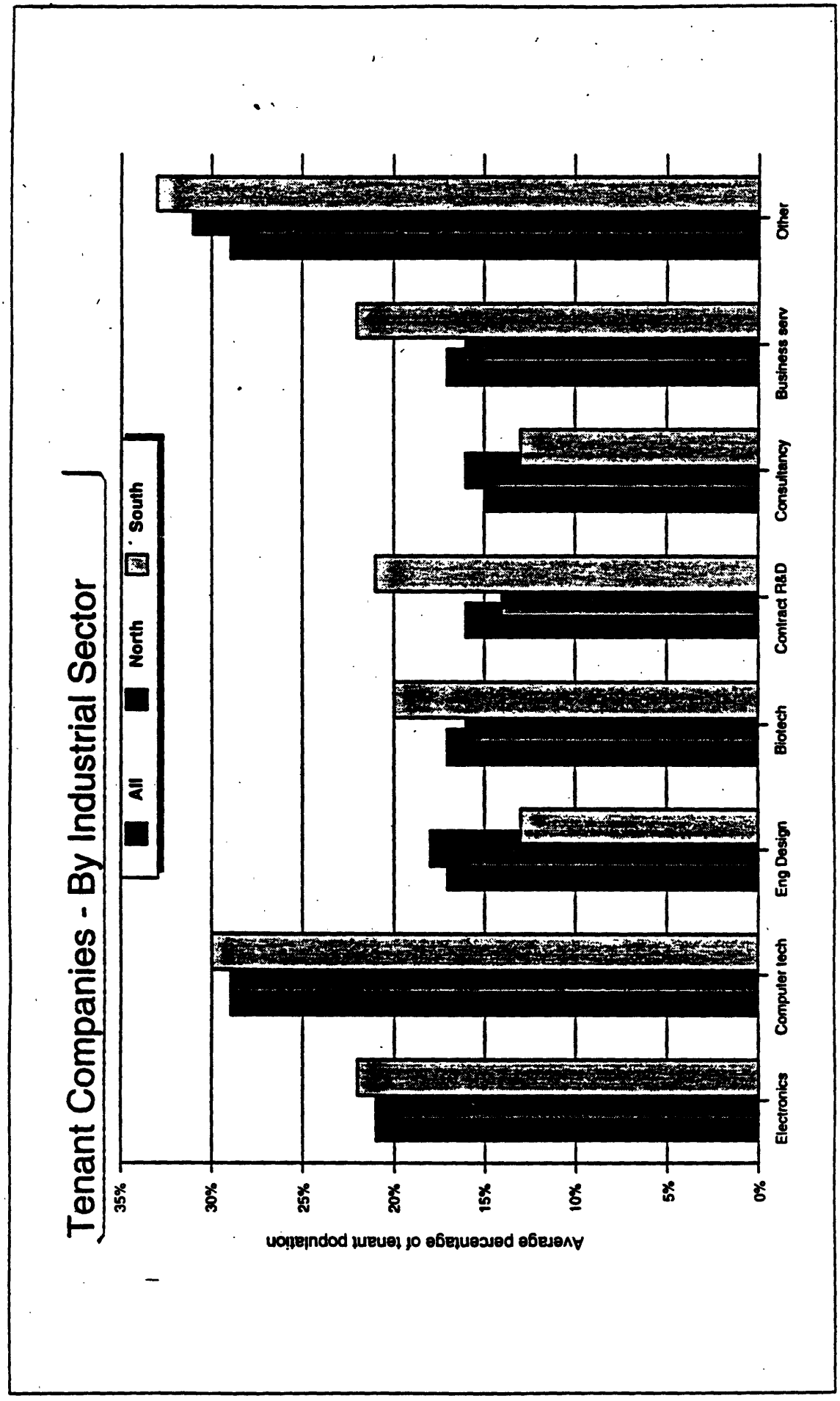
Tenant Companies - By Industrial Sector
All
North
South
Average percentage of tenant population
35%
30%
25%
20%
15%
10%
5%
0%
Electronics
Computer tech
Eng Design
Biotech
Contract R&D
Consultancy
Business serv
Other

Figure 3

4.11 There was a fairly wide spread of industries across all science parks in the EU with computer technologies including hardware and software (29%) being the most prevalent sector followed by engineering design (17%), biotechnology (17%), contract R&D (16%) and business services (17%). There was also a significant category of 'other sectors' which included environmental technologies, medical and health care.

Clustering

4.12 A significant feature of a number of science parks and technopoles is the development of clusters of companies in related technologies within particular science parks. In many cases these clusters have occurred by increments over time because companies found it beneficial to be located near to one another and were able to develop synergies, for example, in technological development or in marketing. Technology clusters have also been created by design, through the strategic policies of the science parks which sought to encourage particular types of businesses, generally without excluding other types of tenants. The postal survey indicated a significant proportion of science parks which have over 50 per cent of their tenants in one industrial/technological specialisation. In most member states, about 20- 30 per cent of science parks which responded to the survey were specialised in this way, but there is a higher proportion of respondents were in such specialised parks in Spain (41%) Germany (41%), Belgium (60%) and Denmark (50%). The survey also highlighted examples of technology clusters including:

- biotechnology in two science parks in Denmark
- a developing focus in food technologies in Calabria, Cesena SP Centuria and Montpelier
- the development of specialists sectors on automotive and advanced manufacturing technologies at Valladolid, Barcelona and Warwick
- the cluster of telecommunications companies at Novi science park in Denmark and at the Rennes Technopole in France
- the developing cluster of environmental companies at Aston Science park in the UK.-
- the IT and electronics clusters at Plassey in Limerick

4.13 In addition, a number of new science park proposals have recently been developed which specifically aim to develop science parks focusing on one specialised area such as medical, biotechnology or environmental technologies with additional resources or special facilities being provided to assist the development of the companies in these areas. These include health and medical at the Hannover Medical Park, biotechnology at the planned Nijmigen park in Netherlands, the Agropole at Montpelier and the Offshore Technology park at Aberdeen.

4.14 Opportunities for networking between such science parks could lead to synergies in terms of technology transfer, establishing distribution and marketing arrangements and the exchange of experience and information.

Employment

4.15 The average level of employment on science parks responding to the survey was 572 (full time equivalents) and like the average number of tenants , this was higher (682) in the North than in the South (336). However, this is likely to reflect the greater maturity of science parks in the North since , on average, older science parks had a higher average levels of employment. Multi-site science parks had, on average, a level of employment three times higher than that of single site science parks (1467 compared to 536).

4.16 Despite the recent recession, over half the science parks surveyed had grown in terms of employment between 1992 and 1993 with slightly higher employment growth in the South. Only 9% of science parks had experienced a decline in employment over this period. The greatest increase in employment had been in science park schemes which had been in operation for three to five years and in incubators and innovation centres. The largest decreases in employment were in science parks which had been in operation for between 6 and 9 years. It is possible that many of these initiatives were started during a period when science parks were created as a tool for economic regeneration, for example to alleviate structural problems in areas of industrial decline and that these science parks may have suffered more severely from the effects of the recent recession than other science parks.

Shared communication services for tenants

4.17 The majority of science parks provide services on a shared basis to tenants including switchboard answering service and fax. The availability of such services does not imply that all tenants make use of these services since many companies, particularly the larger companies are likely to have their own systems. In general, the provision of

shared services is highest in incubators and innovation centres where a shared fax service, for example, is available in 91% of schemes. The level of service provision is lower in single site science parks and multi site science parks.

4.18 The level of shared provision of more advanced telematic facilities is considerably higher on science parks in the South where, for example, 59% of responding science parks provide access to E.Mail facilities compared with 49% in the North and 78% of Southern parks provide access to databases compared with 57% in the North. Similarly, 41 % of science parks in the South provide a telematic link to the related university or institute compared with only 30 % in the North. These linkages may be due to the greater importance of academic linkages in the South and may also relate to the provision of facilities such as E.Mail through academic institutions which tend to be more highly used by academics than by commercial companies.

4.19 Shared access to advanced technologies such as video-conferencing, LANS and satellite links was also higher in the South. However, access to ISDN lines is considerably greater in the North (56%) compared with 33% in the South, reflecting the greater provision of investment in ISDN in the North. These figures for ISDN usage may need to be treated with some caution since the concept of ISDN is not widely understood by non-specialists. The greater emphasis on shared provision of advanced telematic facilities in the South may be due to the results of recent investment programmes through STAR and Telematique, possible greater enthusiasm for new technologies in the South, and possibly to an a greater awareness of the savings in the costs of telephony which can be achieved through the use of E.Mail and other advanced technologies.

Summary

4.20 In summary, there are difficulties in classifying science parks which inhibit effective communications and networking. Science parks in the South are, in general, newer than those in the North and have stronger linkages to higher education institutions. There has been a significant development of technology specialisation on some science parks through the formation of technology clusters. Despite the recent recession, over half the science parks surveyed had grown in terms of employment with only nine per cent reporting a decline.

Chapter 5

THE ROLE OF SCIENCE PARKS IN RELATION TO COHESION ISSUES

The context

5.1 This chapter aims to identify whether the creation of science parks in general and their human/telematic networking in particular has a positive effect on economic and social cohesion. In other words it investigates the mechanisms through which science parks would allow LFRs to catch up with core regions in terms of productivity and growth.

5.2 LFRs in the EU have, by definition, a low level of productive activities and insufficient infrastructure. While there are pronounced differences between Objective 1, Objective 2 and Objective 5b regions, lessons are very similar when one comes to science parks, BICs and incubation activities more generally.

5.3 Undoubtedly in the last decade one can observe a rather rapid improvement of RTD capabilities in the LFRs, which has been partly caused by the funding opportunities offered by their respective CSFs and participation to the Framework Programme of the EU. Research activities increased rapidly, as suggested by the improvement of bibliographic indicators, the creation of some scientific excellence centres and a continuously improving collaboration between academic institutions and industry. In that sense the modernisation of the R&D system stricto sensu has started. However if technology transfer and industrial competitiveness through adaption to technical change are taken into account, the impact is much less visible with few widespread economic benefits, the gap between LFRs and core regions widening rather than closing. Success stories exist, but they are less spectacular and more fragmented than in the case of research capabilities. For this reason both national policies and EU guidelines aim more and more at linking R&D systems with their local economic environment. In that sense science parks, BICs and any kind of incubation activity are only one instrument among others targeting cohesion.

5.4 In order to see to what extent this particular instrument is effective, a brief outline of the development of science parks in LFRs is presented, followed by the presentation of the relevant parameters identified, which are considered as characteristic for the different outcomes in parks in LFRs compared with the most successful of the parks in core regions. The concluding remarks attempt to summarise how policies for park creation, valorisation and linkages should shape in the future. The recommendations presented at the end of this report take account of the particular needs of parks in LFRs.

The development of science parks in LFRs

5.5 The creation of science parks has been strongly favoured by policy makers in most objective 1 regions but less so in objective 2 and objective 5b regions. The example of the success of the first science parks in core regions combined with the ample funding opportunities offered by the CSFs have triggered a massive wish to promote all kinds of incubation activities in LFRs. This is not a process of matching supply with demand, but a strongly subsidised activity, aiming at eliminating the market failure produced by the absence of adequate demand from the productive sector. One should note, however, that bringing a park into life is a maturing process, and as most parks are still at a planning stage, it might be too early to expect benefits for regional development.

5.6 In Portugal, science parks are conceived as technology transfer mechanisms clearly pushed by the science base. Although industry has become regionally specialised over the years, this specialisation has not been the primary influence shaping the focus of the four science parks in planning. In general, the parks have been oriented more to the RTD strengths of their associated research organisations rather than to the needs and characteristics of local industry. The main problem areas are delays in implementation, a lack of interaction between parks or park promoters and an unrealistically high expectation of demand by future tenants. The nine existing BICs have been a relatively successful development, although their impact has been small relative to the country's needs. International linkages seem to be a major preoccupation, national or regional ones less so.

5.7 In Ireland, science parks have not been favoured over other economic development tools and in some cases have been rated less highly. Thus originally only one park was supported in the Republic and one in Northern Ireland, though recently more feasibility studies for future parks have been launched. Incubation needs were covered by four BICs in the Republic and one in Northern Ireland and incubators in all universities. The high occupancy of incubators has nurtured the idea of parks as a

provision of unique space for knowledge based growth firms ready to leave the university campus. Thus the process of maturing seems more advanced in Ireland than in other LFRs. In addition, Ireland is one of the LFRs where private developers have shown interest in science parks.

5.8 In Greece, four parks were designed around specific research institutions, which are only now reaching the implementation stage. Overestimating the demand by potential tenants, delays, absence of synergies and a very strong influence of the academic unit related to the park are their major characteristics. BICs are less advanced than in the two other entirely objective 1 countries (Portugal and Ireland), two of the BICs offering real consulting services, but with no incubation activities. A proliferation of plans was observed for BICs and parks all over the country, in view of the new CSF.

5.9 In Italy, the prevailing model of the science park is of one big enough to give hospitality to researchers and companies in order to facilitate the meeting and cooperation between scientific laboratories and industry researchers. A coordinated plan for the whole country foresees the highest share of the budget for science parks (330 MECU out of a total 600) for the South. The reason behind that is the belief that parks can be an effective instrument against highly skilled unemployment. In Italy there are parks which grew rapidly both in objective 1 and in objective 2 regions. In particular, the case of Bari has attracted attention for its rapid growth and strong international linkages. Transfer of know how within Italy, as well as the demand by tenants from the North establishing in the South were major strengths. Nevertheless, there is some scepticism about the expected disproportionate increase in the number of planned parks in the South as a tool for economic development.

5.10 In Spain, science parks have a significant presence and can claim some impressive achievements. Most, however, are having serious difficulties in meeting objectives. Relatively few companies are locating on the parks, linkages with HEIs are rarely close and collaborative relationships are at an early stage of development. Reasons for this include the economic crisis (Spanish parks are latecomers) and structural difficulties (including the University system and business-finance environment). Existing networks include other organisations which fulfil similar or complementary functions and are linked to the parks. These include BICs, which on the whole appear to be well managed and reasonably effective.

5.11 The new Bundeslaender in Germany have followed a rapid policy for a considerable number of science parks and centres, aiming at as rapid as possible a change in the industrial culture, whereby entrepreneurship would be facilitated. At the same time they are using these new centres to establish research linkages with former Eastern and Central European countries and the CIS. To some extent the organisation of parks in the new Bundeslaender may be considered atypical for LFRs, since it is structured on the model of West Germany: regional linkages are the more typical, national linkages are sought after, whereas international ones are few and mainly directed to Eastern Europe.

5.12 From this short description of events in LFRs two alternative approaches are apparent, both supply led and with a very limited, if any, role for property developers:

a) Individual initiatives undertaken by specific research institutions: many research institutions feel that they have the quality and the will to improve their linkages with the local economy and decide to proceed with science parks controlled by their institution. Attracting public R&D investment and accommodating their own spin offs is the main driving force behind their decision, supplemented by collaboration with private national enterprises and attraction of inward investment. While their own commitment is strong, the size of the undertaking is such that they need to be supported by local or national authorities for accomplishing their projects and this brings them to a very large extent into competition among themselves.

b) Parks as an economic development tool: more parks are launched simultaneously in selected geographical areas within a broader government strategy. In a sense, parks are now launched all over the territory in the same way industrial zones were created in earlier decades. In this case the commitment of the funds at national level is early enough to avoid too strong competition among interested institutions, though in several cases specific initiatives, even at fairly mature stages, are left outside the national policy. But in this case the commitment of funds is so high, compared to total public R&D funds, that doubts are expressed regarding the return on investment of such an undertaking.

5.13 No matter which of the above-mentioned approaches followed, data on recent creation of science parks in LFRs shows that

- they are proliferating too rapidly, compared with the growth of RTD expenditure and personnel in the Objective 1 regions,

- their financial support is coming almost exclusively from the public budget in various forms including EC, national and regional programmes.

5.14 As this results to a high increase in demand for public funds for science park creation, it is important to identify the key parameters in science park development and compare them, if possible, in successful parks in advanced countries in order to establish some guidelines for an effective use of public funds.

Relevant issues for parks, BICs and other incubation activities

5.15 The diagnosis and remedies for improving industrial competitiveness in LFRs are well analysed and include the need to shift the RTD process towards commercialisation, by increasing linkages, creating synergies, extending and valorising training etc. The question that has to be answered here is whether and to what extent science parks and improved telematics infrastructure can really support this process.

5.16 The majority of parks planned in LFRs appear to be having serious difficulties in meeting their objectives. Their planning stage takes longer than anticipated in business plans, and the demand of tenants is lower than initially believed. Moreover, the synergies and collaborative relationships expected are not much in evidence. This rather unpleasant situation has of course different shades as some parks grow faster and succeed more than others. It is hoped that as the process matures delays with diminish. On the contrary, in the case of BICs it is the majority which meets their targets, but there again a minority of different grades of failure was identified. In particular, BICs, being smaller and less ambitious by definition, have a very limited effect in economic development, even when they are successful but they also cost less.

5.17 Several groups of issues can be studied. A typology is suggested here (see Table 2), which helps classifying the problem areas described above. A comparison with successful science parks in core regions allows for the identification of some parameters that can be used for guiding science park or BIC policies in the future.

5.18 <u>The origin of the park:</u> In core regions, parks were initially created upon the initiative or with strong cooperation with local productive forces or regional governments and synergies emerged as a result of will and commitments from a variety of institutions.

Public funds were partly used to substitute for market failure, but only as a response to the generalised demand for the science park creation. On the contrary in LFRs where the productive forces show less interest, the initiative comes often from academic institutions (with the exception of Spain where regional governments are the key promoters) and, as the expectations for return on investment are moderate, private funds (with the exceptions of state banks) are hardly involved. Parks created upon the initiative of specific institutions become often a status symbol, which strongly reinforces the competition element among them. This controversy among parks sometimes reflects or even feeds pre-existing hostilities among supervising institutions (eg Ministries, universities).

5.19 Barriers and opportunities from the environment: The environment in LFRs is almost by definition unfavourable to the creation of science parks and this creates technical difficulties at the implementation phase. The typical structure of industry, composed of SMEs in traditional sectors, the low propensity to innovate and the absence of industrial culture are the origin of a very low demand both by potential tenants as well as for results of technological activities in the parks. As a consequence, it is not surprising that the ideas for the creation of parks and the specialisation suggested are related to the local HEIs. Besides, in most cases (with the exception of Spain and Shannon) regional authorities have no power to impose their decisions since the RTD budget is decided and administered at national level. This creates an additional burden, since parks see themselves as competitors in the absorption of public funds.

5.20 The above mentioned constraints result in difficulties in the operations and management of the parks. While often there are separate management companies established, the key institutions (predominantly academic and political interests) involved believe that they have a very important role to play. In order to keep a hands-on approach, and sometimes also trying to save operational cost, they participate very actively in the daily management of the park, which results in the absence of professionalism and in the predominance of academic interests. This (combined with the problems arising from the unique role of public funding mentioned above) results in important delays. Often projects, which start with ambitious targets, are revised to become more realistic at later stages, when budget constraints and demand prove inadequate. While this flexibility is a positive element, it denotes that business plans (when they exist) are in many cases unrealistic. In some cases, ademic leadership is also reflected in the emphasis given to adequate and up-to-date infrastructure rather than to capacity utilisation. Thus a need appears to diminish the role of original promoters and to emphasise the managerial skills required.

5.21 The immediate result expected from science parks and BICs is to create synergies that would benefit their tenants and give them better opportunities for growth than if they would be located elsewhere. This appears to be a weak point in most incubating activities in LFRs and sometimes in core regions as well. While R&D infrastructure, in terms of location of laboratories and proximity to HEIs is achieved, technology transfer institutions are less important and venture capital, a key success element in several parks in core regions, is almost entirely absent.

5.22 Human networks are not very developed, while infrastructure for traditional telematic networks is sufficient. Besides, in all LFRs there are now public packet switching networks (TELEPAC/COMNEXO by British Telecom and VIASAT by Marconi in Portugal, HELLASPAC in Greece, EIRPAC in Ireland, IBERPAC in Spain, ITAPAC in Italy) though, in general, with high tariffs and a bad "value for money" reputation, with the exception of Ireland. Academic networks are also available (RCCN in Portugal, Ariadni and FORTHnet in Greece, HEANET in Ireland, ARTIX in Spain, GARR in Italy) which are operated almost free of charge and are connected to EuropaNET and INTERNET.

5.23 Infrastructure for advanced telematics is also more developed than expected in several cases, but even there the use made is very limited and for the more traditional applications (e-mail, file transfer) rather than teleconferencing (with few expectations like Bari) or multimedia. Interactive uses, CAD/CAM or EDI are low. Besides, it is mainly the research labs benefitting from advanced telematic networking and only very few specialised tenants.

5.24 In rating telematic networks with respect to the:

- availability of infrastructure
- capacity utilisation and
- quality of utilisation,

LFRs seem to be advanced in the first stage, with a strong need to improve the second and the third, whereas core regions score better into the second, but also need to improve the third.

5.25 Finally, the justification for the massive public intervention in the creation of science parks and (less important) BICs should be found in their role for economic development. Current experience shows that expectations have been overambitious and the impact on the regional economy very limited as yet. From a regional point of

view, they are sometimes considered as a "nice" plus point for the local support infrastructure for SMEs and for knowledge-based companies as well as for foreign direct investment. In few cases (Zamudio, Bari) the parks achieved a critical mass, but no cost benefit analyses or return on investment calculations were available to demonstrate a developmental success. It seems that, on the average, due to the ample funding opportunities, parks in LFRs have developed their international linkages relative to regional ones faster than in advanced regions, whereby sometimes the benefit of the promotion of international linkages, as a target per se, is strongly questioned. Besides, the small size and limited scope of science parks in LFRs (in most cases institutions are not described best as "science parks" as defined by the IASP but rather constitute extended incubation or industrial liaison office activities) indicate that one cannot expect spectacular results for the regional economy. The majority of parks in LFRs cannot go beyond the local scope so they are only addressing R&D spin offs and local SMEs/NTBFs. In that sense the structure and needs of their tenants differ strongly from some highly successful cases of science parks in core regions, where few tenants succeeded in growing into important companies.

5.26 Parks which see as their primary role the attraction of high tech inward investment should be considered as a different category. While LFRs would have to compete fiercely for fulfilling this target, experience shows that they can be at least partially successful. It should be emphasised here that different conditions and skills are necessary, if this is the primary objective of the park.

Table 2: Presentation of the key issues and indications on the success and failure of science parks (and incubation activities in a broader sense

ISSUE	INDICATIONS	LFRs	SUCCESSFUL PARKS IN CORE REGIONS
ORIGIN	Initial idea	Often an academic institution, sometimes with a doses of megalomania, in Spain local/regional authorities	Often the initiative of local governments and real estate promoters based on anticipated demand by future tenants
	Raison d'etre	Principle building	
	Role of private capital	Virtually non-existent, the participation of banks is usually a response to government initiatives	Yes

Table 2: Presentation of the key issues and indications of the success and failure of science parks (and incubation activities in a broader sense) (continuation)

ISSUE	INDICATIONS	LFRs	SUCCESSFUL PARKS IN CORE REGIONS
ENVIRONMENT	Industrial specialisation	Low, though in some cases (Portugal) clusters exist	High
	Research specialisation	High	High
	Power of regional authorities	Usually low, strong national governments, except in Spain	Responsibility of local governments high
	Overall availability of productive activities and technological demand	Low	Adequate

Table 2: Presentation of the key issues and indications on the success and failure of science parks (and incubation activities in a broader sense) (continuation)

ISSUE	INDICATIONS	LFRs	SUCCESSFUL PARKS IN CORE REGIONS
OPERATIONS/ MANAGEMENT	Priority of professional management	In LFRs management is often trusted provisionally to the scientific unit promoting the park. In other cases independent management teams are subjected to political influence.	Successful parks have a strong and independent management
	Co-responsibility of promoters	Too many institutions in the decision making process are often the origin of slow progress. While consensus is important in the initial stages, current management is one authority's job	It seems that on the average promoters do not interfere with management
	Implementation speed	Considerable delays, overambitious plans	Variable, but on the average satisfactory
	Capacity utilisation	More often than not parks are working with spare capacity	High degree of capacity utilisation important

Table 2: Presentation of the key issues and indications on the success and failure of science parks (and incubation activities in a broader sense) (continuation)

ISSUE	INDICATIONS	LFRs	SUCCESSFUL PARKS IN CORE REGIONS
BENEFITS FOR TENANTS	R&D infrastructure in the park	Planned to be adequate in an ultimate stage	Sufficient
	Availability of TT institutions in the park	Less emphasis than on R&D	Sufficient
	Availability of venture capital in the park	Totally absent in the overwhelming majority of cases	Not always available, but a key element of success
	Rents, as an instruments of financial support	In most parks rents are close to market prices, with some parks offering indirect financial assistance through lower rents (eg Zernike)	Rents are close to market or sometimes higher, to incorporate the value added of park services (eg Copenhagen three times the market rate)
	Consulting services for organisation and sales	Less emphasis	Variable
	Role of HEIs	Central, initiator except in Spain	More instrumental
	Human formal networks	Networking is low	Variable, with a general wish to improve
	Low tech telematic networking	Sufficient	Sufficient
	High tech telematic networking	The hardware is in many cases more developed than expected , used by few tenants and almost exclusively for e-mail and file transfer	Infrastructure is less developed than expected, with emphasis on adequate utilisation not high tech per se

Table 2: Presentation of the key issues and indications on the success and failure of science parks (and incubation activities in a broader sense) (continuation)

ISSUE	INDICATIONS	LFRs	SUCCESSFUL PARKS IN CORE REGIONS
ROLE FOR ECONOMIC DEVELOPMENT	Regional linkages	Variable, but on the average low	Variable, but on the average high
	National linkages	Moderate	Moderate
	International linkages	Relatively high, mainly because of the role of HEIs	Moderate, their utility sometimes questioned (Germany, Holland)
	Regional/national/ international linkages	The case studies suggest that both parks and BICs in LFRs have relatively higher international linkages	Most parks have a regional dimension and strong national linkages. International linkages are created through EU support and form a small fraction of activities. Their utility is often disputed
	Size and scope	Companies on the park are usually extremely small, thus the number of employees is a better indicator than the number of companies	In the UK small, HEI related SPs are considered a success, whereas in Germany a bigger size is considered as a prerequisite for a potential of commercialisation
	Provisions for companies that outgrow the park specifications	Hardly	In some successful cases
	Big success stories	Usually park tenants remain very small during their life time, though it may be argued that it is too early to expect that	In some parks the target of inward investment was amply met
	Inward investment	An ambitious target, but with no success in most cases	In some parks the target of inward investment was amply met
	Type of activities encouraged	Technology creation, exploitation of know how of associated HEIs, service orientation	Technology production, plus services plus in many cases manufacturing activities

Concluding remarks

5.27 The analytical presentation of issues mentioned above leads to the conclusion that, overall in the past, the promotion of science parks in LFRs has been overambitious. Several science parks demonstrate a slightly positive impact in the economic performance though in most cases it is rather marginal. While one can argue that it is early to expect spectacular success, it is also true that most of them suffer from the same inadequacies. On the other hand, they also have a real merit in improving the linkages of research establishments with their environment. In that sense designing a policy for science parks in LFRs should concentrate around two important issues:

a) A science park is not an instrument from which one can expect widespread economic benefits so a very serious question about value for money is raised. In that sense dedicating too high shares of industrial or regional budgets in science parks appears unwise.

b) Linking universities with the local (national and international) economy is an important element of R&D quality and of improved competitiveness, so science parks which serve this purpose should be supported through R&D budgets, but with several pre-determined criteria. In a sense parks until now served technological cohesion more than they served economic and social cohesion and this needs to be changed.

5.28 The general idea emerging is that the regional level is the most appropriate one for designing and supporting science parks. The national level provides additional friction and is too vulnerable to change, while the institutional is strongly influenced by academic considerations and interests and less sensitive to economic and social cohesion. The inherent constraints in objective 1 regions (less so in objective 2) suggest that it is inevitable to accept the fact of small size and limited scope of science parks, while BICs are by definition a small and less costly undertaking. Thus general guidelines are related to managerial issues and the effort to maximise benefits for tenants, rather than suggestions on how to increase scope and size:

5.29 If a case is presented, with high perceived demand, strong regional commitment and a substantial share of private funding (real estate, banking sector etc) available, then it should be supported.

5.30 Because not all parks respond to the above prerequisites, it is necessary to have a strategy on park support, based on overall appreciation of country needs, absorptive potential and availability of public funds. This national strategy must also stress the need for "collaboration and competition" rather than opposed interests of parks, and promote the idea of national science park associations. Linkages among innovation support infrastructure are the key element missing in LFRs, much more than the infrastructure itself.

5.31 Such a national strategy may prove dangerous if it is too rigid. On the other hand it is important to give parks the time horizon necessary to grow and to protect them from frequent changes in government which in their turn provoke changes in priorities, whereby parks are left in the middle of their implementation to look for new sources of funding. Built-in independent, real time evaluation mechanisms can partly resolve this problem.

5.32 The overall share of the national budget devoted to parks should not be too high a share of public R&D expenditure, since other instruments are equally, if not more, important for adaption of industry to technological change. While it would be arbitrary to give an absolute limit, it is important to have, ex ante, an idea at national level on what funds are expected to be dedicated to science parks and document this choice, compared to other instruments.

5.33 A realistic business plan becomes an important instrument for decision making. Experience shows that too high expectations in LFRs do not materialise, so it is absolutely essential not to start with unrealistic targets and then look at the same time for additional budgets and functions in order to adjust to current practices. The real issue, which is to help change the local business culture, cannot be addressed by the creation of science parks. Reinforce realism is then an important element of policy, which can inter alia be promoted through the evaluation of business plans and reinforced management support. In that sense the creation of linkages of new parks in LFRs with a list of accredited successful Southern parks is an efficient tool. North-South linkages are important for helping companies in LFRs to find research partners (which is what they mostly seek at the moment), but the real challenge is to find ways to promote linkages for commercial opportunities.

5.34 The following list of ideas appears helpful, when trying to shift the emphasis on the regional level and reinforce realism:

a) It is important (except in Spain) to reduce and better shape the role of HEIs and at the same time increase the role of other participants, in particular regional authorities and private capital. Though with such an approach there is a risk in loosing the only driving force behind park creation, policy makers should accept the idea that it is better to have no parks at all, than to allocate public funds to inefficient initiatives. One should not go as far as Germany, where in the second wave of science park creation (eg Baden-Wuertenburg, Nordrhein-Westfahlen) the direct involvement of an HEI was not considered necessary any longer, but one should at least be clear that the involvement of academic institutions is relevant but totally insufficient for a wider success of incubation activities.

b) The success of science parks and BICs (measured in value added for their tenants and local economic development) depends, as for all organisations, on the quality of their management. Efforts to substitute professional management with ad hoc solutions should be avoided. Professional management is associated with several basic decisions, like the fact that the primary goal is to mobilise latent demand. Parks and BICs should not be recognised as loss making activities in the long term. While massive public support is needed for the set up of the initial infrastructure, operational cost will have to be covered in the medium term. In that sense, important provisions should be made like HEIs being invoiced for the services used and tenants rents using formulas for progressive increases, so that it is clear that companies are expected to outgrow the park. Publishing of balance sheets and accounting control, giving shares to the management etc is also helpful.

c) Increasing human networking is the basic task the park management has to resolve. Successful models are based on synergies that arise from "exponential internal linkages", which make a "glue", holding institutions together. Imitating this in LFRs is the real challenge, as companies are primarily concerned with sales or subsidies, not in the establishment of linkages with potential long term benefits. Additional difficulties arise from a culture favouring competition more than collaboration among similar companies and from the fact that there are many cases where companies served are off site. Difficulties can be addressed with a strong emphasis on measures like student placements, joint research projects and joint academic appointments.

d) Telematic networking is used only in its simplest form. In advanced equipment the emphasis is on the technology rather than applications available on it. This will have to be reversed and business plans for the use of telematic services should be associated to each new telematic investment. Demonstration activities and recruitment of a specialised person to access information, training courses, seminars and help desks are activities that have to grow in equal place with the development of infrastructure.

e) Networking among parks is also a relevant issue, though no formalised models or best practices were identified. Relation of tutor-disciple model (as promoted in Bari) and North-South or South-South exchange of experiences (Spain, eg Valencia IMPIVA: Mediterranean Axis) are useful steps for the creation of initial contacts and promotion of ideas but their long term establishment does not appear associated with substantial benefits. Overall the linkage helps the management and possibly the set up of partnerships eligible for international support, not company performance per se.

5.35 Thus, in summary, one can suggest that the role of incubation activities for cohesion has not been positive as yet. In order to improve it has to be placed in a better organisational shape and closer to market requirements. The soft elements like good management and human networking are of highest importance.

Chapter 6

COMMUNICATIONS

6.1 The communication needs of science parks and their tenant companies need to considered against the background of the needs of specific actors such as science park managers and the needs of tenants including SMEs, established technology based companies, branch sites of multinationals, research institutes and other bodies. Each of these actors may need to communicate with a wide variety of other organisations such as customers, suppliers, universities, government departments, commercial databases, trade and professional associations etc.

Communications patterns

6.2 The mechanisms used for communication depend upon the traditions and communications patterns established within a particular group, for example, the dominant mechanism for communication in one field may be telephone or letters, while others may use fax, E. Mail or video conferencing. The extent to which a particular communications mechanism is used may also relate to the role of major companies in a sector where some companies have a dominant trading position and are able to impose their requirements on smaller suppliers. The needs of a small firm supplying CAD drawings to a large company, for example, will be determined by the systems and communication methods used by the large company including specific types of CAD/CAM interchange.

Critical mass

6.3 The communication requirements of actors on science parks may be constrained by the extent to which there is a critical mass of users within a particular community, for example academic researchers frequently use E.Mail for messaging and document transfer but the usage of E.Mail by SMEs is limited because a critical mass of users has yet to be established. As a consequence the incentives for SMEs to invest in E.Mail systems are small.

6.4 The communication needs of these actors will also need to be considered in relation to the reasons why communication is taking place such as finding information from databases, communications with suppliers about purchasing, communications about marketing and communications, to find partners for research collaboration or for technology transfer. The different needs of various actors involved with science parks are considered in the following sections.

The communications needs of Science park managers

6.5 The communication needs of science parks managers depend on the stage of development of the science park and the objectives they are seeking to achieve. There are a number of functional areas where science park managers need to communicate including marketing the park, providing information and assistance to tenants, communications concerning the management of the science park and communications within the wider economy.

Science park marketing

6.6 First, science park management need information, contacts and effective communications to understand the market and to promote the development of the park. This requirement will naturally be most pressing during the early stages of a park's development or during a period of expansion, but is likely to be a continuing requirement at any stage. Science park managers seeking to attract public or mobile private R&D investment require networks and communication mechanisms to identify and attract potential tenants.

6.7 The survey of science park managers showed that a high proportion of managers saw benefits in networking with managers of other science parks in the EU. Fifty two per cent of respondents to the postal survey said they would like to receive advice about science park marketing from other science parks (possibly in other countries). The need for advice and expertise was stronger in the South (61% of Southern respondents) than in the North (50% of Northern respondents) and in new science parks under two years old (60%). However, the survey also showed a lack of knowledge about where to obtain such advice with over seventy per cent of science parks who returned a questionnaire being unable to identify any science parks in Europe where they would like to obtain advice if this were offered free of charge. Of those science parks who could identify a potential source of expertise, the majority indicated science parks

which had a high profile, for example, in journal articles. More science parks in the South were able to specify a named science park than those in the North.

Tenant support

6.8 Second, science park managers need effective communications to provide information and advice to enable them to meet the needs of their tenants more effectively. This is particularly important for those managers of parks such as incubators or innovation centres whose key objective is the development of New Technology Based Firms. For all categories of science parks, the survey showed that science park managers rated communications with tenants on the site as being the most important with an average rating of nine out of ten compared with the next highest rating of seven for communications with universities and research institutes and seven for communications with government and development agencies. In a number of cases science park managers undertake activities on behalf of tenant companies, for example, to help them find market information or to locate a suitable partner for technology transfer purposes. The survey indicated that a high proportion of science park managers would value advice , expertise and assistance from other relevant science parks in areas such as helping tenants with technology transfer (64%), obtaining finance (59%) and identifying sources of technology needed by tenant firms. In all these areas the needs of Southern science park managers were greater than those in the North.

Science park management issues

6.9 Third, science park management need information and communications to learn how better to perform their management function. The sharing of experience between science park managers about fundamental management issues such as property issues, legal issues, linkages with universities can greatly assist managers in creating a successful scheme. However, there are a number of constraints to such communications including competition between some science parks, the differences between science parks because of their different objectives or stages of development and the need for intermittent communications rather than a continuous interchange. The survey indicated that some 23 % of managers communicated with other managers of science parks at a local level, but that this increased to 47% at regional level and increased to 65% at national level. Communications between managers of science parks at the EC level, however, decreased to 45%. In general, science park managers in the South were less inclined to communicate with managers locally or regionally than

their counterparts in the North, but more inclined to communicate with other managers at a national and EC level than those in the North. They also rated these communications as being of greater importance than did their counterparts in the North. This is likely to reflect the relative newness of science parks in the South and their greater need for information and advice about management issues.

Local and regional economic development

6.10 Fourth, science park managers need to communicate with companies and other bodies in the wider economy. This requirement will depend upon the extent to which the objectives of the science park are outward looking, for example, science parks and BICS which are concerned with technology transfer to local industry are more likely to need effective communication mechanisms within their regional economies. This requirement also depends upon the resources available to the science park management for the provision of support in areas such as technology transfer, business and financial planning and marketing which can be time consuming and costly to carry out.

Communications mechanisms used by science park managers

6.11 The survey indicated that telephone calls, letters and faxes were the most frequently used communications medium used by science park managers. On average, 143 telephone calls were made and 44 letters and 40 faxes were sent each week. However, respondents in southern science parks were much greater communicators than their counterparts in the North making almost twice as many telephone calls (234 per week) and sending almost twice as many faxes as their northern counterparts. The number of letters sent was about equal at around forty per week.

6.12 More advanced forms of communications such as E.Mail were used less frequently, but Southern science parks were, again, over three times more frequent users of E.Mail (39 times per week) than their Northern counterparts. This could be due to the relative cost advantages of using E.Mail as well as to the higher reliability of such systems. Figure 4 shows the average usage per week of different forms of communication by science park managers.

6.13 Science park management used a number of associations and networks for communication purposes and many science parks were members of several networks, the most frequent of which were the relevant national science park association (68% of respondents). However, these associations were far more significant to respondents in the North where 74 % of respondents were members compared with 47% of science

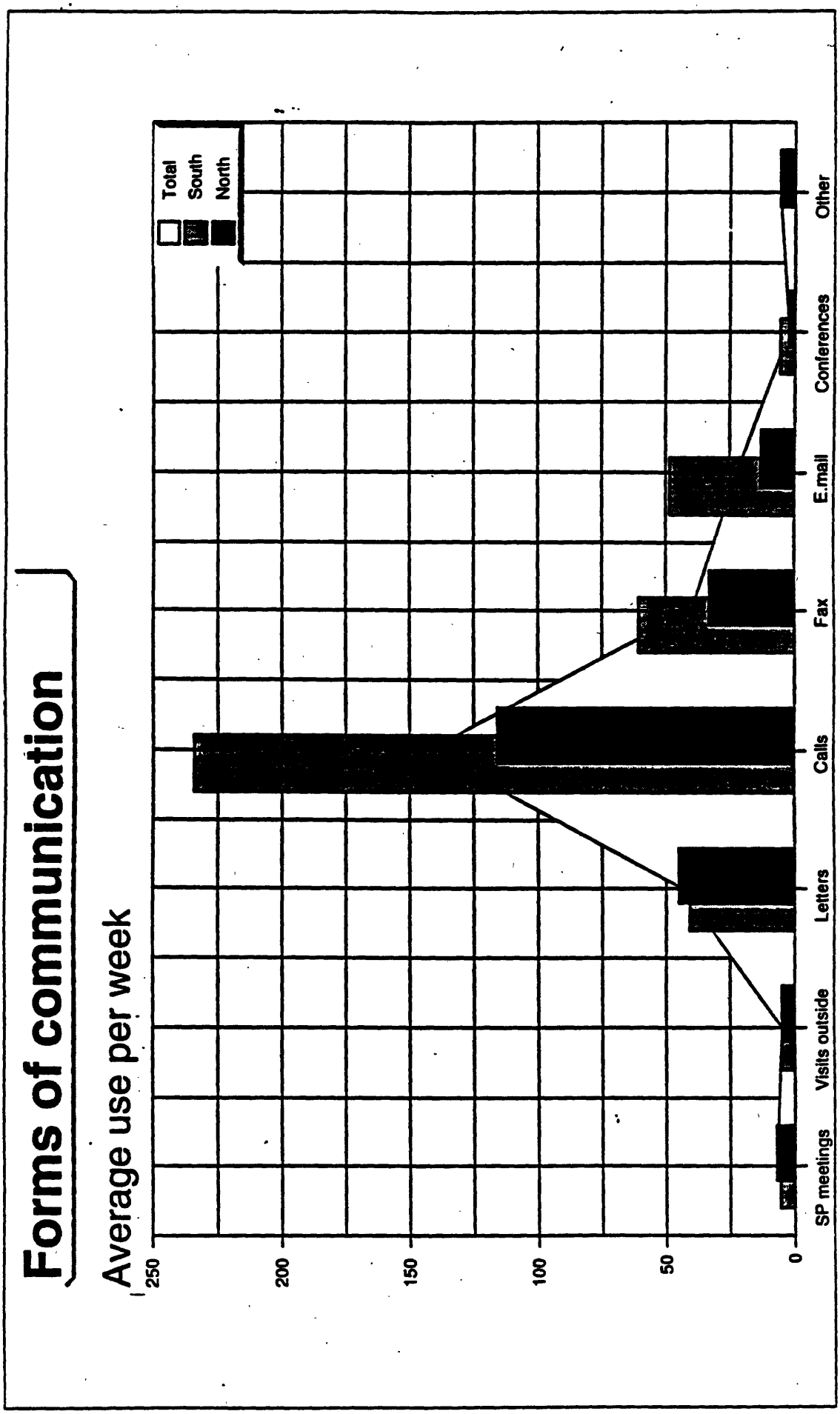
Forms of communication
Average use per week
Total
South
North
250
200
150
100
50
0
SP meetings
Visits outside
Letters
Calls
Fax
E.mail
Conferences
Other

Figure 4

park managements in the South. In some Southern countries there is no national science park association.

6.14 The converse was true for international science park associations where 39 % of respondents in the South were members and only 24% in the North. Other more specialised associations such as Incubator associations, TII and SPRINT networks were specified less frequently and were each were utilised by around 20% of respondents. The lowest usage was for BCNET which was used by 12 % Surprisingly few (26%) of respondents among science park managers wished to establish closer links with other organisations although this was slightly greater in the South. This could reflect the good relationships which already exist or lack of awareness of the possibilities for networking and lack of knowledge of the specifics of other science parks which would enable respondents to establish effective linkages. The latter would seem a more likely explanation given the lack of data available on science parks within the EU.

Telecommunications restrictions reported by science park managers

6.15 Very few science parks responding to the postal survey reported any restrictions on their communications caused by the availability of telecommunications facilities with only 22% of respondents reporting problems. Of those who reported restrictions, a higher proportion of Southern respondents reported problems (28%) than Northern respondents (15%). A significant number of science parks however were concerned about lack of access to ISDN.

Requirements for advice of science park managers

6.16 Science park managers had varied needs for advice and assistance. The most significant topic was technology transfer issues where 64 % of respondents would like to obtain advice, followed by advice on finding sources of technology needed by tenants (59%) and advice on obtaining finance for tenants (57%). On each of these issues a higher proportion of Southern science parks were interested in obtaining advice than Northern parks. Issues such as rental agreements, site maintenance, business planning and legal issues were of interest to about 20% of science parks. Obtaining advice about establishing links with HEIs and research institutes was of interest to about 45 % of parks overall , but with a higher proportion of Southern parks and younger parks under two years. Advice about how to act as a focal point for information to tenants was of interest to 43% of respondents with slightly more interest in the Southern parks.

Delivery mechanisms for advice

6.17 Responses to the postal survey about the delivery of advice showed a strong preference for on-going advice rather than as a single unit of training and for face to face delivery (84%) rather than other mechanisms such as telematics (39%) although Southern parks were more likely to accept telematic delivery than Northern parks.

6.18 As noted previously, science park managers were asked to identify which science parks or related organisations in Europe they would like to receive free advice from. The majority of respondents (72%) did not answer this question , despite the fact that large numbers of science parks had identified the need for advice in previous questions. This would tend to confirm the view that science parks need advice but do not know where to seek it. This was confirmed by several of the interviews during the fieldwork programmes. Of those who answered the question, most of the science parks named were in France (21 out of 45 parks named) or in the UK (12 out of 45 named). Germany and the Netherlands received 4 citations each, while Belgium had three citations and Spain one. Individual science parks with the highest number of citations included Sophia Antipolis (seven citations), and Aston , Heriot Watt, and Zernike Science parks each with 3 citations. Many of these individual citations may reflect the greater age and higher profile of French and UK science parks rather than their inherent relevance to the needs of the respondents. Indeed, the issues raised by science parks on which they would like advice such as obtaining technology for tenants and technology transfer were areas where science parks in Germany were likely to be as well placed to provide advice as those in France or the UK.

Management strengths

6.19 When asked to identify the strengths of their science parks which might be of value to other science park managers, respondents to the postal survey identified fewer issues where they had strengths than issues where they would like advice. The highest rated issue of strength was linkages with universities and research institutes (29%) followed by technology transfer (17%). Unsurprisingly, newer science parks and those in the South thought they had fewer strengths and less to teach than older science parks and those science parks in the North. The match between requirements for advice and the needs for advice was therefore asymmetrical since several areas where supply of strengths were identified such as business planning were areas where demand for advice was relatively weak. In addition, fewer parks identified strengths than identified weaknesses. This reticence to identify strengths may reflect a natural modesty as well as an unwillingness to give away experience which has been built up over many years. As such, the evidence suggests that there the strongest match

between supply and demand for advice and assistance would be in the area of technology transfer but that some incentives would be needed to encourage the transfer of this knowledge and experience.

6.20 Managers of science parks were also asked about the benefits of networking with other managers of science parks to share information. There was a generally positive response to this question with the highest number of responses for networking at an EC level (80%) with stronger support in the South (92%) than in the North (77%), but conversely support for networking at a regional level and at a national level was more strongly supported in the North.

The communications needs of science park tenants

6.21 The mix of tenants on science parks varies considerable between different science parks, but, in general, the majority of science park tenants are small and medium sized companies operating in specialised technologies and niche markets. The survey asked about the communication needs of science park companies and the highest rating was given to communications with customers and suppliers which were rated 8 out of 10, while potential distributors and sources of technology were rated seven. The need to find potential R&D partners was rated 6 overall, but with a slightly higher importance in Southern science parks than Northern parks. The emphasis on finding customers may reflect the pressures caused by the recent recession while the needs of science parks in the south to find partners for technological purposes may reflect the relative peripherality of these parks from centres of expertise. In general, science park managers rate contacts within their own countries more highly than contacts at an EC level.

6.22 The survey sought to examine the communication needs of tenant organisations including the needs of different types of companies and institutes on science parks and these are discussed below.

<u>The communications needs of larger firms and multi- national companies</u>

6.23 The tenant mix of many science parks includes a number of branch plants of multinational companies as well as companies which have grown beyond SME status. In many cases such firms are operating in international markets and utilise proven technologies for their communication requirements. This frequently includes the use of E.Mail mainly involving internal company systems and on some occasions video conferencing. This is particularly the case where companies are themselves the suppliers of equipment such as computer work stations which utilise ISDN linkages

or, possibly, desktop video conferencing boards. In general, large firms are able to look after their own reqtuirements with respect to human and telematic communications, but in some instances large companies can exert an important influence on smaller companies through their requirements for EDI or for CAD/CAM interchange.

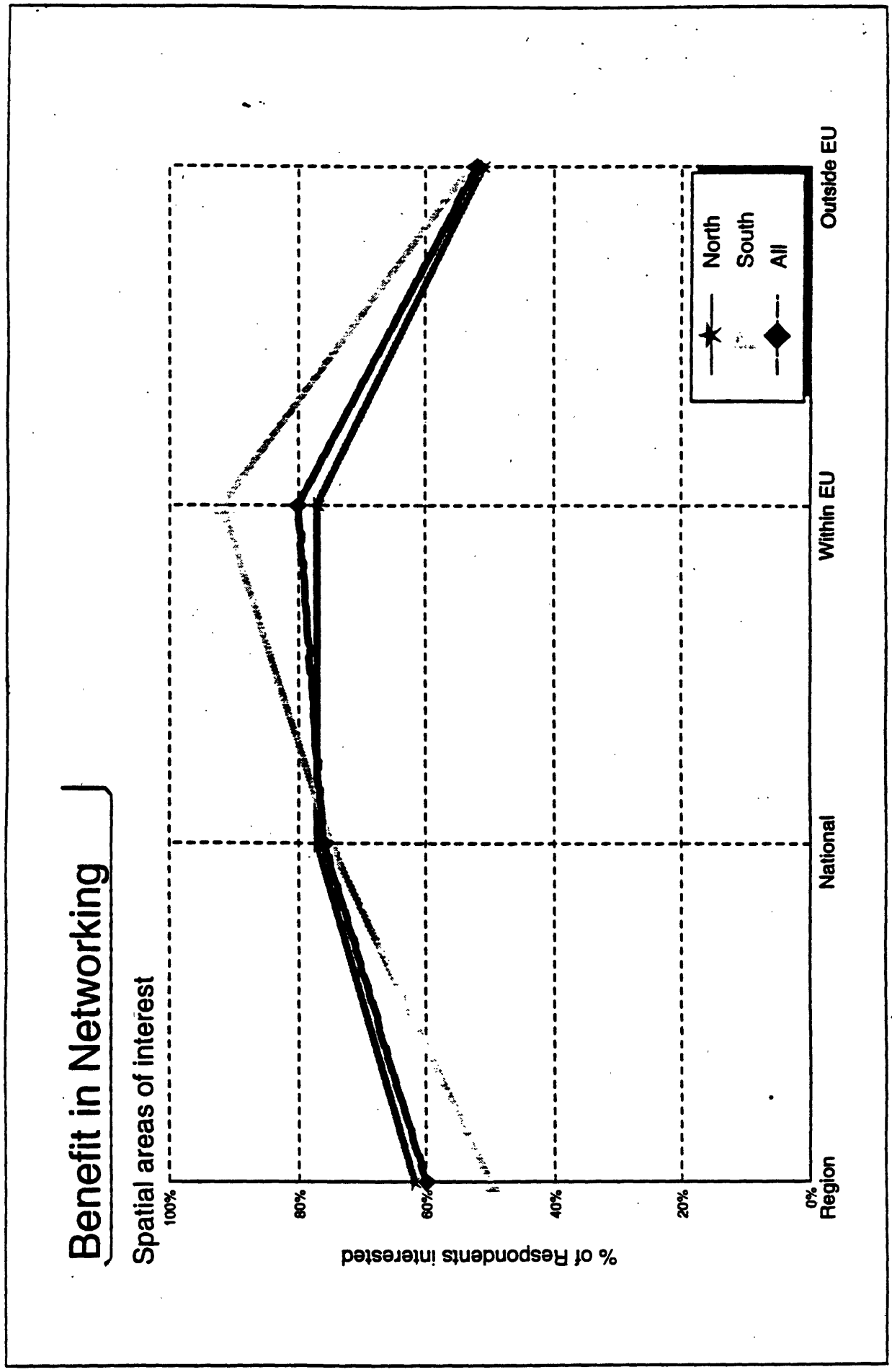
Benefit in Networking
Spatial areas of interest
% of Respondents interested
100%
80%
60%
40%
20%
0%
Region
National
Within EU
Outside EU
North
South
All

Figure 5

6.24 The survey indicated that such companies are likely to be among the first users of advanced technologies such as multi- media and desk top video conferencing. In many cases such companies will have the technological and managerial resources needed to implement these technologies and , more importantly, are likely to have a regular volume of traffic to make such investments worthwhile.

The needs of small and medium sized firms

6.25 SMEs represent a high proportion of tenants on science parks. The survey indicated that 54% of firms had fewer than 10 employees. The communication needs of small firms are likely to relate to a number if business and technology functions and these are discussed below.

SMEs' communications with Suppliers

6.26 SMEs need to communicate with suppliers of materials, components, business services and sub- contract manufacture and, in general, they seek to maintain such supplier bases within their local area in order to maintain more effective control of quality and delivery. In some cases, small companies need to communicate with suppliers for the transmission of modifications of designs or drawings carried out by suppliers and a few cases were found where companies were utilising modems and ordinary telephone lines for this purpose. In a number of cases, small companies were able to make cost savings by utilising the remote services through teleservices such as accounting or banking but these were also relatively few in number.

SMEs' communications with customers

6.27 The need to identify and communicate with customers and potential customers is a very important factor for small firms which operate in specialised niche products and technologies and which need to identify potential customers over a very broad geographical area, often in different market segments. Almost all respondents reported a need to identify potential customers for the product they currently produce or for new product areas which are still being developed. In many cases the use of databases including commercial databases and European Commission databases have been used, but frequently these were found to be difficult to operate or required too much management time to be worthwhile. Small companies need to communicate with existing customers for a variety of reasons including sending modifications to designs and diagnosing faults in equipment installations. In several cases the survey identified

small companies using modems with data compression and ordinary telephone lines for this purpose since their requirements for communications were intermittent and the relative slowness of this technology was not perceived to be a major problem. A few companies, particularly in Germany, are beginning to use ISDN to communicate with customers.

SMEs' communications with Technology Partners

6.28 The need to communicate for technological purposes relates to the need to find solutions to technological problems or to find partners for collaborative research projects. In general, most SMEs had rich technological contacts which they had been able to develop through as variety of mechanisms such as communications with academic and institutional researchers and through conferences, seminars and publications. Some science park researchers who had previous been employed in universities were accustomed to using E.Mail as a communication medium , particularly in countries such as Netherlands and Denmark but, in general, the main requirement for communications about technological matters related to the search for partners to undertake joint research projects and to find collaborators for technology transfer purposes.

The communications needs of universities and research institutes

6.29 Universities and research institutes which are located on, or associated with science parks usually have a high level of communication with similar bodies in other locations. University researchers have traditionally maintained networks of research collaborators with whom they communicate frequently about issues such as publications, research applications, conferences etc often on an international basis. In recent years these communications have been enhanced by the availability of electronic mail and document transfer through the provision of national research networks and also through international networks such as Europanet and Internet.

6.30 In many countries the research network links all major universities and institutes and provides a subsidised or free service to academic researchers. In addition, research networks have also been developed in many countries to provide the first demonstrations of advanced wide band telecommunications such as ATM networks, allowing researchers to experiment with applications such as full motion video conferencing for teaching purposes or to interconnect supercomputers or to allow the visualisation of complex models shared by users in remote locations.

6.31 In most cases the use of such network facilities is entirely non-commercial and usage of the network is restricted to research related purposes. Nevertheless, in some countries such as Denmark and the Netherlands, companies on science parks are connected to the research networks for communication purposes. In some instances, science parks are linked to the computer networks of their related university or research institute, however the actual usage of such linkages appears to be small. The potential for linking companies on science parks to the wider research community through national research/academic networks could provide valuable benefits to some science park companies.

Summary

6.32 In summary, a wide variety of communications mechanisms are used by science park managers and tenant companies. In many cases, science parks in the South were utilising telematic equipment such as E.Mail more frequently than those in the North, possibly because of a need to overcome constraints of remoteness. Science park managers had a wide range of needs for advice from other science parks, particularly in the South. Tenant companies were in the main SMEs operating in highly specialised niche markets and were concerned with improving communications to find potential customers, distributors and technology partners in wider market areas.

Chapter 7

THE USE OF TELEMATIC TECHNOLOGIES ON SCIENCE PARKS

7.1 A wide variety of telecommunications and telematic technologies are being used by science park managers and science parks tenants including telematic communications systems and the provision of remote services. These are discussed in the following sections.

The provision and use of teleservices

7.2 About half of the science parks which responded to the survey could identify at least one tenant providing teleservices to customers or clients. However, this does not imply that half the companies on science parks were providing teleservices, rather that at least one company on each science park was doing so. The most significant of these teleservices were remote consultancy (27% of responding science parks) and remote diagnostics (17% of responding science parks). Other remote services included remote surveillance (17% of science parks) and remote accountancy and remote translation, each identified by 12 % of science parks. This corresponds broadly with the findings of the interview programme which found several examples of companies using modems and ordinary telephones to provide remote diagnostic services and to down load software updates as well as companies using teleservices such as remote accounting. For example, a company in Denmark was using telematic equipment to provide remote facilities for gathering data and control of remote equipment as far away as India. Similarly, companies in Germany were using ISDN systems to remotely access computer systems in customers' premises.

The use of telematic technologies by managers of science parks

7.3 Science park management and organisations on science parks utilise a range of telematic technologies and services including telephones, faxes, modems, electronic

mail, document and drawing transfer, ISDN systems and video conferencing. The study sought to examine the current use of these technologies and the potential use of developing technologies in the future.

7.4 The recent history of the introduction of telematic research networks into the academic research community demonstrates the potentially wide range of uses for this technology , but these initiatives, which are largely publicly supported, do not demonstrate the commercial viability of these applications without public support. In examining the use made of telematic technologies, there is consequently a need to bear in mind the extent to which usage is being encouraged by outside intervention and the extent to which usage is demand led. A number of networks and other systems examined during this study were implemented through the use of public subventions and the extent to which any benefits can be compared to the costs would require a more systematic and detailed evaluation. In the following sections we consider the main types of telematic applications which are currently in use with science park managements.

7.5 The postal survey identified that 57% of science park managers responding to the survey used a PC and modem in their work with higher usage rates in the South (69 %) than in the North (53%). The greatest use of PC and modem equipment was for accessing computer networks and databases (45%), for E.Mail (34% of respondents), for sending faxes (30% of respondents) and for file transfer (24% of respondents). In each of these areas, usage rates were higher in the South than the North.

7.6 A surprisingly high proportion of science park managers who responded to the postal survey said that they were using ISDN (39% of respondents overall) with higher usage in the North (48%) than in the South (5%). However, although definitions were provided there may have been opportunities for misunderstanding the difference between ISDN and conventional telecommunications lines since these concepts are not widely understood by the non-specialist. The survey indicated that the greatest usage of ISDN was for fax (33%), accessing networks and databases (15%) and telephone conferencing (12%). The use of ISDN for video conferencing was reported by eight per cent of respondents. Both video conferencing and telephone conferencing were seen as significant areas where usage was likely to increase in the future. In all these areas usage of ISDN was predominantly a Northern phenomenon, with the greatest reported usage in Germany. Some Southern countries are only now gaining access to ISDN because of delays in the establishment of the Euro ISDN standard and because of technical problems.

7.7 Science park managers were also asked whether they considered themselves to be more or less advanced in the use of telematic services than other science parks or other organisations in the local area. About half of all science parks considered themselves more advanced than other science parks but a higher proportion considered themselves more advanced than other organisations in the area. This was particularly the case for Southern science parks where nearly 70% of respondents said that they were more advanced than local organisations.

The use of telematics by tenant companies

7.8 The postal survey asked respondents to identify whether any of the tenant companies on the science park used certain telematic applications. This question relates to any tenants on the science park and the responses do not therefore indicate an average for tenant usage. The highest response was for fax (85%) of responding science parks followed by E.Mail (70%), accessing networks (72%) and CAD/CAM interchange (60%) and ISDN 45%. Fewer respondents reported any tenant companies having EDI (42%) telephone conferencing (27%) or videoconferencing (14%). The areas where the greatest potential growth for the future was seen where in E.Mail, data file transfer, EDI, video conferencing, teleservices and use of ISDN. The rate of use of these applications by tenants was fairly even between North and South apart from ISDN which is predominantly a northern phenomenon. In the following sections we discuss some of the main uses made of telematic technologies by companies which were found through the interview survey.

The use of modems

7.9 Several of the companies interviewed on science parks had developed their own solutions to communications problems by purchasing modems of up to 14.4 baud with data compression and suitable communications software to communicate directly with similar systems installed in their customers' or suppliers' premises. One Danish company , for example was a totally dependent on modem links to clients and suppliers. Modems were often used for diagnosis purposes, for example, to diagnose problems with equipment installed in the USA or to down load new software modules or to transmit drawings and data. Often companies used these systems for a single purpose and did not use modems for E.Mail or other communications. These systems were not connected to a host computer with store and forward facilities and could only be used for specific point to point communications. Other facilities such as fax were used in tandem with use of modems. In many cases companies had developed their

communications approaches on an incremental basis and did not have the time or resources to analyse whether their approach to telecommunications was optimal. In some cases companies using modems for specific purposes also had fax machines which were running for most of the working day. However, these companies did not consider that E.Mail systems to be an adequate substitute (although this would have saved telecommunications costs) because few customers or suppliers were linked to E.Mail systems.

7.10 Several examples of tenant companies using modems to link to a central server were found during the fieldwork, including the UKSPANET created by the UK science park association. This is a low cost system which provides linkages at local call rates through a host computer based in Manchester. However, the system has very few users (about 7 science parks) and usage is relatively modest. Other systems based on similar principles include the EBN telematic network which uses the AT&T Easynet system to link BICs throughout Europe. This system has only recently been installed but has achieved a much greater success in attracting users to join the system with the majority of BICs becoming connected to the system during 1994.

Company E.Mail systems used for large scale and international communications

7.11 Large companies with research and customer support facilities on science parks frequently operate their own internal E.Mail systems. This allows information to be passed around the world instantly and key policy changes or systems to be implemented at the same time. In addition, the use of E.Mail allows such companies to respond more quickly to changes in markets and customer requirements and to optimise their research, production and distribution systems. In general, large companies are able to satisfy their own requirements from their own resources. However, there may be arguments for encouraging such companies to establish themselves on science parks to provide demonstration facilities or assistance to companies more widely. Small companies in the Netherlands and Denmark were also using E.Mail for communications purposes.

Linkages between the science park and the university network

7.12 Several examples of such linkages were found during the course of the fieldwork, for example, in three out of the four science parks visited in Denmark. In a number of cases these linkages were infrequently used since there was little requirement for communications or because people preferred face to face communications. In some

instances, these linkages provided access for science park companies to the national research networks and thence to the world wide Internet. However, the criteria for connecting companies to such systems often preclude commercial activities since the widespread usage of academic networks by commercial companies would be likely to reduce the incomes of the licensed telecoms companies and of the database providers unless users are tagged. Nevertheless tenant companies were attached to the relevant research network in countries such as Denmark although they had to pay a small fee for their usage. The possibility of extending such links in other countries may be worth consideration.

The installation of local area networks around science parks

7.13 A number of science parks have installed their own networks around the science park to facilitate communications between tenants and to allow the dissemination of useful information more quickly. In a number of cases, networks have been installed in anticipation of demand on the basis that such systems will be required in the future and will prove an attractive selling proposition to potential tenants. Examples of such networks include Malaga, Tagus Parque and Sophia Antipolis. In the two cases where LANS had been installed in Denmark, few tenants had taken up use of the facilities. It was not evident however from the fieldwork that there is any major unmet demand for telematic communications between tenants on the same science park or technopole.

The installation of wide area networks or metropolitan area networks

7.14 A number of science parks have become linked, or are considering the possibilities of becoming linked, to advanced telematic networks covering a wide area or region. Examples of such networks include R2D3 in the PACA region of the Cote D'Azur which has been implemented by France Telecom to link high technology and information intensive industries to wider communication networks. Examples of advanced telematic linkages around cities which are currently under discussion include the proposal for a 'Virtual Science Park' in Leeds which would link a variety of research and medical facilities and the proposal for a wide band network around Manchester (G.MING) which would link the large number of academic sites in the city to the national broadband 'SuperJanet' system. In some cases such wide band networks have been proposed by organisations other than science parks which have proposed that science parks should become part of the system. In other cases , wide band telecommunications is being proposed to provide the networking benefits of a science park as an alternative to building one.

The use of ISDN lines

7.15 The availability of ISDN is becoming widespread throughout large parts of the EU and the European market for ISDN is growing rapidly. The European Commission (DGXIII) has developed a clear policy for the development of ISDN in Europe (Trans European Network) based on harmonised standards for ISDN to which European countries have agreed to migrate. The availability of ISDN is growing with a planned roll out to large areas of the Community by the end of 1995, although more peripheral regions may achieve ISDN services somewhat later. Further discussion of the implementation of ISDN in Europe is provided in Chapter 9.

7.16 The study found a number of cases where ISDN was being used by science park companies and managements. Usage was most prevalent in Germany probably due to the wider installation of ISDN and to questions of cost. In Denmark, for example, a UN database on the environment is being installed which is designed to be accessed using ISDN.

7.17 In addition, desk top video conferencing trials using ISDN were being undertaken in the North West of England linking the Merseyside Innovation Centre, Pendle Training and Nimtec, a regional technology organisation. The relevance of video conferencing using ISDN is enhanced with more users on the system and the pilot project in the North West is planned to be extended to allow technology transfer discussions to take place with collaborating organisations in several European countries.

7.18 In several science parks, companies are themselves developing the equipment needed for desk top video conferencing including the development and testing of work stations incorporating ISDN and desk top video conferencing by companies such as Sun in the UK and personal computer based cards for video conferencing by New Media Graphics in the Netherlands. These and similar companies require ISDN lines to develop and demonstrate their equipment. These companies and bodies such as the National Microelectronics Centre in Ireland would naturally provide a possible centre for the demonstration of advanced telematic applications.

The use of more advanced telematic technologies

7.19 In general, the survey indicated that the most widespread users of advanced telematic systems are often larger companies who have sufficient resources to see through the implementation of new technologies and sufficiently large communications within

their internal structures to form a critical mass of users as well as sufficient traffic to make the investment in systems worthwhile. The use of E.Mail and the increasing pressure for the use of Electronic Data Interchange is being led by major companies who frequently buy large amounts of goods each day from a wide variety of suppliers.

7.20 The first use of ISDN on a large scale has been in areas where the potential cost and speed of transmission benefits have been recognised by a sufficiently large community with common interests such as the printing, publishing and graphic arts industry or the radio and television companies who utilise the more cost effective attributes of ISDN such as bandwidth on demand. However, industries such as the graphics arts industry are not prevalent on science parks.

7.21 A wide range of experimental systems at the leading edge of technology such as ATM networks are being implemented in various countries as well as state subsidised networks and facilities of a more conventional nature. The extent to which these applications are demonstrating the capabilities of new technologies which will have important commercial possibilities is as yet unclear.

7.22 Experimental or development systems include a wide range of applications such as:

- the installation of video conferencing suites in science parks to enable point to point video conferencing such as those provided at Malaga or Sevilla. However, the requirement of a critical mass of users of such systems has meant that for many users there has been insufficiently large network equipped with similar equipment to make the investment commercially justifiable.

- the investment in desk top video conferencing facilities on science parks and in regional technology transfer organisations

- investments in special technology facilities such as the Letterkenny Information Technology Centre which helps companies develop and implement appropriate telematic strategies.

7.23 The study found some evidence that advanced telematic technology provides benefits to the users, for example, the video conferencing and E.Mail system provided through the AMBAR project provided foreseeable benefits such as easier communications but also unforeseeable benefits such as the better organisation of video conferencing meetings which makes them quicker and more efficient than conventional meetings.

The need for assistance from the EC for science park managers

7.24 The postal survey asked science park managers to specify the type of help they would most like to receive from the European Community. The highest rated assistance was databases of specific information (80%), easier access to EC information (79%) and subsidies towards the costs of equipment (79%). The provision of training and help and guidance in using networks were specified by around 70% of respondents with simplification of networks, standardisation of systems technology, demonstration centres and the development of specific new applications each mentioned by around 60% of respondents. These high figures may merely reflect that fact that people were being asked to specify what assistance they would like on the assumption that no charge would be levied, but the relative importance of different factors may be of greater significance.

7.25 There was almost universal support for the development of a low cost, easy to use telematic network which could be used to share experience and find out information about other science parks throughout the EC. Interest in such a network was higher in the South (94%) than the North(90%) and in younger science parks (95%) and those involved in technology transfer (100%)

The need for assistance from the EC for tenants

7.26 Science park managers were also asked to specify where help with telematics from the EC would be of benefit to their tenants. In general, respondents rated databases of specific information, easier access to EC databases , training and subsidies towards the costs of equipment the highest.

Summary

7.27 In summary, a wide variety of telematic applications were in use in science parks, in many cases companies were using technologies such as modems to provide remote services to customers or to diagnose faults in equipment. ISDN is being introduced into science parks particularly in Northern countries such as Germany and Denmark. More advanced systems are being introduced in some areas including Metropolitan Area Networks and other wide band systems. In general, interest was expressed in simple, low cost communication systems which are easy to use. In some areas there was growing interest in the use of E.Mail and desk top video conferencing.

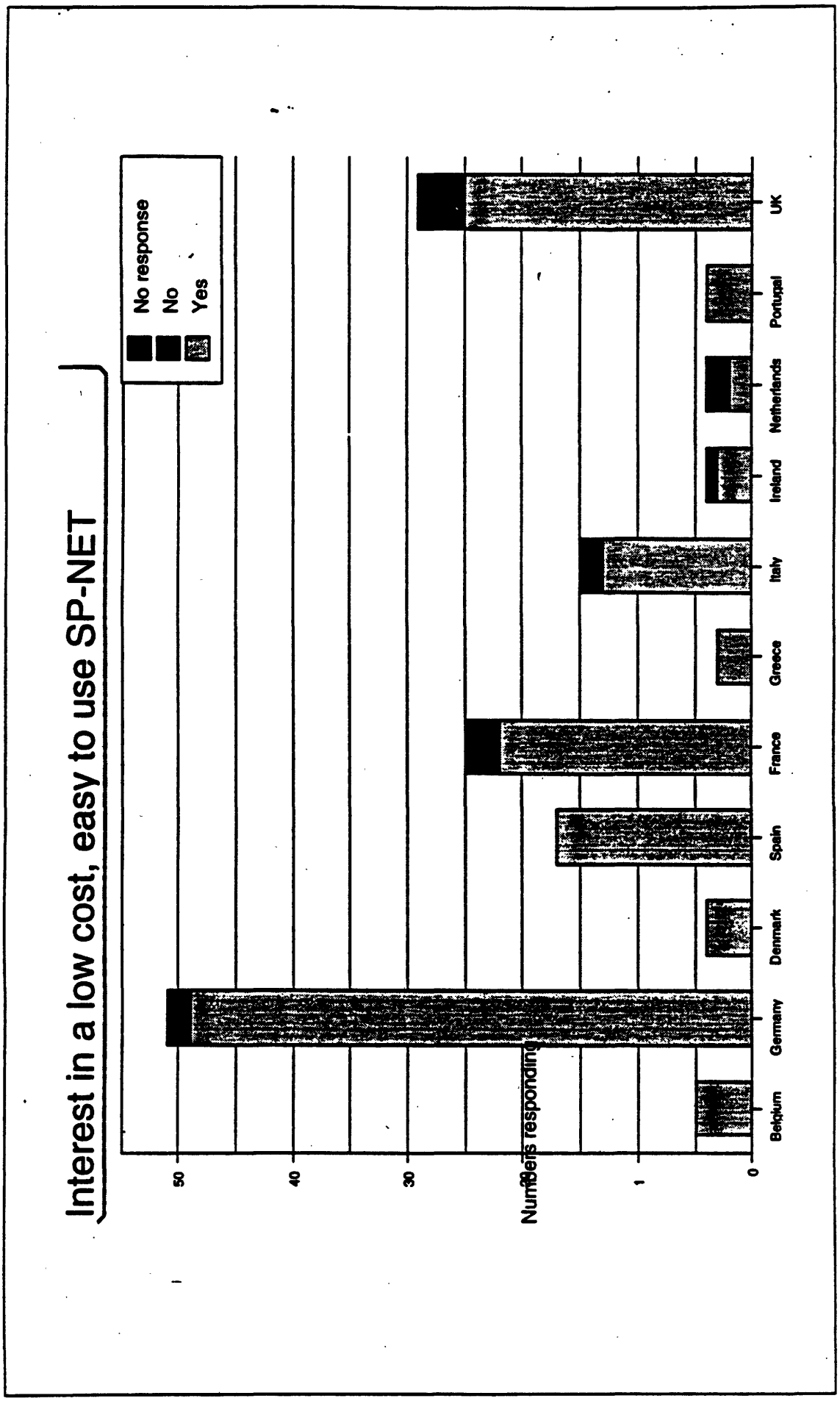
Interest in a low cost, easy to use SP-NET
No response
No
Yes
Number responding
50
40
30
1
0
Belgium
Germany
Denmark
Spain
France
Greece
Italy
Ireland
Netherlands
Portugal
UK

Figure 6

Chapter 8

NETWORKING OPPORTUNITIES AND REQUIREMENTS

Network dynamics

8.1 Networks are systems through which a variety of players act and interact and in which the actions of one member affects the others. Networks are more than communications mechanisms, although they can act for the mutual exchange of information. At any one time, the nature of a particular network may change depending upon the recent actions and reactions of the participants and upon what the various parties expect to happen in the future.

8.2 Although organisations may be the nominal members , networks are made up of individuals and the personal nature of the commitments, trust and responsibility required for networks to succeed requires personal commitment and knowledge within the network. Trust is a measure of the confidence that members have that they are able to confidently predict the actions of other members. Without trust, the risks of depending upon other members for the success of an activity would become too great and the network will fragment or dissolve.

8.3 In general, networks operate most effectively where there is a strong element of mutual gain from any collaboration. Networks also require some element of reciprocity if they are succeed. A network where the requirements are asymmetrical, for example, where one member is continually providing information or advice but receiving little in return is unlikely to be robust. Where such asymmetrical requirements exist there may be ways in which reciprocity can be restored through the intervention of an outside agent who can balance the contributions and benefits received.

8.4 In addition, there are costs related to membership of networks, not only the costs of communication, but more importantly the management time and effort required to be an effective member of the network rather than a sleeping member. As a consequence, networks need to provide quite specific benefits to their members if they are to have value and survive. These benefits of network participation are often most easily developed where a common interest group can be identified, for example, a group of companies with common interest in environmental research or a group of science park managers with common problems of overcoming urban decay or of living in the shadow of a much larger and more significant institution.

8.5 The role of personal knowledge and trust between the members of a network has important implications for the development of networks between science parks. This is particularly significant in relation to networks for technology transfer purposes. However, before networks can be formed, the potential participants need to obtain information about the other potential participants with which they can judge whether suitable networks can be formed.

8.6 The importance of human factors in the development of networks was emphasised in almost all our of the discussions during this study. In many cases, participants recognised that culture, ways of doing business and personal likes would have an important part to play. The alignment of goals between the potential participants and factors such as the size, age structure and background conditions of science parks are all factors which would need to be taken into account in developing robust networks. Even when prima facie evidence of a suitable structure for a network seemed to be present, respondents stressed the need for face to face contact to ensure that the participants would have a suitable basis on which a network based on trust could be developed.

8.7 Networks require a common interest or theme which enables them to develop a distinctive contribution to the needs of the participants. Networks which attempt too many things become unfocused and are likely to loose their identity and dissolve. As a consequence, there are initial costs involved in setting up networks which relate to the time and effort required in identifying potential network participants who will be able to work together constructively. The alternative approach to developing networks is trial and error which brings networks together at relatively low cost but incurs costs due to fragmentation of effort and loss of efficiency.

8.8 In considering the characteristics of networks, it is helpful to consider the various potential actors in science park networks and their requirements at the local, regional, national and international levels and these are discussed below.

8.9 The main conclusion of our discussion with members of existing networks are summarised in the following sections of this Chapter. However, a more detailed description of the various networks which currently exist, or which are being developed, is given in a separate Annex.

Local networks

8.10 At a local level science parks participate in a variety of networks such as the network organised to tackle the problems of urban decay at Hulme, Manchester where the science park participates in a network aimed at developing improved telecommunications infrastructure for the area. Some are part of a de facto network created by a large umbrella organisation such as Shannon Development. Some science parks such as the technopoles at Montpelier, Bari and Trieste have developed constructive networks with local BICs to provide an infrastructure of support from two complementary perspectives. The technopole at Bari, for example provides the exogenous contribution through the attraction of mobile R&D projects while the BIC concentrates on the development of endogenous potential through the provision of financial and business planing advice to SMEs.

Regional networks

8.11 At a regional level, many science parks such as the technopoles found in France have, for many years, operated as a network of research institutes and technology based companies on several sites. Some technopoles such as Montpelier, Bordeaux and Sophia Antipolis have developed extensive human and telematic linkages to support such networks. The regional network in the Basque country includes linkages between the various parks, universities and institutes which extend across the border into France.

8.12 Networks in Germany in regions such as Baden Wurttemberg, Saxony and Thuringia have been developed for technology transfer purposes and these include a wide range of relevant institutions as well as the science parks and innovation centres. In addition, networks in the border regions of Germany such as Karlsruhe and Aachen have developed linkages which extend across the border regions with France and Netherlands. These linkages include the science parks and a wide variety of other players.

8.13 New networks are also being developed at a local/regional level such as the NEST network in Veneto in Italy which will be based on three main poles, Venezia, Padova and Verona and ten nodes in other towns in the Veneto region. The main objective of this network will be technology transfer to local industry and attracting industry from other areas. The network will also include advanced telematics for voice, video and data transmission.

National networks

8.14 At a national level, many science parks are members of national science park associations which provide a range of networking possibilities through their regular meetings and seminars. The postal survey of science parks indicated that 68 per cent of science parks were members of their national science parks associations, but membership was much more common in the North (74% of respondents) than in the South (47%). Examples include ADT which provides a range of services for a large number of innovation centres and science parks which are members in Germany, the association of Portugal business innovation centres and UKSPA in the UK which organises meetings for members every quarter which include a seminar on a specialist theme. However, in a number of countries there is no national science park association for example in Portugal or in Ireland. In some of these countries the possibility of establishing science park associations between countries might provide additional networking opportunities, for example, an Iberian association or an association between science parks in the UK and Ireland or Holland and Denmark. However, there may also be obstacles to such developments because of the different criteria for membership which exist in different countries.

European and international networks

8.15 A number of international associations exist for science parks and related bodies. These include IASP/AURRP, NBIA and EBN. The postal survey showed that membership of international science park associations was considerable lower with only 27 % of respondents having membership, but with higher membership rates in the South (39%) than in the North (24%). This is thought to reflect the low membership of IASP by UK science parks and almost non - existent membership of German science parks in IASP. About 20% of respondent were members of an incubator association and membership was equally spread between the North and the South. Membership of EBN was slightly higher (25%) with higher rates of membership in the South (56% of respondents) than in the North. These data for membership of EBN probably reflect the small number of BICs in the UK, Germany Denmark and other Northern countries.

8.16 A number of networks linking science parks and related bodies in different European countries have been established including:

- AMBAR which links Malaga, Sevilla, Montpelier and Bari
- Arc Atlantique which links Madeira, Lispolis, Porto, Rennes, Plassey and Heriot Watt
- LINKOR which links Bruxelles, Montpelier, Nancy and Paris
- EBN which links BICs in most European countries
- SPRINT inter firm network linking Louvain, Karlsruhe , Warwick
- Valladolid, Bordeaux and Louvain.

8.17 In most cases, such networks have been facilitated by the provision of public subventions to cover the costs of initiating and maintaining these networks. However, the costs and benefits of these networks to the participants have not been evaluated systematically (with the exception of the new evaluation of the AMBAR network)

8.18 In addition to the networks listed above, a wide range of networks have been supported by the EC in areas such as linkages between small firms, regional technology organisations and university technology transfer organisations. In a number of cases such networks were discussed during the fieldwork phase with the relevant participants.

8.19 The SP-NET study sought to examine the benefits deriving from networks and the good practice which might be utilised more widely. In general, respondents stressed the importance of human networking and the need to establish opportunities to develop a common understanding and sense of trust. Telematic aids to networking were seen as a secondary issue which could be relevant once good human relations had been established, primarily as a means for improving the efficiency of established networks rather than as a means for developing new ones.

8.20 A number of respondents reported positive benefits from initiatives such as AMBAR, both at the regional level where local contacts had been improved and at an international level where small firms had been able to establish collaborative arrangements with those in other countries. Other networks such as Arc Atlantique report progress in establishing programmes in areas of common interest such as naval design, but there have also been criticisms of such as networks on the grounds that they are talking shops.

8.21 The potential for establishing networks is clearly considerable, but the benefits of doing so have yet to be demonstrated rigorously. This is likely to remain the case until more evaluations of publicly supported networks have been carried out.

The potential for improved networks

8.22 As discussed earlier, effective networks need to provide benefits to their members which, at the minimum outweigh the costs of participating in the network. In order to achieve efficient networks among science park managements, companies and institutes, there is a need to identify areas of common interest such as the provision of information and to facilitate the introduction of potential collaborators. The effectiveness of science park networks will also depend upon the personal relationships established between the participants which enable them to establish the trust required for effective networking. Among science park managers the study has

demonstrated that there is a need for networking not only for the provision of information , but also for the provision of advice to enable science parks to carry out their roles more effectively and provide a better service to their tenants. However , the survey also indicated a number of factors which would affect networking among science park managers. These include:

- the lack of knowledge about other science parks in other parts of Europe and which science parks might be suitable collaborators within a network
- the asymmetry between the needs for information and assistance and the supply of knowledge
- the wish among some science parks to extend their role within their local and regional economies.

8.23 These factors indicate a need for the provision of timely and up to date information about science parks in Europe , some form of support to encourage those with information and advice to provide it to those who need it and mechanisms to enable science parks to integrate more effectively into their local economies and develop a wider role in local and regional development.

8.24 Among companies on science parks, there was initially a fairly sceptical response to the question of networking on the grounds that networks which were likely to be of value could not be constrained to companies on other science parks since many of the most relevant companies were likely to be located elsewhere. However, there was also some recognition that the development of technology clusters on particular science parks could lead to greater opportunities for networking.

8.25 Any networks for companies would therefore need to take into account:

- the variety of technologies and markets in which science park companies are engaged
- the small size of most science park companies and their lack of resources for non-central activities
- the preference of many companies for face to face communications
- the need of many companies to identify market and customer opportunities
- the wish of some companies to retain a local or regional focus and of others to network nationally and internationally.

8.26 The scope for enhancing networks among companies therefore relates to the ability to identify areas of common interest where companies can form viable groupings . The study found a range of existing technology clusters on science parks as well as a growing number of potential clusters where there would appear to be greater opportunities for identifying scope for linkages. Potential technology based opportunities for networks were most likely to develop in areas such as software, electronics, health, advanced manufacturing technologies, biotechnology, telecoms and environmental technologies.

Summary

8.27 In summary, there are opportunities for networking at local,regional, national, and international levels. However, effective networks require the identification of common interests or themes and, more importantly, the development of human interactions based on common understanding and trust. In some areas the regional development authorities provide effective networking through their existing mechanisms. Science parks in member states are very varied and the opportunities for improving networking appear to be strongest at the regional level between bodies with complementary objectives such as BICs and science parks and at a pan-European level between science parks with a similar technology focus.

Chapter 9

DEVELOPMENTS IN COMMUNICATIONS TECHNOLOGIES

Introduction

9.1 The pace of technological development in telematic technologies is quickening with a wide range of new technologies becoming available or being developed. In addition, the costs of telematic user equipment such as desk top video conferencing equipment is falling and the availability of more advanced public networks such as ISDN is growing. The postal survey sought to examine the current usage of different telematic technologies in science parks and their future needs.

9.2 This information was complemented by the face to face interview programme with science park companies, telecommunication companies and others. In addition, a wide variety of information was gained from a number of other sources specialising in advanced telematics which has provided a background for considering the future potential role of telematics in enhancing networking between science parks.

9.3 A number of technological developments are likely to impact future communications between all companies within Europe as well as companies and managements on science parks. In order to ensure that any proposals for networks arising from the SP-NET study did not become rapidly obsolete, a review was made of recent reports including the Commission White Paper on 'Growth , competitiveness and employment', the Eurescom 'vision' of the future of telematic technologies, the Commission's 1993 progress report on the introduction of ISDN, the Eurie Guide to ISDN and the EITO 1993 Observatory.

9.4 In addition, a Vision Workshop was held at which experts in telematics technologies from several European countries were asked to identify the most important technological trends and their potential impact on science parks. The workshop included representatives from Germany, Netherlands, UK, Eire and France and representatives of telecommunication companies, software companies, research network providers, science park managers and academic experts. A summary of the key conclusions of the Vision workshop are discussed in this Chapter, but a more

detailed discussion of technological developments and their potential impact on science parks is provided in a separate annex.

9.5 The work on technological developments indicated that a number of important factors were driving developments including:

- advances in hardware and software which were making telematics easier to use
- reductions in cost and price, which were making technology more widely available
- the growth of networks of computers through Local Area Networks and linkages between networks which were creating a world wide network 'The Internet'
- the fast development of applications on the Internet including hypertext applications and information search tools to faciliate usage.

The development of networks

9.6 A number of general conclusions about the development of telematic networks emerged from the work. These include:

- applications should drive the development of the network
- the provisions of applications requires the availability of a value added service provider who can take information and services from a wide area network and provide a tailored service for local users
- the updating of user services on a network is normally evolutionary. In general, companies will not 'jump generations' of technologies of their own accord.

9.7 A number of new user friendly applications are being developed through advances in technology and through the growth of applications within computer networking. The growth is likely to depend on:

- the extent to which users perceive market benefits from the applications
- the extent to which they can obtain cost savings from new technologies
- the extent to which there is an initial mass of users of technologies and applications so that they become part of the normal ways of doing business.

Current systems and applications

9.8 A number of key applications are already available or are developing at a fast pace which are likely to have an increasing impact on science parks and which are discussed below.

E.Mail

9.9 E.Mail is a basic service provided in most network applications which provides a range of benefits over fax. In many areas of business, E.Mail is becoming a normal way of communicating. The savings which can be made through the use of E.Mail which are of the order of ten times cheaper than Fax as well as being ten times faster is likely to speed the change to E.Mail. The potential savings to companies can be increased if the access node for the E.Mail system is located on the Local area Network so that telephone access to the nearest local node is no longer required.

Internet information services and World Wide Web

9.10 The Internet is the dominant global network. It provides a growing number of services which are used by over 37 million people worldwide. The fastest growth in usage of the Internet is now outside the USA.

9.11 The Internet is becoming the marketplace of the future. If companies want to reach the international market there are growing opportunities for them to market their products by making them available to browsers through the World Wide Web. This provides opportunities for companies to create pages of hypertext documents which allow the user to access more detailed information through a simple 'point and click' system. The possibilities for accessing video clips of products or services also exists through the World Wide Web. The Internet and particularly the World Wide Web, is consequently becoming the market place of the future. However, the growth of the WWW is leading to problems in indexing the products and services available and this is likely to lead to automated search methods.

9.12 The growth of this Internet provides opportunities for companies to establish new and creative linkages within countries and between countries. The concept of the Virtual company which is established through telematic linkages of a series of smaller companies is likely to enhance the competitive position of small firms in the future.

Transactions through the Internet

9.13 At present Electronic Data interchange (EDI) is used by a limited number of companies and is mainly encouraged by large firms which purchase large volumes of products from other firms. However, the development of secure encryption methods is likely to enable much wider use of the Internet for transaction processing, possibly using credit cards. This could lead to much greater use of the Internet as a forum for business transactions.

Video conferencing

9.14 The use of video conferencing using low cost desk top systems with point to point ISDN links is now becoming available. However, the extent to which companies are likely to want to use this application is not yet clear. This is also likely to depend on the development of a critical mass of users with directories of users so that calls can be made to others. A potential application for video conferencing of growing potential interest is the use of video conferencing to enable companies to create short term alliances with other companies, or virtual companies which can compete with larger companies.

The implications of telematic developments

9.15 As a consequence of the fast pace of development of telematic technologies, a number of policy issues are likely to need to be addressed including:

- telematic technology will continue to advance and to shape the future. It will be the dominant force for change in the 21st Century. However, there will need to be road maps and information to keep policy makers and the broader community informed

- the public sector should not seek to interfere with the development of advanced telematic services in which the private sector is already heavily involved, but rather to focus on financial support in pushing the boundaries further

- there is a need to be aware of the barriers of national boundaries. The lack of access to end-user equipment is limiting some use of advanced telematic services. In LFRs, the lack of functional local end-user infrastructure is also limiting use, but costs are coming down in most countries with competition. All PTTs should be encouraged to ensure that the local end-user infrastructure is effective. Science Parks should consider improvements to their local end-user infrastructure. There

may also be a particular opportunity for shared telematics equipment and access, eg ISDN access on the LAN, modems

- policy makers at the national and EC levels should be attentive to the project infrastructure legacy left behind. All projects funded by the public sector whether at national or EC levels should make provision for participants to utilise modern telematic means of communication, for example funding the purchase of video conferencing equipment as an alternative to paying travel and subsistence costs for meetings

- developers of science parks should plan for the growth in advanced telematics. Any new science park proposals should include ducts for telematics

- there are opportunities to offer a package of applications to SMEs on Science Parks. This package would be particularly attractive if a local value added service could be provided which minimised costs, for example by linking science park tenant companies into broader networks through a local area network. A local champion who could provide training, support and tailor information would be valuable

- companies will substitute new technologies of communication for old ones. But, it is not clear that the companies are making these substitutions as early or as fully as they could. Telecoms audits for SP companies could be one means of ensuring that companies use the optimum mix of technologies

- on-line information (such as commercial databases) is very important to companies, especially fast growth companies which are more typical of the SP community. However, companies are not always effective at interrogating and interpreting this information

- a local area value added services provider could provide assistance in interrogating databases and/or perform the search and analysis on behalf of the company. Alternatively, this value added services provider could have an arrangement with an information consultant

- 'virtual companies' are an extended production system in which smaller companies and opportunistic alliances replace large, inflexible corporations. Telematics is playing a key role in making this possible

- instead of funding a demonstration centre, fund the development and provision of a network which provides access to information and services companies and managers need.

Connection to the Internet

9.16 Connections can be made to the Internet through two main routes:

- national academic/research networks
- commercial Internet providers

National academic/research networks

9.17 The national academic/research networks have been created in each country of the EU to link public sector researchers in universities, institutes and government laboratories. These networks have usually been created through the use of public funds and connection is governed by Acceptable Use Guidelines which limit the extent to which the network can be used for commercial activities unless these are for research purposes. The most advanced of these networks is the UK SuperJanet network which provides 13 nodes at 34 Mbits/sec from London to Scotland.

9.18 A range of applications are being developed in the Europanet including the MICE multi-media application using the existing 2 Mbit/sec services on the MBone 2Mbit/sec backbone. However, there are limitations in some parts of Europe on the availability of local infrastructures such as 34 MBit/sec leased lines and on the availability of end user equipment such as studios for multi-media applications. Multi-media applications include video conferencing, shared workspace, remote imaging, control of complex processes, publishing and distance learning.

Commercial Internet providers

9.19 A range of commercial internet companies provide access to the Internet for a wide range of commercial companies. The growth of these commercial access providers is determined by the growth in demand rather than leading demand. The TCP/IP protocol has become the de facto world wide protocol for the system although the X400 standard is used in small more specialised networks. Access to the Internet provides a range of applications including:

- E.Mail which accounts for about 90 per cent of the traffic

- newsgroups which provide a focus for information on specialist subjects
- remote log-in which enables users to access data globally

9.20 This provides powerful opportunities for companies to find information quickly by accessing world wide newsgroups. A range of tools for searching for data such as Archie, Gopher and WAIS are available on the network. However, the growth of the information available on the Internet is leading to problems with classification systems and new protocols, tools and standards are continually being developed to enable users to maximise the functionality of the system.

9.21 Companies can also provide information on their products and services for others by publishing catalogues and other materials. A range of opportunities are available for companies to market their products by developing hyper-text pages on the World Wide Web. The World Wide Web and the Mosaic interface allow users to point and click and therefore provides a much more user friendly approach. There are also opportunities for companies to make available short video clips of their products which can be made available to potential customers through the WWW.

9.22 Examples of companies which are currently using the Internet for marketing purposes include:

- a machine tool company which allows customers to log-on to its computers remotely and check the status of orders
- a computer manufacturer which allows users to log-onto their computers to access the latest information and solves customer problems over the Internet
- a publishing company which allows customers to access its catalogue and search using key words

9.23 In addition, companies can create Virtual Private Networks linking their various sites with considerable cost savings over leased lines.

9.24 However, there are limitations to the types of communications which can be transmitted using the currently available IP protocols. In particular, the currently available protocols will not support real time interactive video conferencing since the time delay in transmission would lead to unacceptable loss of quality. However, ISDN is developing at a fast pace throughout Europe and provides a point to point digital

technology which is capable of supporting limited video conferencing applications. ISDN is likely to become the dominant technology for point to point communication.

9.25 The possibilities for networked technologies (like the Internet) to co-exist with ISDN and for the development of integrated applications might enable them to play complementary roles. Such integration of technologies and applications is being developed by the Leeds Virtual Science Park which is discussed elsewhere in this report.

9.26 The costs for a company of gaining access to the Internet ranges from 25,000 ECU per annum for a 256k line to a few thousand ECU per annum for modem access. However, the cost of access for a small company on a science park might be considerably reduced if the science park were to negotiate with an Internet service provider for the provision of a local access node which could be connected to all companies on the science park through a local area network. In addition, the science park might be able to provide value added services by screening information from the Internet to provide a local specialised information service and to provide support to users by acting as a local champion.

9.27 As a consequence of these developments, a number of policy implications are likely to need to be addressed:

- networked and point to point technologies could provide a complementary solution
- science parks have opportunities to establish Internet nodes providing a local service through a local areas network to their tenant firms
- science parks have an opportunity to provide a value added service by tailoring information and acting as local champions of networking
- dial-up video conferencing is certain to develop in the short to medium term as a versatile medium of communication and interaction, but, at present, there are no directories detailing who has the facility. Clearly, this limits its use.

Advances in telematics

High speed networks

9.28 High speed networks allow greater bandwidth and provide opportunities for a wide range of applications to be made available cheaply. However, such bandwidth can not be provided universally using the existing copper cable system which is limited to the capacity of ISDN (128kbits/sec) and consequently requires the availability of fibre optic systems end to end to enable the full bandwidth to be transmitted.

9.29 In order to provide real multi-media applications such as video conferencing , remote diagnosis complex visualisation and virtual reality, there is a need to provide higher bandwidth. Within Europe the largest network providing high bandwidth is the SuperJanet network which operates at 34 and 140 Mbits/sec using ATM protocols. Such systems provide a useful test bed for researchers to carry out experiments and to carry out remote applications. A number of experiments have been carried out in the USA in which higher speed network experiments have been subject to an evaluation under the Cosine programme. These high speed networks include the CASA tested in California at 2.4 Gigabits/sec, the Auvora tested in the East Coast at 2.4 Gigabits/sec and the Blanca, Nectar and Vistanet testbeds which function at 45 Mbits/sec and 622 Mbits/sec. Each of these experiments is primarily government or supplier led with no business user involvement.

Advanced applications

9.30 The pace of innovation in telematics and networking is leading to ever increasing functionality and ease of use. In the longer term a number of development may be possible including:

- the use of intelligent agents that are able to search for information throughout the Internet and learn the types of information the user finds most useful. This would obviate the need to define key words or search strings

- the use of automatic summarising tools to cope with the information overload. These would summarise text and abridge articles to extract the most important sentences

- the use of advanced modelling, visualisation and virtual reality techniques to enable complex data to be understood and manipulated

- the use of mobility aids so that a person with an active badge can be instantly located and their computing environment can be provided to any terminal on a global basis.

Chapter 10

DEMONSTRATION CENTRES

10.1 A survey of demonstration centres for advanced telematics and IT within the EU was carried out by Centrale Management and an executive summary of their report is provided in the appendices. The full report is available as a separate annex.

10.2 The study developed a categorisation system for the different types of demonstration centres including teleports and both public and privately operated demonstration centres. Following analysis of the fieldwork results, the factors which led to success within each of the different categories were analysed. A number of broad conclusions were reached including:

- technology demonstration centres were often unable to maintain reasonable utilisation without public support
- in fast moving technologies demonstration centres run the risk of demonstrating technologies which are no longer leading edge
- successful demonstration centres had a focus on consultancy and training initiatives and had human resources with a high level of expertise.

10.3 The study therefore suggests that an effective approach to technology demonstration for the future might be to fund applications based projects which were driven by the needs of a potential user and where demonstration to similar potential users could be arranged.

Chapter 11

CONCLUSIONS

11.1 The study of science parks and existing networks has led to the following main conclusions about the development of science parks and their needs for networking. We have grouped these conclusions into a series of related themes which are discussed below.

Information issues

11.2 In general, science park managements did not have good information about other science parks in Europe or about which specific science parks might have information and experience which might have relevance to their needs. The existing mechanisms such as national science park bodies provided networking opportunities within some countries, but similar opportunities for networking across European borders were not easily available. There is a need for easier access to information about science parks covering issues such as size, age, regional context, strategic objectives, key features, ownership, planned development etc to allow science park managements to identify relevant science parks for networking purposes.

11.3 Many science park managers did not know about existing information databases and systems such as those provided by the EC. Of those that did know about them, a large proportion found them too complex and difficult to use. This indicates a need for simplification of these systems and provision of easy to use interfaces. In addition, there are opportunities to encourage intermediaries to act as information brokers.

11.4 There was a widespread wish for exchange of information and experience between science park managers which was most prevalent in Southern science parks. In addition, a smaller number of science parks reported expertise in specific areas of science park management. However, there was a mismatch between the types of advice offered and what was required. The main area where a useful exchange of experience might be possible would be in the field of technology transfer. However, the willingness and ability of science parks to engage in an exchange of experience without receiving something in return is unlikely to be sustainable in the longer term,

consequently an opportunity for a valuable exchange of experience exists but there is a need for assistance to facilitate it.

11.5 Some science parks were interested in exchanging experience with other science parks similar to themselves,for example at the same stage of development, while other were more interested in exchanging experience with science parks which had similar objective but which were at a later stage of development. The process of establishing networks should therefore provide opportunities for networks to be established along a wider range of axes. Existing mechanism for establishing contacts such as Euro Business days, Euro Alliances and Europartenariats might be extended to assist such contacts.

11.6 Tenant firms on science parks had little knowledge of EC sources of data and , in general, did not have the time or resources to use these systems. Most such firms had specialised information needs in relation to technology but would have liked information and assistance in relation to markets, customers, distribution and also potential collaborators for research and technology transfer. Few such companies make use of existing market and other databases provided by the European Commission and others. This relates to lack of time and resources, but also to the complexity and lack of user friendliness of such systems. The need for a simple to use, standardised user-interface was widely expressed. The scope for the provision of improved information services to tenants should therefore be explored.

11.7 A wide variety of information brokers already exists for technology and market databases and other information sources, including the EC's own brokers such as the Euro - Info Centres and the Value Relay Centres. In general, such public sector organisations were little known or were considered of little relevance. Linkages between such organisations and science parks was not strong. However the scope for exploring the possibility of greater use of these organisations rather than creating further fragmentation was suggested. This might be achieved by providing user support at science park for a limited period to allow tenant companies to get to know what currently exists. This could include financial assistance and, more importantly, personal assistance support and training.

The management of science parks

11.8 The study revealed a number of issues related to the management of science parks, particularly new science parks, which were inhibiting their success. These included:

- lack of management continuity

- lack of definition of the scope of delegated authority given to science park managers
- lack of clarity about the criteria for appointing science park managers and the relevant training and reward systems required
- lack of training and skill in science park management
- lack of information about key ratios and standards of excellence

11.9 In addition, the study revealed a desire from science park managers for an exchange of experience on a number of more specific topics such as the development of spin outs, obtaining finance for tenants, technology transfer , intellectual property, and university/industry links. The study also revealed that a range of experience was already available in the management of science parks and the possible scope for exchange of this experience to enable improvements to be made.

11.10 The study raised questions about the entry criteria which are used by science parks and national associations. There are indications that criteria may be too restrictive and that limitations of tenant activities to research and development may not be viable especially in the South. The growth of new information based industries such as airline reservation systems or inter-active multi-media databases is likely to blur distinctions between R&D and the commercial information processing. In addition, innovation increasingly requires simultaneous R&D on both products and processes which militates against the separation of research onto science parks and away from production processes. Finally, the study indicated a number of questions about the ability of growing technology based companies to remain on the science park when they need manufacturing or commercial space. This was particularly a problem for smaller science parks and innovation centres. These conclusions suggested a need either for less restrictive entry conditions, or for collaborative networks between science parks and other local bodies such as business and commercial parks to facilitate the needs of growth industries.

11.11 The study found evidence that some science parks were seeking to extend their roles beyond that of serving the tenants on the science park site to one of networking with the wider economy in order to foster synergy between the science park and other organisations. In many cases,science parks were struggling to define such a wider role. The study indicated that a number of options were possible including:

- widening role of science parks through the management of offshoot organisations on other sites, for example, an innovation centre on a separate business or technology park

- acting as resource centres for the wider economy for example in the provision of information from databases or as demonstration centres of new technology

- acting as a focus for the development of networks, for example, as the focus for the development of metropolitan area networks.

Networks

11.12 The study clearly showed the importance of effective human networking as a pre-condition for telematic networking, particularly in sensitive areas such as technology transfer where a great deal of trust and integrity is required. Networks depend on human inter-actions and there is therefore a need to allow partners to define networking arrangements for themselves or allow a lead contractor to define the network within certain guidelines. However, there is also a need to facilitate opportunities for human interactions between potential network participants especially between participants in different European countries.

11.13 The study indicated that the greatest potential for enhancing networks was likely to lie:

- in enhancing regional and local networks

- in enhancing networks between science park management for the exchange of experience

- in enhancing wider networks between science parks and science park tenants who have common interests such as technology.

Regional networks

11.14 For some science parks the importance of regional networking was likely to be of growing importance leading, for example, to increasing linkages with local industry sectors for the provision of technology and technical services to both traditional and new technology areas. Other science parks needed assistance in developing effective linkages with other bodies such as technology parks and BICs

11.15 The study looked at a number of existing networks from the standpoint of the participants in different countries. In many cases these had been supported by public funds, but the concrete benefits to the participants were not easy to discern. Although positive statements were made about such networks, the actual benefits and usage of the network were relatively intangible and a more rigorous approach to evaluation,

such as the recently commissioned review of AMBAR would be necessary to evaluate the benefits in relation to the cost and in relation to any displacement effects.

11.16 The potential for complementary activities between science parks, BICs and similar bodies was demonstrated throughout the study. In particular, science parks often have exogenous objectives related to projecting a marketing profile to the outside world and attracting investment to the areas, while BICs have an endogenous role in assisting local industry and developing new firms. The study also demonstrated the potential synergies between different types of organisations for example between science parks and BICs where one might have strengths in technology transfer and intellectual property and the other might have strengths in business planning and finance. However, in many countries there are few BICs which limits the opportunities for such cooperation. The opportunities for encouraging collaboration between science parks and other relevant bodies within regions may therefore need to be considered.

11.17 The European Commission has funded a wide range of other networks under schemes which are not specifically oriented towards science parks. Many of these networks would appear to have insufficiently clear objectives and would benefit from evaluation.

Networking tenant companies

11.18 Companies on science parks are very often small firms operating in highly specialised niche markets. In general, such companies have well developed networks for their core technologies and competencies, although companies in Southern science parks may experience some remoteness from centres of technological and market expertise. However, tenant companies would benefit from a number of networking/information facilities:

- assistance in accessing marketing information more easily
- assistance in finding partners for technology collaboration or for distribution/ technical support for products

Technological development

11.19 The study led to a number of conclusions about technology trends and their relevance to science parks which include:

- the falling costs of telematic technologies based on increasing functionality of microprocessors and reducing prices together with the increasingly widespread availability of digital broad band communications such as ISDN

- the scope for companies on science parks to take advantage of these trends to develop new equipment and develop new market opportunities

- the extent to which large companies were already utilising telematic applications and were capable of utilising whatever technologies were appropriate to the needs, reliable and cost effective. Increasingly these included E.Mail, CAD/CAM interchange and desk top video conferencing

- the rapid growth of computer networking and the opportunities provided by the Internet

- the growing availability of harmonised ISDN across Europe and the positive policies being pursued by the Commission to promote ISDN as a cost effective solution to the needs of SMEs

- the lack of knowledge among many of those on science parks about modern telematic applications and the potential for more cost effective solutions as well as the scope for completely new activities.

- the developing networks of wide band communications which are being installed by the public sector including the academic /research networks in most countries which are leading to proposals for Metropolitan Area Networks to link science and technology based organisations within cities, including possibly science parks.

- the lack of use of existing demonstration centres and , the technology push approach.

11.20 In some cases, existing companies on science parks could provide a basis for a facility for the provision of database searches or demonstration of technologies, for example, firms supplying advanced ISDN compatible work stations with desk top video conferencing facilities would be well placed to provide demonstration facilities for other companies on science parks and more widely.

11.21 The use of advanced telematic systems by companies on science parks and by the managements of science parks was limited. In many cases, companies were able to solve their communications problems through the use of existing technologies such as

modems. Where systems such as E.Mail had been introduced by national science park associations without subsidy or promotion the uptake and the usage had been low.

11.22 In a number of cases, science parks were utilising networking technologies such as dedicated video conferencing suites which had been paid for by public subventions rather than from their own resources. However, in many such cases, usage was also limited by the lack of a critical mass of other users to communicate with. The need for a critical mass of users was apparent with almost all networking applications including E.Mail, ISDN and video conferencing.

The development of science parks

11.23 There has been an explosion of interest in the development of science parks in recent years, but this has not necessarily led to the most productive outcomes or to the results intended. In a number of cases, particularly in the South, progress has been slow and the results have been disappointing.

11.24 In a number of areas several competing science parks have been developed in a region by national, regional and local organisations in areas where the science and technology and industrial infrastructure is insufficient to provide a viable future for all these science parks. This affects their ability to network, since science parks are effectively competing for the same market. As a consequence, many of these science parks are likely to operate at a sub-optimal level. The possibility of some form of strategy or criteria to limit support for science parks within a region or to encourage the various actors in a region to collaborate may need to be considered.

11.25 The survey indicated that a number of science parks have unclear and diffuse objectives which affect their ability to project a coherent picture into other geographic areas. In some cases, science parks have changed their objectives, for example, to relax entry criteria in order to attract tenants. In other cases, science parks have clear objectives and strict criteria , but these are inappropriate to the economic environment in which they are operating. In some such cases, particularly in the South, science parks may need to allow limited manufacture or service provision in order to succeed. Assistance in defining science park objectives and criteria may therefore be required.

11.26 In the light of these conclusions we believe that a certain number of key principles should guide the development of a any initiatives developed to enhance networking between science parks.

KEY CONCLUSIONS FOR THE DEVELOPMENT OF NETWORKS

11.27 We have distilled a smaller number of key conclusions which will assist in the development of initiatives for networks to provide the greatest benefits for science parks in Europe. These principles are discussed below.

Human networking

11.28 There is a need to recognise the importance of human interaction in the development of networks, in particular, the development of common understanding and a sense of trust. This requires the development of mechanisms to allow potential network partners to identify one another and to meet face to face.

Recognise variety

11.29 There is a need to recognise that different science parks have different requirements and that initiatives suitable for one park may not be suitable for another. Within a particular network the benefits which might attract one park to participate may be quite different from the benefits that would attract a different park. There is therefore a need to develop a menu of opportunities and benefits.

Recognise the science park as one of several local/ regional actors

11.30 Science parks do not exist in isolation from the other economic actors. There are many routes to economic success which are pursued by bodies such as city councils, regional development bodies etc and science parks networking. Initiatives should seek to develop synergy by encouraging the involvement of other bodies in complementary activities. In particular, joint initiatives from a consortium of local/ regional bodies are likely to have greater potential for success.

Set targets, milestones and evaluation criteria

11.31 Science park networks should be subject to evaluation against a series of transparent, objectives, milestones are criteria. This would allow lessons and good practice to be applied to the development of meaningful objectives for future science park networks.

Utilise proven modern technology

11.32 Science parks may need to utilise modern telecommunications and other technologies for networking purposes. Proven technologies where falling prices make these technologies economically attractive eg Internet and ISDN, are likely to be more effective than custom made non-standard solutions which are unlikely to lead to a critical mass of users.

Encourage developmental objectives

11.33 Science parks exist to exploit existing S&T strengths and to contribute to improving the economic environment. Science parks should have clear objectives, which include the improvement of the role of the science park in relation to its tenants and the wider economy. Improvement through Management Training and Quality schemes, should be encouraged.

Encourage creativity

11.34 It is not possible to envisage all the possible ways in which science parks and other bodies could network throughout Europe. An attempt to impose a structure on networks from above would be insensitive and less likely to succeed. Effective human interactions will be more likely to develop when participants are able to select networking arrangements for themselves. There will be a need to facilitate the development of networks through a pro-active approach eg visits/workshops etc to assist the formation of consortia as well as to identify clear criteria to judge proposals for assistance.

Enhance existing networks

11.35 A wide range of networks already exist. These should be subject to evaluation, but the opportunity to build on and enhance existing networks should be taken.