SCIENCE PARK NETWORKS

A report to the European Commission

Volume Two

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BELGIUM

EXECUTIVE SUMMARY

BELGIUM

1 In 1971, the Government authorised public and private universities to collaborate with local authorities in order to manage industrial areas linked to universities. The flagship decision initiated the technopolitan movement in the country.

2 There are currently 13 science parks in Belgium, with one still under development. The study reviewed two developments: the scientific park of Louvain-la-Neuve, and the science park cluster in the Bruxelles Metropolitan area (Evère-Bruxelles, Neder-Over Heisenbeck, Meylemeersch-Anderlecht and Nivelles) which are connected in a local network named Technopole Bruxelles.

3 The scientific park of Louvain-la-Neuve is a part of the project of the new town of Louvain-la-Neuve which was initiated by the Catholic University (UCL) in 1970. The University has 10 faculties and more than 200 research units. In 1992-1993 research contracts for a total amount of more than 50 millions Ecus have been signed with industry. The technology transfer office of the university employs 8 persons.

4 The scientific park is mainly intended for high technology firms who want to collaborate with the university. About 50 companies are currently working on the park, They have been selected on pre-established criteria by the university. Financial income from the park is entirely reinvested in University Research. The university has also created an incubator for new companies. A common programme for building an international telecommunications area has been initiated in 1993 with Belgacom. The facilities interest the firms of the park which spend more than 2 million Ecus per year in international communication. Actually, few companies are currently interested in advanced telecommunications services. An open access room dedicated to transmission facilities already exists on the park but it is not often used. A common project of teletraining could be operational in 1994 with Louvain-la-Neuve and Chareleroi University.

5 Technolopole Bruxelles works as an economic development agency with decentralised bodies, the science parks managers of Evère, Neder-Over Heisenbeck, Meylenmeersch-Anderlecht and Nivelles. It was created in 1990 with the success of the science park of Evère. The mission of Technopole Bruxelles is to develop a scientific and technological environment to attract new companies and to improve global performance of existing companies. The association has a budget of 5 million Ecus and employs 15 persons. Three major tasks have been defined:

- inform SME about research, technological opportunities, public financing, and support transfer of knowledge from universities

- set up projects of partnerships in the fields of food industry, telecommunications, precision instruments and health

- stimulate international programmes through the LINKOR network created with the technopoles of Montpellier, Nancy, Ile de France, Malaga and Casablanca.

Telecommunications could be a support to all of these activities:

- ISDN lines would be useful to transmit information to SMEs; a software might be also useful to facilitate the use of telematics databases

- new telematics applications might be tested for example in order to stock and share X-Ray photos between hospitals and doctors

- long distance communications could be useful to support projects of collaborations in LINKOR; databases would also be useful to inform the members of the network about the core competencies of firms involved in the different science parks.

DENMARK

Chapter One

INTRODUCTION

1.1 There are, at the moment, six Science Parks (SP) in Denmark, all in proximity to a HEI. Generally science parks are not seen as a means for development of the regional economy. The Danish government has embarked on a new focus on SME, which are seen as the means to carry industrial development forward. However, Denmark has one of the lowest start-up rates in Europe.

1.2 SPs have up till now played a little role in this, but the government is working on a new law concerning SP and their role in the Danish industrial scene and in economic development. SPs have played a more important role in being a channel for technology transfer, or in developing practical technical competence (development R&D).

Five of the six SPs have created a national association of SP managers, (the sixth is not considered to be a real SP because it lacks direct links with a HEI or research establishment). This association is informal and used for exchange of experience and discussion of common problems/issues. This association is planning to become a member of IASP. The SP which is currently outside the national association is working more as a business park, but is building up its connection with HEI's etc, and has recently established an innovationhouse (incubator) for knowledge based companies at Danish Technological University (DTU).

1.4 Four Science Parks were visited for this study, two on Zealand and two in Jytland. 19 companies/organisations were visited in connection with the SPs. As mentioned earlier, the science parks in Denmark have not until now received much attention from the government, and the local municipalities or counties have not used SPs as an active part of their regional economic development. The government is about to submit a draft law on science parks but the draft is not appreciated, or as one SP manager described it 'completely useless'.

1.5 Municipalities/counties have in all cases supported the SP with either land, property or by being helpful with planning permission etc., but have otherwise not seen the SP as a part of their economic development strategy. In one case where the county has closer contact with the SP, the county's view on the SP role in the local economy was to create technical competence in the two main industry sectors; electronic (including telecommunication) and material technologies, the county sees as the backbone for economic development in the area. The objective of this SP was perceived as being a place for spin-outs from the local university, both from the HEI and the SP management to commercialise R&D, not so much to create new jobs. Job creation is, of course, seen as the positive side effect of the commercialisation. The science park has had projects come from big companies and close down and return when an idea had been developed into a commercial product.

1.6 The infrastructure in Denmark is very developed, with everybody having the ability to have a telephone/fax installed. Similarly ISDN covers Denmark 100%, with an installation price of twice a normal telephone line. The telecommunication company (TeleDenmark) had expected to have 20,000 subscribers on ISDN by now, but so far only 3,000 have chosen it. ISDN is today mainly used in the graphics industry for transfer of drawings etc. Denmark has one of the lowest telecommunication tariff in Europe, and Germany has threaten to cut the mobile telecommunication connections to Denmark because the price difference is so big.

1.7 Two of the Science Parks interviewed had direct access to e.mail and InterNet through the local university. All universities in Denmark are linked up to an organisation called UNI*C which is operating a network (DE-Net) between academics in Denmark. It is possible for an organisation in Denmark to have installed all kinds of company specific telematic networks if the organisation is willing to pay for it.

1.8 Most of the companies perceived their networks (human & telematic) as being sufficient, both with customers and academic/organisations. All of the companies would, of course, like to find more customers, but finding partners for professional development of their company or product has a much lower priority. Exploring potential needs for further network contacts revealed interest in professional contacts, though with the reservation that a potential telematic network not should be confined to SPs. From discussing networking and linkages, all the respondents argued that face-to-face contact is essential to create trust between partners. At the same time many of the respondents were tired of going to conferences which had a useless programme, and little time for what most people attend a conference for - to create and maintain network contacts.

1.9 In order to keep in contact with their customers and professional partners most companies mostly uses 'normal business communication' (letter, tel/fax) The use of e.mail and other advanced telematic media (huge datatransmission etc) were mostly confined to companies who's staff originated within academia, whereas companies founded by entrepreneurs outside academia knew about the opportunities but did not use them. Academic staff brought the tradition of communicating with e.mail to the companies which often gave the companies worldwide contact and easy access to their linkages and new information. Similarly academics are more used to having international contacts from their research work, which they continue to use after moving to a private company, giving them a wider contact range.

1.10 Only a few people had tried videoconferencing and only a few private firms/organisations in Denmark use it regularly. Videoconferencing can be used to maintain contact between partners, but was perceived as unsuited for creating contact, because it is impossible to create a feeling of trust without seeing the other person face-to-face.

1.11 Reactions and potential needs for telematic network between SPs in Europe were extremely varied, from a request to install highspeed datatransmission network tomorrow to a company who did not see any use for it. All people argued when prompted about a network amongst SP that it should not be confined to science parks, but it should be possible to access organisations etc outside the network.

Chapter Two

REGIONAL BACKGROUND (Zealand - Denmark)

2.1 This description is covering two science parks, Symbion in Copenhagen and Forskningscenter ved Hørsholm (FvH). The parks were visited in January 1994.

2.2 FvH is located in the North of Zealand, next to a motorway and close to a railway station. The area has mainly light industry consisting of offices and general businesses industry, but as in many other areas there is a huge surplus of office space. Next to the SP are two very prestigious office buildings with 42,000 free Sqm.

2.3 There is no HEI next to FvH, but they have Danish Technical University (DTU) 10 km down the road. DTU is Denmark's biggest educational institution for civil engineers. Symbion is a similar case, with no HEI close to it. Most of the HEIs in Copenhagen are within approx. 15 min. drive from the SP.

2.4 Being located in the capital, Symbion has the biggest concentration of educational and research institutions in Denmark. Most of the bigger companies have representation in Copenhagen. The main focus of companies within the SP's (bio-technology) is based in and around Copenhagen.

2.5 The main economic players in the region are public administration/services and financial services. The medical industry has a strong presence in the region with a company like NOVO NORDISK.

2.6 In Copenhagen, a number of municipalities and counties are currently setting up a new initiative for attracting foreign investment and mobile research projects (domestic and foreign). This initiative is slightly different to those of normal development agencies. The group which consists of five municipalities in the area, is trying to sell projects rather than promote Denmark/Copenhagen as a wonderful place to locate. This is done (or will be) by finding interesting technological projects, seeking a partner, nationally or internationally and afterwards trying to attract partners to attach to this project. As the initiative has only recently started there is no way to tell whether it is a success, but is certainly an interesting initiative.

2.7 In Denmark there is a group of institutions called 'Akadamiet for Tekniske Videnskaber' (ATV). The Academy for Technical Sciences acts as a bridge between science and industry. Industry has the option to contact a ATV for practical research or technical surveys. An ATV also carry out research and development within its technical area. This institution has recently undergone a restructuring has reduced the number of ATV centres. The ATVs are located around Denmark but with the majority in and around Copenhagen. FvH has a number of these ATV on its land, but there is no reason why they should not have been placed elsewhere.

2.8 Being located North of Copenhagen in an area populated with professionals and well educated people, FvH has advantages for knowledge-based companies seeking new employees.

Chapter Three

FORSKNINGSCENTER I HØRSHOLM

Introduction

3.1 Forskningscenter I Hørsholm (FvH) is Denmark's oldest science park and was established 32 years ago in 1962. It has changed it strategy within the last two years. After its start in 1962 the centre mainly functioned as a business park with a number of public research institute (ATVs) and a few private companies. The private companies decided to locate on the centre because of the image and address the science park gave, rather than because of any access to technical competence or potential networking opportunities.

3.2 There are currently 42 companies/organisations with 1560 employees of which approx. 700 are researchers/scientists. The SP also includes an innovation-house with 15 tenants. The SP has an area of 100 hectare on which 70,000 Sqm of buildings have been built, of which some are privately owned.

3.3 FvH is located 10 km from the Danish Technical University (DTU) which has 14,000 students and 3,500 scientists. FvH were originally thought to be the place for ATV and related activities in the hope this would create a high-tech environment. Nine ATV moved to FvH, but there is little if any dynamic created by this, since then a few private companies have located on the SP. One is a company specialising in research and development of food and food-ingredients and another is D.O.N.G, Danish Oil and Natural Gasses. The grounds have been used for experimental planting (trees and bushes etc) by the Danish Agricultural University, and the land is therefore very beautiful.

3.4 The Innovationhouse was created in cooperation with DIC, a DTU department which has entrepreneurship as its focus and has a small incubator facility on DTU. Developing entrepreneurs to 'businessmen' on DTU is a three step procedure which involves: testing their product and market at DIC, moving on to the Innovationhouse if the project looks commercialiseable and finally building on the land of FvH (step three has not been achieved yet). The manager together with a DIC person hopes with their combined network would be able to help the newly established firms with professional board members, market contact and hopefully contacts to financial sources.

3.5 The current manager of FvH has only been in the position for 9 months, and is currently trying to change the strategy of FvH from being a business park to a Science Park, with the Innovationhouse as the first step. As they are currently formulating their strategy is it impossible to clarify in which other areas they will change and which area they will focus on. There has been no help to the tenants from the Science Park management in previous times except for issues related to the buildings and land.

3.6 Currently FvH is nothing more than a beautiful location with a number of knowledge based organisations/firms which is accidently called a SP. FvH might have a bigger potential in the future if they manage to make the Innovationhouse and their connection with DTU work, but it will depend on which strategy they choose to pursue.

Telematic

3.7 The SP administration is currently only using normal business communication facilities, and has no plans in the near future to use more advanced telematic tools (database search, ISDN, e.mail etc). Firms/organisations in FvH are using a varying degree of telematic facilities including e.mail, though it was not certain whether any was using ISDN.

3.8 The future use of telematic facilities will be very dependent on the chosen strategy for FvH, but as the tenants are so different and placed on a multi-site is it not likely that the SP management will offer any services for all the companies. The SP management might adopt telematics for its own purposes and possibly in the Innovationhouse, but this was constrained by the lack of knowledge within the management about telematic possibilities. The tenants in the innovationhouse have a local area network which they can use on their own and connect to the rest of the house. Telematic is perceived as a small concern to most of the companies in the innovationhouse at their current development stage.

Linkages/Networking

3.9 Locally is there a very strong network contact with local firms, but there was no knowledge about the tenants' degree of networking because the manager is new in the job. There are linkages through the DIC to the NBIA (National Business Incubator Association) in USA and it is the intention to develop this further, potentially to find markets in USA (agents, distributors etc) for the companies in the Innovationhouse.

3.10 The DIC had been contacted by EBN, but this was totally rejected because the representative could not explain the benefits of being connected.

3.11 The manager is uncertain about potential networks/linkages as it will depend on which strategy the science park chose to pursue.

3.12 There was recently a possibility that the Eu-environmental agency might be located at FvH but it was decided that this should be located in the centre of Copenhagen despite FvH having several ATVs related to environmental issues. The FvH is therefore trying to create closer connections with governmental politicians in order to raise their awareness about FvH.

3.13 Because of recent changes in management, FvH is interested in networking with other SPs in Europe on almost every aspect of running a SP, from maintenance to technology transfer. FvH would therefore be very interested in a SP-network. This network should mainly be a place for searching information and to find contacts in other SPs.

3.14 FvH is in co-operation with DIC trying to get the innovation house to adopt a network concept of Mr Kutzmetsky of Austin, Texas. Mr Kutzmetsky has developed a simple model which shows that a fertile environment for developing new knowledge-based companies can be generated by combining capital, enterprise and intellect. This environment does not exist in Denmark sofar. The concept includes the necessity to network as many people/organisation as possible, and also includes industrial development programmes, higher education, venture capital, banks, networks of business managers etc.

3.15 In order to create this network and generally to widen the network for FvH. There was, therefore, a sceptical attitude to a telematic network linking only SPs need for a network which was not limited to firms/organisations located in a SP. A medium such as e.mail/InterNet could be used for networking. It could be useful if EU had a SP service and general easily accessible information about EU on InterNet or similar.

3.16 Users of a SP-service should mainly be a SP-manager who then would act as a network-node for the tenants in the SP. Another service which EU could provide for tenants in SP, especially small newly established companies was a number of CD-ROMs. These CD-ROMs should contain information on companies/organisations over the whole of Europe. Company information should not be confined to name, address etc. but should be much more comprehensive, so that it would be possible to use them for market research and direct mail. Using CD-ROM instead of on-line network gives economic advantages as the user is more likely to spend time searching for information when the costs are significant lower.

3.17 For the Innovationhouse FvH would like to develop a financial network where EU could help by ie including Venture Capitalist, etc on a network or arrange conferences where finance and intellect participate together.

Chapter Four

SYMBION SCIENCE PARK

Introduction

4.1 Symbion is based on a private initiative, and is not seen as an essential part of the regional economic development. This is further underlined by the fact that there is no incubation or entrepreneurship support facilities in the SP, though this is a facility the management hope to develop in the future.

4.2 There are currently 32 organisations in the SP, of which five are public organisations, employing 175, an increase of more 100% compared to the previous year. Half the companies in the SP are working with bio-technology or related services, and an other quarter with contract research. The SP moved to new premises in the summer of 1992 from 3,000 to 15,000 sqm and currently have 50-60% occupancy. Because of this, the SP was in some economic difficulties, but they are now doing better. The SP has links with 5 HEIs in the Copenhagen area, but the SP does not seem to have the same visibility amongst academia as the SP in Jytland.

4.3 The strategic objectives of the SP are to establish and develop new knowledge based companies, which can be difficult as the SP-management is not offering much assistance to the new companies apart from office facilities (fax, telephone etc). On the other hand Symbion has been successful in attracting part of the Chemical Lab. from the University and are thereby enhancing their position in Bio-technology.

4.4 The Science Park has a very prestigious building, with flexible rooms. It has the facilities a new start-up company would need, except that it has high rents (3 times those of other property in Copenhagen). Everything from telephony to fax and database searches, cafeteria, meeting rooms is offered. The SP-administration also offers conference facilities, arrangement etc. both for tenants and outsiders. The SP has a meeting room equipped with PC's with modems and CD-drive, which is used by the tenants and off-site firms for training/demonstrations.

4.5 The manager of the SP is acting as the network creating person for some of the companies, though mainly for technology transfer and foreign partners.

Telematic

4.6 Two years ago IBM Denmark gave the three SPs in Denmark (at the time) a computer each and a network which they could use to communicate with each other and the rest of the world through IBM's net. This was never a success. The user interface was difficult to use, and making the network function was a big problem. In addition, the managers of the parks found little need for it, consequently the network never took off and was soon forgotten.

4.7 Symbion has installed a local area network in its building, but this is not operational. A few of the tenants have used the facility to install a local area network within their own office. DK-Net the Danish representative of InterNet is talking about creating a service for all the tenants in the SP. As a part of the Copenhagen University's Chemical Lab is moving into the Symbion, it brings with it access to UNI*C which is an organisation (computer centre) servicing all HEIs in Denmark with IT-services including e.mail etc. Through this network the SP and its tenants get access to InterNet for a reasonable price. The manager hopes to able to provide this service to all its tenants, and will make en effort to promote this possibility.

4.8 Besides normal business communication facilities (telephone, fax, etc) Symbion offers the PC described above and one of their tenants is a Dialog representative (database host). The manager is promoting this service amongst his tenants and one tenant is using Dialog on a daily basis. The administrative staff includes a person who is more or less dedicated to offering IT and network services to the tenants.

4.9 The level of telematic use amongst the tenants varies from one company who would like to see a high-speed datatransmission (>32mb) line installed in the SP, to another company working with software, but not using any advanced telecommunication tools and with no interest in it. All the companies visited were using normal business communication facilities, either their own or those in the SP.

Linkages/Networking activities

4.10 The manager of Symbion is a consultant in the SPRINT SP consultancy scheme and this has given him and the SP a wide network for contacts, with access to potential partners and technology transfer. Symbion is also a member of the TII/TRN network, which the manager did not use very much.

4.11 Symbion's administration provides membership and administrative services for special interest associations including the Danish Automation Association. Providing the administration and meeting place for these associations gives Symbion direct access to experts within the fields of the associations. At the moment an association (engineering) from the USA is considering whether to locate its European branch in Symbion. This service also give a better usage of its premises, with very little sales effort.

4.12 Networking and linkages for Symbion are at the moment very informal, and dependent on the manager. However, the manager is trying to build a close network of between industrial development officers and financial partners and business development counsellors (BDC). The BDC is a new framework of 120 people nationwide who will provide assistance to entrepreneurs and help them evaluate business ideas, and business plans. Symbion has managed to get one of the BDCs to locate and work from within Symbion.

4.13 Organisations and companies in Symbion had varying degrees of linkages/networking ranging from contact with only a few customers/organisations, to worldwide contacts with customers and academics. All the companies interviewed stated that their linkages/networking both with customers and academic/organisations were very important for their operations. When talking about potential linkages/networking with the companies, they all stated that of course they would like to find more customers, except one who was already extremely busy and could not cope with more businesses.

4.14 On the other hand few of the interviewed companies knew about potential sources of information on the technical/theoretical side of the their business. There was a varying degree of perceived need for more linkages/networking, but further discussion disclosed a potential need in most of the companies. They could all see telematics a medium for this, though there were different opinions about the practical organisation of the such of network.

4.15 In developing a telematic network, all respondents argued that face-to-face (ftf) contact is almost impossible to leave out. If the physical contact is missing it is much more difficult to build up the trust which is necessary to exchange ideas and work together.

4.16 Video conferencing received mixed responses, but few thought it could be used for building trust in a business partnership. Some thought it could be used as a 'daily' method of contact after meeting ftf. Similarly two companies thought that you would lose too much 'communication' in videoconference and that textual (ex. e.mail) communication would be enough.

4.17 One of the organisations (an institute of Copenhagen Business School) interviewed was involved with a project to teach entrepreneurs and students how to start a business in Denmark, North of Norway and Ireland. This is achieved within a concept where a team is created and trained in a meeting decision support tool called CUBE. When the team understand this concept, an idea/project is placed in the team which then transforms the project into an operational business. This project has been applied successfully in Ireland and Norway. There is a concept of creating 'virtual' companies with the participation by scientists/manager from different SP in videoconference where they form a business and run through this system. This requires the participants to understand CUBE, EU's role in this could be the infrastructure (videoconnection) and support to training.

4.18 A concrete suggestion for action by the EU would be to create a ISDN based network. On this network it should be possible to communicate in several ways with e.mail as the underlying feature. On top of this the EU should create a service function were companies can store a videoclip presenting their company, product, or technological equipment offered/required. If the network is based on ISDN this would give Science Parks and their tenants a possibility to 'invite' outsiders to on-line live presentation where the opposite side can ask questions etc. If the customer/tenant finds a company or product interesting he/she then orders a videoconference with the particular company for further discussions.

4.19 A less advanced version of this suggestion is to create a project exchange, where all tenants in Science Parks in Europe can input requests or offers regarding technology or money. This service should be textual and could be placed as a forum on InterNet or similar telematic network. It would also be desirable to invite venture capitalists etc to the network as finance often is a problem in realising a technological project. The project exchange should be arranged with a short description of the project offered/technology required plus a number of keywords to make it easy to search for relevant projects/technologies.

4.20 The user interface was mentioned as being a very important part of any potential system. It should be very easy to use (Apple Computer concept), as many of the tenants only might use the system once or twice a year. Part of the network should, for the same reason, be limited to the SP management.

4.21 Providing a service with descriptions of all the companies in Science Parks around Europe raises the question of who should be responsible for updating the information. It would require a central service function (host organisation) to maintain and develop the system, but responsibility for updating of company information should probably lie with the SP manager.

Summary and conclusion

4.22 The two science parks in this region play little role in regional economic development and have a small impact on the technological base in the region.

4.23 Networking/linkages with existing and potential partners and customers were in most cases perceived as sufficient, but, of course, all wanted to get more customers. All types of telematic tools are used in communicating with their network, and all organisations interviewed could see telematic as media for communication.

4.24 Most of the interviewed organisation/companies were potentially interested in a telematic network among science parks in Europe, but with the reservation that it should not be confined to science parks and its tenants. The request for such a telematic network ranged from a highspeed datatransmission network to a more or less indifference to a telematic network. The biggest barriers to implementation were seen to be the need for people to realise the potential of such a network and the ease of use of the system. Language was not seen to be a potential problem as most communication in telematic is already in English. Respondents could see a potential problem of connecting new users who are not familiar with communication in English to a telematic network

4.25 A line through all discussion was a wish to have a database containing information about other companies' technical capabilities together with a short description of the company and whether they are requesting or offering technologies. Searching in this database should be done with keywords. Users of a telematic network might find it difficult to translate a 'problem' into a keyword to search for, the EU could therefore play a role in educating users in this process, or at least representatives from each SP.

Chapter Five

REGIONAL BACKGROUND, JYTLAND

5.1 I have chosen to unite the two regional descriptions for the Science parks in Aarhus and Aalborg. Although they have differences, the distance between them is only about an hours drive. Jytland is generally seen as the growth area for Danish industry, with more newly established production companies in Jytland than on Zealand (round Copenhagen).

Aarhus

5.2 The area around Aarhus is mainly dominated by trade and service industry. There is also a concentration of agricultural industry as the dairies have their HQ in Aarhus. This has led to a concentration of bio-technologies firm. The second largest hospital is also placed in Aarhus which gives biotech and medical services a unique opportunities to have their product tested. A few years ago TeleDanmark, the holding company for the telecommunication companies located in Aarhus which has created a concentration of telecommunication services which are in particular working with speech recognition

5.3 From the municipality and the university's point of view the Science Park is seen as a neutral meeting point between industry and HEI. Aarhus has the second largest concentration of HEIs in Denmark, with University, Business School, architecture and a technical university.

Aalborg

5.4 North of Jytland is one of two areas in Denmark that is an Objective 2 area, the other area lays in the south of Zealand (Lolland).

5.5 In its industrial development policy, the county is not focused on creating new companies, but rather on enhancing the existing business infrastructure within two key areas (electronics and materials technology). Furthermore the region has a cluster of mobile telecommunication, with the biggest concentration of the public and private R&D. In this environment the county is interested in sustaining the current technology base and developing more knowledge based employment.

5.6 The region has been through a structural adjustment from the primary to secondary industries. This was not totally successful in the 1960's and 70's as women in the region found it difficult to find jobs. Currently there is high unemployment in the region, mainly due to loss of employment in the primary industries, fishing and agriculture. The fishing industry is particularly hard hit, as fish stocks are slowly disappearing and there are restrictions on how much they are able to catch. The otherwise sound secondary industry sector has no capacity to absorb the surplus from the primary sector and consequently there is structural unemployment.

Chapter Six

FORSKERPARKEN I AARHUS

Introduction

6.1 Forskparken i Aarhus is located opposite the university and, temporarily, has several of the university's administrative facilities in its building, including the principal.

6.2 The science park's main focus is bio-technology companies and knowledge-based companies. This focus has been strengthen by the Laboratory for Gene Expression which has been located in the Science Park. This has until now given two spin-offs, with one of them doing well. The Science Park's strategy has changed since it started in 1986, when tenants were mainly existing companies and private sector R&D. The strategy has now changed to encourage more start-ups and small companies.

6.3 The Science park sees its role mainly as being the link between local research and development (both in private companies and HEIs) and commercialisation, and being a place where companies can develop their network and receive help in finding new contacts.

6.4 The science park and its tenants are today very dependent on the manager, who is the only person in the SP who can help new and existing companies with new contacts. It appears that the administration works mainly with providing office facilities, though the manager is trying to reduce dependency on his network and reorganise the administration's services towards a more 'business consultant' oriented approach.

6.5 The science park has a 'star' example of the potential in HEI. This is a professor in theoretical statistics who has used his research in prime numbers to create an encryption code for telecommunications which is now used by the big banks etc world wide. Similarly there is a spin-off from an EU-programme which now is doing quite well, also selling world wide.

Telematic

6.6 The science park administration itself does not offer any sophisticated telematic services, but offers all the normal business communication facilities (telephony, fax etc). There is a plan for installing a local network in the SP, but at the moment is there no money or demand for such service, the same is true for potential investment in ISDN.

6.7 Because of its close relation and proximity to the university, the SP can offer its tenants connection to the university's network (AuCom) which gives the tenants access to InterNet and about one-third of the tenants are connected to AuCom. If the tenants need telematic services apart from these they need to have them installed separately. The SP management can generally not help technically with these things. The SP administration normally buys in the consultancy services they need, as they prefer to keep overhead costs low.

6.8 Two of the tenants are using heavy datatransmission and this is expected to increase in the future. Two companies are also providing remote telematic services, of which one is environmental surveillance gathering and controlling equipment world wide.

6.9 One company is developing an educational system which is going to be part of a world wide information system and plans to use ISDN as the underlying communication platform. The system will be interactive with text, pictures, etc and the possibility of viewing information from around the globe.

6.10 With the location of the telecommunication company in Aarhus the possibility of installing a telecommunication demonstration centre has often been discussed, but up till now this has not gone further than talks.

Linkage/networking activities

6.11 As already mentioned, the manager of the science park is the network contact for tenants. He was previously a consultant for Dansk Teknologisk Institut (Danish Technological Institute) (DTI) which has given wide contacts to Danish industry. He is also working as a consultant for SPRINT's SP scheme which has given him international contacts.

6.12 Tenants in the science park have varying degrees of network and varying use of telematic network. Generally, for all the companies their international contacts were very important to them as the Danish market typically is too small.

6.13 For one company, the presence of the university and the hospital was of vital importance as their equipment (prototypes) are tested in a real environment before they are sent out into the world. Similarly, the company could draw on scientists for presentations of their products as the management did not possess enough theoretical knowledge to explain it to professionals.

6.14 Some of the companies in the SP were generally too small to have time to find out about telematic communication facilities. Companies with former researchers from the university generally used e.mail and Internet as they had got used to this facility at the university. One company's employees spent most of their time in front of a computer and mainly used this for communication with their network. All the employees had a modem at home enabling them to connect to the company on a 24-hours basis.

6.15 Of the companies who currently did not use telematic in their linkages, all could see telematic as media, though they thought that their use would depend on cost/benefit. One of the considerations was the ease of use. Training and demonstration from the EU could certainly be very useful.

6.16 The SP management thought that the current SPRINT SP consultancy scheme is a good medium for linkages/networking, but could see a potential for telematic. At the same time it was argued (generally) that face-to-face contact is essential for many contacts. Even the company which uses InterNet for communication and marketing thought that personal contact was needed.

6.17 A potential telematic network for science parks in Europe should be based on professional contact (technological transfer etc) and not for finding new customers. It should be possible to search for technologies on keywords. A 'central' service to maintain a network was thought to be needed by all respondents, linked with a database of all the companies/technologies on science parks in Europe.

6.18 The user interface needed to be very simple as many users will use such a facility irregularly. The system should be implemented with some promotion and perhaps demonstration days in the SP with subsequent talks/demonstration in the companies interested. As mentioned before, the telematic network should not be confined to science parks.

Chapter Seven

NOVI, SCIENCE PARK AALBORG

Introduction

7.1 NOVI, North Jytland Knowledge Centre was opened in 1989, and has since then changed its role. When it first opened it took on companies without much consideration of how they fitted into the overall objective of the SP. This has now changed and firms which do not fit into the overall concept of knowledge-based companies are rejected.

7.2 NOVI see's itself as the commercial base for Aalborg University Centre (AUC), and as a channel for commercial developments of ideas in the university environment. They focus especially on two areas; telecommunication and acoustics. Areas in which AUC is strong.

7.3 NOVI has 30 companies of which one is foreign. These 30 companies employ 120 persons. Last year the SP had 130 person employed and 25 companies, but a research group finished its work and moved 40 people out of the SP. Since then a number of new, but smaller companies have moved in.

7.4 The main industry sector is IT&T especially telecommunication, due to much research at Aalborg University Centre (AUC) in telecommunication and mobilecommunication. The big research group mentioned above was a joint research project between two major mobiletelephone firm in North Jytland. Because of the strong technical base in mobile telecommunication, a South Korean company has chosen to place its R&D in a new building on the land belonging to NOVI. This will bring 100 new jobs to Aalborg and strengthen their position in mobile telecommunication.

7.5 NOVI is unique in Denmark in so far as they have a venture capital fund, which can provide start-up companies with some money. The SP management try to use the money for concept-maturation in order to bring the project from an idea to a commercialisable project/product. This is based on the concept that it is easier to get finance for a product/project the further it is developed. The SP management have had success with this in the past.

7.6 Through this system of concept-maturation and focus NOVI aim to reinforce industrial development in the North Jytland. An aim which coincides with the county's perception of NOVI's role in the regional economy.

Telematic

7.7 As a result of the focus of NOVI and AUC's specialisation in telecommunications, the level of telematics is generally higher than in the other SPs in Denmark. All the tenants are connected in a local area network, which if needed gives them access to the university's network and further to InterNet. For new companies, NOVI gives access to normal telematic services, telephony and fax. NOVI does not offers its tenants ISDN, and there is no plans to do so in the near future.

7.8 Of the companies visited all were using e.mail and InterNet, combined with normal business communication. The SP is currently considering a restructuring of the internal telematic network in order to include e.mail internally with linkages to InterNet.

7.9 There has for some time been talk about creating a demonstration house of the future. NOVI has worked on including wireless telecommunication in this house, and is trying to have it placed on the land next to NOVI. So far these plans have not progressed beyond talk.

Linkages/networking

7.10 The companies in the science park have a high degree of international connections, as several of them have participated in EU R&D programmes, but the management were criticised for being insufficiently internationally orientated. The management themselves saw little scope in working closely with other SP managers as each science park is unique and therefore has little to give the other.

7.11 There appear to be a well developed informal internal networks between the companies in the science park. Companies interviewed had good knowledge of what everybody else was doing, and were interested in developing links. The management also helped in this process by pointing out other tenants who could help with a problem.

7.12 NOVI is hoping to become a member of IASP through the membership of the Danish Science Park Association, and would like to become a member of the UK SP Association as they believed they have a lot of good ideas and that they represent a homogeneous mass. NOVI by virtue of its venture fund is also member of the European Venture Capital Association.

7.13 Conferences and seminars were generally seen as a good way to create trust between potential partners, but also as a waste of time, since many conferences consist of insignificant programs and too little time for networking. Videoconferencing was seen a medium to reduce travelling, but not for first FtF contact. This might change when new computer accustomed generations starts working.

7.14 There are strong linkages between AUC and NOVI and the management also have very good relations with the county and municipality. NOVI together with Aarhus and Odense science park and CAT (Centre for advanced technologies) are bidding for new venture capital fund concept supported by the government. The idea is to combine capital with competence development in the receiving companies as a requirement for the money. They hope by combining forces that they can create a fund with reasonable investment resources together with a pool of competencies new companies can draw upon.

7.15 A company which had just moved into NOVI found it very difficult to create the right sort of contacts/sources of information about research & development programmes within the EU, and certainly thought this should be part of the information in SP-Net.

7.16 As already mentioned, the management of NOVI is somewhat sceptical of the idea of creating a network between science parks in Europe. They would rather have one contact in each country, who then had contact with other science parks in their own country, who acted as a node for local contact/information. The science parks in the country network should preferably have an area of focus in which they are specialist. A reason for their sceptical attitude is the enormous amount of work related to updating information about companies/technologies. An experience they have on hand with their own companies, who use little time to update information about themselves.

7.17 If a telematic network is going to be developed it was thought it should be very simple, perhaps with the possibility to add on modules later when it has proven its success. To get it running, the use of the network should be free at first, subsequently, traffic dependent costs could be introduced. A mentoring service would also be an useful instrument for implementing a telematic network, with a person who could work with companies directly and tell them specifically where they might gain from the network.

7.18 Commercial traffic, ie finding new customers should be kept out of the network both because it should focus on technologies and because companies on science parks throughout Europe are unlikely to have much in common commercially.

Summary and conclusion

7.19 In Aarhus the Science park is an extension of the University for Technology Transfer. The similar is true for NOVI, but with the further objective of sustaining and developing technological competences in telecommunication and acoustics. The county's objectives for the science park were similar, aiming at creating jobs through retraining people and having a technical base upon which to develop new companies.

7.20 In the two science parks there was generally little interest in a telematic network between science parks in Europe, as most of the respondents felt that their current networking was sufficient. All respondents could see telematics as a more effective medium for networking and also for finding technological information. A potential network has to be very simple, and not confined to science parks.

7.21 The management in one science park did not see any use or need for communicating with other science parks in Europe, and saw little scope for SP management to have international contacts. As science parks are very different in their focus and structure, the potential benefits of talking across borders would be limited.

7.22 If a telematic network were installed, the scope for it being taken up by the science parks and their companies in this area is limited. It would need to be marketed intensely with clear evidence of benefits. This is partly due to an already advanced level of communication via telematics and the perceived potential bureaucracy in such a service.

3.17 The Karlsruhe Chamber of Commerce is also heavily involved in trans-national technology transfer initiatives. Karlsruhe is part of the Pamina region which encompasses the northern part of Elsace, the Karlsruhe sub-region and the southern part of Palatinate. Joint initiatives between these three regions are supported through the European Union's INTERREG Programme. This includes seminars on various topics including biotechnology, micro systems technology or financial support for innovative ventures. Another intra-regional project has been the development of a research 'Who is Who' for the whole of the region covering 618 research institutes and published in German and French.

3.18 The Fabrik has recently invested in new telecommunications equipment and is now offering ISDN to its tenants. There is a telephone answering service, electronic mail and access to on-line databases (through the Chamber of Commerce). However, for some companies with high data transfer needs, ISDN is already insufficient to meet their requirements.

3.19 **Hilan** is developing high speed communication networks in an asynchronous transfer mode (ATM) technology. The company was founded in May 1993 and moved into the Fabrik in July 1993. The company founder's previous professional experience includes a period of academic work at the University of Karlsruhe (faculty of informatics) and work as an employee in a Karlsruhe based company specialising in local area networks. One important advantage of the location in the Fabrik for Hilan is the presence of other companies that perform specialist work, for instance in logic programming.

3.20 For Hilan's sophisticated telecommunications needs, the Fabrik's ISDN system is insufficient. The company would have been very pleased if the broad band pilot project which Telekom is running in Berlin, Hamburg and Köln with branches in Bohn and Stuttgart would have been expanded to Karlsruhe. It is currently applying to participate in bi-national ATM pilot project which would link Paris, Strassburg, Karlsruhe and Stuttgart. In Karlsruhe, the project would integrate the University, the nuclear research establishment and the Technologie Fabrik. The decision on the project is expected towards mid 1994.

3.21 **Ikarus** is specialising on software for computer aided design (CAD) systems and advice on the purchase of CAD equipment. The company has two owner managers, two additional shareholders and three full-time employees. Both founders come from the Forschungszentrum Informatik (FZI), a research institute independent of the University (but with a number of personal links) which specialises in information technologies. Ikarus was keen to move to the Technolgie Fabrik because its activities

FRANCE

EXECUTIVE SUMMARY

FRANCE

Introduction

1 There are, at the moment, about 40 technopoles in France. The technopolitan movement dates back to 1969. Many regions, departments or cities claim to have working technopoles, but these are at different stages of development with different concepts and ideas.

2 First there are those which are sometimes called the ancestors: Sophia-Antipolis, the Meylan Zirst, Nancy Brabois and Rennes Atalante. There is then a need to distinguish between the technopoles and the "technopolitan areas"; Rennes-Atalante, Nantes, Bordeaux, Toulouse, Montpellier, Meylan Zirst, Lyon Technopolys, and Nancy Brabois along in this last category. Finally there are the networks of Technopoles such as the "Routes des Hautes Technologies", the "Technopole des Pays de L'Ardour", the "cite scientifique de l'Ile de France Sud", and the "Technopole de Haute Alsace".

3 Four technopolitan areas were visited for this study: Rennes Atalante, Bordeaux Technopolis, Montpellier Technopole, Nancy Brabois Technopole. The Route de Hautes Technologies has been also studied; Metz 2000 was visited because of its investments in telecommunications. In addition, Centrale Management participated in a seminar organised for the creation of a park named "Parc Agro-industriel du Lauragais" in Carcassone.

4 First, this report describes some of the main characteristics of the technopoles, technopolitan areas and networks identified during the fieldwork. Second, the report focuses on telecommunications needs and in conclusion we propose some recommendations to the Commission.

Main characteristics identified during the fieldwork

Economic contexts

5 There are significant differences between the economic contexts in which technopoles, technopolotan areas and networks of technopoles are created:

- the "Route des Hautes Technologies" was created in the context of traditional mixed manufacturing industries with an important range of SMEs
- Rennes-Atalante, Bordeaux Technopolis, Metz and Nancy-Brabois areas have a high level of knowledge based and service industries,
- Carcassone is in a region with primarily an agricultural tradition,
- Montpellier technopole is in an area of agricultural tradition but the existing facilities of IBM suggests an evolution of this tradition.

Most of the technopole developments are based on high level public research capabilities

Public policies and management of technopoles

6 City governments and districts play a major role in the development of technopole initiatives, but Regional Governments are more and more involved in the development of technopoles. An example is the creation of networks such as "Routes des Hautes Technologies" at a regional level.

7 Most of the technopoles studied are quite full in terms of tenants companies. Generally these tenants are SMEs with a high proportion of High Tech SMEs. Consequently, the job of technopole managers is changing. They were initially in charge of development but are now becoming prime movers especially in the field of technology transfer and innovation.

8 The primary issue is that technopole managers should find their place among the different intermediaries involved in technology transfer and economic development at a local level. Capalpha at Montpelier Technopole and Promotech at Nancy are interesting examples supported by the Commission through the BICs Programme. The creation of the network "Routes des Hautes Technologies" contributes to organise technology transfer activities in the region.

9 In order to encourage technology transfer and innovation, several technopolitan areas have chosen to specialise some sites and to develop poles of innovation. For example:

- Metz 2000 which is dedicated to telecommunication and information technologies
- Rennes Atalante which has four sites with three specialised in information technologies, biotechnology and biomedical, food industry
- Bordeaux Technopolis with three sites: Unitec specialised in materials, Productic and Montesquieu for which development is based on core competencies in the field of life-sciences
- Montpelier Technopole with 4 poles: Euromedicine, Informatique, Agropolis, Antenna (telecommunication area).

10 Technopoles have two main tasks:

- to develop actions in favour of innovation and technology transfer and economic development with local networking as a preliminary action
- to strengthen the visibility of the R&D potential through international collaborations

Telecommunications needs

Managers and promoters of technopoles

11 Most of the managers of technopoles experiment with programs which could offer added value and enhanced level of services to their clients. The general point of view is that human networking is an essential precondition to any use of telematics. Nevertheless,

- databases describing the core competencies of public research institutions and firms located at technopoles appeared several times were suggested as a tool which might be useful to support networking
- videoconferencing was suggested as a useful method to lower the time spent in trains and planes and to enhance meetings.

Tenant companies

12 E.Mail and advanced telematics appeared to be used mainly by large companies or high-tech SMEs. These firms invested in these technologies themselves. With the exception of these, there is no special kind of demand for telematics but this does not mean that there is no need.

Public research centres

13 Public research centres located on technopoles generally have very strong links with similar organisations all over the world. Such networking has always been a strong characteristic of such organisations and sophisticated telematic networks have been established. RENATER is the new version developed in France and connected to INTERNET. Most of the technopoles we have studied are connected to RENATER.

Conclusion

14 The schemes proposed by the DG XIII and the DG XVI (Science Parks Feasibility Studies, Science Parks Evaluation Scheme, RITTS and RTP, BICs) address most of the issues of technopole development. Nevertheless, the Commission should support:

- evaluation of BICs activities especially from the local development point of view
- development of databases on core competencies of technopoles tenants and local experts as a support for networking
- uses of advanced telematics (E.Mail, Videoconference, Modem) in research collaborations already financed by the Commission.

15 Actions in favour of telematic should raise the awareness of advanced telematics and of advanced telematics support providers. The ideas of financing "information flow audits" and "demonstration projects" involving users and suppliers of new telecommunication equipments are also of interest.

GERMANY

Chapter 1

FEDERAL REPUBLIC OF GERMANY

1.1 The Federal Republic of Germany has the largest number of technology parks and innovation centres of any of the European countries. By the end of 1993, according to ADT statistics, there were 162 Centres operational of which 111 were in the old and 51 in the five new Länder.

1.2 As can be seen from the table, the average size of technology centres in Germany is relatively small: 6,000 sq m in the old German Länder, 2,000 sq m in the new Länder and 4,700 sq m on average. On the one hand side, the small average size of centres can be seen as an indicator of an essentially pragmatic approach towards the development of technology parks in Germany which does not get carried away by 'megalomania'. However, it is also considered as a potential problem by the German Association of Technology Centres, who feels that small centres do not encourage commercialisation of research at a scale which is considered necessary for Germany to stay internationally competitive. The example of the French technopoles and the Japanese technopolises is quoted as a step in the right direction although it is not entirely clear whether there is a causal link between size of technology parks and commercialisation activity.

1.3 Moreover, the parks visited during the field work for this study had all managed to signpost companies to alternative sites and premises once they had outgrown centre accommodation. This was done either through developing a bigger technology park adjacent or very near to the existing centre (Dortmund, Berlin (Adlershof and BIG) Heidelberg, Zwickau and Karlsruhe (planned), or through developing a network of satellite initiatives (in addition to a bigger Park) (Aachen).

1.4 All centres studied were initiated by a local authority or Chamber of Commerce. While universities had played some role in the development of the Park, they were not normally involved in the management and did not consider the parks as essential elements of their educational or research strategy. However, there was normally a high level of support on the part of the participating university for the centre and for individual members of the university setting up spin-off companies. The use of laboratory and other facilities tended to be handled very liberally. Normally senior managers from the universities were represented in the board of the technology park.

1.5 In terms of networking by management, all Centres visited were very active locally and regionally. This included frequent contacts with Chambers of Commerce, local authorities, academic institutions, banks, accountants, patent agents etc. In Northrhine Westfalia, both Dortmund and Aachen were in the centre of a network of associate parks and schemes and used frequent referrals to help companies on the Park.

1.6 In addition to the technology park networks, some Länder have organised regional technology transfer mechanisms. The Steinbeis Foundation in Baden Württemberg (now replicated in Saxony and Thuringia) is combining all academic institutions through a network of technology transfer offices working for the particular benefit of small and medium sized companies. In Berlin, the Technologie Vermittlungs Sgentur (TVA) is fulfilling a similar function. Technology parks are loosely integrated into these technology transfer networks although there could be more scope for cross-referrals

1.7 There are also interesting services which are provided by some of the technology transfer organisations which could be of benefit to technology parks. For instance, TVA in Berlin runs an information service for German Chambers of Craft which could be of great interest to science park companies.

1.8 National networking is done by ADT which organises frequent seminars. ADT has also been a major resource for the development of the 50 technology centres which have been developed since 1990 in the former East Germany. ADT had been organising a range of training courses which were helping the new managers quickly to learn from the experience of the schemes in the old German Länder. In addition, various partnerships were established between eastern and western schemes whereby managers from western schemes were seconded to eastern schemes for up to three years to transfer knowledge and experience.

Table 1: German technology park statistics

Land	no	co	jo	co/c	jo/co	jo/c	sqm (000)	sq/p	sq/co	sq/ce (000)
BW	19	252	2474	13	10	130	100	39	385	5,1
Bav	6	94	737	16	8	123	34	46	362	5,7
BerW	3	132	2505	44	19	835	100	39	746	32,9
BerE	4	67	711	17	11	178	21	29	309	5,2
Bra	7	107	626	15	6	89	20	32	189	2,9
Bre	2	58	379	29	7	190	12	31	203	5,9
Ham	2	57	284	29	5	142	13	47	232	6,6
Hes	4	157	1603	39	10	401	30	18	188	7,4
Mec	7	143	695	20	5	99	11	16	75	1,5
Nie	13	168	1214	13	7	93	44	36	263	3,4
NW	49	889	7676	18	9	157	287	37	323	5,8
RP	6	48	430	10	9	86	12	28	248	2,4
Saar	1	32	307	32	10	307	12	39	375	12,0
Sach	15	151	944	10	6	63	25	27	168	1,7
SA	11	131	598	12	5	54	14	23	106	1,3
SH	6	86	556	14	6	93	22	39	255	3,6
Th	7	123	593	18	5	85	18	30	145	2,5
old	111	1973	18165	18	9	165	661	36	335	6,0
new	51	722	4167	14	6	82	109	26	151	2,1
tot	162	2695	22332	17	8	138	770	34	286	4,8

no	number of centres
co	number of companies
jo	number of jobs in centre
co/ce	number of companies/centre
jo/co/	number of jobs/company
jo/ce	number of jobs/centre
sqm	total square metres
sq/p	square metres/person
sq/co	square metre/company
sq/ce	square metre/centre

BW	Baden Wurtemberg
Bav	Bavaria
BerW	West Berlin
BerE	East Berlin
Bra	Brandeburg
Bre	Bremen
Ham	Hamburg
Hes	Hessen
Mec	Mecklenburg
Nie	Niedersachsen
NW	Northrhine Westfalia
RP	Rheinland Pfal
Saar	Saarland
Sach	Sachsen
SA	Sachsen Anhalt
SH	Schelwig Holstein
Th	Thuringia
old	'old' German Lander
new	'new' German LanderADT would be

Source: ADT Focus: Zehn Jahre Innovationszentren in Deutschland, Berlin 1993

1.9 ADT would be interested in more organised forms of networking. For instance an up to date database of national and international centres and schemes would be welcome. To keep it up to date, it should be the responsibility of each individual manager to maintain their entries in the database.

1.10 International networking in Germany is relatively weak. Only a small number of schemes are members of any international association of science parks. The managers interviewed during the course of this study felt that, although it was interesting to visit other European or international schemes, the direct benefit of such international networking was not obvious because the environment in other countries was just too different to be able to draw meaningful conclusions for the German situation.

1.11 There are, however, two important exceptions to this rule. First, in the border regions of Germany (Karlsruhe near the French border and Aachen near the Dutch and Belgium borders) there are an increasing number of cross-country initiatives, in some instances supported by European programmes. these were not restricted to technology parks but involved a range of economic players including local authorities and chambers of commerce.

1.12 Second, there are increasing links between Germany and Easter Europe and Russia, in particular involving the schemes in the former East Germany and Berlin. These links concern various aspects. They include park managers getting involved in partnership links with Easter European schemes (often supported by the Federal Ministry of Research and Technology) and technology transfer agreements with Eastern academic institutions to enable commercialisation of their research in the West. The Berlin Adlershof development has the ambition, once it is established properly, to play a particular role in this field.

1.13 Companies on West German technology parks tend to trade both nationally and internationally. The German market is big enough to provide interesting market opportunities even to specialised high technology companies but inevitably opportunities abroad are important to secure market leadership. Companies on East German schemes tend to see the West German market as a first step towards internationalisation. A number of companies, both in West Germany and East Germany, commented that the potential of technology parks to identify partners for sales and supplies as well as for research collaboration, is not utilised.

1.14 Looking at the telematics infrastructure of German schemes, those in West Germany do not tend to consider themselves as leaders in the field of telematics applications. Their telecommunications infrastructure is of a good but not of a leading standard (with the exception of those schemes that have specifically been developed with a telematics focus). In many cases, managers confessed that they were not experts in this area and would, in cases where new investment decision have to be made, appreciate expert advice. Many technology parks have recently acquired ISDN which is seen by tenant companies as an attractive feature of the location. However, telematics applications such as teleworking or videoconferencing are not yet widespread.

1.15 East German schemes tend to be equipped with state of the art telecommunications infrastructure. For a number of companies on Eastern schemes, this has been one of the important locational advantages of the centres because they could not have accessed ISDN in any other way. Some of the Eastern German schemes see advanced telecommunications as an interesting means of achieving closer communication with Eastern Europe and particularly Russia. Given the time it take to travel to remote areas in Russia (and the inconveniences in everyday life one has to cope with), telecommunications could be a welcome means of facilitating closer links between East and West

Chapter 2

BERLIN AND BRANDENBURG (ADLERSHOF)

2 Regional Background

2.1 The economic situation of Berlin and Brandenburg changed radically after the reunification of Germany. Before 1989, West Berlin (with some 2 million inhabitants) companies had been supported by the Federal government as an industrial location by a high level of subsidies (at a level of some DM 12 billion annually). Partly for that reason, it had been chosen by many German companies as their administrative headquarters location and it had also attracted some production and research activities. East Berlin (with about 1.5 million inhabitants) had been the administrative and cultural centre of the German Democratic Republic but had also had a sizeable industrial sector.

2.2 After the political changes, industrial employment in Berlin plummeted, both in the West and in the East. While in 1991 industrial employment in Berlin was 290,000, this fell to a level of about 180,000 by June 1993. In East Berlin, industrial employment was 180,000 before the changes which fell to a level of 20,000. Unemployment in both West and East Berlin is now higher than the federal average (12.4% in the West, 13.1% in the East).

2.3 At the same time, prices for land and buildings in Berlin were rising steadily because of its new status as capital of the reunified Germany. It was becoming increasingly difficult for industrial and service businesses to pay the high level of rents and many companies are moving out of Berlin, either to the surrounding area of Brandenburg or further away.

2.4 While the Länder governments of Berlin and Brandenburg are working together in many aspects of economic policy, such a joint strategy would have been much easier if Berlin and Brandenburg had become united as one Land rather than two. There are discussion of such a merger but just after reunification would have been the time for the crucial planning and infrastructure investment decisions to be made.

2.5 In their industrial strategy, West Berlin authorities are trying to attract the European headquarters of international companies. They are also targeting technology intensive employment (biotechnology, medical technologies, new materials, communication technologies, environmental technologies, energy). This strategy is supported by the fact that there are some 260 research institutes in Berlin and Brandenburg.

Technology Transfer Mechanisms in Berlin and Brandenburg

2.6 In addition to the individual transfer posts attached to the various academic and research institutions in Berlin and Brandenburg, there is a second network of technology transfer organisations.

2.7 In Berlin, the TVA (Technologie Vermittlungs Agentur Berlin eV) was founded in 1978 to assist small and medium sized companies in Berlin with finding contacts in academic institutions and in providing information on various questions of technology and innovation.

2.8 One of the services provided by TVA is 'Berlin Information Support System' (BISS) which enables small and medium sized enterprises to undertake database researchers with commercial hosts in interaction with a database professional. To access this service, companies have to pay about ECU 500 for the installation of the necessary equipment and between ECU 75 and ECU 150 for their monthly subscription fee (this depends on the type and number of hosts chosen).

2.9 For the individual searchers, companies can benefit from a Federal support programme (MIKUM - Modellversuch zur Unterstützung der Informationsbeschaffung aus Datenbanken für Klein und Mittelbetriebe). The initiative gives support in two areas:

- for database searches, small and medium sized companies can apply for a grant of 75% of the total costs of the search. Maximum support is ECU 5,000

- companies who want to develop their own information search capacity can get support for the necessary technology, training, personnel and search costs.

2.10 TVA's information services are currently marketed through the network of Chambers of Craft. They could be made available to other networks including technology parks. The German Association of Technology Parks has expressed interest in exploring the possibility for cooperation in this field.

2.11 TVA was also responsible for the development of a technology transfer infrastructure across all five new German 'Länder. This work was sponsored by the Bundesministerium für Forschung und Technologie and the five Länder governments. There now exists a network of technology agencies with five main nodes and a number of satellite agencies. In Brandenburg, the Technolgie und Innovationsagentur (TINA) Brandenburg is located in Potsdam with satellites in Cottbus, Eberswalde, Frankfurt/Oder and Wittenberge.

2.12 Another initiative which is encouraged to stimulate technology transfer is the new Federal Programme 'Forschungskooperation' which is being administered by the Association of Industrial Research Institutes (AIF) on behalf of the Federal Ministry for Research and Development. The objective of this initiative is to encourage small and medium sized companies to undertake innovative R&D projects, both within Germany and internationally, either in conjunction with another small or medium sized firm, with an R&D institution or with a large enterprise. The initiative is specifically meant to encourage cooperation between enterprises in Germany and institutes in Eastern Europe.

Technology Centres in Berlin and Brandenburg

2.13 There are a total of 14 technology parks and centres in Berlin and Brandenburg, seven in Berlin and seven in Brandenburg.

Berliner Innovations und Gründerzentrum

2.14 The oldest technology centre in Berlin (and the first centre in Germany) is the 'Berlin Innovations und Gründerzentrum' (BIG), also known by the name of 'Silicon Wedding' (Wedding being the particular part of Berlin where it is located). The BIG was founded in 1983 by the Technical University Berlin, supported financially by the Berlin Senat (Länder government) and the European Regional Fund. It is located in converted premises of AEG (one of the largest electrical engineering and electronics companies in Germany that was undergoing radical change in the late 1970s).

2.15 In 1985, the Centre was expanded with the opening of the adjacent TIB (Technolgie Park Berlin). In total, the Park and the Centre is now encompassing some 96,000 sq m of space and is housing 60 companies employing 1,500 people and 15 research institutes from the Technical University with 500 researchers.

2.16 One third of employment is in production and two thirds in production-related services. Fields of activity include:

- environmental technology
- process engineering in chemistry and medicine
- automation techniques
- measurements, monitoring and controlling
- information and communication
- technological services
- media production and satellite transmission.

2.17 In 1985, the BIG was separated from the University and became part of the Berlin Economic Development company through subsidiary Innovations Zentrum Berlin Management GmbH.

2.18 One of the companies is De-Te-Borkom/Detecon. De-te-Berkom was founded on 1 January 1993 and is a subsidiary of the German federal postal service Telekom which is based in Berlin. Detcon is an associate company of Telekom based in Bonn providing consulting services in the telecommunications and postal sector both in Germany and abroad. The two companies complement each other in terms of their respective functions and cooperate in Berlin under common management.

2.19 De-te-Berkom conducts research and development to advance the applications services and user systems for the German telecommunications network. Its efforts are primarily focused around the ISDN broadband. De-te-Berkom collaborates with users as well as researchers in industry and the universities.

2.20 The BIG has close links with some of the other technology parks and centres in the Berlin and Brandenburg area, in particular with the partner Centres Teltow and Wuhlheide as well as the 'associate' centre Adlershof.

Adlershof Johannisthal

2.21 Adlershof Johannisthal is one of the major development sites of the new Berlin. A total area of 130 hectares will be available for integrated activities involving academic institutions, research and development institutes and industry. Adlershof is located in the south east of the city on a site which used to be occupied by Academy Institutes and also includes the former Johannisthal airfield. The total development (including housing and recreation) will be about 400 hectares.

2.22 The development of the whole site is being managed by the Adlershof Development Corporation (EGA) which was established in 1991. It supervisory board includes the Senate of Berlin (municipal authority), the Berlin Industrial Bank, the Kreditanstalt für Wiederaufbau, the Berlin Chamber of Commerce and the Berlin Chamber of Craft. Shareholders in the Adlershof Development Corporation are the State of Berlin (51%), the Economic Development Corporation of Berlin (24.5%) and the Trade Settlement Corporation (24.5%).

2.23 The development of the site has proceeded more slowly than expected, mainly due to the fact that there is total uncertainty as to the value of the land and the terms and conditions at which it should be made available to private investors but also due to the enormous scale of the development task. To accelerate the process, the supervisory board has recently (end of January 1994) been changed and now includes top level representatives of industry and the public sector including the head of the economics division of the Senate, the head of the German Association of Chambers of Commerce and some high profile executives from leading German companies.

2.24 The 'mission' of the Development Corporation is the promotion and development of the Berlin-Adlershof site as an integrated landscape of industry, science and technology. Its main lines of activity are:

- attracting manufacturing and services companies to Adlershof
- facilitating cooperation in research and development
- creating facilities with multi-disciplinary potential
- setting up technology transfer facilities between east and west
- providing support to all Adlershof tenants.

2.25 The site is exceptionally well endowed with science and research institutions. There are already some 3,500 scientists, technicians and other ancillary staff working at various public and private research institutions and companies. These include a number of Max Planck Institutes (physics), the Hahn Meitner Institutes (physics, photovoltaics), the German Institute for Aeronautical research and the Mathematics and Data Processing Corporation, and a number of Fraunhofer Institutes. Future plans include the relocation of the Humboldt University with its biology, computer sciences, pharmacy, physics and chemistry faculties and the establishment of a state-of-the-art electron synchotron (BESSY II).

2.26 Eventually, Adlershof will provide exceptionally well endowed sites and buildings for its tenant companies. This will include state-of-the-art telecommunications facilities. This will be complemented by companies on site offering communication and technology oriented services.

2.27 Part of the Adlershof development is the Innovations und Gründerzentrum (IGZ) Berlin Adlershof which is being developed on a total area of about three hectares. The first phase of the Centre development (currently occupied) comprises some 1,000 sq m while the second phase (to be occupied in Summer 1994) will make available some 6,500 sq m. In Phase three and four, it is hoped that an additional 20,000 sq m will be made available but not until 1999. It is hoped that the next two phases will be financed with private support (through a financing model which allows private investors to use depreciation allowances to set off personal taxes).

2.28 The idea of the Centre was first discussed in 1989, at the time of the dissolution of the old Academy of Sciences. Since 1991, the development has been supported by the Federal Bundesministerium für Forschung und Technologie. In the beginning, the main objective of the development was to encourage and support scientists from the Academy Institutes to commercialise some of their work. While this has happened to some extent, the present tenants of the Centre also comprise people who previously had no existing links with any Academic institutions. It is too early to evaluate whether the main objective of the Centre development (to commercialise Academy research) will be achieved but in any case there is seen to be no compelling reason to define new objectives.

2.29 There are currently 24 tenants in the Centre of which 22 employ less than 10 people and two employ between ten and 50. Total employment in the Centre is 110 (an increase of 20 when compared with the previous year). Almost three quarters of companies are active in the field of electronics, information and telecommunications technology.

2.30 The Centre is equipped with ISDN, an internal telephone network for tenants and access to academic and commercial databases. There is also a communal telephone answering service and access to electronic mail.

2.31 The Centre is a member of ADT and EBN. It is also an active member in the local association of science and technology parks which combines the Berlin and Brandenburg schemes. In its starting phase, the IGZ benefited from the BMFT initiative to support the development of new Innovation Centres in the East. However, some disappointment was expressed with this initiative because the mentor for the IGZ was not really that interested in providing support. The Centre itself is now involved intensively with providing support for the development of Centres in other Eastern European and Russian locations.

2.32 There is a significant interest in intensifying links with other science and technology parks. The Centre's manager sees his foremost role in facilitating contacts for tenant companies and would welcome a networking mechanism that would enable worldwide partner searches for science park companies. A computerised database could be a practical medium for such networking. However, it would be crucial for the information not to be inputted centrally but by the management of each individual science park. Centrally maintained databases inevitably suffer from out of date and incorrect information.

2.33 There are two specific networking initiatives in which Adlershof is already involved:

- the European Science and Technology Transfer Network (ESATT), part of the Copernicus Programme of the European Union, is helping in the set-up and provision of a network infrastructure and information services between Eastern and Western Europe. The most important user groups of the final network and services will be scientists and researchers from Western and Eastern European countries who would get additional or new possibilities of Pan-European information access and communication. This is seen as the starting point of the establishment of new networks of excellence similar to those already operating in the European Union.

  At its early stages, the project includes a range of surveys. These are a survey of the potential user population, user selection criteria and establishment of national contacts; a survey of the available telecommunications infrastructure; and a survey of available information sources and supply conditions.

  Based on the information supply concept, the needs for additional telecommunications facilities will be identified. This will lead to a concept for the ESATT network facilities and its information relay centres. Implementation of the programme is then planned for a period of about five years.

- the second networking initiative is the German French Office for science, technology and economic transfer. The office was opened in December 1993 to facilitate contacts and direct investment of French companies in Berlin and Berlin companies in France. One of the promoters of the initiative is Pierre Lafitte who had been closely involved in the development of Sophia Antipolis.

2.34 The impact of Adlershof on the economic development of Berlin is difficult to forecast. Due to the size and ambition of the development, there is certainly enormous potential to generate new companies, attract inward investment at a large scale and to act in a technology transfer capacity to existing industry in Berlin. Whether this potential will be realised will depend partly on whether the planning process for Adlershof will gather momentum and partly whether the potential for research commercialisation is as significant as currently expected. This does not only apply to technology from the Berlin research establishments but also for research for other parts of Eastern Germany and other Eastern European countries.

Focus Business Service Centre/Teleport

2.35 The Focus Centre was developed as a completely private venture in 1988 on the basis of a feasibility study commissioned by the Senate of Berlin and undertaken by Arthur D Little on 'Berlin Centres of Excellence'. The Centre was developed for services companies with particular communication needs. It provides 37,000 sq m of space in three buildings near the old Western City Centre. It includes modern telecommunications facilities such as ISDN and videoconferencing. Its first tenants included the Berlin offices of NCR, Sony and Prime Computers.

Technologiezentrum Teltow

2.36 Teltow (Brandenburg) is a small City with 16,000 inhabitants about 20 kms south of Berlin. Before 1991, the main source of employment in the City were three large companies employing between 12,000 and 15,000 people in the field of electrical engineering and electronics. These companies used to be the main source of electrical resistors for the German Democratic Republic and the whole of the Comecon economic bloc. In mid 1990, it was recognised by the management teams of the companies that there was little point in continuing with this production and the big companies were split into smaller enterprises. It is now recognised that this fast decision was very beneficial and gave the companies and the Centre an advantage of about 1.5 years.

2.37 The idea of the Technology Centre Teltow was developed by the management team of the companies supported by various academic institutions in Berlin and Potsdam (Brandenburg). It was seen as an important mechanism of giving hope to the local population and demonstrating that setting up a technology oriented business could be a possible alternative to unemployment.

2.38 The development of the Centre was being supported by the German Federal government through its technology centre assistance programme (from which 15 Eastern German Centres benefited). This included financial support and a partnership arrangement with a West German Centre (in Teltow's case the Technology Centre in Cologne). The initiative was administered by VDI/VDE (Verein Deutscher Ingenieure/Elektroingenieure) which acts as administrator for many projects of the Federal Bundesministerium für Forschung und Technolgie VDI/VDE used to located in the Centre of Berlin but has recently moved out to Teltow and is now adjacent to the Technology Centre.

2.39 The Teltow Centre started with about 1,200 sq m of space which quickly proved to be too small. This was extended to 4,800 sq m. The Centre currently houses 37 companies employing between 150 and 160 people and it is reaching capacity constraints. There are therefore plans to extend the Centre yet again because the Centre management wants to keep companies in Teltow rather than losing them to other parts of Brandenburg or Berlin.

2.30 Of the companies in the Centre, many are dependent on public support which is being distributed through research programmes. Eight companies have benefited from the so-called TOU (Technologieorientierte Unternehmen) Programme which ran in West Germany during the 1980s and was introduced into the East in the early 1990s. This is a very high concentration of TOU companies in one Centre (there are only 17 cases in Brandenburg). In terms of industries and technologies, not surprisingly electronics and information technology is dominating (a total of 80% of companies are active in these two areas).

2.31 The Centre is just being equipped with an advanced telecommunications infrastructure (ISDN). There have been some problems with Telekom. As an electronics company, the building had its own independent cabling but this was not accepted by Telekom and therefore needed to be renewed. This led to a significant delay in making good quality telecommunications services available to the tenants of the Teltow Centre and was still creating havoc during my visit.

2.32 The only association the Centre is a member of is ADT which it considered to be of very high value and which helped enormously in the development of the East German Centres. International networks are seen with some scepticism and compared to networks in the old days of the Comecon when everybody liked to travel to international meetings but the tangible value of attending them was limited. However, there are plans to build intensive working relationships with some Centres in Belorussia and Ukraine. These activities are being supported by the Federal Ministry for Research and Technology through help to set up partnership agreements.

Strausberger Technologie und Innovationszentrum (Brandenburg)

2.33 Strausberg is a City of some 30,000 inhabitants, about 30 kms east of Berlin. It is located in an attractive area which is often called the 'Markische Schweiz' because of its high scenic value. The district (Märkisch Oderland) has a population of about 170,000 people.

2.34 Strausberg used to be dominated by defence-related activities production (electronics) and services (large army headquarters) which were undergoing a radical restructuring process after the political changes. Although the number of defence-related jobs will go down significantly, a core of such activities will remain in Strausberg as part of the Bundeswehr. There are also plans to develop an Academy for Information and Communication and Bundeswehr Institute of Socio-Political studies (currently located in Munich).

2.35 The Technology Centre was founded in 1992 mainly on the initiative of District and City authorities and the Chamber of Commerce (IHK Frankfurt/Oder). The main objectives were to encourage the development of technology oriented companies and to support the process of 'defence conversion'. The development of the Centre was supported financially with funds from the German regional assistance budget (Gemeinschaftsaufgabe) and European money (Periphra).

2.36 So far, the Centre has attracted 20 companies of which seven are new start-ups. The new companies are active in the field of electronics, automation technology, construction and renovation technology (potentially a very large market in the East), communication technology and quality assurance.

2.37 There are no academic or research establishments (apart from the planned Bundeswehr Institutes) in the neighbourhood. The Centre has a collaboration agreement with the Fachhochschule Technik und Wirtschaft in Berlin. It sees its technology sources to be located in Eastern Europe and the CIS countries. There are currently negotiations between the Länder government of Brandenburg and the district government of the Moskau district to establish a variety of collaboration mechanisms including partnership links between technology centres in Eastern Germany and Russia. Strausberg is earmarked to form a special link with the technology centre in Lytkarino south of Moscow.

2.38 The Centre is well equipped with telecommunications infrastructure (ISDN) and sees this as of major importance to make up for its peripheral location. For some companies, the availability of ISDN in the Centre was one of the major reasons for locating there. The ISDN equipment was brought with the help of European funds (Periphra and Vision). By the end of 1994, it is planned to have a satellite link with Moskow. This will be particularly important to support the various collaboration activities which are planned with Moskow and its region. It is hoped that Videoconferencing will be used intensively.

2.39 Networking of the Strausberg Centre is particularly intensive with ADT and other East German schemes. ADT organised a range of seminars and education programmes in 1990 and 1991 without which, it is argued, all Eastern Centres would have faced enormous difficulties to get off the ground. All Brandenburg Centres have formed a working group (Innocollege) which meets in irregular intervals to discuss problems that affect them all. For instance, the last meeting discussed the charging of common services to tenants.

2.40 International networking is currently not considered to be intensive enough. The Strausberg Centre already finds it difficult to contact Centres in West Germany because of the different level of experience but getting in touch with parks and centres abroad is seen to be almost impossible.

Technologie und Gründerzentrum Fläming (Belzig Brandenburg)

2.41 Belzig is a town of some 40,000 inhabitants, about 60 kms south west of Berlin. It is located in a predominantly rural area with some industrial employment. With agricultural and industrial employment falling since 1989, Belzig is now faced by a serious lack of employment opportunities. The technology and incubator centre is one way by which the district council is trying to create alternative employment opportunities. A feasibility study for the Centre has been produced and a Sprint consultancy initiative is currently on-going. A manager has been appointed and is being supported with the help of a support programme of the Economics Ministry of the Land of Brandenburg. The further development of the Centre is currently uncertain because of lack of financial resources for the necessary investment.

2.42 The Centre manager is networked into the group of Brandenburg and Berlin Centres. He received significant support in his work from one of the founders of another Brandenburg scheme (Innovationspark Wuhlheide) who is now also involved in the SPRINT initiative.

2.43 There are two different types of target clients for the Fläming Centre:

- indigenous companies from Belzig and its surrounding area who are looking for a mixture of good quality accommodation and support in how to develop their businesses

- small and medium sized companies currently located in Berlin who are unable to afford the high level of rent for business and residential accommodation and are looking for good quality space (and housing) at cheaper terms but still accessible to Berlin.

2.44 To overcome Belzig's remote location, the Centre manager is keen to build up a variety of regional, national and international networks. There are existing contacts with the group of Berlin and Brandenburg technology centres, the German Association of Technology Parks and, through SPRINT, with other European schemes. The wish to overcome remoteness also impacts on the desired telecommunications infrastructure. The Centre Manager hopes to be able to equip the new Centre with ISDN although the cost implications of such investment had not yet been spelled out.

Conclusions

2.45 Berlin and the surrounding Brandenburg will change radically over the next few years due to Berlin's new status as capital of the united Germany and Brandenburg as its Hinterland. The City will attract a large number of central administrative functions from national and international, public and private bodies. Land and buildings will become very expensive and will make Berlin a location for high value added activities only.

2.46 Berlin has traditionally been a centre for advanced science and research. It was here that in the 1930s original research on nuclear physics was undertaken. Berlin was also one of the first German locations where the commercialisation of science and research was given high priority. In 1983, the first German technology park opened in Berlin. The plans to develop Adlershof as a major landscape for science, industry and technology build on this component of the City's economic strategy. However, it is not clear yet whether the potential of Adlershof will be realised because the planning and development process is taking much longer than first expected.

2.47 There is a wealth of knowledge on how to develop technology parks in Berlin and this is being tapped into through intensive communication between the various science parks in Berlin and Brandenburg and within the Association of German Technology Parks which is based on BIG Berlin. The Berlin and Brandenburg schemes are now beginning to become themselves mentors of similar developments outside Germany, in particular in Eastern Europe.

2.48 There is a strong interest in intensifying communication links between East and West and the Berlin science and technology parks see themselves to be ideally placed to play a bridging function. The first steps in this direction are already being undertaken with a number of partnership links between Berlin and Eastern and European parks. Such links are also supported by the Bundesministerium für Forschung und Technologie which is encouraging VDI/VDE (which administered the Federal support programme for East German science parks) to use its science park know how in Eastern Europe.

2.49 No doubt there would be strong interest to play an East/West bridging function not just for Germany but for Western Europe. First steps in this direction are already being taken with the opening of the French German office on Adlershof. Topics of communication would include research results, patenting and licensing information, market data and contact points. Due to the difficult environment in many parts of the old Soviet bloc (in particular Russia) telematics technologies including videoconferencing could facilitate more intensive links. This includes videoconferencing and ISDN.

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Chapter 3

Baden Württemberg (Karlsruhe and Heidelberg)

3 Regional Background

3.1 Baden Württemberg, in the South West of the Federal Republic, has a population of about 10 million people. It is one of the most prosperous of the German Länder, well known for its large number of small and, in particular, medium sized companies, most notably in the engineering sector. Many of these companies work as subcontractors to larger companies in the automobile or aerospace industry (Daimler Benz, Porsche, Bosch). There are also a large number of textile and clothing companies and one of Germany's biggest chemical manufacturers (BASF).

Science Parks in Baden Württemberg

3.2 There are 17 Technology Parks/Centres in Baden Württemberg.

Table 1: Time profile of technology park/centre developments in Baden Württemberg, 1984 to 1993.

Year	Number of existing Parks/Centres
1984	3
1985	8
1986	10
1987	12
1988	12
1989	13
1990	15
1991	16
1992	17
1993	17

3.3 As in Northrhine Westfalia, there are two types of technology parks in Baden Württemberg. The first type was established in a location with a strong university, for instance in Freiburg (founded 1985), Heidelberg (founded 1985) or Karlsruhe (founded 1984). In the second wave of park establishments, the existence of a university or knowledge base was not considered to be necessary condition and the main purpose of the park development was for economic development reasons.

3.4 In most cases, municipal governments and Chambers of Commerce and Industry have been instrumental in establishing technology parks. These local initiatives have been financially supported by the Länder government of Baden Württemberg. Universities have generally been supportive but have played more of an arms length role and have not become directly involved.

3.5 The development of technology parks is only one aspect of innovation and technology policies in Baden Württemberg. Other initiatives are:

- the work of the technology transfer advisor (Technologie Transfer Beauftragter). This high level post was created in the mid 1980s to advise government in matters of science, technology and innovation policies. The technology transfer advisor is also the head of the Steinbeis Foundation.

- the Steinbeis Foundation, a network of technology transfer centres across the whole of Baden Württemberg. Professors and other academic staff become members of the Steinbeis Foundation and are made available as consultants, predominantly to small and medium sized companies.

Technologie Fabrik (Factory) Karlsruhe

3.6 The Karlsruhe sub-region has a population of just under one million people. It is located in the South West of Baden Württemberg, not far from the French border. Due to its historical status as a border area, Karlsruhe has not had as strong an industrial tradition as many other parts of Baden Württemberg.

3.7 The overall working population is about 400,000 of which 1.2% are in agriculture, 42.1% in production, 44.6% in services and 12% in the public sector. The most important industrial sectors are electrical engineering (31%), mechanical engineering and vehicles (25.2%), timber and paper processing (12.3%). Other important sectors are chemicals, plastics processing, food and drink and textiles.

3.8 Karlsruhe (with a population of about 300,000) is the administrative centre of the region. The city has an above average share of service employment because it is the home of the Federal constitutional court (Bundesverfassungsgericht) and the Federal supreme court (Bundesgerichtshof).

3.9 One of the strengths of the Karlsruhe region is the high concentration of technical knowledge. With 32 scientists per 1,000 employees, the region shows the highest research density of the entire Federal Republic.

Research institutions include:

- Karlsruhe University with particular expertise in information technologies and telecommunications. The University has the largest information technology faculty of the whole of the Federal Republic

- the Information Technology Research Institute which is attached to the University. The Institute specialises in expert systems, telecommunications, image processing and various other disciplines

- the Karlsruhe Nuclear Research Facility. This is a centre of expertise in the field of energy research, materials research and various other areas

- the Fraunhofer Institute for information and dataprocessing with the specialism of optical and acoustic signal processing

- the Fraunhofer Institute for Systems Technology and Innovation Research

- the Karlsruhe Polytechnic

3.10 In 1987, Karlsruhe and its neighbouring municipalities formed the 'Technologie Region Karlsruhe', an alliance of six city and two rural municipalities who collaborate on various issues of regional planning including promotion of the region to the outside. The municipalities have defined a common promotion strategy which is symbolised by a logo. The economic area covered by this region stretches from Bruschal in the north to Bühl in the south with Karlsruhe as it geographical centre. The region is more or less identical with the boundaries of the district of the Chamber of Commerce. Its unique selling proposition is the high concentration of science and technology resources in the locality.

3.11 One important component of the marketing strategy is the Technologie Fabrik. It is hoped that some of the technology spin-outs which are being 'hedged' in the Centre will eventually move out and create employment and income for the whole of the region.

3.12 The Technologie Fabrik was founded in 1984 on the initiative of the Chamber of Trade and Industry and the Chamber is (and has always been) the only body which is involved in the management of the Centre. The Technologie Fabrik sees itself as being close to other organisations (in particular the various academic and research institutions and the municipalities in the sub-region) but these other organisations are not represented in the management company.

3.13 The motivation of the Chamber to develop the Technologie Fabrik was that it was felt that Karlsruhe had the potential to become a German 'silicon valley' due to the high concentration of technology institutions in the area and that this possibility should be supported by active policies.

3.14 The Centre has been developed in one building of 18,000 sqm, a converted sewing machine factory building (hence the name 'Technologie Fabrik'). The 'Fabrik' currently houses about 40 companies many of which are spin-outs from the various academic institutions in the area or originate in other local technology oriented companies. Companies are allowed to stay for up to five years. After that period they are encouraged to move out and find premises on sites in any of the municipalities that belong to the 'Technologie Region'. Some of the companies have become sizeable businesses since moving out, for instance Schneider and Koch which moved to Ettlingen.

3.15 It is estimated that there are currently about 650 employees in the Fabrik and that about the same number of people work for companies who have moved out since the start of the development.

3.16 Management of the Fabrik is well networked within the region, in particular through the Chamber of Commerce and the various municipal authorities which participate in the Technologieregion Karlsruhe initiative. The Chamber of Commerce is involved in a range of activities which are designed to bring together researchers, industry and the financial community. These include a range of seminars on management or technological topics. Many of these seminars are with very high level participation from industry and the research community.

are on the borderline of academic research and commercialisation and it thought that the Technologie Fabrik would be helpful in terms of marketing and working environment. In the event, it is felt that most tenants use the Fabrik predominantly as office space and that contacts between companies are not very intensive. It is felt that there is some unused potential for cooperation between centre companies which could probably be encouraged by the Centre management company.

3.22 While the City of Karlsruhe is a supporter of the concept of the 'Technologie Region', it is also promoting the City of Karlsruhe as a high quality location for technology oriented companies. There now exists well developed plans to establish a technology park in Karlsruhe on a premium site not far from the Technologie Fabrik. The city is adamant that it will take its time to fill the site and will wait for proper technology tenants. This project is being developed within commercial development parameters and will not accommodate start-up companies.

Technologiepark Heidelberg

3.23 Heidelberg is a town of about 140,000 inhabitants. It is part of the so-called Rhein-Neckar Triangle (population: 1.8 million) which is the area at the intersection of the Länder of Hessen, Rheinland Pfalz and Baden Württemberg. Apart from Heidelberg, the biggest towns are Mannheim (population 311,000) and Ludwigshafen (population 160,000).

3.24 The area is highly industrialised with 48.8% of the working population in manufacturing, 13.7% in trade and 37.5% in other services. In manufacturing, chemicals is by far the most important sector (45% of industrial turnover; this is to a large extent due to BASF which is based in Ludwigshafen). Other important sectors are mechanical engineering and vehicles manufacturing (18% of industrial turnover), electrical engineering (9%), and food, drink and tobacco (6%).

3.25 There are two universities (Heidelberg and Mannheim) and a number of public and private research institutes. These include the Max Planck Institute for Nuclear Physics and the Max Planck Institute for Astrophysics.

3.26 Heidelberg is well known internationally for its beauty, traditional architecture and the quality of its university. It is the oldest German University (founded in 1386) and has distinct research strengths, in particular in the fields of medicine, physics and molecular biology. Research institutes of international importance include the Zentrum für Molekulare Biologie Heidelberg, the 'Big' Research Establishment for Cancer Research and IBM's German Science Centre.

3.27 The Technologiepark Heidelberg was founded in 1984 on the initiative of the City of Heidelberg and the Chamber of Commerce. The then Mayor of Heidelberg (Herr Zundel) had close contacts to the then Minister President of Baden Württemberg (Lothar Späth) who was particularly interested in questions of technology transfer and the creation of stronger links between universities and industry.

3.28 The land for the Park was contributed at a notional price by the Land while the bulk of the investment was provided by the City. The main objective was to support the development of spin-out companies from the University and the Research Establishments. While originally the Technology Park was perceived mainly to benefit the development of the City, it is now increasingly seen as integrated into the Rhein Neckar Initiative which combines the various local authorities and Chambers of Commerce to provide a consistent and appealing image for the whole of the region.

3.29 The Park has been set up as a limited company (GmbH). The company had a founding capital of ECU 255,000 of which ECU 250,000 was provided by the City and ECU 5,000 by the Chamber of Commerce. The Park has an advisory council with eleven representatives from the University, the Chamber of Commerce, a number of research institutes and Heidelberger Druckmaschinen, one of the biggest companies in Heidelberg.

3.30 The first executive director of the Park was appointed by the City from within the City administration. He continued to be based in the City Council's offices which reflects the attitude of the City to maintain an arm's length attitude towards the management of the Park. He has just been replaced by another member of the City administration who will also continue to operate from within the City.

3.31 The Park consists of two buildings on two different sites: the first building is on a site of 1.2 hectare adjacent to the University and the major public research institutes providing 6,000 sq m of space. In addition to the University site, expansion space for companies was provided in a disused slaughterhouse near the Central train station.

3.32 Rents for both buildings are at market price. It was felt from the beginning that companies should have to fend for themselves and should not benefit from subsidised provision. There are no common services on site, except that companies are linked with the University's computer network. Companies are looking after their telecommunications needs themselves. There is no central ISDN but access to the University's mainframe computer is possible.

3.33 There are currently 15 tenants on the two sites of the Park the majority of which work in the field of medicine, biology and scientific instruments. Turnover of tenants is very small. Companies who needed more space have kept a presence in the University site and have developed production facilities on the slaughterhouse site. There is no concern with long duration of tenure which reflects the arm's length attitude towards management on part of the City.

3.34 Orpegen was founded in 1982, to some extent as a German reaction to the establishment of Genentech in 1979 in the United States. Orpegan is undertaking contract research, development and production of proteins for therapy and diagnostics with an annual turnover of ECU 4 million. It is employing 160 people on two sites (technology park and production park). The proximity to the University and its laboratories is important for the company. Particularly in its early days, there was intensive cooperation between some of the University institutes and there continues to be intensive links. The rental level on the park is considered to be relatively high but it is felt that the amenities of the space outweigh this disadvantage. However, networking within the Park is seen to be rather weak. This is partly due to the fact that there are no common services or events. Also it is felt that the international networking potential of the Park is not used to its full potential. Such networking could be particularly relevant with respect to research collaboration.

3.35 Despite the arm's length management attitude, it is felt by the City Council that the full potential of the Park for the region as a whole has not been realised. In particular, this concerns the possibilities to use the Park as part of the science and technology communication infrastructure. It is felt that there is a wealth of science and technology research establishments in the Rhein-Neckar triangle but that industry and newcomers to the area cannot easily access it. Moreover, it is argued that the Park could intensify its role of bridging industry and the research base. Thirdly, although the Park is one of the few German Parks that is a member of the International Association of Science Parks, the benefits of this membership could be increased.

3.36 A number of initiatives, involving state of the art telecommunication equipment and databases are currently at the conceptual stage. The City Council sees Heidelberg as particularly well endowed with organisations with particular interest in communications technology. This includes IBM's European Research Centre, the Springer Scientific Publishing House, the University of Heidelberg and Eurescom.

3.37 **Eurescom**, the European Institute for Research and Strategic Studies in Telecommunications was formed by 20 Public Network Operators (PNOs) from 16 European countries on 14 March 1991. The main purpose of Eurescom is to be an instrument for the PNOs to perform collaborative research and development in telecommunications. This kind of cooperation has been considered necessary to establish pan-European telecommunication services in addition to the already existing telephone service. Competition for Eurescom's location was intensive. Heidelberg came top, partly because of its high research density, its central location in Europe, its high quality of life and the availability of a very good building and site.

Euroscom's current work areas are:

- strategic studies (evolution of services, networks, technology and effects of regulation)
- telecommunications services (development of Pan-European services identification of new market opportunities)
- intelligent networks (introduction of pan-European IN services, service modelling and specification of concepts for service creation)
- telecommunications management networks (strategies and policies for its introduction, information models and platforms)
- infrastructures and switched networks (improvement of the performance capabilities of existing networks, preparation for the broadband ISDN)
- software requirements and practices (harmonisation of life-cycle practices and procurement procedures, exploitation of new system development prototypes).

3.38 Although it is not quite clear yet how Eurescom will work with the Technology Park or any other regional initiative, there is great interest on part of the City Council to harness its potential and competence in the telecommunications field for the region.

Conclusions

3.39 Baden Württemberg is one of the most prosperous regions in Europe. Its wealth is based partly on a very healthy mix of large and small companies who have formed symbiotic relationships. It is also endowed with a large number of public and private research establishments.

3.40 The Länder government is very supportive of any initiative to intensify technology transfer between universities and research establishments and industry. The work of the Steinbeis Foundation is highly influential in this direction. Science parks are an important aspect of these policies and apart from Northrhine Westfalia, Baden Württemberg has the highest number of technology parks in any of the German Länder.

3.41 Within Baden Württemberg as a whole, there has been a movement during the recent past to form smaller regional groupings. These do not always correspond with Länder boundaries and indeed can even cut across countries (as in the case of the Pamina Euroregion). These links concern common planning decisions, marketing, and information policies on joint facilities.

3.42 Science parks have a role to play in such regional initiatives because they are at the node of many networks (educational, academic, innovation, technology transfer). However, such networking needs to be managed. In Karlsruhe, the Chamber of Commerce has taken the responsibility to facilitate this process and it is engaged in wide-ranging intra-regional and cross-country networking initiatives. Heidelberg is just beginning to harness the potential of the technology park for wider networking purposes.

Chapter 4

NORTHRHINE WESTFALIA (AACHEN AND DORTMUND

Regional Background

4.1 Northrhine Westfalia is the biggest of the German Länder. The country consists of two parts: Westfalia and Northrhine. The so-called Ruhrgebiet (the area around the river Ruhr) which was the traditional coal and steel area in Germany has an overall population of 3.8 million people.

4.2 Northrhine Westfalia has been undergoing a radical process of restructuring in the 1970s and 1980s. It has been the traditional coal and steel area of Germany but partly due to geological reasons (depletion of coal reserves) and partly due to changed energy prices (two oil crises). Northrhine Westfalia's economy went into crisis in the mid 70s. Overall unemployment rose to about 700,000 in the first half of the 1980s. In the late 1980s, there was a slight recovery and unemployment began to fall, partly a reflection of the increased economic activity due to German reunification. However, in the early 1990s, unemployment was beginning to rise again and by 1993 reached a level of 715,000. About one third of this unemployment (250,000) is in the Ruhr area reflecting the particular problems of this area.

4.3 Northrhine Westfalia continues to be one of the most industrial areas of the Federal Republic of Germany. In total, almost 2 million people were working in mining and industry in 1992 (total for the Federal Republic: 7.3 million). However, the economic structure of Northrhine Westfalia has been undergoing some change with an increasing share of service employment.

Table 1: Employment by sector in Northrhine Westfalia: 1980, 1986 and 1990

Sector	1980	1986	1990
agriculture	0.7	0.8	0.8
energy, mining	4.6	4.5	3.8
industry (without constr)	41.6	39.5	38.5
construction	7.3	6.2	6.0
trade	14.3	13.7	14.1
transport, communication	4.3	4.4	4.6
finance, insurance	3.3	3.7	3.6
other services	16.2	18.6	20.3
charitable organisations	1.9	2.4	2.5
state	5.8	6.1	5.9
Total	100	100	100

4.4 The shift from industrial to service employment has been actively supported by economic policies. Economic policies in Germany are the responsibility of various players:

- at the federal government (Bundesregierung) is responsible for overall macroeconomic and fiscal policies
- the Länder governments are responsible for some aspects of implementation of central policies. In addition, Länder governments have a fair degree of freedom to define and implement industrial, innovation, science and technology policies
- the municipal governments (Städte, Kreise und Gemeinden: cities, districts and smaller towns) have particular responsibility for planning permissions
- the Chambers of Commerce and Industry act as representatives of industry and have responsibility for administering the vocational education system.

4.5 Within this framework, there is a lot of freedom to create bodies in charge of the promotion of a region, a local area, a sector or a technology. The main economic players in Northrhine Westfalia are:

- the Länder-Government (Nordrheinwestfälische Landesregierung) located in Düsseldorf
- 20 city and 36 district authorities
- 16 Chambers of Commerce and Industry

4.6 The needs for structural change in Northrhine Westfalia were recognised early. In the 1960s, the Länder-Government promoted the development of universities and technical colleges in Northrhine Westfalia (of which there are now about 50). In the 1970s, targeted support was given to companies to adjust to the new economic environment.

4.7 One of the main pillars of industrial policies in the 1980s was the development of science and technology parks. These were generally joint initiatives by the Länder-Government, the municipal authorities and the Chambers working in close collaboration with the respective university or scientific establishment. By 1994, there will be 53 such schemes in Northrhine Westfalia (out of a total of 124 in the whole of the Federal Republic).

Table 2: Time profile of Technology Park/Centre developments in Northrhine Westfalia, 1984 to 1994

Year	Number of existing Parks/Centres
1984	3
1985	6
1986	11
1987	13
1988	16
1989	19
1990	23
1991	29
1992	38
1993	43
1994	53

4.8 Two phases of park development can be distinguished in Northrhine Westfalia. In the first phase (starting in the mid 1970s and lasting until roughly 1987), the close collaboration between scientists and technological entrepreneurs was the main focus of development. The most prominent schemes of this period were those in Aachen and Dortmund both of which opened in 1984. Other schemes of this type were Bonn, Siegen, Essen, Hagen, Münster, Köln and Duisburg. All of these nine developments were operational by 1987.

4.9 In the second wave of technology centres, the existence of a university was considered to be not essential and other sources of knowledge and technology were used:

- technical colleges (Fachhochschulen) in Detmold, Iserlohn, Bochum, Dortmund and Gelsenkirchen
- branches of the Paderborn University College in Meschede and Höxter
- branch institutes of the Technical College Iserlohn in Lüdenscheid (light technology, materials technology, plastics processing technology)

- the Emscher Lippe Institute for Automation Technology and Quality Assurance in Herne
- the Institute of Mechatronics in Moers
- an Institute for environmental technology in Oberhausen
- an Institute for Automation Technology in Hückelhausen (linked to the Technical University Aachen)
- the Euregio Institute for research and development in environmental technologies in Gronau.

4.10 The government of Northrhine Westfalia has been supporting the development of these parks and centres financially. Since 1984, about DM 870 million has been invested in land and buildings. DM 50 million in equipping and about DM 70 million in operating these parks. In addition to its own sources, the origin of these funds have been a number of Federal and European structural and regional funds. A study of the impact of Technology Parks on the regional development of Northrhine Westfalia concluded that:

- at the time of the study (1993), there were about 940 companies employing about 7,000 people on the parks in Northrhine Westfalia
- a further 283 companies employing another 7,000 people were directly dependent on the parks.

4.11 Hence the direct employment creation effect of the technology centres is about 14,000 (without displacement effects!). The induced employment effect of technology centres is probably slightly lower than that of other workplaces in Northrhine Westfalia (higher sourcing from outside the region); it has been estimated that the induced employment effect is one additional workplace for every two workplaces in a technology centre. In total, the direct and induced employment from the centres would therefore be estimated at about 20,000.

4.12 However, it is recognised that this does not take into account the qualitative impact of technology parks and centres, in particular their effect on the image of a region or local area. This has been particularly important for some schemes (eg Dortmund). The various qualitative factors include:

- technology centres are important symbols for the productive collaboration between science, innovative companies and those responsible for economic development

- they demonstrate that it is possible for research and industry to work together

- the centres contribute to making traditional industry more competitive

- the companies in the centres help to diversify the industrial structure of the region to make it less sensitive to cyclical and structural change

- centres help to create good conditions for new companies. In all technology centres in Northrhine Westfalia, only nine companies failed during their stay in the centres and 16 after they had moved out. This is a very low rate of failure (2.3% of a total 1,074). The normal rate of failure amongst technology companies has been estimated at between 20 and 50%

- technology centres exert pull effects for other technology oriented companies. For instance, Ericson and Mitsubishi were attracted to Aachen and Elmos to Dortmund

- with the help of technology centres, disused sites and buildings are transformed into attractive locations. Many of the Centres in Northrhine Westfalia have been built in a very innovative style of architecture which uses the area's industrial past and transforms it in a modern direction.

4.13 There exists a newsletter of all technology centres (Technologiereport) published in Essen four times a year.

4.14 The development of technology centres is not the only aspect of innovation and technology policies in Northrhine Westfalia. Other initiatives are:

- Zenit (Zentrum für Innovation und Technologie) in Mühlheim. Zenit is responsible for transferring advanced technologies to local industry through information and targeted support

- a range of technology initiatives. These are initiatives to help develop and promote specific technologies, for instance telematics.

Technologie Zentrum Aachen

4.15 The Aachen sub-region has an overall population of 1.2 million. It is one of the Euregions, located in the West of Northrhine Westfalia, adjacent to the Dutch and Belgium borders.

4.16 There are 11 technology centres in the Aachen region. The two centres which were studied most closely for this study were the Technologiezentrum Aachen and the Technologiezentrum am Europaplatz. These two centres host a total of 76 companies. All 11 Centres are linked very closely, albeit only by personal and not by telematic links.

4.17 The development of all 11 centres is part of a regional initiative which started in the late 1970s. The Aachen region has traditionally been dominated by coal mining and textile industries both of which were facing serious problems in the mid 1970s. The first initiative to provide a stimulus for diversification through the development of a technology centre came from the Aachen Chamber of Commerce. The first Aschen Centre was meant to provide good and flexible conditions for technology oriented new companies. This was embedded in a strategy to enable technology transfer between the Aachen Technical University (Rheinisch Westfälische Technische Hochschule) and industry in the region. The University is one of the leading technical universities in the Federal Republic of Germany and has an international reputation for excellence. Its special areas of expertise are in the field of production, laser and automation technologies.

4.18 In addition to the Chamber of Commerce and Industry, the other founding partners of the Centre were the Aachen City government, the Technical University, the local Aachen savings bank, the Aachen-Münchener Insurance company and the Aachen municipal utilities company.

4.19 In 1993, the management company AGIT (Aachener Gesellschaft für Innovation und Technologietransfer mbH) was founded. The municipal utilities company provided a redundant building which could be transformed at low cost.

4.20 Since its establishment, AGIT has attracted other members (other financial institutions, the Chamber of Craft and the nuclear research establishment Jülich which is located near Aachen).

4.21 The contribution of all partners was absolutely crucial for the success of the scheme:

- the Chamber of Industry and Commerce provided the initial stimulus and continued to promote and develop the concept
- the municipal utilities company provided the building
- the Länder Government provided financial support
- the Central government of the Federal Republic supported the establishment of companies through its initiative to fund innovative ventures (Programm für Technologieorentierte Unternehmen TOU).

4.22 However, it is generally recognised that without the quality and size of the RWTH Achen, the Centre would not have succeeded in meeting its objectives. The 2,000 science and engineering graduates from the University are an enormous potential for innovative companies (both as founders and as employees) and in addition, academic staff of the university also contributes as founders and experts.

4.23 One other important reason for the success of the project was a federal initiative to promote technology oriented company formations (Unterstützung für technologieorientierte Firmengründungen). Under this project, promising companies could get support of up to DM I million for innovative projects. A number of the successful Aachen companies (for instance Parsytec and Head Acoustics) were beneficiaries of this scheme.

4.24 The first two years of the Centre's existence proved that the concept was feasible and worthwhile. At the same time (in the mid 1980s) it became clear that the coal mining in the Aachen region did not have a future. The Chamber was therefore instrumental in widening the remit of AGIT for the whole Aachen region including the Kreise of Düren, Euskirchen and Heinsberg. Moreover, AGIT's objectives were widened to include technology transfer to existing industry and the attraction of new industry in addition to encouraging technology spin-outs. A joint strategy for the attraction of inward investment was felt to be necessary to prevent that potential inward investors were lost for the sub-region as a whole if a suitable site could not be found in the local authority area first contacted.

4.25 Since the mid 1980s, AGIT is responsible for all three functions: development and running of the technology centre; technology transfer to local industry; and promotion of Aachen as an industrial location. The most spectacular successes of the inward investment attraction function were Mitsubishi and Ericson both of which have developed production sites in Aachen.

4.26 To reflect the changed character of the initiative, the board was significantly enlarged in 1986 and now includes about 26 members including representatives of all local authorities (city and all Kreise). By the mid 1980s, the existing technology centre was beginning to be short of space and it was decided to build a new centre in Aachen (Technologiezentrum am Europaplatz). In addition, it was decided to develop a network of regional centres:

- Medizintechnisches Zentrum Aachen. This centre is targeted at company spin-outs and small companies in medicine and related areas. It has strong links with the University Hospital of the Aachen Technical University. This Centre will open early in 1994

- Gewerbehof Alsforf. This Centre which opened in 1990 is a traditional industrial development offering a total of 10,000 sq m of space

- Internationales Transfer-und Service-Centre Baesweiler (its). This Centre targets foreign companies (in particular from outside the European Union) which want to start a small operation in the region which could lead to a larger presence. The Centre opened in 1990 and has an overall area of 4,000 sq m. It currently houses three Korean and eight American companies who get a special range of services that make their start in Germany as easy as possible

- Euro Service Centre Geilenkirchen. This Centre is particularly targeted at new production, services and craft companies. It offers a total of 2,400 sq m of space and companies on the scheme can benefit from specific initiatives to support young companies

- Technologie-Park Herzogenrath. This scheme was opened in 1989 and offers 20,000 sq m of space. The scheme will be expanded in 1994 with another 4,000 sq m. This Centre targets technology-oriented companies in computer software and hardware and benefits from close proximity to Aachen Technical University

- Gründer-und Service Zentrum Hückelhoven. The Centre caters for new companies in services and production but also tries to attract companies moving into the area from abroad. The Centre is particularly attractive for companies who want to form close links with mining related businesses

- Technologiezentrum Jülich. This Centre opened in March 1992 and is directly linked with the Kernforschungszentrum Jülich which is one of the 13 big research establishments in Germany. The Centre is particularly attractive to companies who have close links with the large research establishment

- Handwerker Innovationszentrum Monshau. This Centre is scheduled to open in 1995 and will target craft companies with particular interest in environmental technologies. It is hoped that this Centre will exert an impact on the whole of the Euregio Maas-Rhein. Particular attention is being given to companies in the Belgian neighbourhood

- Carolus Magnus Centrum Ubach-Palenberg. This Centre is also planned to open in 1995. The building is the former administration headquarters of the Carolus Magnus coal mine. 5,000 sq m of space will be available to new and established companies, in particular design and engineering consultancies and environmental companies. In addition to the office building, companies will have expansion space to construct their own buildings on adjacent sites.

4.27 The management of the two centres looked at in detail sees its main role in marketing and networking. Marketing to attract more companies to all 11 Aachen Centres and more investors to the region. Networking to help tenants to form contacts in the regional and sub-regional economy as well as abroad (although to a lesser extent). Contacts between tenant companies and the University are seen as of crucial importance. To enable these contacts, the Centre employs a full-time technology transfer person (who is also responsible for technology transfer to industry outside the Centre). In addition, the University employs a technology transfer specialist. However, due to the large number of university spin-out companies in the two centres, most of them have their own contacts with the University and do not need the help of the Centre management.

4.28 Management communicates most intensively with companies and managers on the 11 schemes of the sub-region. This communication is done through personal visits, telephone calls and letters.

4.29 Communication is also important between the other technology centres and science parks in Northrhine Westfalia. There is an association of science parks in Northrhine Westfalia (based in Dortmund) with informal meetings arranged about once or twice a year. Centre managers also visit each other to find answers to specific management or tenant problems. For instance, the manager of the Aachen scheme visited another scheme in Northrhine Westfalia to find out about the specific terms of a leasing contract with a catering establishment for the park.

4.30 The Aachen Centres are also part of the Association of German Technology Centres (ADT) which organises a yearly conference. These events are seen to be very useful to exchange information on very specific questions.

4.31 An interesting communication aspect of the Aachen scheme relates to the 'Euroregional' character of the area and the scheme. The Euregio Maas-Rhein has a total population of 3.5 million inhabitants (including Limburg in the Netherlands and Lüttich in Belgium) and discussions are taking place on a variety of issues including infrastructure investment and taxation.

4.32 The Aachen Centre has also close links with the Chemnitz Technology Centre in the new German land of Saxony. There had been a close collaboration agreement between Aachen and Chemnitz and the manager of the Aachen scheme spent a significant amount of time in Chemnitz to help the Centre develop.

4.33 Neither of the two Aachen City Centres offers a particularly sophisticated telecommunications infrastructure although the new Technologiezentrum am Europaplatz is clearly more advanced than the old Centre which opened in 1984 in a refurbished building.

4.34 The old Centre started off by offering central telephone answering and fax services and continues to work in this way although by now most companies have their own facilities. The new Centre am Europaplatz has attracted a company which offers office services including telephone answering and fax but again companies tend to have their own facilities. The new Centre has 60 ISDN gates (for which companies have to pay if they want the use). 200 analog and 100 digital telephone lines. Companies in the old Centre have to arrange their won ISDN link from German Telekom. Both Centres have internal telephone links within the Centres but there is no special dedicated line between the two centres or between the 11 sub-regional centres. There is also no dedicated link to the University.

4.35 There are no satellite links or videoconference facilities. Investment in such a facility was considered at some point but it was felt that it would not be used enough to justify the high investment costs. The Centre has access to facilities owned by an Aachen insurance company.

4.36 The Aachen Centre has attracted some very sophisticated tenant companies. One of these is Parsytec which started off in 1985 as a spin-out from a local computer company. The company benefitted from support under the TOU scheme and is now one of the leading producers of transputers (parallel computers) worldwide with a total of about 120 employees. The company has a very international network of customers and suppliers. About half of its 1,000 customers are in the Federal Republic of Germany and the other half are abroad (United States of America, Japan, Hong Kong, Singapore, England, France, CIS countries).

- management is complaining that Euro-ISDN protocol has lower specification than German ISDN. That meant that they could only use a limited number of suppliers for their internal telephone system (for instance Ericson has Euro ISDN but not German ISDN)

- communication of park management is mainly with tenant companies (visits and letters) and other managers in sub-region

- there is some communication with managers of other parks in Northrhine Westfalia

- regular meetings with Association of German Technology Centres (ADT)

- telematics in the sense of videoconferences and satellite links are still considered to be too expensive

- some of the companies are quite sophisticated and need advanced telecoms infrastructure: they get their own ISDN gateways and E.Mail; they are constrained by the lack of ISDN across worldwide; they still have to work with modems/lines which offer insufficient capacity.

Dortmund Technology Centre

4.41 The Dortmund Technology Centre also belongs to the first generation of technology centres in the Federal Republic of Germany. The Centre was developed on the initiative of the municipal authority (Stadt Dortmund and the Dortmund Chamber of Industry and Commerce. It opened in 1985. The board of the management company (Technolgie Zentrum Dortmund GmbH) includes representatives of the City government, the Chamber of Industry and Commerce, seven financial institutions and the Chamber of Craft and one of the first tenant companies of the Centre (Gesellschaft für Prozeßautomation mbH).

4.42 Dortmund, in the heart of the industrial Ruhr area, was undergoing a process of transition in the late 1970s and early 1980s. The City's traditional employers in the field of steel and heavy engineering were facing change and were making large numbers of people unemployed.

4.43 Dortmund, a city of about 220,000 people, was searching for ways to counteract this decline. The University, which had been founded in 1962 at the outskirts of the City, was seen to be one major asset upon which a rejuvenation strategy for the City should build. The University has recognised strength in engineering and science subjects, in particular in the field of information technologies. The University was seen to be an important source of process and product innovation but also an important source of highly qualified manpower. In the 1960s and 1970s, most of Dortmund University's science and engineering graduates had to move to other parts of the Federal Republic of Germany to find employment in their disciplines (in particular Munich and the greater Stuttgart area).

4.44 The Centre started off as a development and prototype Centre providing space and support to spin-out companies from the University as well as some technology oriented large companies. The first phase provided 4,800 sq m. Technology transfer to existing small and medium sized companies, both outside and on the scheme, was always seen as a n important second dimension of the Centre which does not want to be solely considered as a spin-out centre. Since 1985, two additional buildings have been constructed and by 1994, the Centre provides accommodation for 64 companies on 25,000 sq m of space.

4.45 Larger companies can construct their own buildings on a 45 ha site adjacent to the Centre (Technology Park Dortmund). The Park has attracted about 100 companies employing a total of 2,000 people.

4.46 The companies on the Centre and the Park are concentrated in the following sectors:

- materials technology
- automation/robotics
- software/information technology/electronics
- environmental technologies.

4.47 To become a tenant in the Centre, companies have to prove that their development plans fits into the overall concept of the Centre and they will cooperate with the University or other research institutes (for instance Fraunhofer Institutes).

4.48 Companies have to pay rents which are higher than in many other centres to reflect the market orientation of the Centre. The Centre is now self-funding through rental income and service charges. However, significant investment support was given in the development phases.

4.49 Centre Management communicates most intensively with tenant companies on the Centre and Park and managers of other centres and parks in the region and in Northrhine Westfalia. Particularly close communication is within the sub-region Hamm-Dortmund-Unna which houses a number of centres including Hamtec (opened 1989).

4.50 The Dortmund Technologie Zentrum offers a very similar telecommunications infrastructure to the Aachen Centre. There is a central telephone answering service and central fax but most companies have their own facilities. The Centre also has an internal telephone network but this does not extend to companies on the Park or indeed to the University. There are a number of ISDN gates which have been taken up but companies that have recently moved into the Centre will have to wait for some time before they get access to ISDN as additional lines are expensive to install and will have to be shared between a range of interested parties.

4.51 The Centre and the Park houses some companies with very sophisticated telecommunications requirements.

4.52 Nexus which is located on the Park is involved in the development of expert systems. The company is started off as a University spin-out in the first Technology Centre building. The company's network of customers and suppliers is international and for communication it is increasingly relying on E.Mail and ISDN (since early 1993). It took some time (about six months) to get ISDN. The company does not use international databases which it considers to be of little value, particularly considering the high cost of use. Nexus was one of the founders of the so-called 'Software Hanse', a consortium of six Dortmund Software companies which was formed to assure large customers that they would be dealing with a credible supplier and also to facilitate collaboration in international projects, including those from the European Union (in particular ESPRIT). Communication between these companies is intensive and happens through regular face to face visits and some remote working.

4.53 Nexus appreciated the role of the Technology Centre for its development although it did not rate the value of collaboration with the University very highly; most joint projects with the University had little practical value and were solely undertaken for reasons of academic curiosity. However, as a source of well-qualified people, the University was of great importance.

4.54 ITK (Institut für Telekommunikation) is involved in two lines of activity: Production of PC cards for ISDN use and telecommunications consultancy. The company has only been operating for less than three years and has become one of the market leaders in the field of PC ISDN cards employing 40 people in Dortmund. Its telecommunications consultancy is for large clients who are planning to equip new buildings with telecommunications infrastructure that will last for a medium term time horizon.

4.55 The company is using its own telecommunications system but would have found a central telecommunications service and telematic server useful. The main attraction of being in the TechnolgieZentrum was in the early stages of the company's existence when the Centre solved many of the practical problems of setting up in business and provided it with attractive rooms. By now, ITK could exist outside the Centre and was in fact wondering whether being in the Centre would provided it with an image of immaturity. Communication with other companies on the Centre or Park was not very intensive with the exception of the other five software companies which formed the 'Software Hanse'.

4.56 Experteam was the third member of the Dortmund Software Hanse visited in the course of the project. The company was founded in 1985 and was one of the first tenants of the Technology Centre. Its turnover in 1992/93 was DM 31.3 million; employment in June 1993 was 173. The company headquarters has been moved to Cologne and apart from Dortmund the company has other branches in Dresden, Duisburg, Frankfurt, Munich, Oberhausen, Stuttgart and Vienna.

4.57 Advanced telecommunications infrastructure and applications was seen as an interesting aspect of Experteam's activities. It was felt that telematic offered very interesting new ways of working; for instance the interaction between lawyers or consultants and companies was considered to open very interesting aspects in this respect because remote working would save time and money.

Conclusions

4.58 As in the case of Aachen, Dortmund Technologie Zentrum and Park did not offer very sophisticated telecommunications infrastructure as part of the park management function. However, it certainly had companies on site which must be seen as some of the leaders in this field. These companies were making intensive use of ISDN and E.Mail and felt that there was great potential for others to use these services. They did not feel constraint by lack of appropriate telecommunications infrastructure in the Park as ISDN was available although it took some time to be installed (in one case). Telematics applications were seen as the responsibility of individual companies.

List of consultees

Northrhine Westfalia

Aachener Gesellschaft für Innovation und Technolgietransfer mbH
Dr Gisela Kiratli; Geschäfsführer Technologietransfer für die mittelständische Wirtschaft;
Herbert Pagel; Geschäftsführer Technolgiezentrum Aachen
Bernd G Thomas; Vorsitzender der Geschäftsführung; Aachener Gesellschaft für Innovation und Technolgietransfer mbH
Kornelia Wirtz; Sekretärin des Geschäftsführers; Aachener Gesellschaft für Innovation und Technolgietransfer mbH

Experteam GmbH & Co KG; Professor Dr Strunz; Geschäftsführer; Dortmund

Fern Universität Gesamthochschule Hagen; Fachbereich Elektronik; Facjgebiet Kommunikationssysteme; Johannes Wissing; Christine Stefanski

Gensym; Michael Lauer; Area Sales Manager (Dortmund)

Industrie-und Handelskammer Aachen; Dr Lothar Mahnke; Geschäftsführer Technologie-Orientierte Wirtschaftsforderung

Industrie-und Handelskammer zu Dortmund; Herr Brenscheidt

ITK (Institut für Telekommunikation); Dr Wolfgang Schroder; Geschäftsführender Gesellschafter

Nexus GmbH Gesellschaft für wissensverarbeitende Systeme: Herr Bense; Dortmund

Parsytec; Detlef Segschneider; Manager Applications Software; Aachen

Patent-und Innovationsagentur NRW GmbH (Aachen); Dr Waldemar Kütt

RWTH Aachen; Professor Helmut Breuer; Lehrstuhl für angewandte Geographie

Siemens AG; Jürgen Behle; Specher der Zweigniederlassung Aachen

Technologiezentrum Dortmund
Guido Baranowski; Geschäftsführer
Marina Blank; Assistentin des Geschäfsführers
Volker Steinke; Projektleiter

Universitate Dortmund; Transferstelle; Fritz Krieger

Venture Engineering; Peter Dietz; Geschäftsführer; Mühlheim an der Ruhr
Wirtschaftsforderung Dortmund; Wolfgang Homann

Chapter 5

BUSINESS AND INFORMATION CENTRE ZWICKAU

5.1 Zwickau is located in the south of Saxony, not far from the Czech-German border. Saxony is one of the five new German Länder and used to be one of the traditional industrial agglomerations of the old Germany. Zwickau has a population of about 120,000 which has been decreasing for some time, mainly due to the lack of employment opportunities. The district of Zwickau has a population of about 330,000 people and is embedded in the three combined Chamber districts of Chemnitz, Plauen and Zwickau with an overall population of about 1.8 million people.

5.2 The predominant industrial sectors in Zwickau and its surrounding area used to be vehicle manufacturing, electrotechnical industry, textile industry and chemical industry. After the reunification of Germany, all these sectors were undergoing radical changes, finding it very difficult to compete in the new environment. Only vehicle manufacturing could maintain its importance through a major investment undertaken by VW to produce Golfs in a new green field investment project employing some 6,000 people. This is one of the most modern vehicle plants in the world. So far, it has encouraged the establishment of some 75 parts and components supplier.

The BIC Zwickau

5.3 The initiative for the development of the Innovation Centre in Zwickau started in April 1990. One of the causal factors was the fact that the Technical University in Zwickau was to be downgraded as a university to become a technical college. In the GDR, 60% of the university capacity had been concentrated in Saxony and this was to be changed in favour of a better coverage across the whole of the five new Länder. After the reform, four new universities were created (Dresden, Leipzig, Chemnitz, Freiberg) and five technical colleges including Zwickau.

5.4 There was concern within the university/college about the negative implications of this change. One way to help maintain the know how and expertise of the old technical university was seen to be by developing an Innovation Centre. The rationale for such a centre was strengthened by the fact that since 1983, the University had been heavily involved in constructing technical instruments and equipment. About 55 people had been involved in this application oriented activity.

5.5 By the time Zwickau expressed interest in the development of a technology centre it was, however, difficult to get financial or any other support from the Federal German government. The Federal Bundesministerium für Forschung und Technologie had supported the development of Technology and Innovation Centres in the new German Länder through a special initiative. In total, the development of fifteen Centres was supported through technical assistance (partnership arrangements with West German technology centres) and investment support. All available funds had been committed quickly and Zwickau had to explore alternatives. At this point, the possibility arose to become a European supported Business and Innovation Centre.

5.6 The approach to EBN was facilitated by a West German (Dortmund) consultancy firm (Experconsult) that had played a role in the development of a number of East German technology centres.

5.7 The main objective of the BIC is to support the establishment and growth of new technology oriented companies (30%). However, it also wants to play a role in attracting inward investment projects (also 30%) and other public (10%) and private (10%) research projects. Technology transfer to new and existing local companies is rated with 5% each. It is felt that it is too early to say whether these objectives have been met but that so far results are positive.

5.8 The BIC was formed as a limited company in June 1991 with four shareholders:

- Zwickau City Council (50% of which 10% will be handed over to the District soon)
- local savings bank (25%)
- Chamber of Commerce and Industry (5%)
- Experconsult (25%).

5.9 The Technical College decided after all that it did not want to carry the responsibility of becoming a shareholder. There are, however, links between the college and the BIC. For instance, the former head of the scientific instruments and equipment branch of the University has become first assistant chief executive and now, after the resignation of the Chief Executive a few weeks ago, acting Chief Executive. There will be a formal appointments procedure to refill the vacancy.

5.10 Investment support was provided by the Länder government (Freistaat Sachsen) and the City of Zwickau. Running costs are being supported by the European Commission through EBN which will, however, cease soon.

5.11 There are set 'models' for the development of BICs. The Zwickau BIC was graded as one with five employees (one chief executive, one assistant to the chief executive, one project manager marketing, one project manager technology and one secretary/receptionist.

5.12 The BIC currently occupies a total of 1,000 sq m of space in the former headquarters of the Secret Police (Staatsicherheitsdienst - Stasi) which was renovated to a good standard (although nobody is quite sure whether all secret telephone lines have been removed). Occupied space also includes some surrounding garages that can be used as workshops. It has attracted some 18 companies employing about 50 permanent and some 20 part-time staff (mainly students from the technical college). The Centre is normally about 93% occupied which is considered to be ideal to allow some of flexibility.

5.13 Rents are charged at market level and are similar to high quality office accommodation in Zwickau. The only cost advantage which BIC companies have is that common services are at high level.

5.14 Companies currently occupying the BIC are active in the following sectors:

- mechanical engineering (vehicles, machine tools, motor design)
- electrical engineering/electronics
- automation technology
- software development
- environmental technology
- alternative energies.

5.15 Plans for a technology park (Technolgiepark Zwickau Stenn Schönfels) are well advanced and it is hoped that the Park will be operational by March 1995. There will be a new building of 6,500 sq m on a 5 ha site. There is extension potential for another 10 ha. The Park will cater for companies that are outgrowing the BIC and for technology oriented companies that are moving into the area. To help define the strategy for the expansion, BIC Zwickau is receiving support from a SPRINT consultancy study for which the final report is about to be produced. This study includes Nancy BIC (Promotech) which has been nominated as Zwickau's partner BIC.

5.16 The BIC is trying to become a major focus for technology oriented companies and technology transfer in the region. One of the networking initiatives is the so-called 'BIC Forum Wirtschaftsförderung' which meets monthly and brings together representatives of larger companies, those responsible for economic development in the municipal governments, the rector of the technical college, the Chamber of Industry and interested participants from small and medium sized enterprises.

5.17 Close links with the technical college are being maintained through the acting Chief Executive who has a teaching appointment at the college (management training courses for spin-out companies). In addition, the Technical College has developed a transfer office which helps to identify relevant contacts and a wider-ranging technology-transfer network is being built up through the Arbeitskreis Technologietransfer (ATT) Chemnitz which links the various science and technology resources in the Chemnitz sub-region through bringing together their various representatives. The ATT has an office in the BIC Zwickau.

5.18 The BIC has also tried to build up a group of experts (for instance lawyers, intellectual property rights specialist, technical experts) who are giving advice to BIC tenants and other technology oriented small and medium sized enterprises.

5.19 Services provided by the BIC to its tenants are wide-ranging and include:

- provision of good quality office space and adjacent workshops
- common services (telephone answering, fax, cleaning, conference facilities, joint organisation of fairs)
- support with business problems (marketing, finance and others)
- networking
- help in applying for Länder, Federal or European funds
- translation services (English and Russian).

5.20 The telecommunications infrastructure in the BIC is of a very high standard including ISDN. It is said that for some tenants, the availability of ISDN has been one of the major reasons for moving into the BIC.

5.21 A number of the companies in the Innovation Centre have former and existing links with the Zwickau Technical College and other research institutions in the area.

5.22 Procim is a computer software house specialising in computer aided design and computer aided manufacturing. The company also supplies computer hardware in any configuration.

5.23 Procim started operating from within the Technical University in 1989. It was founded partly on the initiative of a West German company (itself a spin-out from a university in the Ruhr area) who had been introduced to a group of researchers from Zwickau Technical University in 1988 during a conference organised in Zwickau.

5.24 Procim was one of the first companies that moved into the BIC. It appreciated the high quality accommodation which meant that guests, in particular potential customers, could be received in an appropriate setting. The company currently employs two people and is thinking of expanding with another two posts.

5.25 The company's main customer based is within Saxony with its high concentration of mechanical engineering companies. Communication with customers and suppliers is through visits and through telecommunications. Procim is occasionally using ISDN for data transfer although it is constrained by the fact only few of its partner firms have ISDN themselves. There is some joint work within the BIC. Procim supplies three companies there.

5.26 While Procim hopes to widen its customer base throughout Germany, there are currently no plans to start exporting. Foreign countries are seen to be too difficult to deal with, partly because of the language barriers and partly because of general lack of market knowledge. Although it is appreciated that the BIC is part of the European network of similar organisations and could therefore play a role in creating links with foreign companies, this is not currently seen to be of high priority.

5.27 However, the role of the BIC in creating links with similar companies in Germany is appreciated. This is seen to be particularly relevant for development contracts, in particular for large industrial clients, because linking up with other small suppliers helps to create confidence. Procim has already used the Arbeitskreis Technologietransfer (ATT) which has an office in the BIC to find other small partner companies in the region.

5.28 **Dakoda** is a branch of a West German computer software house specialising in software for production planning and stock control. The Zwickau branch office is undertaking both development work and distribution.

5.29 The director of the Zwickau branch used to be Professor at the Technical University but became unemployed when the University was made a technical college (his position was filled with a Professor from a Western University). He contacted the West German company that was working in his field of specialisation. The idea of developing the Zwickau branch was to use relatively cheap development resources in Zwickau and to build up a firm position in a market that could grow significantly over the next five to ten years. The company sees its main market in Saxony, the southern part of Saxony-Anhalt and the Eastern part of Bavaria (Franken). It also sees Slovakia and the Czech Republic as a potentially interesting area. Currently, the market is very depressed and the level of sales in insignificant.

5.30 The company does not rely on sophisticated telecommunications infrastructure. It was not even aware that there is ISDN in the BIC. Communication is undertaken through telephone and personal visits. He travels regularly to the mother company in west Germany and also visits customers on their own sites.

5.31 The BIC was an attractive location because it offered a wide range of common services which meant that Dakoda could concentrate on what they were good at. The networking opportunities offered by the BIC were also appreciated. This includes other interesting firms in the BIC and, through ATT, a wider group of complementary firms.

5.32 **Produs** specialises on environmental management. The founder's background is in environmental management in a large company. She employs two other people. Her main motivation to set up her own company was to be independent and to be able to reconcile bringing up a son as a single mother with a career. She was interested in the BIC concept from the very beginning and wanted to be part of it. It was also conducive that the BIC was located centrally. Although there was an expectation at the beginning that there would be many synergies between BIC companies, in her field of activity this does not seem to have happened. There is a feeling that maybe a little more could be done on part of the BIC management to bring companies closer together. Also, there is a feeling that the BIC could play a bigger role in marketing the expertise of BIC companies.

5.33 Sophisticated telecommunications infrastructure is not crucial for Produs. Personal visits and meetings are much more important than data exchange. They would have no problems to live without ISDN. Regarding computerised databases, there was no awareness that the Zwickau technical college makes such databases available to companies. Produs was using a supplier in Chemnitz for database researches.

5.34 So far, Produs has only been working nationally. The managing director is generally interested in widening her contact network but is slightly concerned that it will take too much time and will be generally too difficult to build up trust and a smoothly running working relationship with international partners. She does, however, see the role of the BIC in such international networking and feels that not all opportunities have been sufficiently utilised yet.

Conclusions

- local networking does not appear to be a problem. Companies within the BIC work together well and through various groupings (BIC Forum Wirtschaftsförderung and ATT) companies on and off the BIC can find commercial and academic partners

- the telecommunications infrastructure on the BIC appear to be generally more sophisticated than necessary, at least for the time being

- however, for some BIC companies the availability of ISDN has been a major factor influencing their decision to locate on the BIC

- BIC management has clearly appreciated the EBN network including the partnership arrangement with the Nancy BIC

- other than that though, national and international networking is much less intensive than local networking. The membership in the EBN network does not appear to give any special advantage to companies on the BIC.

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SP - NET
Case study: Greece

(Final draft)

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ABBREVIATIONS

Ariadne: The national academic electronic network
ATP: Attica Technology Park
BERD: Business Expenditure on Research and Development
BIC: Business Innovation Centre
CSF: Community Support Framework
EPET: The Greek RTD CSF
EOMMEX: The Greek Organisation for SMEs
ESF: European Social Fund
ETVA: The Hellenic Bank for Industrial Development
EU: European Union
FORTH: Foundation of Research and Technology - Hellas
FORTHnet: The telematic network of FORTH
FP: Framework Programme for R&D of the Commission of the EU
NTBF: New Technology Based Firms
FP: Framework Programme (EU/DG XII)
GERD: Gross Expenditure on Research and Development
GSRT: General Secretariat for Research and Technology
O.P.: Operational Programme
OTE: The Greek PTT
PSP: Patras Science Park
SME: Small and Medium Sized Enterprise
STEP-C: Science and Technology Park - Crete
TPT: Technology Park of Thessaloniki

1. Introduction

The main objectives of the study were, according to its specifications

a) to assess the needs for communication and the actual practice of human networks in science parks at the transnational, national, regional and local levels,

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

c) to assess how science parks equipped with telematics applications can act for disseminating these applications locally.

The methodology used in the report is based on the Inception Report for the "Study on Networks of Science Parks and the diffusion of advanced technologies", prepared by Segal, Quince, Wicksteed, as a document which standardises the issues to be tackled by the national reports and lays the foundations for a European synthesis. Data collection, with the exception of chapter 2, which is based on desk research, was the result of face-to-face interviews with policy makers, park administrators, tenants and the relevant division of OTE (the national PTT). A list of institutions and people interviewed appears on Appendix I.

As science and technology is now recognised to play a key role for economic development, investments in the necessary infrastructure have rapidly increased. Within this context one can also observe parks rapidly proliferating within Europe during the '80s: each member state has made its own plans and arrangements suiting its national R&D and innovation system. In that sense Chapter 2 of the Greek report is dedicated in a brief outline of the national RTD infrastructure which has been the determining factor on when, why and how the existing and planned parks were designed.

Following this outline the third chapter presents the telecommunications infrastructure in the country. The whole territory is characterised by an insufficient telecommunications network, which is being rapidly upgraded through support from the structural funds. The fourth chapter includes the general characteristics and trends of the Greek parks. While each one of the four existing parks is described in an Appendix, there are several tendencies which are common. A brief outline of the existing BICs and their activities is presented on Chapter 5. All desk research and interview results are summarised in terms of key issues (Chapter 6) regarding activities, plans and opportunities for telematic links. A final chapter on conclusions and recommendations is taking up the same key issues following the standardised methodology for hypotheses/conclusions, as suggested in the SQW Inception Report.

2. Strategies and context for the emergence of science parks in Greece

It is common knowledge analysed in several previous reports that the Greek RTD system has been weak in terms of both resources and scientific output. At the same time manufacturing activities have been primarily based on price rather than quality competitiveness and their production was dominated by a low adaptation to technical change and that mainly embodied in production equipment.

The modernisation of the innovation system has only started in the '80s and it has to a large extent been linked to and supported by both the EU competitive R&D programmes and the Greek Community Support Framework. The national administration for RTD design and implementation has adapted rapidly and promoted a new, more competitive and quality oriented environment. Within this context the traditional public research centres have tried to increase their funding through project participation and several new, dynamic and competitive institutions emerged, of which the biggest one at national level was the Foundation for Research and Technology Hellas (FORTH), composed of the three originally independent research institutes of Crete (biotechnology, laser, computational mathematics and information technologies), Patras (high temperature chemistry) and Thessaloniki (chemical process technologies). At the same time industrial firms have started to take RTD and innovation into their management agendas, mainly as a reaction to an institutionalised yearly call for supporting industrial RTD (PAVE) and a very successful bottom-up STRIDE.

The modernisation process, accompanied by (compared to earlier periods) abundant funding opportunities, has i.a. put emphasis to the need of linking academic research with industry, which seemed in many cases to be best served through the creation of a science park by the institution interested to improve its contacts to the productive sector. For this reason all three parts of FORTH have started the effort to build a science park, followed closely by the biggest and oldest multidisciplinary public research centre of the country (Demokritos) in Attica. These are the four parks discussed in this report.

As the term science park is very fashionable in S&T literature several other attempts have been made to launch science parks: one by the university of Thessalia and one by the technical university of Chania, which are both only at conception stage. The Hellenic Bank for Industrial Development (ETVA), originally responsible i.a. for building and managing the industrial zones in the country, has promoted an ambitious plan for the creation of several technopoles in the country (a mega-model initially hoping to earmark 3 billion drachmas, i.e. 10 MECU under the second Greek CSF), which had to be cut down at a later stage, into the idea of creating two technopoles, one in Thessaloniki and one in Athens, due to the realisation that neither the bank nor the conditions were mature for the original undertaking. ETVA plans are still under consideration and expected to crystalise into concrete proposals. At the same time a lot of discussions took place under the lead of the Technical Chamber of Greece, for the creation of

a technology park in the socially deprived area of Lavrio, a traditionally industrial area in 60 km distance from the centre of Athens, which has been very severely hit by the industrial restructuring process and the recession. This is again only a plan with no precise shape, budget or time schedule. The above mentioned ideas are not further discussed within this report, since they only constitute preliminary ideas and no quantitative data is available.

National policy for science and technology parks has followed the initiatives undertaken by the emerging R&D poles in a bottom-up rather than top-down approach. The three emerging poles, Patras, Thessaloniki and Crete, have almost simultaneously decided to proceed to the creation of autonomous institutes, outside the academic hierarchy and rules. In order to facilitate the accommodation of the new institutes and assure their financial support the GSRT has adopted the following strategy:

a) The institutes should be financed on a project basis more than with permanent institutional funding, as part of the competitive calls for proposal under EPET I (the R&D O.P. of the first CSF), STRIDE and in the future EPET II (the R&D Operational Programme of the second Greek CSF was launched last year but project selection is not yet completed).

b) In order to make sure that the newly founded institutes would not replicate pure academic work in an autonomous environment, the criteria for funding were set in a way to facilitate the infrastructure and at the same time create incubating activities, both for spin off companies and for new technology based firms or relocation of existing companies. This concurrent development of technologically competent institutes with incubating activities has been "baptised" science and technology parks in the country. As the emergence of the three parks took shape, Demokritos was encouraged to proceed with a science park (in the extended incubator sense) in the Athens area, since most of the industrial activities are concentrated around the capital.

This policy has been more or less followed during the five changes of government and even more changes of heads of GSRT in the last five years, though with several amendments in the level of political support and conviction of the hierarchy to the science park experiments. Thus, at that stage the situation of the parks is that they are strongly related to the associated institutes, they all constitute incubating activities dependent on project funding with no real estate development associated with them and (to the extent they achieve it) are additionally supported by EPET, STRIDE and the regional part of the CSF, plus external funding from the FP or other competitive national or international sources. The close interaction between parks and institutes makes it difficult in some cases to understand who are the immediate and long term beneficiaries, what are the targets and the sources of some projects.

At that stage, an international comparison of the Greek case, shows that in its efforts to create science parks the country is ahead of the other less favoured countries of the EU, and with some indicators ahead of more advanced countries as well. In all less favoured regions the number of science parks compared to GERD or BERD is extremely high, while their numbers come close to those of the developed small countries in Europe like Austria, Denmark or Finland. In that sense an artificial element of supply-led initiatives is very clear.

Table 2.1: Comparative data with other countries

	Nr. of parks	Parks/1000 ECU GERD
Greece	4	17.30
Ireland	1	n.a
Portugal	3	n.a
Austria	7	3.59
France	45	2.20
USA	160	1.23

* Source: Technology Parks in Greece, K. Papadimitriou, To Vima 13.3.94

3. The telecommunications infrastructure and the national electronic networks

Telecommunications infrastructure is notoriously lagging behind in Greece, even if compared with only the other LFRs of the EU. Waiting time for simple telephone lines is tremendous, reaching several years in some cases, and the quality and compatibility of the switches is very bad. Digitalisation of the telephone network has started only recently, but it proceeds fairly quickly.

Telecommunications infrastructure and services are still a state monopoly. OTE goes through a difficult period of persistent insecurity about its future, which has paralysed decision making in several areas. The previous government had legally prepared the ground for privatisation (Law 2167/93) and proceeded to the announcement of an international call for tenders, in order to identify a (foreign) investor with strategic interests to take over 35% of OTE's stock as well as its administration. The new government, formed after the election of October 1993, has stopped the procedure and taken the political decision not to massively privatise

telecommunications. Alternative scenaria discussed now are to trade part of its actions, 14% initially in the stock exchange, or to try to assure that OTE will remain a 100% public property.

The absence of a clearly defined policy is also reflected in the fact that a "Special Telecommunications Committee" has been created in the Ministry for Transport and Communications, the supervising authority for OTE, which can on a case-by-case basis permit the offer of telecommunications services by interested actors, in which case OTE is obliged to support them with the necessary infrastructure. The only case where the Committee already issued such a permission was for the cellular telephone service, which was given to two private, independent consortia. This situation hampers all decision making in terms of major supplies and is in the origin of substantial delays in the implementation of the telecommunications investment programme.

The availability of modern telecommunications services offered by OTE and networks providers are described in more detail hereafter.

3.1 Availability of modern telecommunications services by OTE

In this climate of persistent uncertainty OTE has at least succeeded in launching several new initiatives, under the Directorate for New Services. The directorate itself is also in an unstable situation at the moment, since two alternative scenaria are studied, one suggesting the creation of a big commercial directorate within the organisation and another pleading for a spin off subsidiary, more flexible and autonomous, which will administer the existing new services and launch new ones.

The new services of relevance for the telematic links are:

a) Hellaspac is the national (analog) Public Packet Switching Data Network piloted in 1989 and officially launched in 1990. The Hellaspac network has been expanded and upgraded in 1992. Until 1990 demand for data transmission was covered by the public switched telephone network, leased telephone circuits and partly through the HELPAC concentrator, using asynchronous terminals. The network includes 8 nodes (packet switching exchanges) located and operating in Athens, Pireus, Thessaloniki, Patras, Heraklion, Kavala, Larissa and Tripoli) and aims to expand into 35 nodes. The Management Control Centre in Athens is responsible for usage charges, statistics, quality control etc., while after the expansion four additional control centres are planned. Technically the network adheres to series X (communications protocols) and V (modems) of CCITT recommendations, as well as the IBM standard SDLC. Data terminal equipment connected to Hellaspac can communicate with DTEs connected to the networks of most countries worldwide.

Access to Hellaspac can be direct or via the P.S.T.N. The latter case, whereby subscribers are only able to make but not to receive calls, is used for asynchronous connections only at the moment. Dial up services are foreseen to be made available for synchronous communications and make/receive calls in the near future. Appendix II gives the technical details of the basic services available through Hellaspac and the optional facilities available for inland communication.
The charges for the use of the network are composed of:

* A non-recurring **connection charge** including the cost for connecting the data circuit terminating equipment to the user's premisses

* A **fixed monthly fee** determined by the basic services (speed and access mode) selected by the user

* **Communication charges** for set up, duration (charge per minute) and traffic volume (charge per segment). Traffic volume charges vary depending on the time of the day and special discounts are in effect for high traffic volume users. Inland communication charges are distant independent.

Demand for Hellaspac services has grown substantially from 727 in the end of 1990 (142-X.25 direct connections, 50-X.28 direct connections and 535 X.28 via PSTN) to over 1500 in 1993.

In commercial terms Hellaspac needs 2-3 seconds per page transmitted, i.e. the transmission of a 1000 pages document needs about one hour. Its costs are

Table 3.1: Hellaspac charges

	Connection charge	Fixed monthly fee
X.25	100 ECU	100 ECU
X.28	140 ECU	100 ECU

plus the variable cost per time and segment. In any case a rule of the thumb is that Hellaspac is economically preferable to alternatives (e.g. Ariadne) for more than 1 hour use per day.

b) **Hellascom** is a point-to-point network with digital type circuits. It is at a pilot stage expected to be commercially available within 1994, which aims at the creation of the

necessary digital infrastructure for use in a new totally digital transmission network for data and voice transmission. In its first phase the network only provides for two-way data transmission services and is expected to be an ideal solution for high volume data in high or low speed.

Hellascom is able to support the following services of stable digital switches for transmission up to 2 Mbit/s

* offer of digital switches for low speed (2.4 -19.2 Kbit/s) for data transmission following the X.50 recommendation of CCITT

* offer of digital switches for high speed n x 64 Kbit/s (for n = 1-31), according to G.703/G.704 CCITT recommendations for data and voice transmission

* offer of digital switches for sign transmission at 2048 Kbit/s (=2 Mbit/s) following the CCITT G.703-6 recommendation.

Hellascom will be offered to users for full time use or for the high speed traffic for pre-determined segments (4hours, 8hours). Its first clients are expected to be banks, the merchant marine, telemedicine and to a lesser extent business enterprises. R&D, tourism, the public service and educational needs are envisaged as future clients. Initially it will operate 71 nodes in 15 towns and it is foreseen to extent them to 52 at later stages. The system is based on 8 digital cross-connects interconnected with 2 Mbit/s and using optical fibers for further connections.

Current clients in the R&D system are the National Technical University of Athens has acquired the first switches and FORTHnet uses Hellascom for some of its remote connections.

The invoicing will be based on a connection fee, a basic monthly fee depending on the speed, a monthly fee determined by the distance, speed and duration of use of the circuit and finally specific fees for dedicated services. As the commercial phase is not yet reached the exact cost of invoicing has not been calculated, but it is expected to be "reasonable".

OTE sees as the main problem of Hellascom the fact that it has been designed for commercial use but meanwhile OTE himself has blocked half of its capacity for own use. As a consequence there is no point in marketing the network, before an extension permits to cover the anticipated demand.

c) **Teleconferencing** in two studios available at OTE premisses.

d). **Hellastel** is the national Minitel service, expected to be commercially launched within the next months.

e) **Demonstration centres:** A demonstration centre has been created by OTE in the port of Pireus, which has not been correctly organised and marketed, and as a consequence it remains underutilised.

There is no policy for the promotion of a national ISDN.

The banks have their own networks, while the merchant marine, which was the prime client the centre was aiming at is now trying to create its own infrastructure for high speed transmission. OTE considers this approach as breaking its monopoly and is trying to stop the project.

Within this context of poor OTE support, independent network providers may find an easier market access than in other member states. In that sense science park administrations can see windows of opportunities in this area, since it is most likely that if they get the funds and design tailor made services for their own needs, they will most probably be able to hire part (time sharing) of their infrastructure to interested clients outside the park, in a spirit of covering their running costs more easily than with the initial demand from their own tenants. A key issue which needs to be discussed with all interested parties is the tariff structure of data transmission services. If commercial rates are taken into consideration, data transmission compared to simple telephone charges are extremely more costly than in other European countries. This is one of the reasons Hellaspac has been underutilised by individual users. At the same time, since the academic networks launched are totally subsidised, academic users have almost no charges and OTE protests that companies try to circumvent the public network by using the subsidised academic networks. *It seems extremely important that a serious discussion starts among all interested parties (OTE, GSRT and current plus potential users) on the tariff structure with development considerations but also taking into account the need to stop offering too cheap services.*

3.2 The "Ariadne network"

The General Secretariat for Research and Technology, in its vision to link the Greek academic community among itself but also with the rest of Europe and the US, has foreseen in the late '80s the creation of a national telematic network. This project has then been entrusted to the National Research Centre Demokritos for its installation and operation. Ariadne has thus been created, with project funding under the CSF and STRIDE, belonging to the GSRT and sheltered/ran in Demokritos.

Ariadne has grown rather rapidly, based on CSF and to a lesser extent national funding. The services (originally conceived for X.25 but now working on a TCP/IP protocol) it offers at the moment are:

* E-mail
* Telnet (i.e. physical access to computers, but with no centralised contracts for access to data bases)
* File transfers (FTAM, FTP, Copy)
* Information services to its users (i.e. on-line demonstrations and training, in order to improve the user friendliness of the network)
* Dial-up services.

Ariadne, conceived as the central national network, offers access to international connections, like

* INTERNET
* BITNET
* COSINE IXI (EMPB)
* X.400 MHS
* DECNET
* CLNS - PILOT

The highest use for international access is with INTERNET.

The network allows only for data transmission and its capacity is

* in Greece 9.6 Kbit/sec
* one line abroad at 9.6 Kbit/sec (Telecom cost of 40 KECU per year)
* a second line abroad at 64 Kbit/sec (Telecom cost 60 KECU per year).

All lines are physical, since satellite is considered too expensive. Ariadne uses no satellite lines, although the equipment is available in Demokritos for its connection to CERN.

Under its current position Ariadne has operated on a fully subsidised basis, where even telecommunications costs were covered by the project. Since 1993 users pay

* 1100 ECU per month for leased lines outside Attica
* 100 - 300 ECU per month inside Attica
* 150 ECU per year for dial-up services
* companies have to pay a small fee as well, whereas the research community gets the services free of charge.

The current philosophy is that the marketing period is over, resources from the state budget are diminishing and as a consequence fees will have to be introduced in the form of a yearly flat rate, independent of the density of use. The future plans of the network, if the funding can

be made available, are to offer services in 2 and 140 Mbits/sec, but it is not expected to happen very soon, since there is no pressure from the demand side.

OTE sees a certain competition between Ariadne and Hellaspac. Ariadne makes use of Hellaspac for its connection to COSINE or other services. OTE suggests that for this reason if the network is used longer than a certain time limit, clients should pass directly via Hellaspac. OTE accepts to charge symbolic rates (an adjusted equivalent for 25 ECU per month) if traffic does not abuse the network. If use is higher users are expected to pass directly via Hellaspac.

Two main preoccupations are expressed from Ariadne:

a) Its legal status being on a "project basis", there is no assurance of continuity and this does not allow for a long term plan of upgrading. At the same time this is also demoralising the personnel working for Ariadne.

b) While Ariadne has been originally conceived as the national backbone for telematic services to the academic community, with a main target to offer services to third parties, it has during its life found that it is often entering in competition with FORTHnet, originally created to offer services to the FORTH-Institutes, but going far beyond that.

The uncertainty of the future of the project, in terms of finance and status has created major problems and at the moment there is no marketing of the network, nor training courses offered.

3.3 FORTHnet

FORTHnet, conceived originally to cover the needs of the seven FORTH institutes in four different towns, is the largest and technologically most ambitious network in the country. The network uses mainly digital and some analog leased lines, public switching voice and data networks, as well as privately owned fibre optic cabling. FORTHnet is a multi-protocol wide-area network, interconnecting LANs all over Greece and linking them to Internet, for which it is the top level name server for the GR country level domain. All infrastructure is multivendor technology in both hardware and software, fully interoperational, and provides routing procedures for IP (RIP, IGRP, EGP, BGP) and the full range of internet services from e-mail and file-transfer to sophisticated information services. Other protocols, like DECnet, LAT and AppleTalk are also routed through the network.

Its international link is currently served by a 64Kbps leased line connected to Ebone, Paris. Locally routers are connecting a dozen 10 Mbps IEEE-802.3 LAN segments. Analog and digital leased lines sometimes of quite high speeds (128 Kbps to 2 Mbps) connect other FORTH

offices all over the country and the various parts of the University of Crete. spread around the island. Other Greek institutions use network connections over Hellaspac/Hellascom or dial-up and leased lines in order to establish links with FORTHnet's routers. Currently FORTHnet operated from rented offices in the town of Heraklion. but it is expected to move very soon to the Science and Technology Park Campus.

Network Operational Centres are organised in every FORTHnet point of presence with full time personnel working with the latest network monitoring and management tools.

FORTHnet is connected to EARN, as the central Greek EARN node for serving all other Greek EARN hosts and operates GREARN, the Greek part of EARN, which is currently in a migration stage of its connection to TCP/IP. FORTHnet serves as the backbone of EUnet in Greece, providing UUCP mail and USENET news services. FORTHnet's OSI part is based on the ISO connectionless services and is connected to the European CLNS backbone network. It operates under the umbrella of a European CNLS project, supported by RARE. It is mostly based on Cisco multiprotocol routers and uses the same equipment as the European IP backbone.

FORTHnet is organised in line with the directions of ECFRN on the structuring of European R&D computer networking and falls somewhere between the national and the site level where the FORTH-Institute of Computer Science provides all design , development and management of the network. It handles all operation and services management. does much of the exploitation of the research project results. as well as building pilot projects and designing the expansion of the network by connecting new sites, providing new services. and broadening the links bandwidth.

Several experimental services are offered, like the World Wide Web Server (WWW), which offers music, picture and short movies. access to a Library System and an on-line bookstore.

FORTHnet has been mainly supported by the foundation itself and on a project funding basis it has received funds from various EU supported projects like STAR, RACE (NEMESYS), AIM, ESPRIT etc. and the Greek CSF plus STRIDE. It has built a very competent team for network support formed by researchers of the Institute of Computer Science, system support people from the research centre and the university and graduate students. which is being continuously upgraded by hiring people with background in fiber optic networks and data networks.

Despite the undoubtedly excellent technical work that has been made by FORTH, from a marketing and non-academic users' point of view the same criticism applies for it as for Ariadne (though for other reasons): the use of the network has been up to now mainly academic, serving the needs of researchers or software related companies that are mainly using

the system for research proposals and access to their partners. No marketing plans or promotion was undertaken, because of lack of means to become more commercial, though several applications seem to be of interest to companies in more traditional sectors as well.

3.4 Other telematic services in the country

Beside the two national networks several of the European networks are used by companies, industrial associations and academics in the country. ESPRIT club has launched Y-net, which to a large extent is overlapping in its target groups with Ariadne, while the Regional Chambers of Trade are users of BC-Net and the most important ones among them are Euro-Info-Centres, whereas the BICs are users of both BC-Net and EBN. The National Documentation Centre is a Value Relay Service and in specific cases project participants are connected to specialised networks (e.g. RECITE, ORA etc.). Finally Kapatel is a privately operated "minitel" service, which does not seem to be strongly appreciated by users. PRAXI, a joint venture of the Federation of Greek Industries and FORTH, with the aim to promote information of EU funding opportunities, is served by FORTHnet.

4. The characteristic features of the existing parks

This is a short description with comparative features on the four science parks studied. based on the analytical case studies on Appendices III - VI.

All four parks have been *launched on the initiative of research institutions*. which wanted to promote their industrial linkages via the park. They constitute small incubators built by the institutes rather than big, ambitious property development. The Attica Science Park (associated to Demokritos) aimed at the establishment of new high tech companies and of firms interested to use Demokritos services. Its first incubation unit is operational and land is available for expansion if needed. It is the most pure case of Strategy 1, in terms of the Inception Report. The Thessaloniki and Crete Parks (associated to the local FORTH institutes) have built their incubation units in a broader campus including the buildings of the institutes, congress facilities etc. The buildings are almost ready, and both the institutes and incubation activities are expected to move into them (from provisional rented space) around next summer. In administrative terms the Crete Park is slightly more advanced than the one of Thessaloniki. In terms of the standardised methodology the two parks adopt also Strategy 1, with a strong element of trying to shelter their own spin off activities. Besides. both want to play a role for technology transfer and local industry energising. thus elements of Strategy 5 are within the targets of the park. though at that stage less developed than the Strategy 1 elements. The FORTH Park in Patras, though 100% owned by FORTH, has an autonomous status vis-a-vis its parent institution. It has from the beginning put emphasis into the soft element of park services and has a number of associated companies, which are supported by it. The problem with Patras is that due to several mistakes and misfortune the park could not build its own premisses. despite an agreed grant. For this reason it will rent space in the new building of the local FORTH institute, which will move into new premises in the summer. The Patras Park, also of Strategy 1, has in its record the strongest element of Strategy 5.

The financial means of the parks have been sufficient in terms of capital cost because of the first CSF. In aggregate terms the major financial support was initiated by the EPET I (the RTD O.P. of the first CSF), further supported in many cases from additional sources, like STRIDE or the regional authorities, but this more on a project basis. Because of the very close linkages of the parks and the institutes, it was in some cases very difficult to identify whether funds and projects were undertaken on behalf of the one or the other. The parks did not until very recently (the Thessaloniki Park still does not) have an administration of their own. Management has been organised on an ad hoc bases, strongly seconded by the human resources of the associated research institutes. Expecting and planning their autonomy. in particular projects, the funds have been received by the institutes, which also assured the national contribution, with the target to pass the results over to the park administration, when operational. The financial structure is indicated on Table 4.1.

The problem that all parks claim to face, as inhibiting their rapid progress. is the fact that they have no permanent financial support. Depending on project selection for funding, which at present is expected to come from EPET II, notably the RTD O.P. of the new Greek CSF, has for them the disadvantage that they cannot undertake early commitments and in a sense continuity is endangered. On the other hand, the funding on a project basis seems to guarantee quality and bottom up approaches much more than any clear strategy with permanent funding. The clear solution to that problem would be to turn to investors outside the public sector, which in cases proved impossible, despite sincere and persistent efforts.

The financial support is strongly linked to the *relation of the park with the regional administration.* In this case Crete proceeds in the most constructive climate, since the Peripheria (NUTS II), is strongly supportive both strategically and financially. Patras lies in the other extreme, where a confrontation with farmers close to the land bought for the park, has created an unfavourable climate with the local authorities, which not only did not support it but succeeded in postponing it for a very long time. Thessaloniki and Athens have regional support, but being both located in bigger areas, the commitment is less clear than in the case of Crete.

Table 4.1: Structure of financial support of the existing parks

	EPET I	STRIDE	Regional funds
Attica Science Park	1.1 MECU		1.2 MECU (originally approved 1.8)
Patras Science Park	4 MECU (originally approved slightly less)	On a project basis for the institute	-- (bad relationship to the local authorities)
Scierlce & Technology Park - Crete	2.5 MECU	On a project basis for the institute	2.5 MECU
Thessaloniki Technology Park	8 MECU (originally approved 4 MECU)	On a project basis for the institute	unknown

* Current rate 1 ECU = 275 Drachmas

Tenants in the strict sense of the word exist at the moment only in the Attica Science Park. They are very few and very small, predominantly service oriented R&D companies, with clients in the wider public sector. Patras also has associated members, which are not physically located in the park, since the incubator has not been built yet. The Patras Park companies, some of which are in Athens or elsewhere in the country, are mainly manufacturing companies. In Crete a first list of future tenant companies, who will also be members of the Board of Administration of the park, was set up. Firms have signed the necessary documents and the first Board was appointed in December 1993. They constitute a mix of local FORTH spin offs, some of the best local manufacturers and companies from the tertiary originating in Athens. Thessaloniki is following the same pattern as Crete, but the future tenants have not signed any commitments as yet. Some of the best known NTBFs, RTD sensitive companies and service providers appear associated with more than one park. Overall tenants seem to see the park as an opportunity for RTD collaborations with or through the institutes, not as a shelter of their overall activities.

Because of this approach of tenants *the networking expectations within the parks*, both existing and planned, are associated to research consortia. The Patras Park is the only one which offers commercial advice to their members. Though it is too early to judge for parks hardly operating, it seems that most emphasis is put from their conception to links with sources of complementary technologies, and much less (if any) to market opportunities or distribution possibilities and potential investors.

Since networking expectations are related to RTD, *the only telematic services promoted until now are of academic nature*. In line with the general rule of project funding telematic services are partly funded from the general budget of the incubation activities, partly through dedicated projects. There has been no national policy on how to best serve the networking needs of the parks. This explains why, as it will be analysed in the description of each park, several initiatives are emerging, which seem totally uncoordinated among themselves. The two telematic networks described above, Ariadne and FORTHnet, are initiatives of the institutes which have created the parks. They are used more widely than within the parks, with a very strong element of international linkages and a very weak of regional ones. Their problem is that they are too academic, they have not as yet been based on a business or promotion plan, and could not support the needs of commercial companies, except for R&D collaborations. The parks of Crete and Thessaloniki are best served by FORTHnet, the Park of Demokritos has no telematic service itself, but when needed park tenants only need to walk to the Ariadne headquarters, located in less than 100 meters away from the incubator. The Patras park has plans of its own for its telematic linkages. All four parks consider the academic telematic networking as a very important element of their activities, but they don't include commercial use and information within their immediate plans.

Table 4.2 summarises the issues raised for the four parks studied:

Table 4.2 Comparative data of the science parks studied

	Attica	Patras	Crete	Thessaloniki
Status	Incubator functioning in the Demokritos campus	Legal entity, 100% FORTH owned	100 % FORTH owned, new board and shareholding structure from 1994	Same model as Crete, to be implemented in the near future
Number and type of tenants	7 NTBFs	12, not physically located, but associated	19 committed, with contracts signed, not yet physically located	12 under discussion
Fees	a) 80 ECU per month for association b) 80 ECU per month and per 12 m^2 for tenants	400-500 ECU annually	Approximately 8 ECU per month and m^2, the local market rates	Not yet specified
Other services	Special rates for collaboration with Demokritos research institutes	Spin off support RTD services to companies all over Greece	Academic, entrepreneurial, excellent electronic networking	Research facilities, entrepreneurial, electronic networking

Future plans	Extend the incubator, attract more tenants	Own building	Improve coverage of the campus, increase the number of tenants	Implement the model of Crete, increase interest for more tenants
Telematic situation	No LAN, served by Ariadne, located physically very close	No infrastructure	Excellent physical infrastructure, FORTHnet	FORTHnet, good physical infrastructure
Telematic plans	No own plans, ambitious plans for high speed services by Demokritos	Three independent proposals	Become a broadband island	In relation to FORTH
Advanced telematic needs	Not identified by the tenants, Demokritos wish to become a broadband island	Unknown	Multimedia, specified by academic needs, not tenants	Unknown
Specialisation	Advanced materials Information technologies Biotechnology	Chemical processes Computer sciences Medical research and services	Biotechnology Laser applications Software development	Chemical processes Environmental protection Energy
Current type of networking (non telematic)	Research collaboration, public procurement		Academic	Unknown

5. The characteristic features of the BICs

The first conception for the creation of BICs in Greece came from EOMMEX, the organisation for SMEs, in the early '80s. The idea was to start with BICs in the major industrial poles and then extend them to all 16 Greek Peripheries. Under this plan one BIC in each of the major towns, Athens, Patras and Heraklion was created, and people were appointed in the local offices of EOMMEX of Thessaloniki and Volos to start the procedures for local BICs. The Athens BIC has acquired equipment in the mid '80s and in the course of events, through ESF grants it was transformed into a CAD/CAM training centre. The Patras BIC was the most successful one in terms of collaboration with SMEs, while the Heraklion one never really started off the ground. General problems of EOMMEX administration and a very centralised approach, that followed the decentralisation in the early '80s, has led to the decision to close these BICs. Nevertheless this decision has not fully materialised, in the sense that there is still some EOMMEX personnel responsible for the BICs and some people in the administration express the hope that the BIC project will be renewed. But this seems highly unrealistic.

The most active EuroBICs at the moment are those of Patras and Larissa. They both don't dispose of incubating units, and as such they have no tenants, but they have associated members (the latter more than the former) which they support with traditional services, like business planning, commercial and distribution plans etc. They are very closely linked to the local Chambers of Industry and Commerce, which in their turn are linked to the national network providing information on EU opportunities (PRAXI), EBN and BC-Net. Because of this linkage the BICs can offer this information to their members, but as yet their experience is that the use made is negligible, for two reasons:

a) The local SMEs are oriented towards immediate problem solutions only and
b) there is not enough acquaintance of what these services can offer and how.

The Patras BIC works closely together with the Patras Park. Recently a joint proposal they had made for SME support in Western Greece was approved and they expect this to give a new impetus to their activities.

The Larissa BIC has no linkages to any of the existing parks, but studies seriously the possibility of launching a new park in Larissa. If materialised this park will act as a technology transfer initiative for the local industry, and it would be the first park in Greece not to be built upon the initiative of a research institution.

6. The key issues for Greece

a) What are science parks really in Greece? The four attempts studied to create science parks show moderate ambitions limited to building incubators in the same campus with research facilities. There are no elements of the classical real estate approach or plans to attract inward investment. The national administration, and in particular the GSRT, has been supportive to this idea of extended incubation activities though selectively and on a project basis. In that sense the parks feel very insecure to proceed faster or more ambitiously. The role of regional administrations is different ranging from strongly supportive in Crete to hostile in Patras.

As a lot more plans for science parks are announced it is important for both the national government and the Commission to elaborate a medium term strategy on how many parks and for how long they should be supported, otherwise the proliferation will end up by continuous friction and delays.

b) What is the situation and the problems in telematics? The infrastructure in Greece is notoriously bad, and there is no strategy on future services, competition or even alternative tariffs. In this unfavourable environment two national academic networks have emerged, competing with each other in some cases.

While in this unstable situation this was a "second best" solution, it is important now to take all interest parties for a serious discussion and planning on the future activities.

c) Telematic linkages in the parks are of academic rather than commercial nature and *plans for the future are in all cases inspired by technological opportunities rather than user needs.* The academic nature is strongly related to a very extroverted use of the electronic networks, international traffic being more important than national and regional being almost non existent. The key question that arises is then whether parks should go in pace with overall national technological developments (which dictates demand for telematic services) and save resources for more commercial needs or whether they could and should go faster and be used as demonstration centres. The answer to that is very difficult, depends on costs and alternative scenaria and should be addressed in the synthesis report.

d) Independently of what is the right answer to c), the capacity utilisation aspect of the existing networks has been neglected, for good reasons though. It is very urgent to change this attitude and promote the marketing and training aspect of the networks. Serving tenants should be seen as equally important as serving academics, and not only for research collaborations as it is almost always the case until now. In that respect both

the GSRT and the Commission have an important role to play and this should not be delayed.

e) No specific emphasis was given until now to telematic support for the management of the parks, but this is again understandable, since professional management was not established in any of the parks.

In short no best practices were identified in Greece and cohesion does not seem to be strongly served through the creation of the parks. Having said that, it seems fair to add that the parks are too young to be evaluated and they have achieved most of their (supply side) targets until now, despite serious difficulties and often an unfriendly environment. If, in the near future, they can take a more aggressive approach towards production and not research only, at least Crete and Thessaloniki may prove interesting models for both technology transfer mechanisms and local economy enhancement.

7. Conclusions and recommendations

For standardisation purposes the key issues mentioned above are taken up here again, using the hypotheses to be tested as suggested by the inception report of SQW:

i) Unclear or generalised objectives

The two electronic networks have been set up with clear initial general targets, but with limited support to enhance their activities following a coherent business plan and extend their capacity utilisation. The aim of Ariadne was to created a backbone which will cover academic needs at national level, while FORTHnet, technically more ambitious, targeted the coverage of the needs of the FORTH-Institutes initially, but has then expanded to support a lot of other academic users. The plans are to serve industrial users as well in the near future.

In both cases there was a clear element of "networking being in itself a good thing", related in the former case with the absence of any other similar initiative in Greece, in the latter with the geographically disadvantageous position of Crete.

ii) Human and telematic network requirements

The importance of effective human networks as a pre-condition for effective electronic networking was more than confirmed. In fact the electronic networks promoted in Greece are, as yet, mostly used by the academic community and in particular for multinational projects or project proposals, or by repatriating scientists.

Some use is also made by students or academics who use the network for general information and training purposes, but not for addressing specific receivers. In that case telematics advanced the human networking.

On the contrary use by economic agents is very limited. This is partly due to the fact that the parks are not yet off and running. Two divergent views have been identified on the future use of networks in the parks. The first was that human linkages (including to a large extent informal linkages not covered by the present report) are the only key element for identifying commercial partners and for this reason electronic support is at that stage only a luxury for academics or companies relying to a large extent on revenues for project subsidies. The second point of view on the future needs of the network was that the information available is by now relevant and, though the network will hardly ever be a substitute for selling activities, it can offer important opportunities to companies (including SMEs) to get information on products on the market, being thus very supportive in the management information system.

iii) **Lack of market research**

No market research could be identified in both cases of the Greek telematic networks. They were both initially conceived to serve research communities and for this reason the justification of their existence was found in their technological abilities and not in their capacity utilisation.

iv) **Lack of ex post evaluation**

The network providers themselves have never undertaken any kind of ex post evaluation. The GSRT, which has (directly or indirectly) funded to a large extend both networks is planning to launch an evaluation study next month, which evaluates both networks and identify whether the existence of both is justified or whether the public budget is funding overlapping activities.

v) **International orientation**

The fact that the predominant use of networks is made by academics explains why there is a very clear international orientation.

vi) **Local networks**

No telematic local networks were identified (except for the local parts of FORTHnet). There are two local networks for information diffusion are those of the National Documentation Centre (a VALUE Relay Centre) and PRAXIS, a collaborative venture between FORTH and the Federation of Greek Industries aiming at the dissemination of information on RTD funding opportunities.

vii) **Subsidy**

Both telematic networks have been strongly subsidised both for the creation of infrastructure and for their operational cost. For Ariadne this has been based on market failure and demonstration arguments. As the network has gone beyond its pilot phase a very small fee is now charged to subscribers (16000 drachmas, i.e. 60 ECU, per trimester), which is symbolic rather than aiming at cost coverage. FORTHnet is still totally subsidised, because beside the above mentioned arguments, it is considered as the only means to fight against the peripheral nature of Crete.

The notion of subsidy has to be seen in coordination with the comparison of simple telephone versus data transmission tariffs charged by the national PTTs. This is a

crucial issue for subsidy policy. Greek users complain for being in a very unfavourable situation, if this dimension is taken into account.

viii) **User friendliness**

As no evaluation has been made and the industrial use of both networks is very limited, no specific comments were made on the user friendliness of the networks.

ix) **Uncoordinated discrete initiatives/ proliferation of systems**

The two networks have developed independently but have grown to overlap substantially. This was clear from the beginning and a task force has been set up to draw a plan for coordinate or merge them, in order to avoid duplication. The report of the task force has been made available to the GSRT in 1993, but there was no follow up, probably because there is no expertise or responsible division within the national administration. The evaluation study mentioned above is expected to tackle this issue now.

Although it is self-evident that the lack of national strategy and uncoordinated efforts result in a duplication of funding, a major effort to centralise decision making can be very dangerous in the country. The absence of strategy and direct state intervention has at least permitted the two networks to become operational. Expecting national strategic decisions is very likely (as many examples in the country show) to delay any kind of initiative and increase the backwardness of the country.

Having now the two networks operational, it would be time now to

* ask them to proceed with a (late) business and marketing plan and

* emphasise their promotion and training to non academic parties.

Recommendations for the Greek case are strongly associated to the general uncertainty in the country, as well as to a very academically oriented system. These elements lead to believe that what was achieved until now was a result of enthusiasm rather than professionalism, often with financial sacrifices. In particular:

a) The persistent uncertainty and absence of strategy have led to uncoordinated initiatives. It is most important now to try and coordinate them. For this reason it is important that some people in the GSRT take the responsibility for following up what is happening and designing future steps for the academic networks.

b) By the same token within the parks the establishment of professional management is a precondition for the success of the park.

c) The relative size of the park is an important component for its weight to the local economy. Whereas in Crete the park is seen as a key player for economic development, and is supported by the local authorities for this reason, in Athens it is a tiny initiative, lost within the interests and size of broader industrial interests. In that sense a recommendation to strengthen the linkages with the local economy has a totally different dimension, depending on the relative importance of the park.

APPENDIX I

List of people interviewed

LIST OF PEOPLE INTERVIEWED IN GREECE

1. Attica Science Park

A: Management

* Prof. I. Siotis, Chairman of the Science Park, Director of the Institute *********
* Mrs. N. Vallianatou, Administration
* Mr. S. Delivorias, Public Relations

B: Tenants

* Mr. Doganis and Mr. Marineros, Terra Ltd.
* Mr. Nassiopoulos, Chourdakis S.A.
* Mr. Arnelos, General Magnetic Ltd.

C: Other relevant people

* Dr. K. Arvilias, Manager of Ariadni Network
* Dr. D. Makroppoulos, Director, Responsible for future telematic projects in Demokritos

2. Patras Science Park

A: Management

* Prof. X. Verykios, Chairman
* Dr. J. Garofalakis, Informatics manager

B: Tenants

* Mr. Christidis, Knowledge
* Mr. Barlos, Chemical and Biomedical Laboratories S.A.
* Mr. Matsoukas, Peptide Mimetics Ltd.
* Mrs. Kotroni, First S.A.
* Mr. Pallikarakis, INBIT
* Mr. Androutsopoulos, Expertnet
* Mr. Katsoris, BIOLAN

C: Other relevant people

* Mr. Mousseos, Management consultant associated to the park
* Mr. Kyriaxis, Former Park Director (resigned to go to the private sector)
* Mr. Floratos, Chairman of the Chamber of Industry and Trade of Achaia, Chairman of the local BIC

3. Science and Technology Park of Crete

A: Management
* Prof. G. Kyriakides, General Director
* Mr. Sartzetakis, System Analyst, FORTH-Net support team

B: Tenants
* Mr. Ch. Giannakopoulos, Planet, Athens (Chairman of the Adminsitration Board)
* Mr. Manoloudis, Cretan Marbles
* Mr. D. Pattakos, ITANOS, (Spin off FORTH)
* Mr. M. Lebidakis, Plastika Kritis
* Mr. Magganas, Knossos, (Spin off FORTH)
* Mr. Saitakis, MINOTECH, MITOS (Spin off FORTH)
* Mr. Baladinakis, ARTT, (Non profit, spin off FORTH)

C: Other relevant people
* Mrs. Kassotaki, Regional Authority

4. Thessaloniki Science Park

A: Management
Prof. J. Vassalos
Mr. D. Kosmidis, CPERI-Net manager
Mr. Milios, Scientific collaborator

B: Potential tenants
Mr. Doufos, Logismos (Information technology consultant)
Mr. Giannakopoulos, Planet

C: Other relevant people
Mr. Melfos, EOMMEX BIC

5. National authorities

Mr. Xanthopoulos, Director of new services, OTE
Mr. Deniozos, Special Secretary, General Secretariat of Research and Technology

APPENDIX II

Technical data of Hellaspac

APPENDIX II: HELLASPAC - BASIC SERVICES

ASYNCHRONOUS COMMUNICATION			
X.28 PROTOCOL TRANSMISSION SPEED BITS/sec	ACCESS TYPE	CONNECTION TYPE	MODEM TYPE
300 bps	via P.S.T.N.	2-wire	V.21
1200 bps	via P.S.T.N.	2-wire	V.22, V.22 bis, V.32
1200 bps	DIRECT CONNECTION	2-wire	V.22, V.22 bis, V.23
2400 bps	via P.S.T.N.	2-wire	V.22 bis, with MNP* 4 or V.42/V.42 bis
2400 bps	DIRECT CONNECTION	2-wire	V.22 bis

* Microcom Networking Protocol

SYNCHRONOUS COMMUNICATION			
X.25 PROTOCOL TRANSMISSION SPEED BITS/sec	ACCESS TYPE	CONNECTION TYPE	MODEM TYPE
2400 bps	DIRECT CONNECTION	2-wire 4-wire	V.22 bis V.26
4800 bps	DIRECT CONNECTION	2-wire 4-wire	V.32 V.27/V.27 bis
9600 bps	DIRECT CONNECTION	2-wire 4-wire	V.32 V.29
* 19200 bps	DIRECT CONNECTION	2-wire 4-wire	Base Band Base Band
* 64000 bps	DIRECT CONNECTION	2-wire 2-wire	Base Band Base Band

* Transmission speed of 19200 and 64000 bps may not be available in all cases. Special arrangements between OTE and the user are required.

SYNCHRONOUS COMMUNICATION			
X.32 PROTOCOL TRANSMISSION SPEED BITS/sec	ACCESS TYPE	CONNECTION TYPE	MODEM TYPE
2400 bps	via P.S.T.N.	2-wire	V.32

X.32 Protocol will soon be available.

Optional facilities available for inland communication

OPTIONAL FACILITIES			
AVAILABLE FACILITIES FOR INLAND COMMUNICATION ONLY	X.25 DIRECT CONNECTION	X.28 DIRECT CONNECTION	X.28 ACCES VIA P.S.T.N
1.Closed User Group (C.U.G)	*	*	*
2.C.U.G with outgoing access	*	*	*
3.C.U.G. with incoming access	*	*	
4.Outgoing calls barred within a C.U.G	*	*	
5.Incoming calls barred within a C.U.G	*	*	
6.Selection of Closed User Group	*	*	
7.One way logical channel outgoing	*		
8.One way logical channel incoming	*		
9.Outgoing calls barred	*	*	
10.Incoming calls barred	*	*	
11.Reverse charging-Reverse charging acceptance	*		
12.Fast select acceptance	*		
13.Nonstandard default packet size	*		
14.Nonstandard default window size	*		
15.Flow control parameter negotiation	*		
16.Throughput class negotiation	*		
17.Abbreviated address calling	*	*	*
18.Multiling procedure	*		
19.Hunt group	*		

APPENDIX III

The Attica Technology Park

APPENDIX III: THE ATTICA TECHNOLOGY PARK (ATP - Demokritos research centre)

1. Introduction

Demokritos is the biggest and one of the oldest research centres in Greece. Its age, size and multidisciplinary nature (as well as its origin as a nuclear research centre) have contributed to the creation of a rather rigid structure with mainly academic interests and no linkages to industry.

In an effort to modernise the centre and assure a technology transfer function, a Technology Park was created within the Demokritos campus. The park was created "on a project basis", co-funded by EPET I, because the initiative was welcome by the GSRT for two reasons:

a) the valorisation of research work and infrastructure in Demokritos and

b) since Athens is the biggest industrial pole of the country it was difficult to promote the three FORTH technology parks only in the economically more deprived areas.

2. The Park - achievements and future plans

The ATP is designed to be implemented in three phases:

Phase 1 was the creation of the incubation facilities, financed by the regional (Attica) O.P. of the first CSF. This phase has been achieved and the first tenants have moved into the building.

Phase 2 which is financed by EPET I aims at the creation of a technology transfer centre and full administrative support for tenants. The park goes through that stage now.

Phase 3 is expected to be financed by private funds and the banking sector for the attraction of private investment. Additional possibilities for building another 42000 m^2 shopfloor are available within the Demokritos campus and initial discussions with some of the biggest, technology aware companies of the country have started.

The technology areas, where the park wants to specialise are

* new, advanced materials
* information technologies and telecommunications
* biotechnologies
* prototypes and quality control

At that stage an incubator of approx. 2000 m^2 has been built and the administration of the park provides general services, against a small fee (20000 drachmas/month), to its associated members, space for regular tenants in more or less market rates (20000 drachmas per month and module of appr. 12 m^2) and use of the Demokritos facilities against agreements on a case-by-case basis.

The general services offered by the ATP to its tenants and associated members consist of

a) Information provision on EU and other R&D programmes, as well as the development of consulting services for the submission and monitoring of proposals.

b) Use of the scientific library of Demokritos

c) Mail services

There are 7 tenants in the incubator are mainly very small companies which decided to be located there because of their previous collaboration with various institutes of Demokritos. One of the major problems, as compared to other parks, is that it seems that there is a *policy by the research centre not to support spin off companies from the institute.*

The major characteristics of the three companies interviewed are summarised on Table I.1, while the remaining four only indicate their size and area of activity, but no detailed interviews for their human networking and telematic needs were effected:

One of the major achievements in the park is the creation of a new product, a multi-drier, which is able to dry many agricultural products (raisins, figs, tobacco, tomatoes, potatoes, apples, plums, apricots etc.), which has been conceived by KINITRON Ltd., one of the parks companies, and has gone through all necessary quality improvements and tests in the Demokritos laboratories, so that its design, energy consumption and competitive performance are now judged very satisfactory. The product is on the market and supported by FEOGA in its purchases.

3. The telematic services, needs and plans

The telematic support services of the ATP are totally merged with those of Demokritos, which created, hosts and manages one major academic R&D networks (Ariadne), as well as several projects under way. Such projects are a pilot network covering the needs of high energy physics, which links the centre to CERN and a linkage with Patras to assure R&D collaboration and possibly tele-training. More ambitious projects are the passage to a 2 MB system, that would allow multimedia applications and making a broadband island in Demokritos. The latter are

initial conceptions for which the financial means have not been found yet. While it is not clear that demand would exist for such services, the more ambitious plans suggest to partly hire the system (if implemented) to sources outside Demokritos, in order to cover its cost.

Table I.1: Characteristic features of the park tenants

	Year of foundation	Technology area	Employment	Current network use	Future needs	Comments
1.	1992	Representative techniques of medical diagnosis	--		Data from medical centres & hospitals, technology enabling the transmission of medical images on-line.	Physically located in the park
2.	1993	GIS	3 (co-founders)	Hellaspac, Ariadne,	Access to ECHO, CORDIS, higher speed and better reliability. Main partners for networking: collaborators for EC common projects.	The company entered the park because of joint programmes with Demokritos research institutes.
3.	1978	Construction of printed circuit boards	45	Ariadne, Hellascom	Access to NUMERICE is required. Current networks are inadequate for interaction with collaborators.	The company is not physically located in the park, but has an association relationship for the appropriation of specific knowledge.
4.		Innovations in solar energy systems	4			
5.		Sensors based on magnetic materials	2			
6.		Drier for agricultural products	3			
7.		Technology transfer and demonstration for supercomputing systems	1			

The Park, virtually in a distance of 150 meters from the Ariadne computers, has not yet undertaken the physical infrastructure to be linked to the network. As a consequence all tenants who wish to use the network "walk" to the headquarters and use it there free of charge. As the

park has no identification code as such, it is not possible to identify the use made by administration and tenants. In later phases the park plans to draw the necessary line and create a LAN within the park to serve its tenants and administration.

Discussions with tenants suggest that for them the current telematic links would be sufficient, would the OTE infrastructure be adequate. It is mainly time and reliability that are insufficient parameters and not the inability to proceed to image transmission and interactive working. But while current demand for such services was not identified, latent demand is highly probable, since interviewees themselves believe that if value added services are offered to be tested, they will most probably start using it.

This interdependence of ATP and Demokritos for telematic support services has to be seen from a double angle: On the one hand it has one main advantage for the park, namely that a mature R&D demand has preceded the creation of the ATP, but on the other hand the academic needs dominate any kind of commercial information needed. In that sense the future projects find Demokritos and ATP planning needs split: while the Demokritos view is that one should proceed to a quick adoption of international state of the art technology (dominated by the needs of high energy physics, application of computational techniques in chemistry etc.), the park's administration sees very high speed as premature. In any case there is a view in the park that not too many funds should be dedicated to high speed telematic linkages, since there is no use for the park to go beyond what can be offered in the country as a whole.

4. The key issues for the Attica Technology Park

The park, though physically the first one operating in Greece, is still in an embryonic stage offering incubation activities only. Overall these activities are limited, due mainly to

- its young age
- the project nature of the Park, which increases uncertainty
- the reluctancy of Demokritos to facilitate spin off activities
- the absence of venture capital in the country.

It is nevertheless too early to make any sort of evaluation for the activities of the ATP.

For the telematic linkages the strong dependence on Demokritos has been an advantage in the sense that a pre-existing infrastructure was made available, in the same way as the research facilities of the centre. But as the technology transfer function increases, extension to commercially relevant information and training is necessary. In that sense the park needs to take a more pro-active approach towards planning the telematic needs of present and future tenants and adopt a business plan on how to cover them within or outside the scope of Ariadne.

APPENDIX IV

The Patras Science Park

APPENDIX IV: THE PATRAS SCIENCE PARK

1. Introduction

Despite a dynamic local university and the old tradition of Patras as an economic pole of Western Greece, with substantial industrial and trade activities and an international port, the recent history of the area may overall be described as a series of lost opportunities, as several examples of declining industrial activity, relocation of multinationals and institutional failures can demonstrate.

The local environment has been very unstable to permit a quick development and this affects equally any efforts to institutionalise modernisation and incubation facilities. This is best indicated with the examples of institutions founded with EU structural support and diluted after a short period of time, as their evaluation demonstrated their inability to play a crucial role for local development. The Development Company of Western Greece has stopped its activities, while the first BIC established by EOMMEX has been diluted, after some initial success, due to a central decision to transfer all incubation activities to the central offices in Athens and limit the former autonomy of local agencies. At the moment there is one BIC active, under DG XVI initiative, which is associated to the local Chamber of Industry and Commerce, but which has several problems of internal organisation.

The Patras Science Pard (PSP) was the first one designed in the country in the mid '80s. It has been conceived as a technology transfer mechanism and as a real estate development for industrial tenants, based on anticipated linkages with the University of Patras, the Institute of Chemical Engineering for High Temperature (IHT is the local branch of FORTH) and the Institute of Computer Science of Patras, an independent institute supervised by the Ministry of Education. The Park was founded as a partnership between FORTH and the Development Agency of Western Greece. When the latter was diluted FORTH bought its stake and became the only shareholder of the Park.

Despite its early start the PSP ran into serious difficulties in the late '80s, because of opposition from people within the University, local farmers who objected to its construction plans and various reorganisations in the GSRT, which did not permit a coherent approach to the development of the park.

2. The Park - Achievements and future plans

In that unfavourable context the park has proceeded with gradual limitation of its ambitions. The financial support it receives is limited to the structural funds and the state budget (GSRT),

with no co-funding from the regional authorities. Although the Mayor of the city of Patras is ex officio member of the board of the PSP, the local authorities are not directly involved and do not have a firm position regarding incubation activities in general or the PSP more specifically. Legally the Park is an independent, non-profit organisation, which owns approximately 1.5 acres of land, nearby the University and the IHT estate, expected to be built in the future. Extensions to 9 acres are foreseen, if achievements meet plans.

From the very beginning the management of the PSP has distinguished two directions, one towards the creation of a physical infrastructure and one towards the organisational, intangible infrastructure. The former has evolved in a very unsatisfactory way. For various reasons, as explained above, no constructions were undertaken and the parks administration is still located in a very small rented house. It is foreseen to move into 1000 sq. meters in the new IHT building next spring.

The organisational achievements are much better and promoted around four activities:

a) *Identification and support of tenants*: The physical infrastructure does not allow the offer of physical sheltering of companies, but 12 companies are associated to the park, which for an annual fee of 100.000 - 150.000 drachmas (400-500 ECU) have access to the services offered by the park, i.e. administrative, accounting, financial consulting and marketing support. Contracts with external advisers are signed and their services are charged with developmental considerations.

b) *Promotion and support of spin off companies.* While three such companies from the University of Patras are considered to have an interesting potential at the moment, the absence of space and venture capital mechanisms, does not allow for a very efficient support. Efforts to establish a moderate, dedicated venture capital fund are under way.

c) *Technology transfer*: The PSP belongs to several networks (Multi-pole Network of SPRINT. Technology International Exchange, IASP) where they access information, by on new technologies by conventional means. This information is distributed to the companies which collaborate with the park. Plans for technology exchange days are under implementation.

   While no technology transfer agreements have been signed until now, several expressions of interest have taken place.

d) *Extension of services to productive companies* takes two forms. The first envisages the creation of consortia for research programmes with specific industrial targets, such as the development and testing of a cheap and efficient catalytic transformer, a desalination/windmill for power generation and biological treatment. The second is the

Table II.1: Characteristic features of the park tenants

	Year of foundation	Technology area	Employment	Current network use	Future needs	Comments
1.	1988	Hardware development	35	Hellaspac Y-Net Internet Hellascom	Higher reliability, higher speed, in peak hours electronic communication is a problem	A competitive company with strong linkages to the local University. The company is strongly involved in the FP and the CSF.
2.	1991	Special products for protein production	3	--	Cover electronically access to patent data and commercial data	The company is too new and too small and has not yet identified needs in networking or telematics
3.	1992	Development of new medical products based on imitators	1 (15 in Canada)	--	Specific medical information, identification of customers, libraries	The company is closely related to a company founded in the Calgari Science Park in Canada, the owner, being of Greek origin tries to have a new subsidiary in Greece
4.	1988	Hardware and software development	20	Hellaspac, Internet, frequent use of hosts like ECHO, ESA, IRS	The current level is fairly satisfactory, but speed and reliability can still improve.	The current situation provides for the necessary information. The company is strongly involved in the FP and the CSF.
5.	1991	Service provider to hospitals	15	Hellaspac, Ariadne, Y-Net	Contact with customers is the most important communication needed. TNO is a network they would need access to.	It is a non-profit organisation.
6.	1991	Computer science and telematics consultants	12	Ariadne, Hellastel	Speed improvement	The company is located in Athens, but the expertise of the PSP has attracted it to collaborate there, instead of the Attica Park.

promotion of linkages of industries from Western Greece with higher educational establishments and public research centres. A very recent achievement is for the implementation of this target is the creation of a consortium with the local chamber of industry and trade for servicing local SMEs. Efforts to improve quality control and certification linkages

are still at an infant stage and face severe problems, mainly because of differences in the mentality of academics and industry.

The plans for the future start at the immediate need for relocation in the new IHT building, which is expected to be very soon. Once space available the park will turn to an aggressive marketing of its own services, since it will be able to host and service more tenants. For the medium term the plans for an own building are not given up. Ideally in the long run the park administration hopes to earn such a reputation that it will be able to attract bigger Greek companies or even multinationals in the broader park area.

The PSP has at the moment 11 "tenants", associated but not physically located in the small rented offices. Eight of these associated tenants are located in Patras and three in Athens. The technology areas the park specialises are information services, medical/pharmaceutical products and services as well as design in mechanical engineering. Table II.1 gives the characteristics of the seven companies/tenants interviewed. Overall they are fairly young, believe to benefit strongly from their association to the Park, in particular because of the services and R&D networking opportunities it offers.

3. The telematic services, needs and plans

At that stage there are no telematic services whatsoever in the park, because in their expectation to relocate soon any ivestment on physical infrastructure would be wasted. IHT is linked to FORTHnet, but not the park itself. International networking for technology transfer is ran with conventional means. When specific needs for research projects arise they are served by the infrastructure of the university or the companies themselves, since some of them are linked to Hellaspac.

Nevertheless, the park has a strong view for the needs and opportunities for telematic services and an information science specialist has been appointed to (i.a.) follow up this target. *A first project* conceived and discussed with OTE for the creation of a telecommunications centre in the park, which would serve the broader area of Patras had to be abandoned due to the difficulties of its implementation and the reluctancy of OTE. *A small common project with Demokritos* funded by Telematique, whereby the PSP would become a broadband island and connect its LAN to that of Demokritos, is under negotiation.

A current integrated approach is included in a proposal to the GSRT, which is the supervising authority of FORTH and the PSP, to study and implement the physical infrastructure for a fully equipped telematic centre, which would be part of the computer centre of the park. This proposal, with a cost estimate of 175 million drachmas (600 KECU) for investment, included in particular:

a) The connection with the optical fibre cable linking Patras and Athens (still under construction).

b) A teleconferencing studio via Hellascom (when it reaches 2 Mbit/sec).

c) Connection to the following networks:
   * the LAN of the University of Patras
   * BIT, Internet
   * Hellaspac
   * Hellascom
   * Hellastel

d) The development of applications, in particular E-mail, tele-working and EDI.

Recent information is that this proposal will be adopted by the GSRT, but it is not known to what extent it will be autonomous or coordinated by FORTHnet.

A third proposal will be submitted next week to the RTD O.P. of the new CSF, which emphasises LAN services, but also extended telematic services to potential users outside the park.

All these proposals are independent of the university, which is promoting its own telematic infrastructure and where both institutions believe that the networks will be complementary rather than competing.

Overall the estimate of the parks' specialists is that at that stage the needs of the tenants are mainly EC information, BC net being the most important source. For services within Greece Hellaspac is more or less adequate. Access and connection with other member states is seen as a future option.

Tenants declared that they cover their initial telematics needs by the existing country-wide facilities.

a) They believe that higher speed and reliability is necessary. This is particularly relevant for those among them that have already close links for research programmes via the EU support mechanisms.

b) They want to have better and well organised access to commercial data, in particular clients, suppliers of raw materials, market data etc. This seems to be much less formalised and very strongly needed if the companies want to go beyond the "new technology based firm" status into commercially viable entities.

c) Very high speed, image or voice transmission facilities are not perceived as an immediate need at the current stage. Most companies believe nevertheless, that is available and a competitive price, they would check to see their merits.

4. The key issues for the Patras Science Park

The absence of support from the local authorities has been the major problem of the PSP. If this is not eliminated the Park will most probably never succeed in becoming more than a small incubator. Nevertheless, in these less ambitious functions as an incubator and industrial liaison office, the park can demonstrate some very encouraging success stories.

Tenants are not physically located in the park, but they are satisfied with the services they receive. They are both regional companies, but also bigger firms from remote areas. Telematic services are not offered at the moment and it is difficult to plan infrastructure, as long as the permanent location of the park has not been decided. A discussion of alternative strategies and invoicing (with OTE, Ariadne, the GSRT and the local university) is necessary, in order to avoid splitting and duplicating efforts.

A common project with the local BIC for SME support, approved only two months ago, may be the most appropriate mechanism to check the networking needs of associated members.

APPENDIX V

The Science and Technology Park of Crete

APPENDIX V: THE SCIENCE AND TECHNOLOGY PARK OF CRETE (STEP-C)

1. Introduction

The Science and Technology Park of Crete was conceived as a natural extension of the Research Centre Crete (RCC), in order to create favourable conditions for the invention and development of new products and techniques. RCC is a model institution in terms of scientific excellence and is an emerging pole of national expertise, built to a large extent with EC competitive and structural support.

The local economy has been traditionally based on agriculture and tourism and has experienced a rapid growth after the accession to the EU through FEOGA and FEDER support and promotion of early fruit and vegetables in the European market. Manufacturing activities are very limited, with only 400 companies having a corporate structure, the others being very small family businesses. In such a context RCC has a high prestige and the STEP-C has been adopted and supported by the local society and by the regional government.

2. The Park - achievements and future plans

The Park is based on the expertise of the RCC, and its fields of specialisation are:

a) Molecular biology and biotechnology, and in particular mammals, insects, plant proteins, enzyme technology, immunobiology, diagnostics, microchemistry and microscopy.

b) Applied sciences, notable laser applications, computer simulations, laser surface interaction, electronic products, III-V semiconductor devices, amorphous semiconductors and polymers.

c) Computer sciences and informatics, i.e. software technology, decision support systems, medical systems, VLSI design, concurrent systems, computer vision systems, network management, tele-informatics.

d) Environment, and in particular regional water resources, atmospheric pollution, climatic change impacts, atmospheric UV radiation.

The park is seen as the third step in a broader strategy, which initially aimed at the creation of a high quality research centre (RCC), which was extended to become a nation wide, prestigious establishment (FORTH) and now has to promote its linkages with industry and other economic activities within the country.

STEP-C will cover thirty acres owned by the RCC next to the University campus. It is expected to be implemented gradually, in three phases. The first emphasises training-learning and technological activities designed to meet the demands of interested companies. At that stage a building of 4500 sq. meters is ready and the park is expected to move in the current spring (Stavrakia campus). In December 1993 the organisational scheme has taken its final form: an independent company has been created for the administration and development of the park. The company's stock is owned 35% by FORTH and 5% by each of the first tenant companies. The park itself has now two sorts of economic linkages

a) Companies and organisations which are members of the administration company and are expected to be the first tenants, when the park moves into its own location. At that stage rents are of the order of magnitude of 2000 drachmas/m^2, i.e. 7 ECU, which corresponds to market rates in the area. Modules are offered in 16 m^2 entities.

b) Institutes, foundations, programmes and chambers which will benefit from services offered by the park.

A consultative committee, with broad composition (national, regional, academic, industrial) acts as a key actor for the approval of the STEP-C and its fit into the national and regional society.

A solid preparation work has permitted to establish the criteria upon which tenants will be accepted to the park or not. While the initial tenants were expected to be the spin off companies of the RCC, the aim to attract as soon as possible existing or newly founded companies in high tech areas has started to be fulfilled. Several bigger companies outside Crete have expressed their interest.

The services to be offered by the Park are the following:

Academic, in terms of access to research programmes and teams, access to research infrastructure, access to networks and data bases, E-mail, access to the scientific library of FORTH, training programmes and publishing.

Technological, as far as collaborations for the absorption of national or EU research grants are concerned, access to high technology laboratories for VLSI design, CAD, laser applications, microelectronics, electronic constructions, microchemistry, technology diffusion services and prototype construction.

Entrepreneurial, such as market research, LAN, secretarial support, tourist services, conference facilities, editing, use of the STEP-C logo, as well as financial and legal services.

Networking, both electronic, in terms of access to data bases and physical, like the expositions (planned to take place) in the Park.

In its present state the park has 19 companies, committed to become tenants as soon as the park operates, of which 10 are local companies and 9 have their headquarters in Athens and will move a small part of activities to Crete. Two of them are banking institutions. 5 companies are spin offs, 2 are big ones, 5 are in the service sector. Companies like Siemens and Digital have expressed their interest for close links with the park, but they have not yet signed any type of contractual obligations.

Their reasons for moving into the park are different: for the spin off companies, currently spread around rented space in town, it is their natural location, where they will have easier access to all facilities offered by their parent institutes, like libraries, scientific equipment and human relations. Firms from Athens see the park as the most appropriate location for their local activities, since it guarantees an excellent work environment at current market rates. The two big local manufacturing companies, which are in the administration board and will rent space, are mostly interested in closer R&D and technology transfer collaboration with the RCC institutes, whereas the bigger Athens companies are also interested in closer collaboration but also in using the infrastructure (telematic and other), which is a model case compared to other Greek corresponding structures.

The services offered by FORTHnet as well as the excellent physical infrastructure for telecommunications were mentioned also as important reasons for locating in the park.

Table III.1: Characteristic features of the park tenants

	Year of foundation	Technology area	Employment	Current network use	Future needs	Comments
1.	1986	Technology and business consulting services	80	FORTHnet Y-Net Ariadne	Unknown, open to better services	Frequent use for exchange of documents, FORTHnet seems more suitable for the company's needs
2.	1990	Information technology products, in particular databases	2	FORTHnet Hellaspac	Access to databases with commercial information, tele-training	It is one of the profit oriented spin off companies of the RCC. Human networking needs to be more emphasised and telematic links are also underutilised (e.g. the post is used even with partners where electronic file transfer was possible)
3.	1970	Plastic products	150	BC-Net, Ariadne, FORTHnet, Hellaspac	Unknown, but strong commitment in electronic networking	It is one of the biggest and most innovative local companies, which is strongly supportive to the idea of the park and believes that it will offer the company the possibility to strengthen its links with the local and international academic world, in its effort to remain technologically leading.

4.	1990	Telemedicine	7	Hellascom for hospitals, FORTHnet	ISDN services will be important if access to hospitals can be assured	It is one of the profit oriented spin off companies of the RCC. Human networks with remote hospitals and health care centres are very important and if they can be linked with multimedia networks, the work will be strongly facilitated.
5.	1993	New enzymes	1	FORTHnet for E-mail	Not likely	It is one of the profit-oriented spin off companies of the RCC. Their view is that human networking is the only important investment. Telematics is useful for NTBFs, but the really relevant information from bigger companies is not available on line.
6.	1991	Tourism, service oriented company	1	--	FORTHnet	It is one of the profit-oriented spin off companies of the RCC. FORTHnet and the infrastructure of the park are expected to enhance the activities of the company, which is at the moment working more on an ad hoc basis.
7.	1987	Software support	85	Hellaspac, Internet, internal net	Higher speeds necessary	It is the Greek subsidiary of one of the biggest multinationals, which wants to join the park for better cooperation with the research institutes. Networks are widely used for communication with collaborators.

8.	1986	Bank	400	Hellaspac, Internal net	--	The bank wants to increase its collaboration with the RCC, so it aims to establish a small office for its own software development in the park.
9.	1986	Commercial software	40	Internet, Ariadne	Transfer moving pictures, improve speed	A successful NTBF, which wishes to increase cooperation with the RCC institutes in research programmes.
10.	1989	Biomedical production	160	Kapatel	E-mail, Information on EU R&D projects, Market information	A successful company, with good human networks but no electronic support, which hopes to be able to profit largely from the infrastructure in the STEP-C.
11.	1982	Marble	30	BC-Net via the local Chamber	Commercial information and information about EU R&D funding opportunities	A local company strongly supportive to the park, in order to strengthen the already very beneficial linkages with the RCC.
12.	1988	Software design	28	Hellaspac, Internet-Ariadne	Access to databases like CORDIS and ECHO	It is a rather successful NTBF, which wants to join the park for increased cooperation with the research institutes.

3 The telematic services, needs and plans

Networking, to a large extent because of the peripheral location of Crete, is considered as a key activity for STEP-C. Access to national/international data bases and computer networks, access to business promotion schemes through networks involving other science parks and IASP members, as well as access to the CEC and national business clubs are of priority.

In the Stavrakia Campus a high-speed network environment is operational. It is based on FDDI rings, interconnected through routers and digital lines at 2 Mbps. The main LAN is a star-shaped FDDI backbone. It spans four buildings interconnecting more than 15 ethernets, providing fast network access to hundreds of workstations, and to large multiprocessor file and computation servers. The buildings are fully monomode fiber wired ready for the transition to even higher speed backbones and WAN national and international connections. Among FORThnet's plans is to provide LAN performance over its WAN, providing at the same time a testbed for experimentation in audio and videoconferencing, two-way video lecturing, and distributed image databases. Other plans include the 34 Mbps links for FDDI-to-FDDI communication, and the metropolitan area prototypes at 100 Mbs to 1 Gbps (Frame Relay, ATM, DQDB).

A proposal is being developed for a network linking the science parks at Heraklion, Zernicke (Holland), Bari (Italy) and Symbion (Denmark).

When the next stage, with the establishment of the administration of the park and the tenants in Stavrakia will be completed, and if the means are available, FORTHnet is expected to move towards the needs of users in terms of training and information provision.

4. The key issues for STEP-C

At first sight STEP-C is seen as a model industrial linkages model for the RCC. While the name "Science and Technology Park" is too ambitious for what has been achieved as yet, steps are carefully planned and a correct strategy has started. The key question that arises is whether peripherality can be overcome by a good strategic planning and an excellent telematics infrastructure, and in that sense STEP-C is an extremely interesting model.

The excellent reputation of the RCC, the strong support from the regional authorities and the good start with some very good companies make STEP-C the most interesting case to be supported for a really ambitious programme for improving the competitiveness of SMEs through use of advanced telematic linkages.

APPENDIX VI

The Technology Park of Thessaloniki

APPENDIX VI: THE TECHNOLOGY PARK OF THESSALONIKI (TPT)

1. Introduction

The area of Thessaloniki has a substantial potential, as it is the second biggest manufacturing centre of the country, and it is very close to the former communist Balkan countries, where its industry is already expanding. Several recent analyses point out that the local industry is more dynamic and profit making than the corresponding activities in the Athens area. For this reason two alternative locations of the park were studied, one in the industrial zone of Thessaloniki (Sindos), rejected for environmental reasons, and one in the more prosperous suburbs, which was preferred.

The Technological Park of Thessaloniki is closely related to the Chemical Process Engineering Research Institute (CPERI), one of the FORTH institutes, which has from the very beginning cultivated dense linkages with the local industry. Its mission is to:

1. Promote activities and practices which contribute to the increased competitiveness of the Greek industry with special emphasis on energy conservation and the protection of the environment.

2. Catalyse the transfer of high technology applications to Greek industry and to serve as a springboard of new products and services at a competitive price.

3. Undertake a leading role in training and retraining of industry personnel by serving as a link between Greek industry and other EU regional industry and world known experts in new fields of technology.

4. Promote close cooperation with local Universities especially in areas of basic research.

2. The Park - achievements and future plans

The TPT is at the moment 100% owned by FORTH and closely related to CPERI, which is also the formal structure supporting the interests of the park at this interim stage of its development. CPERI and the park (in a synergetic but not formalised way as far as distribution of revenues among them is concerned) have been offering analytical services like

* SBET Physical Absorption, relevant to catalysts, ceramics, minerals, fuels and additives, petrochemicals and polymers, fertilizers and fibers, pharmaceuticals, cosmetics etc.
* Laser Particle Sizing for research, quality or process control

* CHN elemental analytical services for solid and liquid fuels, petrochemicals, pharmaceuticals, organic substances etc.
* ICP/AES analytical service for the simultaneous quantitative and qualitative determination of about 80 elements
* X-Ray Diffraction for quality and process control
* Refinery gas analysis
* Coulter particle sizing, necessary for polymerizations, biological cell studies, pharamceuticals and suspended microparticles.

The facilities of the park are located in 2.5 acres owned by FORTH/CPERI and include at that stage the building of an incubator of approximately 930 m^2, which is expected to grow further in the future. The new buildings of CPERI including the laboratories, a central administrative unit and congress facilities are located in the same campus. The buildings are in a very advanced stage and the first equipment is expected to be transferred there in the summer.

The incubation activities are expected to be organised in exactly the same way as Crete, with an independent company responsible for the management of the Park. The park's shares will be partly acquired by the future tenants. The organisation is lagging a little behind, compared to that of Crete, since only the first meeting of potential tenants has taken place for the discussion of the founding law of the managing company. It is estimated that the management company will be set up in July. After that FORTH is expected to become a minority shareholder and give all institutions their full autonomy.

When ready the incubator will offer secretarial services (including the use of the telecommunications centre), business and innovation consulting, technology services in collaboration with CPERI, training and telematic services.

Three types of (already committed) future tenants are distinguished:

a) Public bodies, like the American Agricultural School and the Federation of Industries of Northern Greece.

b) Four big companies, which are already well acquainted with the initiators of the TPT, since they are collaborating with CPERI in several areas. The headquarters and production facilities of all four of them are located in the area of Thessaloniki.

c) Three consulting companies, of which one is already a tenant in the Cretan Park. Two of them are in Athens and envisage to locate their local subsidiaries in the park, whereas the third is a local one.

It is true that there has been no aggressive marketing of the park, since it is considered premature, as long as the management scheme and shareholding structure are not definite.

3. The telematic services, needs and plans

The telematic services of the park will be an extension of those currently offered at CPERI. At that stage the activities of CPERI are located in three different areas, partly in premisses rented in the local University, an apartment rented in town for the telecommunications facilities and the CPERI building, approximately 10 km outside the centre of the city. The operation of the telematic service is technologically supported by FORTHnet.

The network (which is informally called CPERI-net) is a node of FORTHnet with a LAN serving the three facilities of the institute. Connections to Ariadne exist but are not used. CPERI is also a Hellaspac user, but as its cost is considered too high, it is used for receiving data only. External users connected with leased lines to the network are the University of Macedonia (a small economic university), the local polytechnic (TEI), the British Council of Thessaloniki, PRAXI (the FORTH-Industrial Federation joint venture for the promotion of information on EU funds) and 3 dial up lines, which have about 100 users with passwords.

The current use of the network is (in terms of volume) approximately

a) 60-70% file transfer (FTP), in particular public domain uses of foreign servers for demos, programmes accessible for limited periods of time and training. These users are virtually all coming from the academic world, professionals and companies have not asked for any information.

b) 20% E-mail

c) Other services, like remote login, in particular for researchers which have an account number in the US, interactive connections, and the news service.

The new services are GOPHER and WWW, distributed databases which can support queries on-line, without file transfer (an equivalent to X.500).

At that stage, where the lowest speed in the network is 9.6 bps theoretically transmission speed should be 8 second per page. Practical examples effected during the interviews have showed a real average transmission speed of 1 minute per page, which the users of the system identified as average, since in peak times and from remote areas this speed can easily be reduced to half. It is self-evident for a system which is in 2/3 supporting FTPs, this speed is totally insufficient.

The plans are to move all this activity to the TPT, expected to materialise in 1994-95. Funding is late, but an optical cable is already installed by OTE until the park. The extension of the network foresees much higher speed, in order to be able to support simultaneous voice/data transmission and as a consequence go into new areas of application like tele-training/multimedia. It is estimated that most of the companies which refuse to sacrifice abundant time of their employees for training, will easily accept to participate to tele-training. In order to have the highest possible use of this network a connection to the industrial zone of Sindos is foreseen. The goal is to go to 2 MB speeds which will also permit to increase the number of users.

Of the potential tenants only the American Agricultural School and the consulting companies use presently telematic services (Ariadne, FORTHnet, Y-Net). The other companies make much less use of networking and when this is necessary it is mainly achieved through the CPERI collaboration.

4. The key issues for the Technology Park of Thessaloniki

The plans for the park are in a satisfactory stage, from an infrastructure point of view and the linkages with local industry practically the best of all parks studied. Nevertheless, from an organisational point of view, the organisation of tenants and finalisation of institutional plans are lagging behind.

At the moment there is no clear distinction between the park and CPERI. This will change when the board of administration will have to be appointed. At the same time there is no business plan for the incubator and no discussions for collaboration with the local BIC. These issues will be taken up once the administrative structure will be definitive.

From a telematics point of view the services already created are unique for the local environment, not only for supporting the park itself but also for serving wider needs of Northern Greece. Their problems are not specific to the TPT, but are related to the overall difficulties and deficiencies observed in the country, in particular

* the inadequacies of the overall infrastructure

* the inadequate funding and staffing, which has up to now strongly limited marketing and training efforts

* the OTE policy on the tariff structure of data transmission.

The support of FORTHnet and the relevance of the park for the dynamic industrial area place it in an excellent position to expand, but it is strongly recommended that it is now time to expand more rapidly (not only) towards soft needs, in particular industrial services, promotion and training.

HOLLAND

Chapter One

INTRODUCTION

1.1 Holland has been working with regional economic development since the beginning of the 1950's but science parks have never had an active role in the government's economic development policy. The emergence of science parks in Holland has been seen by central government as a 'nice' plus point for the local support infrastructure for SMEs and for knowledge-based companies. The government has in most cases supported the investment and initial phase financially, ie for the building or concept maturation.

1.2 One of reasons why science parks is not a topic for the Dutch government is its limited effect on the economy, ie companies in Zernike science park have created 400 jobs since 1988. A recent survey of Dutch science parks shows that 86% of companies in science parks are service companies, compared with 10% that are involved in some kind of production. It was argued that this reflects the cost of starting a company with production facilities compared to the costs of starting a service company.

1.3 There are currently ten science parks in Holland with at least one more under development, including two BICs and some incubator centres. With the exception of the BICs, all the science parks have connections with a university or an educational institution.

1.4 The Dutch government has a number of regional development tools. There are five regional development agencies in Holland, called OM (which when translated stands for development company). These companies work for the municipalities, county and central government who also fund them. Each OM has a venture capital component/company which can be used to support local businesses. Together with this scheme there is a facility called IPR which is a government grant scheme for investment.

1.5 Another network of support organisations for SMEs are the 'Innovation Centres'. An innovation centre's role is to provide local firms and organisations with technological information and advice as well as to create awareness about technological opportunities for SMEs. The Dutch government also has two more instruments which they use in their work. The Dutch government provide a guarantee on loans which banks provide and this has, to date, been a very successful scheme. It is also possible for associations in Holland to receive support for collective research, ie the shoe-manufactures can establish a research programme in how to make their production more effective.

1.6 The infrastructure is generally very well developed in Holland. The railway system is very well connected, and everybody has the potential to have a telephone installed. ISDN covers 95% of Holland with only a few remote areas which have not been connected. There is a growing trend in Holland for using leased data-lines, which are increasingly digital. The Dutch PTT telecom has a monopoly on telecommunication in Holland but is currently being privatised and is working towards an open market. The business infrastructure is characterised by mainly small companies with 90% of all businesses in Holland employing less than 50 people. There are a few multinational companies, about 6,000 SMEs intensely involved in R&D activities and another 100,000 SMEs.

1.7 During the visit in Holland in February 1994, interviews were conducted with 21 people. The interviews consisted of three science parks, two BICs, a teleport, two economic development institutes (one national), two liaison officers and eight companies. The visits were spread over the most of Holland, except the far south.

1.8 During the interviews in Holland nobody expressed a keen interest in the development of a telematic network amongst science parks in Europe. All respondents had some kind of reservation, either about the scope or the need for such a service.

1.9 Companies and organisations within science parks mainly used normal business communications with their customers and partners. The use of e.mail and other advanced telematic tools were limited. Though video-conferencing is increasingly used in Holland, it is mostly amongst bigger international companies. Amsterdam University had introduced a one year trial period for its researchers, but have found it very difficult to find partners to 'talk' with. Videoconferencing is reported to be used mainly in countries with long distances like Norway and Australia, were the experience so far is less than positive.

1.10 The use of e.mail and other advanced telematic communication were mostly found in academia and spin-offs from academia. The difference between academia and private companies could be linked to private organisations anxiety about the costs of such services, whereas academia can use these services free of charge.

1.11 It was stressed on several occasions that a network between science parks in Europe first of all must have a strong organisation behind it. Secondly that the content should not be commercialised, but should mainly be used for factual information and exchange of experience and technologies. It was argued that a potential telematic network should make use of the most advanced technologies available today, and not use for example e.mail/InterNet as it in principal is an 'old and out dated technology'. On the hand, an advanced telematic network might fail because of lack of infrastructure and knowledge to use it, ie not enough science parks have access to ISDN, or can not take on the costs of implementation. An advanced service based on for example multi-media would most likely furthermore require a higher level of knowledge with the user. An implementation should instead be carried out from a market driven perspective. Starting with basic service with the option modular upgrading ie from textual e.mail to videoconferencing and/or image transmission. The actual uptake of these service should the provided on a demand basis, but obviously widely marketed.

1.12 Marketing and a supporting organisation then becomes very important for the success a network facility between science parks in Europe. The establishment of a professional organisation should therefore be the first initiative from the EU, a vehicle for this could be the IASP. Though it would need some help in becoming a more professional organisation. IASP also needs more hand-on experience. When the structure is created, it will be easier to implement the activities, which could include both human and telematic networking.

1.13 EU's role in this process should be limited to develop and pay for the initial investment. The actual diffusion needs to happen on a 'volunteer' basis, though the EU can help in this process with marketing and training. A potential telematic network should not be forced on anybody, if a manager of a science park is not interested, he/she should be left alone.

1.14 Services in a network between science parks should be a combination of human and telematic, where participation in, for example, workshops can help establish the first contact, and make the use of telematic easier. On a telematic network companies/science parks could create a small video film about themselves and project/product or technology offered/requested with the possibility of video conferencing, or it could be done on a purely textual basis.

Chapter Two

REGIONAL BACKGROUND - AMSTERDAM

2.1 Two facilities were visited in Amsterdam. Amsterdam teleport and Amsterdam Science park, the latter being mainly for spin-offs from the university, while the first is a business park with advanced telecommunication facilities, but not really a place for start-up companies.

2.2 Amsterdam has the highest concentration of universities and educational institutions in Holland and is characterised by being extremely international, both in its students and in the workforce. As an example, one teleport company requires its employees to speak at least 4 languages fluently. The turnover period for these employees is about 18 months and the company has no problem in filling the positions. Amsterdam also has a high technology base with two universities, a number of other schools and a lot of research & development facilities, like Shell R&D.

2.3 Economic development in Amsterdam is focused around four areas: tourism, distribution & logistics, service (banking etc) and knowledge city (the least developed). One of the biggest constraints for new businesses in Amsterdam is affordable premises. The science park is not seen as a major tool for economic development in Amsterdam, but is strongly supported by the municipality as a business location around the university, mainly for spin-offs from university, but also for local knowledge based SME and contract research. The teleport is viewed as high-profile business location with reliable communication facilities and good accessibility, nevertheless it is just one of four business location areas in and around Amsterdam.

2.4 The main locations for business development in Amsterdam are around the airport, harbour, teleport and to the south of Amsterdam. There is a very high unemployment rate in Amsterdam, especially in the centre. The Amsterdam Municipality is giving grants for companies moving from the inner-city to multi-tenants buildings in the outskirts, as they wish the renovate the inner-city buildings and only to have light businesses in the inner-city.

2.5 Amsterdam Teleport is placed in the centre of a huge traffic meeting point, there is a station in the middle with less than 15 min to the airport and less than 10 min the centre of Amsterdam. It is close to the ring-road and the harbour is just 'next door'. This combined with the communication infrastructure makes it a very suitable business location for bigger (and international) companies.

2.6 Amsterdam Science park is placed next to the university. It is hidden away behind the Ajax stadium and not easily accessible. The tenants have easy access the university facilities, both for research and work. There are good conference facilities with a good restaurant which the tenants can use free of charge as part of their rent.

Chapter Three

AMSTERDAM TELEPORT

Introduction

3.1 While the name should imply a highly sophisticated science park with a high degree of telematic services, the Amsterdam teleport is nothing more than a business park with a high level of telecommunication facilities.

3.2 Amsterdam Teleport (AT) was started in 1984 and the first building opened in 1988. Of the 40 hectare land 620,000 sqm is available for office space. Currently 70,000 sqm of office space has been built. The AT is created by three partners, Dutch PTT telecom, City of Amsterdam and the Teleport Development Group (a daughter company of a large real estate group). When the teleport was planned, the participants wanted to create a business park with telecommunication facilities secure for future expansion and development. The Amsterdam Teleport Development Group is coordinating the projects and responsible for marketing and site maintenance.

3.3 The AT consists of two types of premises: purpose built office space for single tenants (eg Elsevier Publishing group) and multi-tenanted office buildings. There are two such multi-tenanted buildings within the AT with tenants representing different industry sectors, though most are within the service sector. A number of the companies in AT have located here because of their demand for fail-safe and sophisticated telecommunication facilities including the European branch of SITA (international flight reservation system), and banks' dealing operations.

Telematic

3.4 When the teleport was built, it was prepared for companies needing high volumes of telecommunication traffic, but it has never had telecommunication facilities as the main focus. In the AT, two organisations have chosen to place their European call-centre (all calls in Europe are automatically re-directed to Amsterdam). Other companies in the teleport require a huge amount of lines and easy possibilities to expand their telecommunication facilities. The AT is currently supporting 5,000 jobs. About $2 billion has been injected into AT, of which 90% has gone into property investment.

3.5 The AT management themselves uses normal business communication facilities and leave the more advanced to the tenants of the teleport. The only truly unique feature of the teleport, is a double backbone communication line which means that if one public switch fails all traffic is routed to another public switch. From the management's side there is little knowledge about the tenants' use of telematics, except in the call-centres where an incoming call is detected by a computer which directs the call to an employee on duty who speaks the language of the country calling.

3.6 When Dutch PTT telecom moves into its new head quarters they will have a demonstration centre for ISDN and other telematic services.

Networking/Linkages

3.7 The marketing manager of the AT is working with national and regional public and private bodies in order to attract businesses to locate in the AT. They are currently working on creating a one-stop strategy for foreign companies, which will include all public institutions (Company registration, Dutch Inward Investment Department etc.), telecommunication facilities etc. The marketing manager is working with organisations involved in the economic development of the harbour, Amsterdam Promotion group (Inward Investment) and the national inward investment department.

3.8 In the AT, the marketing manager has created a business association for most of the tenants which is becoming a strong organisation on the operation of the teleport, ie lobbying the county for better road cleaning etc.

3.9 As the AT is mainly a property scheme, there was no interest is participating in a network between science parks in Europe. They also saw very limited use of exchanging information with other managers throughout Europe.

3.10 The World Association of Teleports, of which AT is a member, has completely changed its strategy. Previously they thought that teleports were going to be *the* place for telecommunication. They have now realised that technological developments have overtaken the concept. The organisation has therefore moved its focus to underdeveloped regions in the world (in terms of telematic infrastructure), including the south of Europe and Russia to help them develop their telecommunication possibilities.

Chapter Four

AMSTERDAM SCIENCE PARK, THE MATRIX BUILDING

Introduction

4.1 Amsterdam science park is a joint project between Amsterdam University, City of Amsterdam, RaboBank and NWO (Dutch Association for Scientific Research). The science park was started in 1985, after an initiative from the university. The RaboBank was asked to participate because of their previous success in creating a incubator centre elsewhere in Amsterdam.

4.2 The first phase of the science park consists of one building which is currently running at below its break-even point in terms of tenants. There are currently 20 companies in the science park employing 75 people, a 80% increase compared with last year. The next phase of the science park is under development and there are, in total, 40 hectares available for development.

4.3 The manager of the science park only works one day a week for the science park, as he has other commitments. There is an office manager in the science park who offers little, if no help to the companies on the science park, though he has close contact with them all. There is a good feeling of togetherness in the science park, but the park would probably benefit further from having a full-time manager who could assist some of the young companies better, and use more time for networking etc.

4.4 The university has the national computing centre which influences the focus of the science park, as 40% of the tenants are computer companies while another 30% are in electronic/engineering.

Telematic

4.5 The science park is linked to the university computer network which potentially gives tenants access to InterNet and related services. E.mail is used by some of the companies in the science park, mostly ex-academics who have taken the tradition with them from the university.

4.6 One of the tenants is using videoconferencing and multi-media in his communication with some of his contacts. The company has developed a PC-card for image and videotransmission, which is currently used in a number of Dutch state organisations. The manager of this company is currently working on implementing the system as the communication tool in a EU-medical programme in which the company participates.

4.7 In one of the university institutions, they are relatively advanced in their use of telematics. They are using an in-house video system for announcement of programmes and events. They are also currently working on adding videoconferencing internally and with their researchers at CERN.

Networking/Linkages

4.8 Being both the manager of a bank and a science park gives the manager a wide network of contacts for helping tenants. The manager is currently trying to establish a network between business centres and economic development organisations in Europe, of which he is the chairman of the Dutch association.

4.9 The companies interviewed were all involved in projects funded by EU and had a number of international contacts. There were a few service organisation on the science park who's contacts were mainly local within Holland. In general, the tenants saw their networking and linkages as sufficient. None of the tenants expressed a need to have more professional contacts, but would, of course, like to have more customers. In that respect they could see limited use for a telematic network between science parks in Europe as it was very unlikely that their potential customers would be on a science park. One company expressed an interest in the possibility of talking with other science park companies as they have some degree of similarity, ie they are very small.

4.10 There is a very well developed internal network. Companies in the science park either work for each other or seek each other's advice.

4.11 The manager works closely with the local municipality and the chamber of commerce, but the science park is also a member of a number of international organisations like IASP, AURRP, ICSB and UK Science Park Association.

4.12 The manager sees local contacts as very important for the daily operation of the science park. International contact is used for inspiration, and exchange of good idea/experience. The manager could see telematic as a tool for more efficient communication with his contacts, though he still preferred initial face-to-face contact, but with the use of other means of communication afterwards.

4.13 The area for telematic networking could lay within a professional framework, ie using it for finding technologies, companies and exchange of information/experience for SP managers. The manager expressed serious concerns about the value of such information, as updating quickly would become a critical issue. A way to overcome this problem would be to impose a discount/premium for correcting information.

4.14 In order for such a network to function, three main criteria must be fulfilled: people must know about the system, they must be able to 'see' it (demonstration), and finally the costs must be affordable.

4.15 For EU, this implies that they would mainly have to play a marketing and training role, as well as and a role in setting up an organisation which would service this facility. It was argued that if the EU paid the investment and operation costs, people would not perceive the value, and therefore not use it effectively. There should, therefore, be a connection fee, and on-line/search charges.

Summary and conclusion

4.16 The two science parks interviewed play a limited role in the regional economic development, one is seen a high-profile business location, whereas the other is seen as a business location of knowledge based companies in Amsterdam, though with limited space.

4.17 There is a high level of cooperation between different organisations in Amsterdam, all working towards giving the best service for (potential) companies. Public organisations are involved in the two science parks interviewed, though their activity is limited. Referral between organisations also seemed to work very well. Today all communication between the different partners is via normal business communication. It was argued that telematics might be a tool, but it would take a long time before it would replace the current methods.

4.18 The Amsterdam Teleport has a good and visible image in the public, whereas the Matrix building is to a large extent unknown.

4.19 The reactions for networking science parks were mixed, with one company arguing that the newest technology within video communication should be used, while others recommended bringing in a simple but workable option first, with simple technological requirements, and then developing it later.

4.20 All respondents argued that, of course, it would be nice if the EU paid for every thing, but in reality this might backfire and result in lack of use. If persons/organisation perceive a benefit from using a human/telematic network they will also be willing to pay for the service. The concept of EBN installing equipment and training sounded nice, but was really not needed.

Chapter Five

BIC BARBANT, TILBURG

Introduction

5.1 Tilburg is in the region of Barbant, which is an Objective 2 area. The region was previously the main textile and steel manufacturing area. The region is now hit by the general European recession, which in particular has hit the steel industry. Tilburg is a city with 150,000 inhabitants. In terms of regional development there is, at the moment, limited activity. Only one big initiative has been carried out. When the big auto-manufacture DAF laid off people the DAF CEO together with the BIC advised employees about how to start their own company, and offered counselling sessions.

5.2 The region does not have a strong presence in a particular industry sector, though textiles is still a significant industry.

5.3 The BIC was started last year (1992) and has at the moment four employees. The BIC also includes a venture capital fund which can help new businesses with starting capital.

5.4 The BIC focuses on industrial companies that have some kind of innovative idea and have had about 100-150 clients. The BIC offers advice and capital, but cannot at the moment offer any premises.

Telematic

5.5 The staff of the BIC work with normal business communication and use their computers for word processing etc. None of the staff has any experience with advanced telematic services, but could certainly see it as a tool to enhance their communication with part of their network, though most of their communication is local or national.

Linkages/networking

5.6 The BIC is mainly working locally with the chamber of commerce, the local innovation centre and the banks. BIC Barbant is a member of EBN and is using their services regularly. Their co-operation with the Chamber of Commerce is very close and one person from the BIC moves to the chamber one day every second week.

5.7 Most of the information/advice clients they are seeking is data on markets and on regulations (90%). They would therefore see little scope for being connected to an international network of science parks. They found the concept of BATORLINK interesting, especially if market data were to be included. They argued that it would be more interesting for them to be linked to other BICs in Europe. They are currently working on a big exhibition, where 160 European companies are meeting in Amsterdam. All the companies are clients of other BICs. The European Business days are initiated by the former CEO of the BIC and a private Dutch company.

5.8 In the communication with other people, face-to-face again ranks as essential for creating contact and trust, but every other means of telematics can be used for follow-up. It was argued that face-to-face contact is needed as soon as information goes beyond factual information (numbers, addresses etc).

5.9 EU's role in a potential implementation of a telematic network should be to provide information about the existence of the network and training in using it. They did not believe a fully paid system would be used effectively, as it would lack incentive. The question of security and confidentiality, plus the level of sophistication of information on the network was raised a major constraint.

Chapter Six

REGIONAL BACKGROUND - EASTERN HOLLAND

6.1 This regional description will cover two regions of Holland; Gelderland and Overijssel. Mercator Technology & Science Park is located in Gelderland and BIC Twente is located in Overijssel. There are three universities in the area; in Enschede, Nijmegen and Wageningen, the latter being an agricultural university. Both the two regions have Objective two status.

6.2 Each of the two regions has an OM (economic development) company (GOM and OOM), the OOM being the more active of the two.

6.3 Both areas are located close to Germany, which gives the region an ideal position of transport and logistical links and infrastructure. Gelderland is currently developing a logi-park as a transport node.

Gelderland

6.4 The region has a high level of education, and good knowledge infrastructure. The manufacturing sector is declining whereas the service and public sector employment is high in the region and higher than in the rest of Holland. There is structural unemployment in the region, which relates not only to the old industries since there is also high unemployment amongst higher educated people.

6.5 Gelderland has a strong foundation in the medical and pharmaceutical area with 5-6 very good hospitals in the region. Companies in the incubator centre have benefitted from this, since it is very easy for the companies to gain access to testing, knowledge etc. Another area of excellence in the region is Information Technology. Philips has its microelectronic development centre in the region, and the recent joint venture between AKZO and NOBEL Industries is also thought to benefit the region positively.

Overijssel

6.6 As in Gelderland, this region has been hit by the European recession. The region is dominated by three industry sectors, manufacturing with 25% of the workforce, services (hotels, restaurants etc) with 15%, and finally construction. Twenty five years ago the region was known as the textile area of Holland, but textiles still has a strong presence in the local industry, together with machine tools, and specialised fibreglass.

6.7 One of the regional initiatives has been to help the construction industry find work in the former Eastern Germany. The OOM has also created a project that gives scientist and entrepreneurs financial help to manufacture prototypes on inventions.

6.8 At the moment the BIC Twente in Enschede is part of the OOM, who also run a small incubator centre. The OOM and BIC have created 28 new businesses in the period from 1991 to January 1993. They are also working on the creation of a science park and a teleport in Enschede, mainly to attract foreign Direct Investments (FDI), and help more spin-offs.

Chapter Seven

MERCATOR TECHNOLOGY & SCIENCE PARK, NIJMEGEN

Introduction

7.1 The science park in Nijmegen is currently being developed, but the university has a small incubator centre which will continue to be the first step for start-up companies.

7.2 Up till now the manager of the incubator centre has also been the liaison officer for Nijmegen University, but when the Science park is built a new manager will be appointed who will also take over the managerial responsibility for the incubator centre.

7.3 The incubator centre was created mainly to help spin-offs from the university, but a few companies in the centre come from outside the university. There are currently 25 companies in the centre of which 20 are spin-offs. These 25 companies employ 120 people, an increase of 50% compared to the year before.

7.4 The incubator centre and the university are focusing on two areas, medical/bio-technology and IT. The centre has one of Holland's best computer training firms (UNIX-platform), which was started by a lecturer at the university. The medical/bio-technology firms has benefitted by having a university hospital next door. The hospital is a partner in the new science park, which will be specially equipped for bio-tech and medical firms.

7.5 The manager of the incubator centre and the project manager of the science park (who have a company in the incubator centre) are giving the start-ups some initial guidance/counselling in business management or marketing. One of the service companies specialises in helping start-ups, but on a commercial basis.

7.6 The new science park (Mercator) will be developed on land belonging to the university. The physical outlay will eventually consist of 8 buildings. Each building will be 3,600 sqm, but will only be built according to demand. The first building will be more or less full (70%) before the first brick is laid.

Telematic

7.7 The companies in the incubator are using a mixture of telematic tools, from normal business communication to communication mainly via e.mail (InterNet). The incubator is linked to the university's computernet, and from here to Internet and other academic network (national & international). A proportion of the tenants use this facility. The centre provides normal telephony services for its tenants. Interestingly, all services in the centre are run, or will be run by private companies, even the telephony services.

7.8 The manager himself and the project manager of the science park had very limited knowledge of the possibilities of telematic services. For the new science park they were planning to install state-of-the-art or nearly, in terms of infrastructure in the buildings. They also considering to build a CD-library or similar. Both these ideas are at a very early stage.

7.9 When the companies needed to do on-line database searches they used the University library facilities. They asked a qualified person to do the search, who then deliver the material to the company. It was argued that this was cheaper and more effective than learning to use the system themselves, both from a time constraint (management time in a SME) and money (equipment, dataline etc.).

Networking/Linkages

7.10 As the manager of the incubator centre is also the liaison office for the university, he has a lot of contacts with industry and public organisations. He has been the prime author of the application for the Objective two status for the region and therefore plays a significant role in the regional economic development.

7.11 The manager works closely with all local and national organisations, but had limited international contacts. Currently the manager is working to create a human network between four universities, two in Holland, one in Germany and one in Belgium for exchanging information and experience in technology transfer and liaison between industry and university. The manager could see a benefit in having a telematic network for maintaining the contacts, but would still need to see/meet on a regular basis face-to-face.

7.12 All the liaison officers at universities in Holland meet once or twice a year to exchange experience etc, but also have some contacts throughout the rest of the year.

7.13 All the respondents interviewed perceived their networking and linkages as being sufficient, though all would like to have more customers. Networking and linkages both with customers and professionals (associations and scientists) were viewed as being very important for the operation of their business.

Chapter Eight

BIC, TWENTE

Introduction

8.1 The BIC itself is located as part of the OOM in the industrial area of Enschede. Part of OOM work is a Business Technology Centre (BTC), or incubator centre and currently has 40 businesses operating. It is very difficult to distinguish between the different activities of the OOM and BIC in their every day operations.

8.2 The OOM has an international department of 3 people, working all over the world trying to attract foreign investments to the region. Part of the OOM is also working as a venture fund providing start-up companies with capital with an investment limit of 4 mio NLG in one company. The normal investment is around 1-2 mio, and never more than 49% of the capital of the company.

8.3 The BIC/OOM works with around 10 new clients a year, they only count a request for help as a client if they are assessed to have a real business potential. They are presently working with eight clients.

Telematic

8.4 The BIC has just received a computer from EBN with software and training for EBN's network. The manager of the BIC used normal business communication and was not inclined to start using the e.mail in the BIC network preferring to let his staff do that. He recognised that telematics could be an effective means of communication, but had no interest in learning how to use it himself.

8.5 The manager had no knowledge about whether the tenants in the incubator centre have access to the university network, or whether they have external link themselves.

8.6 The OOM is currently developing an inter-active computer system to provide potential foreign investors with basic information about the region.

Networking/Linkages

8.7 The BIC manager has a very close network with local organisations of which all were located within walking distance of his office. As the manager prefers face-to-face contact he mostly walks over to see relevant people.

8.8 As already mentioned, there is close collaboration between the OOM, the BIC centre and the university, which now is leading to the establishment of a science park.

8.9 The BIC centre is member of EBN and of TII, though the latter is used rarely. The membership of EBN is used as an important tool in their work, with visits to EBN's offices in Brussels every 2-3 month, combined with frequent contacts via telephone/fax. The manager did not expect the communication to become frequent with their e.mail connection, but this would make communications easier.

8.10 It was argued that a potential network between science parks in Europe should be limited to 'information services'. The services could contain information about technology transfer opportunities and company information. The network should furthermore be a combination of human and telematics, as regular face-to-face contact is essential for sustaining good contact.

8.11 The scope of the network in terms of participants should also be considered very carefully, as too many and to diverse organisations would loose focus. The argument for this reservation was due to experience that most problems/questions are solved locally or on a regional basis and international contact is very rarely needed.

8.12 Most of the information/advice the BIC is using today is market information, though the manager could see the possibilities of learning from other BICs especially in areas of spin-offs, how to find starters and the management and organisation of a BIC.

Regional Background - North of Holland

8.13 The north of Holland has for a long time been the least industrially developed region of Holland. Traditionally is was, and still is the agricultural region of Holland. The government has taken a number of initiatives to develop the region including huge infrastructure projects including a big new harbour, and an airport which lack demand and is mainly empty.

8.14 The region around Groningen is characterised by a high proportion of consultancy companies, plus an attempt to establish an industry in bio-technologies and value added food processing.

8.15 There is a high unemployment in the region. The average age in Groningen is under 30 because of the large number of students. There are in total 38,000 students and a population of 175,000. Forty per cent of the unemployed are highly educated people, as a result of students finishing their studies and staying in the region.

8.16 NOM, the regional economic development company is targeting unemployment as their main focus. They hope to solve part of the problem through Zernike Science Park and inward investment. This is in addition to the normal initiatives like retraining etc. As the other five OM companies in Holland is NOM also providing venture capital. They are also shareholder/investors in the Zernike seed fund.

Chapter Nine

ZERNIKE SCIENCE PARK/ BIOSCIENCE PARK, GRONINGEN

Introduction

9.1 Zernike Science Park was founded in 1984 with financial backing from the Ministry of Economic affairs and Ministry for Education and Science and other non-profit organisations.

9.2 The objective of the SP is to help establish spin-offs from university and to minimise the rate of unemployment. There are currently 44 companies on the SP, employing 350. The initial investment was NLG 10 mio, and the seed fund founded in 1992 has NLG 15 mio.

9.3 Today Zernike Science Park consist of a management company with 8 divisions performing different tasks in the operation of Zernike Science Park:

- a property management unit
- a business school (training to-be entrepreneurs)
- a seed fund
- marketing & sales of new technologies and products
- funding for short-term project development
- patent & licensing office for the university and SP
- coordination of providing information, laboratories and other research from profit centres at the university

9.4 The concept is different from most other science parks in Europe because the management team has a share in the Zernike Science Park seed fund. This gives a strong initiative for the management to get involved the success of the companies in the SP. The services available for the companies are very extensive. The management normally gets involved in writing the business plan and helping with the initial market research. The management will normally also place a person on the board of the company to oversee their 'investments'. As a consequence of all these services, 34 persons are involved in the operation of the SP.

9.5 In the process of nurturing spin-offs into business the management operate a two step model. First they fund the project to determine the commercial potential, or to establish a market. In this period the business is recommended to stay in the university. Once the business idea has proven its potential, it is moved to the incubator centre in the Science Park.

9.6 Businesses that grow and are successful have three options, growing from the incubator, into the Business centre which offer bigger premises, then to build their own premises on the land belonging to the SP. Finally, the company can also chose to move elsewhere. Because of the way the Zernike Science Park was founded with public financial backing, the rent for entrepreneurs is cheaper then elsewhere in Groningen.

9.7 The Zernike Science Park seems to be a very unique place in which to work and develop a business. On the other hand the SP appears to be very dependent on the manager, who has all the contacts and drive for the operation of the organisation.

Telematic

9.8 The science park management is using normal business communication, they have the option to get access to the university's computer network. None of the companies in the science park were linked to e.mail or similar. Several of the companies provide remote facilities and have access on-line databases etc.

9.9 One of the companies visited was using on-line database search, and the others could see telematics as a tool for more effective communications with their partners/customers, but regarded security as a big constraint. One company was accessing on-line databases for papers etc. as well as keeping track of EU-projects through the ECHO-database.

9.10 The science park management has a pragmatic approach to telematics. They inform the tenants about the possibilities in the university computer centre, but will not install any advanced telematic in the science park unless a number of tenants actually request it. On the other hand they understand they must be able to give the tenants the opportunity to access advanced telecommunication services when needed.

Networking/Linkages

9.11 The manager of the science park has contacts all over the world and believes that networking is an essential tool in operating a science park and helping companies. To a large extent the manager believes that initial face-to-face contacts are essential but that other means of communication can then be used to maintain contact.

9.12 As with all the interviewed persons the manager thought that his networks were sufficient. He participated in a number of formal networks, and is the president of IASP (International Association of Science Parks), an organisation he would like to see become the host of any potential network. With the reservation that the network should be fully international, or at least fully European, and not only the 12 EU-member states.

9.13 All the respondents in the science park expressed the view that there was a good internal network for exchanging information and helping each other out. This was one of the reasons for locating on the science park, together with the adjoining university and its facilities. Most of the companies had started their companies in the university environment which meant they still have close contacts with the university.

9.14 Companies felt that they had sufficient contacts for their professional interests, but could see an opportunity to find agents/distributors for their products in other EU-countries through a telematic network.

9.15 A network requires a professionally operated organisation behind it, which IASP is not currently geared to do. The manager argued that a network would need to have both a human and telematic element. A network should first and foremost be established to help the SP manager in their managerial operations, though a service which comprised factual information about the science park and its tenants could be a helpful tool.

9.16 A problem in creating an information database is the actual value of the information, as this tends to get out-dated quickly. The manager's idea, around this question was to let the host organisation have a taskforce that travels to each science park to gather information, and promote the network. These people could also act as trainers, their services should be paid through membership fees.

9.17 It was argued that the human part of a network is needed to create the first contact, and that the 'beer' in the bar becomes important for whom you keep in touch with. Telematic networks can then be used for maintaining contact. The sophistication of the network is a difficult question. Since advanced technologies like video adds value to the communication but also require a higher investment from the user. It might therefore be useful to create a system that can be developed using ISDN and similar technologies which are becoming more widespread and cheaper. The EU should not pay for the services, but should restrict their involvement to the initial investment in setting up the organisation and collection of information. The EU could subsidise the costs of on-line searches for the first year, and help the host organisation during the first three years. If, in that time the network not is cable of running as non-profit organisation it should be closed down.

9.18 The manager of the science park does not think language should be a problem, as most people manage to speak with each other in English if needed. English should therefore be the only language of communication on a telematic network, unless there is a cheap and powerful solution to provide translation without loss of information.

IRELAND

Chapter One

INTRODUCTION

1.1 The science park movement, which originated in the United States in the 1950s, is premised on the hypothesis that advanced technology is the key to industrial regeneration. Since the 1960s when radical industrial development truly began in Ireland, much investment has been made in the development of a competitive and innovative industry. This has been done through investment in education and research (to invent a local high tech industry) and in attracting high tech multinationals (to co-opt a high tech industry from which to "breed"). Science parks have played a small but important role in carrying out these objectives, although they have been neglected by policy makers in recent years. However, a renaissance in the science park movement could be taking shape.

1.2 The fundamental importance in cross-border linkages is recognized by all, and so in this report, the relevant frame of reference is the island of Ireland rather than solely the Republic of Ireland. Northern and Southern Ireland naturally share many of the same socio-economic characteristics as well as objectives for development. Segal Quince Wicksteed Ltd was asked to review the development of science parks and business innovation centres on the island of Ireland, consider their networking and communication needs and identify possible lines of action.

1.3 This report is structured as follows. Chapter two provides an overview of the current Irish context in which these science parks are developing. Chapter three reviews the planned Dublin Science Park. In Chapter four, we consider the experience of the National Technological Park Plassey in the Mid West region. Northern Ireland and the Antrim Science Park are addressed in Chapter five, and finally, conclusions and recommendations are presented for Ireland in Chapter six.

Chapter Two

OVERVIEW FOR THE ISLAND OF IRELAND

Economic characteristics

Republic of Ireland

2.1 The Republic of Ireland (RoI) is a relatively young country by demographics and terms itself the "Young Europeans". There is great enthusiasm and interest in the European Union across a population which has benefitted substantially from EC funds over the past decade. In social and cultural characteristics, the RoI has more in common with the more industrially advanced nations. This is clear from a comparison of participation in education between the ages of 14 and 24. Ireland has a strong skills base.

2.2 However, in economic terms the country has more in common with the less industrially developed countries within the European Union, namely Greece, Portugal and Spain. The Republic of Ireland is called the "South of the North" as it shares common problems of high and long term unemployment, traditional low technology industries, over-dependence on agriculture and an underdeveloped innovation system. As in other Southern countries, the capital, Dublin, hosts the great majority of industrial and research activity. Decentralisation will be an important objective for the coming years.

2.3 The RoI economy grown at a faster rate than the Community average in recent years (average annual growth in GDP of 4.9% over the period 1989 to 1991 as compared to the 2.2% average for the Community). The driver for growth has been export performance, which continues to grow and strengthen. Weak domestic demand and low investment rates have put paid to any higher rates of growth in GDP. In 1993, investment was only 15.8% of GDP in the RoI compared with the EC average of nearly 20% of GDP. Furthermore, unemployment continues to be high relative to other Member states. In 1993, the unemployment rate was 16.7% and was forecast to rise to 17.1% in 1994. A factor in this rise is the high net inflows to the labour market relative to the number of jobs available.

COMPARATIVE STATISTICS	Republic of Ireland	EC 12
Basic statistics		
Relative GDP per capita, 1991 (PPS index)	69	100
Unemployment rate, 1991	16.8%	8.6%
Population, 1991 (million)	3.5	328.7
% Population 14-24 in Education, 1989	50	43
% Gross Value Added by Sector, 1988	**1993 figures in bold**	
Agriculture	10 **13**	3
Industry	37 **28**	35
Services	57 **59**	61
Exports of goods as a % GDP, 1991		
All exports	56	22
• Destined Intra-EC	43	14
• Destined Extra-EC	13	8

"Ireland: Shaping Factors", The European Challenges Post-1992, p. 292.

2.4 In fact, the rise in the unemployment rate has been dampened by the resumption of significant net outward migration from the RoI. This renewed trend has possibly been stimulated by upturns in the UK and US markets. Within this overall migration pattern, the policy makers have raised strong concern about the Irish brain drain.

2.5 The Irish economy continues to be more dependant upon agriculture than most European countries, however this sector is highly export orientated and is the focus of new industrial development initiatives. Industry represents 29% of all employment in RoI and 37% of GDP; two-thirds of this sector is related to manufacturing. As in other developed countries, services represents the largest sector by GDP (57%) and is growing as a proportion. A worrying trend from 1988 to 1993 is the increase in importance of agriculture and a decline in industry.

2.6 In reviewing the economic characteristics of the RoI, we are presented with an aberration in terms of rising growth in GDP but poor levels of investment and recession-like levels of unemployment. The cause of this aberration is the well-documented dichotomy of the RoI economy. Strong industrial performance is provided by the externally owned companies which have grown vigorously but have yielded little employment growth, while the indigenous industry - which has significant potential for job creation - has stagnated.

Culliton report

2.7 In 1992, the Government-appointed Industrial Policy Review Group was established to review and to redesign the RoI's industrial strategy for the 1990s. Later that year the Review Group published its report, known as the Culliton Report after the committee's Chairman.

2.8 The Review Group took into account the key problems facing Irish industry, of which a core issue was the dichotomy developing between the externally-owned and indigenous, and devised a number of policy measures, including tax reforms, new directions for state investment in industrial infrastructure, agency rationalisation, improvements in training and reduced but more focused grant support for industry. Clusters were advanced as a means to identify areas national comparative advantage and to build on them. The error in the previous strategy to develop industrial competence through foreign high tech industry was that the industries targeted (pharmaceuticals and chemicals) bore no relation to indigenous competence. By doing so, the Review Group believes that Ireland may finally bridge the separate economies operating currently. A Culliton Task Force was established to bring these policy measures into being.

Policy makers

2.9 As a result of the Culliton Report, the Irish Development Authority (IDA) and the Irish Science and Technology Agency (EOLAS) were restructured to better serve industry. Two new agencies, IDA-Ireland and Forbairt, have been created. IDA-Ireland addresses inward investment, while Forbairt is responsible for implementation of all areas of policy which affect indigenous industry. A new policy making body, Forfás, provides policy strategy and coordination between the two implementing agencies.

2.10 There need to be changes in other policies. Because of the very low taxation on industry, multinationals have tended to locate their profit centres in Ireland while locating their cost centres - such as their R&D facilities - in other countries (particularly as Ireland does not offer any tax concessions on R&D carried out).

Northern Ireland

2.11 Northern Ireland (NI) has a population of 1,589,000 and is under Objective 1 status for Community funding. It is by far the most economically disadvantaged region in the UK. In 1993, unemployment stood at 14.6% compared with 12.3% in the North of England which ranked second. Furthermore, long term unemployment has been a significant drag on the province's economy and indicates fundamental structural weaknesses. Economic development policy in Northern Ireland, like the RoI, is to strengthen indigenous companies and to attract high technology inward investment.

2.12 Over the period 1992 to 1993, manufacturing output in Northern Ireland increased by 5%, compared with 3% in the UK, and productivity increased by 8.6% (8.1% in the UK). Three key sectors which improved were timber and furniture, chemicals and mechanical engineering. However, two of the largest industrial sectors in Northern Ireland, drink and tobacco and footwear and clothing suffered falls in output. The regional economy is still overly dependant upon traditional, low technology industries.

2.13 Inward investment into Northern Ireland has been predominantly in low technology activities which require only a semi-skilled workforce. This stands in sharp contrast to the high profile investments made in Scotland (Silicon Glen), Wales (Japanese investors) and the RoI which has attracted multinationals based on new technologies in IT, electronics and pharmaceuticals. Northern Ireland has lost some of its competitiveness in attracting more high quality investors; this is due in part to the decision to discontinue low taxation agreements and substantial capital grants as well as to the completion of the Enterprise Zone status of many regions in the province. Nevertheless, ten substantial investments took place in 1992 with some matching funding from government in the microelectronics, chemicals and textiles sectors.

Policy makers

2.14 There are two industrial development agencies for Northern Ireland: the Industrial Development Board (IDB) and the Local Enterprise Development Unit (LEDU). In March 1992, a third agency was established which would have sole responsibility for the promotion of research and development in NI industry. This agency is the Industrial Research and Technology Unit (IRTU).

IDB

2.15 The IDB has three areas of activity: inward investment promotion, home industry support and corporate services. Within inward investment promotion, the IDB spent 127 million ECU in attracting 10 new projects to Northern Ireland, including Seagate Technology (a US microelectronics company) to Londonderry and Texmaco (an Indonesian textiles manufacturer) to Antrim. The inward investment team concentrates on a small number of target sectors, namely automotive components, IT, medical technology and electronics. The IDB's home industry focus relates to the larger companies in need of new and expansion projects, sectoral initiatives, strategic development planning and investment. Finally, the corporate services section provides marketing development assistance (including export intelligence, trade fairs and trade missions), Advisory to Industry (ASI) which is managed by the Northern Ireland Technology Centre based and Queen's University in Belfast, property and a corporate rescue service.

2.16 IDB has been the principal sponsor of the Antrim Science Park and now it is also a sponsor of the Ulster Science and Technology Park. However, there is no mention of its policy on science parks or a description of these parks in its Annual Report. It is fair to assume that the IDB does not consider science parks to be a fundamental resource for industrial development in Northern Ireland.

LEDU

2.17 LEDU is the small business agency, and it has recently undergone a significant internal reorganisation. It has divided the small business community into four relevant sections: pre-start, start-up, established and growth firms. In 1992/3, LEDU spent 30 million ECU in supporting these various groups. The focus in LEDU is now on providing effective support services to small business rather than maintaining a simply funding role. LEDU provides a wide range of good small business support related to areas such as exports, sourcing, networking, subcontracting, total quality management and joint ventures.

2.18 LEDU's support for innovation is concentrated in the ***Innovation Programme***, which has been established recently with funding from LEDU. The Programme provides practical help and a team of professional advisers to support indigenous original technology based firms to grow and succeed. This is done via financial assistance (the ***Northern Ireland Innovation Programme Start Up Capital Fund***), business support and training for management, assistance in acquiring premises and a promised special link to the HEIs. The Innovation Programme is a relatively new organisation, but it has already received attention from the media. It is significant, however, that none of the literature provided by LEDU and the Innovation Programme makes any mention of the role of science parks in supporting innovative small firms.

IRTU

2.19 IRTU is the Government unit responsible for the development and delivery of the strategy for collaboration, networking and technology transfer to support research and development in Northern Ireland. In this delivery, IRTU provides an extensive range of financial and professional support services for industrial R&D. IRTU is part of the Northern Ireland Department of Economic Development. As such, it coordinates its activities with the IDB and LEDU. IRTU has a Board of Directors, which includes the Chairman of DuPont (UK), who is also the Chairman of the Board, and the Chief Executive of IRTU, who is the Government's Chief Engineer and Scientist in Northern Ireland.

2.20 There is also a regional R&D strategy focused on innovation and competitiveness, industrial and academic collaboration and market led product/process development. A network of industrial/academic cooperation with key centres of capability and a strong EC dimension with R&D networking is featured in IRTU's innovation promotion literature. Within the document Research and Development Capability in Northern Ireland, centres of excellence are described together with the innovation assistance available in Northern Ireland. However, nowhere in this document is there a reference to the science parks in Northern Ireland.

2.21 IRTU provides assistance in four areas: consultancy help (technology audits, environmental audits, technical advice, specialist scientific advice); technology transfer (information and advice in research, design, patents, visiting engineers, graduate placements); EC funding, support and networking (access to STRIDE, PRISMA and the Framework Programme, partner search); and research and development (access to EUREKA, the UK DTI Link and SMART schemes as well as other funds). IRTU is the Value Relay Centre for Northern Ireland. IRTU's own Industrial Science Centre has over 100 scientists and engineers available for contract R&D and technical support to industry, including advice on IPR, measurement, testing and information services.

2.22 Within the island of Ireland, there is a developing technological cooperation in key areas such as ceramics technology, advanced microelectronics, environmental technologies, rotational moulding, custom synthesis, interactive systems, medical informatics and advanced telecommunications. This cooperation works on all axes: government, industry and academia.

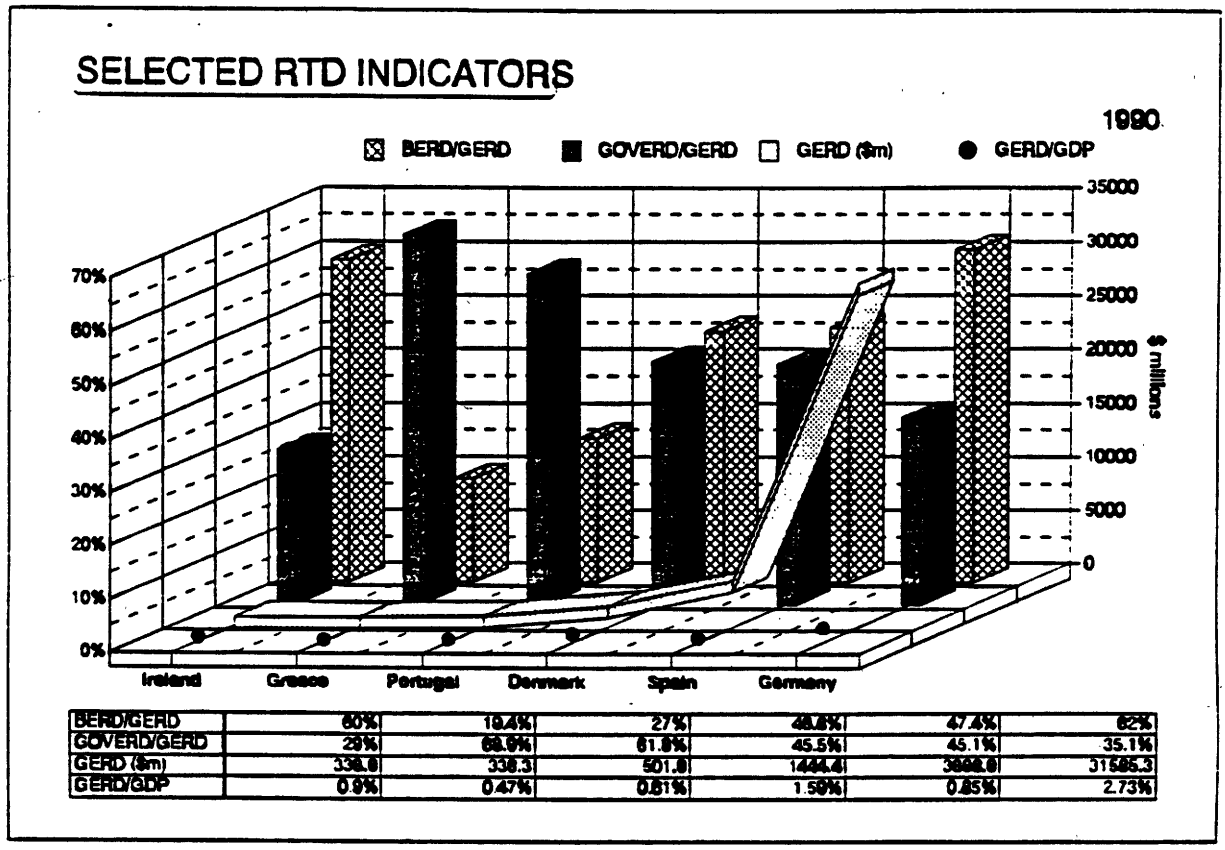
RTD on the island of Ireland

Republic of Ireland

2.23 Ireland is one of the weaker countries in Europe in the area of research, technology and development. Less than one percent of GDP (.9% in 1990) is spent on RTD, compared to 2.73% in Germany and 1.59% in Denmark. (see figure 1) However, the proportion of industrially funded R&D (BERD) out of all R&D expenditure is relatively high at 60% and within the EU is second only to Germany (62%). The big industrial spenders on R&D are the electronics (35% of BERD), pharmaceuticals, chemicals, food, instruments and software. Foreign-owned companies are crucial to this high proportion; they account for nearly two-thirds of all industrially funded R&D.

2.24 Development of the RTD system has been actively supported by the Irish Government for the past decade and has been greatly assisted by Community funds for RTD. Notable developments include the establishment of industrial liaison officers at both the universities and regional technical colleges (although for most institutions these officers have yet to make much impact), the provision of grants for collaborative R&D between industry and the HEIs, R&D placement programmes for graduate students and senior technical staff, and the Programme for Advanced Technologies (PATs).

Figure 1: RTD Comparators



BERD/GERD	60%	19.4%	27%	48.6%	47.4%	62%
GOVERD/GERD	28%	68.9%	61.8%	45.5%	45.1%	35.1%
GERD ($m)	338.6	338.3	501.8	1444.4	3868.8	31585.3
GERD/GDP	0.9%	0.47%	0.61%	1.58%	0.85%	2.73%

2.25 The PATs were designed to development through units in the Irish universities new technologies in niche areas of relevance and industrial applications. In principle, their focus was to bring relevant technology to industry. In practice, this mission has been interpreted differently. For some PATs, this has meant that they should develop new technology and spawn a new industry. For others, this has meant an imperative to develop applications for new technology that should be of interest to Irish industry. The onus now is to involve more industry representatives so that the PATs are developing technology which will truly benefit industry.

Northern Ireland

2.26 The role of innovation and a corresponding increase in investment in R&D is considered essential in promoting competitiveness and growth. The level of industrial R&D in Northern Ireland is comparatively low. This is due in part to the structure of NI industry, which is dominated by traditional, low technology businesses and micro enterprises. The skills level in the workforce has also been evaluated as inadequate for growth in high tech sectors. In general, the two Northern Ireland universities - the Queen's University and the University of Ulster - do not rank at the forefront of UK research, although there are notable exceptions in both institutions.

2.27 The Northern Ireland Economic Council carried out a study on RTD carried out within the province in 1991. The study determined that industrially financed R&D (BERD) in Northern Ireland represented 0.44% of GDP, compared with 1.09% in the UK, 0.55% in the RoI and 1.78% in Germany. Most of BERD was dedicated to applied research or technological development. Big spenders on R&D were the electronics and electrical engineering sector as well as the food, drink and tobacco sectors. Nearly one-half of BERD was carried out by companies employing over 500. In total, 41% of externally controlled companies carried out R&D as compared with only 29% of indigenous firms. Such externally controlled industry-based R&D centres include Du Pont, Short Brothers plc, Northern Telecom, Randox and Norbrook Laboratories.

2.28 UK-financed regional public R&D expenditure (Regional GOVERD) was 28.7 million ECU in 1991 in Northern Ireland or 0.2% of regional GDP and was roughly average to the percentage expended in other regions of the UK. In addition, 8 million ECU in R&D funds were drawn from the EC Framework Programmes (and an additional 39 million ECU from other technology related Community initiatives). Northern Ireland has had a traditionally low take up of RTD funding under the Framework Programmes.

2.29 The Queen's University of Belfast and the University of Ulster both undertake research on behalf of industry and government. In 1991, income from research grants and contracts as a proportion of total income was 12.7% for Queen's University and 4.7% for the University of Ulster. The UK average for all universities was 21.4% in the same year.

2.30 From this study, the Northern Ireland Economic Council made several observations and recommendations for the future. There was a recognized lack of direction in NI research and development policy which had to be redressed. With its establishment, IRTU was given responsibility to set out an R&D strategy based in part on the findings and recommendations of this Council. Broadly, three aims were set out:

- to increase private sector awareness of the value of R&D
- to modernise traditional, low technology industry
- to stimulate the growth and development of new high technology industry.

2.31 IRTU was recommended to review RTD progress and policy regularly to monitor goals. One of the first policy recommendations was to evaluate the role of the Antrim Technology Park.

RTD Policy

2.32 In both the Republic of Ireland and Northern Ireland, economic pressures have forced a more short term policy window for the support of research and development. RTD policy has been measured largely in terms of direct economic impact and job creation rather than as a long term investment programme for sustained competitiveness. There are signs in both that this short termist position is changing and that linkages between industry and the research base are critical for wealth creation from RTD activities. Relevance to industry has been highlighted as the leading condition for new policy measures and RTD support.

2.33 However, it is interesting that Northern Ireland and the Republic of Ireland have restructured the responsible governmental agencies in precisely opposite fashions. The Republic of Ireland has brought together RTD policy and industrial development policy executors under the same agency (Forbairt), arguing that synergies between the two policy areas are essential. Meanwhile, Northern Ireland has split out all of the RTD policy executors from the Department of Employment and Development agencies (IDB, LEDU, etc) into a new and independent body, IRTU.

Technology diffusion

The role of science parks

2.34 On the island, there are four science park schemes either existing or in development. In the Republic of Ireland, there is the National Technological Park Plassey, which was established 10 years ago, and the planned Dublin Science Park. In Northern Ireland, two science park schemes have been developed: the Antrim Science Park and, more recently, the Ulster Science and Technology Park.

2.35 Science parks have not been favoured over other economic development tools and in some cases have been rated less highly. Science parks are seen as an inward investment tool and as an innovation tool to support indigenous growth companies. As such, policy makers compare science parks with other policy tools to achieve these objectives. As an inward investment tool, comparisons are made with other high tech property schemes and direct grants to desirable multinationals. As an innovation tool, comparisons are made with collaborative research schemes, programmes in advanced technology (PATs) and placement programmes. Given the short term policy window held for many years, science parks do not look very attractive as they take a lot of resource and time to reach maturity.

2.36 Things may be changing. The National Technological Park Plassey was regionally determined and led. With the Dublin Science Park proposal, the government is now revisiting the role of science parks on a national basis. It may be a positive sign that in late January 1994, the Minister for Enterprise expressed his support for the establishment of a science park in Dublin at a cost of 12.3 million ECU and potentially a total of 4,000 jobs. The tally of jobs rose to 8,000 in articles related to the Park in March 1994, which included the multiplier effects anticipated from the investment.

2.37 Private developers are becoming more of a feature of science park development on the island of Ireland. The planned science park for Dublin is supported through a consortium of universities, the Dublin Chamber of Commerce and the relevant governmental agencies. However, an initial submission to the EC SPRINT programme for a science park in Dublin came from a property developer. The Ulster Science and Technology Park also has involvement of a private developer.

Business innovation centres

2.38 There are four business innovation centres (BICs) operating in the Republic of Ireland and one in Northern Ireland. In the RoI, these BICs are located in the major cities: Dublin, Cork, Limerick and Galway. All of the BICs are affiliated with the local university to different degrees. In the case of Dublin, the BIC has to relate to several universities and regional technical colleges and is therefore more self-standing. In Limerick, the BIC is part of the regional development agency, Shannon Development. Both the Limerick and Dublin BICs are an integral part of the science park for their area.

2.39 Incubators have also developed at many of the RoI universities, most particularly in Dublin, and it is anticipated that all third level institutions will have incubators within a few years. The Dublin BIC and the local university incubators do meet and discuss things regularly. However, these university incubators have no formal linkages with other innovation centres or BICs outside of their region or country.

Communications on the island

Republic of Ireland

2.40 Significant investment by the EC STAR and Telematique programmes have developed a very strong telecommunications infrastructure in the RoI. Over 90% of all transmissions in the RoI are delivered through digital technologies. Telecommunications applications have also been supported and promoted through these programmes. However, the flagship Minitel project has been a disappointment; the Minitel service has never been taken up by the public and has now been superseded by more superior and internationally compatible technologies.

Telecom Eirann

2.41 The Minitel project belies the growing relationship between Telecom Eirann (TE) and France Telecom. Telecom Eirann's commercial strategy has been based on some of France Telecom's experience. A key project for the future is the roll-out of ISDN. TE has taken the view that ISDN will not be a premium service but a standard product for its customers. As such, they have priced ISDN very competitively (about half the costs of British Telecom). Eventually, they expect 60% to 70% of their ISDN customers to be small and medium size enterprises (SMEs) and the critical markets for ISDN will be the printing and publishing industry, security firms, the financial sector, public services (eg health) and broadcasting.

2.42 TE is promoting ISDN through demonstration centres and sectoral seminars. However, TE's approach to "provide the market for ISDN". ISDN applications are being left to an important group of suppliers which TE is nurturing. These suppliers include many of the collaborative research centres in RoI such as the National Microelectronics Application Centre and the Letterkenny Information Technology Centre, both of which will be discussed later in this report.

2.43 TE supports a commercial telematics network, EIRPAC, which has 6,000 customers. The network was improperly marketed with the emphasis on the technology of the network rather than the applications available on it. It is likely to lose many of these customers with the introduction of ISDN as EIRPAC has only been used as a cheap alternative to leased lines. HEANET is the university telematics network, which has a 128 kb line and is packet switch based (X.25). HEANET now includes the regional technical colleges. HEANET does not allow any commercial traffic at this stage, but the grey areas related to all academic network usage applies here.

2.44 Telecom Eirann has a protected monopoly on voice transmission within the RoI, but international communications are open to competition. BT is its biggest competitor for international communications and as a result of this competition, the cost of international communication has dropped significantly. Full deregulation is scheduled for 1998 but may be delayed until 2003 if a case for protection can be made.

Northern Ireland

2.45 British Telecom (BT) is the principal PTT for Northern Ireland. Mercury Communications is also available for long distance communications within the province. In fact, many of the key issues in telecommunications for Northern Ireland are shared with the UK (including the academic network JANET) and have been addressed in the UK country report under the SP-NET study. What is unique to Northern Ireland is the extensive investment in telecommunications which has taken place since the mid-1980s.

2.46 Over 1,000 miles of optical fibre and 45 local switches in the Integrated Services Digital Network (ISDN) have been installed. Now the Northern Ireland network has the highest density (per head of population) of fibre and switches in the UK. Significant investment in telecommunications was made under STAR and Telematique, both of which were delivered via the IDB. STAR helped to finance the extensive fibre optic network and digital switches. In 1993, STAR funded a demonstration unit within the North East region of the province. This demonstration unit was fitted with high speed computer based communications and was established to demonstrate the benefits of such communications to local industry, such as tenants from the Antrim Science Park which is located in this region. BT itself has made significant investments in Northern Ireland, locating its Cellnet Directory Assistance and BT Services divisions within the province.

2.47 In recent years, Telematique has financed the development of advanced telematic applications and as well as supported the growth in demand for these services. More than 100 companies in Northern Ireland were allocated almost 1.3 million ECU under the Telematique programme for enhanced access to advanced telematic technologies and services. The IDB also held a one day Telematique exhibition to demonstrate the benefits of advanced telematic technologies to NI industry. Roughly 500 representatives from industry attended this seminar.

IT developments

2.48 Specialist centres for IT were established in the mid-1980s to help foster and develop IT in industry. These centres include the CIM Centre in Galway which conducts automated manufacturing research, the CAD centre for the textile industry in Londonderry (at Magee College) and the Information Technology Centre in Letterkenny, which is most relevant to this study.

2.49 The Letterkenny Information Technology Centre (ITC) was established in 1988 to promote advanced telecommunications, multimedia services and software solutions for industry. The ITC is a business service provider which conducts telematic audits and IT solutions for small business, develops multimedia and other ISDN applications in coordination with Telecom Eirann and participates in EC research projects. The Centre was a bottom-up development as the Letterkenny Regional Technical College had been receiving an overwhelming number of requests from SMEs to provide IT training and consultancy.

2.50 The ITC hopes to eventually develop an incubator and perhaps a science park based on the skills and momentum of the ITC, which draws its research talent from the Regional Technical College. There is already spin out activity from the ITC, particularly in the field of multimedia applications. The ITC believes that IT can be a platform for economic development in the rural region surrounding Letterkenny, but as a region, it has attracted little attention from the national government. The ITC hopes to leverage more national support by accessing support from the Commission.

Chapter Three

DUBLIN (Dublin Science Park)

3.1 The Republic of Ireland has been described as a one city nation. The Dublin Metropolitan Area is the single largest conurbation on the island of Ireland. Dublin is the principal hub for finance and industry. Roughly 70% of R&D carried out in Ireland is done so in Dublin. The European Economic Research and Advisory Consortium recently ranked Dublin as the European city with the second highest growth prospects in the 1990s (Barcelona ranked first and Lisbon was third).[1]

3.2 Although the unemployment rate is slightly higher in Dublin than the national rate (18% vs 16.7%), the metropolitan economy has been successfully diversified. The area is now focusing on its comparative advantages, which include a highly skilled workforce, world class telecommunications and a major international airport. Telecom Eirann will be establishing Ireland's only Metropolitan Area Network for Dublin in the near future. The new International Financial Centre, which is a teleport itself, has already attracted much attention from the communications-driven industries (insurance, trading houses, etc).

3.3 The software industry is very important to the Dublin economy. An estimated 70% of software companies in RoI are Dublin-based. The IDA have indicated in the past that Dublin was establishing itself as Europe's main software capital. The pharmaceuticals industry is another prominent industrial sector which has enjoyed strong growth in recent years.

3.4 The proposed science park for Dublin has been introduced as a mechanism to weave together all of these local strengths into an economic drive for the future. The consultants estimate that within five to 10 years the park could create as many as 6,000 to 8,000 jobs, half of which would be created on the Park itself.

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[1] May 1993.

Inception of the Science Park

3.5 It has been observed that Dublin is endowed with the critical mass of universities, industry and research institutions to develop a world class science park. While the city is well catered for in terms of incubator facilities and larger scale premises, there is a gap in the provision of unique space for knowledge-based growth firms ready to leave the university incubator. A first motion to establish a science park came from the Innovation Centre at Trinity College in the late 1980s.

3.6 In the early 1990s, a Park development consortium finally came together under the leadership of the Dublin Chamber of Commerce. Its members include the Chamber of Commerce, Dublin Corporation/County Council, Dublin City University, Dublin Institute of Technology, Trinity College, University College Dublin, Dublin Business Innovation Centre and the IDA. Eventually a proposal was submitted to the EC SPRINT Science Park Feasibility scheme in 1992. Through this funding, a detailed feasibility study has been completed, and the Park project is now awaiting endorsement and financial support from the government.

"A science park is fundamentally a process, not a property development."

3.7 The park will be used to attract inward investment of high tech foreign companies and specifically mobile R&D projects; its second objective will be to develop indigenous knowledge-based industry. Manufacturing will be allowed on the Park as an essential link in the chain of innovation. As set out in the study, the success of this park depends on its ability to develop and grow innovative indigenous firms as well as to effect technology transfer between all of the Park partners.

3.8 One of the partners, the Dublin City University (DCU), has proposed that the Dublin Science Park benefit from the experience of the Research Triangle Park in North Carolina. The DCU President sees similarities in North Carolina of 1959 and Ireland of 1994: high unemployment, declining traditional industries and a strong skills and research base fostered by excellent third level institutions which produced graduates who had to emigrate to find employment.

3.9 The Dublin Science Park is expected to cost 11 million ECU excluding land costs. The intention is to locate the Park on a 400 acre site in Abbotstown, which is in the northwest of the city and four miles away from the city centre. The site currently houses the veterinary research centre and is adjacent to a food research centre.

Promoters of the Park

3.10 If supported, the Park will be owned and guided by a partnership of public and private investors, although the government would hold the controlling stake (51%). Key within the group of promoters of the Dublin Science Park are Dublin's four third level institutions: Trinity College, University College Dublin, Dublin City University and Dublin Institute of Technology. The Dublin Chamber of Commerce played an instrumental role in bringing all four institutions to the table in a cooperative spirit.

3.11 In the fieldwork programme, it was possible to meet with three of the promoters of the Dublin Science Parks which will play strategic roles in the development of the Park.

Trinity College

3.12 Trinity College is the strongest research university in the Ireland and it enjoys worldwide recognition, especially in the fields of electronics and microbiology. Its research budget in 1993 was approximately 14.1 million ECU, of which 35% was provided through research contracts with industry. There are several important R&D centres related to Trinity College. In addition, some companies are also establishing R&D laboratories on site,,including Hitachi and Elan. The College's impression is that multinational companies use their research services and local industry does not. Trinity is anxious to widen their market to indigenous companies.

3.13 The incubator at Trinity College was established in 1988. They have supported over 22 companies to date (with an attrition rate of 10%). Currently, 65% of incubator companies are on a the Trinity computer network, and they have to pay for access. In practice, the university is not policing the companies' use of HEANET. The incubator is at 100% capacity, and the manager has to turn many projects away. Trinity College is land-constrained and cannot develop further incubation space. Together, the desire for better linkages with industry (indigenous and foreign) and the need for additional space have fuelled the College's interest in the science park.

3.14 There are good linkages between the Innovation Centres at University College Dublin, Dublin City University, Dublin Institute of Technology and Trinity College. They meet about once a month to discuss issues. In addition, Trinity belongs to the UDIL Association, which is a UK/RoI network of the University Directors of Industrial Liaison. In this Association, participants share experience. There are informal links with a similar US group and have had visits from the University of Pennsylvania Innovation Centre, Northwestern Innovation Centre as well as the Groningen Science Park. Trinity would like to have more cooperation with other Innovation Centres in Europe to share experience, to undertake training programmes on methods to support innovative firms and other issues of relevance.

3.15 Trinity College is supportive of the planned science park, but are concerned that the loss of geographical proximity will make it difficult to develop linkages. They believe that the incubator companies will not want their first step out of the Innovation Centre to be a very big step away from Trinity College, which it will be if the science park is built on the chosen site.

University College Dublin (UCD)

3.16 University College Dublin is the second largest third level institution in Dublin. It has a smaller research budget (about 9.8 million ECU of which contracts with industry contributes 13%), but they are nationally recognized for their expertise in engineering, veterinary science and agriculture.

3.17 UCD has developed a well-known University Industry Programme (UIP), which has a budget of about 7 million ECU and was initiated in 1992. The Programme is really only underway now as it had an aborted start. The UIP facilitates commercialisation of university borne research. Assistance in patenting and licensing, new enterprise development, a continuing education programme, and University Industry Centre (for conferences and training), and advisory service to researchers about how to get research funding, etc. The Programme employs eight staff and has a Management Board, comprised of representatives from UCD (6) and industry (6), and chaired by the new Managing Director of Digital. Thus far, they have assisted in filing 10 patents and in negotiating 5 licenses. These have been related to agriculture or veterinary science.

3.18 The UCD Innovation Centre has supported over 20 companies, including some of whom have come from abroad (a german company attracted to Ireland because of the tax exemptions on royalties). There is one joint venture in the Innovation Centre between Proteus plc and UCD researchers in diagnostics and vaccines for veterinary medicine. The Centre is at 100% capacity with several proposals outstanding. Unlike Trinity College, UCD is by no means land-constrained and could easily develop a next stage space for its incubator tenants. However, UCD is cash-constrained at present and thus the science park was supported as an alternative to further development on site. The UIP staff also believe that the young companies would benefit from being close together and near to high tech multinationals. However, the university is also concerned that emphasis will be heavier on developing inward investment at the Park and to demonstrate a success in property terms.

Dublin Business Innovation Centre (DBIC)

3.19 DBIC was established in 1988 and it has a wide representation on its Management Board, including the Forbairt, the Dublin Chamber of Commerce, the four third level institutions in Dublin and the private sector. The present Director was recruited from the private sector in 1990 to take over in a "rescue" attempt. The "rescue" was a success, and the Centre is entering into Phase 3 of its development (a five year strategic plan is in place).

3.20 DBIC provides a full service package to their clients: management training, innovation support, space and finance. They have a staff of nine people. The Centre promoted and launched the first seed capital for Ireland with initial capitalization of roughly 1.2 million ECU. This fund owns equity in nine companies. As a BIC, DBIC also has an internal seed capital fund with a capitalization of roughly 250,000 ECU which has been invested in 10 clients. DBIC has a lot of expertise to share with a new science park.

3.21 The four Irish EuroBICs meet from time to time. Each has been established to mirror the needs of its host region. As a result, they do not always have the same orientation or strategy for conducting their activities. The Limerick BIC is part of a regional development agency and it has inherited the agency's pastoral orientation and is funded from other Shannon Development activities. The Dublin BIC has origins in the private sector and has had to become partly self-financing fairly quickly (a minimum 50% of funding has to be generated).

3.22 The present Director sat on the Executive Board of EBN for 1991-92, and he recognizes that there have been many changes in EBN since 1990. It has improved as a service organisation and is a reservoir of good information. DBIC now plays a godparenting role with the newly established BICs in Poland, Hungary and Czechoslovakia, where the Director has been part of the design team.

Likely tenants

3.23 In appraising the likely indigenous company tenants of the Dublin Science Park, the feasibility points to the 138 companies currently based in university incubators across Ireland and a further 82 which have already moved to bigger accommodation. The consultants have also earmarked several important multinationals which may be interested in moving operations to the Park. These include information and communication technology giants such as Lotus, Microsoft, Intel, Fujitsu, as well as pharmaceutical companies (Squibb and Linson).

Communications

3.24 Good communications will be fundamental to the success of the Dublin Science Park. It seems likely that the Park will become a node on the Dublin Metropolitan Area Network (MAN). Without questions, the four third level institutions will lobby to be on the MAN.

Networks

3.25 Networks underpin the conceptual framework for the science park. The park feasibility study outlines four stages of growth of high tech indigenous companies: embryo, nurture, fledgling and maturing. The study maps the current provision of support in Dublin to each of these areas, drawing in the university incubator centres, the Dublin Business Innovation Centre and other IDA Enterprise Centres which will all feed into the Dublin Science Park.

3.26 The pivotal position at the Dublin Science Park will be the "University Industry Manager", who will have the full-time responsibility of developing linkages between the three sides of the science park triangle: the research base, indigenous companies and multinationals. Despite the geographical distance, the University Industry Manager will attempt to provide a "one-stop shop" for access to the expertise in all of the associated third level institutions. This individual will have to be trusted and accepted by all four industrial liaison officers at the third level institutions and by industry. Appointment of the right individual will not be a light matter.

3.27 The promoters of the Dublin Science Park have expressed interest in participating in relevant international networks. They believe that there is more to learn from others outside of the RoI. Europe is clearly the most important area of interest, but it is actually easier at times to network with US organisations. Ireland is perceived as a backward nation in Europe, whereas in the US, Ireland has a position of intellectual and cultural parity (although not economic). At present, they are not part of IASP and would like to benefit from the wider European experience in the future. During the feasibility study, the science park experts played this role but the study is now finished.

Key challenges

3.28 A number of key challenges face the Dublin Science Park, and a few of these are listed here:

- **Will it fall between four stools?** It is impossible to overstate the importance of actively creating the linkages with the four third level institutions and industry. The distance and resulting scepticism will act against the success of the Park.

- **The transition between the university incubators and the science park is essential** but likely to be a problem. Companies taking their first step out of the incubator like to retain some of the same facilities which have been provided by the university. In some cases, individuals are also maintaining a part-time teaching post. Some companies may try to find premises around the university itself instead (particularly around UCD).

- **There is scope for improved cooperation in Ireland.** It is important to set up linkages with the National Technological Park Plassey. Many Plassey firms have business in Dublin, and many Dublin firms may want to sell to companies (especially the big ones) on the National Technological Park Plassey. The current representative from Forbairt in the Dublin Science Park consortium was involved with the establishment of the National Technological Park Plassey, and he may be able to establish these linkages.

- **Irish incubators should be brought into the wider science park/incubator networks.** Incubators at Trinity College and the UCD have many areas in common with St Johns Innovation Centre and Groningen Science Park, but there is little awareness one about the other. Furthermore, parks in planning like Dublin Science Park should be brought into the IASP arena as soon as possible.

Chapter Four

THE MID WEST (National Technology Park Plassey)

The Region

4.1 The Mid West of Ireland includes counties Limerick, Clare and North Tipperary, which together represent a population of between 300,000 to 400,000. The region is the site of the deepest estuary in Ireland and thus it is an important resource for marine science. Traditionally, this has been a predominantly rural area with large stocks of dairy and beef cattle. Since the industrial development programmes of the 1960s, the Mid West has become an important region for the IT, electronics and health care industry sectors largely through significant inward investment. Important tools in the inward investment campaign have been the International Free Zone/Shannon International Airport, the University of Limerick and the National Technological Park Plassey.

4.2 The city of Limerick is the third largest urban centre in Ireland with a population of 100,000 (Cork is the second largest). In recent years, the city has undergone a regeneration through the improved economic performance of the region. Investment by important multinational corporations such as Wang, Dell Computers, Johnson & Johnson and the Cook Group have increased local prosperity and the city has benefitted through the development of new social and cultural amenities as well as increased trade.

Shannon Development

4.3 Unlike other regions in Ireland, the South West has had a regional development agency for the past 30 years which has profoundly shaped the region. Shannon Development, this agency, was first established to meet the challenge of redirecting the airport infrastructure, which had been built to provide a refuelling service for trans-Atlantic flights and which had since become obsolete in this respect with the introduction of new airplane technology. It is the only integrated regional development agency in Ireland.

4.4 At present, Shannon Development is divided into two areas of activity: economic development (cost centres) and commercial activities (profit centres). Within commercial activities, Shannon Development own and manage several properties including Shannon International Airport, the International Free Trade Zone, the National Technological Park Plassey, as well as many tourist attractions within the region. Shannon Development also has consultancy and investment arms which generate income. The income generated by Shannon Development is put towards the many economic development programmes and services offered within the region. In recent years, the agency has been able to cover 70% of its overall costs through income earned. This more commercial model of a regional development agency was loosely based on Lancashire Enterprises in the UK.

University of Limerick

4.5 Until 1971, there was no higher education in Limerick (despite its importance as an urban centre in Ireland). The University of Limerick (at first known as the National Institute for Higher Education - NIHE) was established as part of the wider industrial development strategy, and as such, it was developed as a radically different third level institution to the other universities existing in Ireland. The University was based in part on the Massachusetts Institute of Technology model and was designed to provide a technologically based education more suited to the needs of modern industry.[2]

4.6 Shannon Development was one of the agencies which sponsored the development of the University, and thus close links between the two organisations were in place long before the development of the National Technological Park Plassey.

Telecommunications in the Mid West

4.7 Heavy demand for advanced quality telecommunications has become a feature of the Mid West largely because of the multinational companies established there. Although the majority of the regional network is copper, a great deal of fibre optic cabling has also been used where there is a demand for high capacity requirements. Both the International Free Zone and the National Technological Park Plassey have fibre optic connections. Limerick has been chosen as one of the first four cities where ISDN will be available (some multinationals are already using SDI cables which are a precursor to ISDN). There is a demonstration centre in Limerick for ISDN (specifically Group 4 fax, video conferencing and multimedia). While Dublin is the only city for which a MAN is planned, there is a possibility that Telecom Eirann will provide a spur to Limerick if the demand is sufficient.

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[2]An OECD study in the late 1960s identified a number of gaps in the skills base in Ireland, particularly in the technical fields such as engineering and electronics.

4.8 There are areas within the Mid West that are not comparatively well catered for in terms of telecommunications. The amount and type of services provided are geared to customer density and customer needs.

Challenges for the Mid West

4.9 The "branch plant syndrome" is a concern for the Mid West which has built much of its economic strength on foreign high tech companies in computer hardware and health care. Given the declining profitability in computer manufacture and the pressure on profits in the health care sector, the Mid West region will focus on diversification as well as growth in indigenous companies.

4.10 Accompanying this need to balance and strengthen industry within the region, organisations in the Mid West are conscious of the nationwide brain drain. Young highly skilled graduates are finding more challenging and lucrative employment in other countries. According to one consultee, there are an estimated 1,000 Irish engineers in Japan at any one time. New policies are being devised to help counteract this diaspora of Irish talent through entrepreneurship programmes (to invent high tech Irish industry) and through industrial R&D grants and collaborative projects (to make existing Irish industry more innovative and technologically advanced).

4.11 To begin to address these challenges, one regional policy being advanced is the notion of the **Shannon Technopole**. As a technopole, the region would seek to improve linkages between the different actors in the innovation process and to improve coherence in strategy and action. The National Technological Park Plassey would play a pivotal role in the technopole as the primary interface between research and industry.

National Technological Park Plassey

4.12 The National Technological Park Plassey (NTPP) was created as a regional development tool in 1983 by Shannon Development, the IDA (the Irish Industrial Development Authority) and the University of Limerick. Shannon Development had purchased the land surrounding the University as the site for an innovation centre initially. The NTPP was not consciously planned as a science park at the outset, and from 1984 to 1989 had a loose structure of management and development. Since 1989, the NTPP has had a much more strategic and structured path of development.

4.13 The NTPP comprises 260 hectares bounded on three sides by the River Shannon. There is direct access to the main Limerick-Dublin trunk road (the N7), and the Park is only 20 minutes from Shannon International Airport and the International Free Zone. Advanced telecommunications are part of the basic infrastructure of the Park due largely to the cornerstone multinational technology-based companies which require such facilities.

4.14 There are currently 80 organisations on the Park which in total employ more than 2,000 people. The Park itself is at Phase 2 in its development, and the remaining 100 hectares in the Eastern segment of the site are now being serviced. It is estimated that 300 million ECU worth of new private and public investment will take place over the next few years, adding another 1,000 plus jobs to the Park. In 1994, there is already in place 49.2 million ECU from the private sector for construction of new sites in the Eastern segment.

Park Management

4.15 The National Technological Park Plassey Ltd is a wholly owned subsidiary company of Shannon Development and its offices are located in the heart of the Park. The company was established in 1990, and it reports to a Board of Directors which includes representatives from Shannon Development, University of Limerick, Forbairt as well as private companies on and off of the Park. The Management company is relatively small, employing only 2.5 full time staff, and has responsibilities for the planning and development of the Park in its widest sense: physical and infrastructural developments as well as processes of innovation, linkage and technology diffusion.

4.16 In practice, the Management company relies on Shannon Development to provide assistance in completing these responsibilities. For example, Shannon Development plays a role in promoting the Park within Ireland. The IDA carries out overseas promotion and marketing with the exception of the Euro Technopole which Shannon Development alone promotes. In addition, small business support services offered more widely by Shannon Development are also channelled through the NTPP. As part of Shannon Development, the Park Management company is on the Shannon Development network and has access to the Internet. The Park Management team are avid users of E.mail and file transfer.

4.17 1994 saw the appointment of a new Park Director as the previous Director took a newly established post within the University to develop a strategy for stronger university-industry links and collaboration. The new Park Director was the previous Marketing manager for the Park for several years and is very familiar with the Park's strengths and weaknesses. She has a lot of drive and enthusiasm to work on the more elusive features of science parks - technology transfer in its widest sense and NTBF nurturing.

Innovation Centre

4.18 In operation for ten years, the Innovation Centre was established by Shannon Development to foster and support new technology-based, export-orientated indigenous companies in the Mid West. The Innovation Centre Manager is a trained engineer with substantial experience in support for new starts and innovation. The Centre is housed in Enterprise House and is an integral element within the NTPP. On a personal basis, the Innovation Centre Manager and the Park Director liaise closely on development plans.

4.19 The Innovation Centre currently supports 22 companies on site. The Centre team has seven staff members and provides on-site business and innovation support as well as premises management. Tenants have access to shared services and facilities, including access to the Business and Technical Information Service. After they leave the Innovation Centre (most will stay up to three years on an increasing rent scale), the Innovation Centre provides an "after care" service to help companies make a successful adjustment.

4.20 The Innovation Centre sponsors a very successful Entrepreneurs programme, which is a six month programme led by an experienced entrepreneur and supported by experts from a wide range of disciplines. Candidates for the programme have to pass selection tests and programme fees are charged. The programme is nearly always full. After individuals complete the programme, they are supported either at the Innovation Centre or if they take up premises elsewhere in the Mid West, they are still supported by Shannon Development business development managers. On average, 30 candidates from the Mid West enter into the programme, around five of which will come from the Park and the University, as well as a handful from outside the region.

4.21 Like the Park Management company, the Innovation Centre team are on the Shannon Development network and are avid users of E.mail and file transfer. In addition, they have a telematic link to EBN which they use but find sometimes to be a case of "information overload". Some of the tenants in the Innovation Centre use dial up modems or gain access via University contacts to HEANET. There is no plan in place at this stage to set up a local area network for the Innovation Centre or to otherwise make investments in advanced telematics.

4.22 The Plassey Innovation Centre is a member of EBN and NBIA. In practice, EBN is a good source of contacts at other incubators, although the organisation itself can be a bit bureaucratic. Within EBN, there are a range of styles in innovation centres, and it would be valuable to have the opportunity to meet and share experiences with a sub-group of innovation centres which have similar objectives and responsibilities to the Plassey Innovation Centre. Overall, there needs to be greater emphasis on practical information and advice rather than conceptual discussions. They understand that the EBN databases are very good and would like to access them in future. The NBIA is also a good forum for cooperation and experience sharing. The Plassey Innovation Centre used the NBIA telematic support network, BATORLINK, for a while but found it too orientated to the US to be of much value to them. A European version would be of more interest, and potentially the EBN network could develop in that fashion.

4.23 A key challenge for the Innovation Centre is to develop more programmes to encourage students from the University to look at innovation and entrepreneurship. One mechanism may be the development of a Student Resource Centre in the Innovation Centre which provides information aimed at students looking to establish a new technology-based or otherwise innovative firm. Students should be brought to the Innovation Centre as part of their introduction to the University.

4.24 In addition, the Innovation Centre would like to foster linkages with business innovation centres in Eastern Europe. The Manager recognizes real potential in finding trading and research partners for her tenants with their counterparts in Eastern Europe. At this stage, however, she is not sure how to take this interest forward.

4.25 In addition to the Innovation Centre, Enterprise House brings together two other support centres: the Women's Business Development Centre and the Wood Technology Centre. The Innovation Centre is closely linked with these other two.

Women's Business Development Centre

4.26 The Women's Business Development Centre is a new venture supported by Shannon Development and the European Commission. It is the first in Ireland to focus on the specific needs of women entrepreneurs. The Centre provides business information and training, contacts and advisory services, and was established as part of an EC project to support women entrepreneurs throughout the Union. As such, the WBDC has transnational partners in all Member States.

Wood Technology Centre

4.27 The Wood Technology Centre was formed two years ago as a joint initiative of Shannon Development and the University of Limerick. It provides technical advice, training and business support for wood related industries in the Shannon region. The Business Development Centre is housed at Enterprise House and shares many facilities with the Innovation Centre. Part of the Wood Technology Centre is the Research and Development Centre and the Centre for Furniture Testing, both located at the University of Limerick.

Features of the Park

4.28 On the NTPP, there are several interesting features emerging which will distinguish this science park across Ireland and Europe.

Euro Technopole

4.29 The NTPP has a unique feature developing - linkages with the Japanese. The Euro Technopole idea emerged four years ago and was initiated by the IBIC, a Japanese industry association. The Euro Technopole is now being jointly marketed and developed by the IBIC and Shannon Development to companies in Japan, particularly Japanese SMEs looking for an easy entry into Europe. The Euro Technopole will be dedicated for Japanese investment in R&D, manufacturing and trading enterprises which want to take advantage of the European market. Construction of the first building is underway and should be completed in 1994.

4.30 The focus of the Euro Technopole is to help Japanese companies adjust to European conditions and culture. Ireland has an advantage in being English speaking and lower cost than the UK, and the NTPP has the local advantage in the presence of multinational companies in IT and electronics, which are potential customers or collaborators of these Japanese SMEs, and a strong IT and electronics engineering university which provides a steady supply of highly skilled, relatively cheap labour. Already there are four actual projects being set up on the Euro Technopole. The Park Management company expects this to be a "slow burn" project.

International Science Centre

4.31 One of the built space centres on the NTPP is the International Science Centre, which is located within the University complex. It is dedicated to organisations that wish to develop closer research links with the University, and as such all tenants have access to the University local area network. In practice, the International Science Centre has housed branches of foreign multinationals. Three such organisations are now located in the Centre:

- the BHP Group, a contract R&D company which provides range of technical and management services to industry and Ireland and Europe

- the Boart Group Technical Centre Ltd, the branch which conducts all R&D for Boart Group companies worldwide

- Sumicem Opto-Electronics (Ireland) Ltd, which manufactures and sells fibre optic couplers and is a subsidiary of Sumitomo Cement.

International Business Centre

4.32 The International Business Centre provides space for less research intensive although technology based companies. One of its most notable tenants is the Institute for Scientific Information Ireland (ISI Ireland). ISI is the world's largest provider of secondary source information in the sciences, social sciences, arts and humanities. Information is provided in print, microfilm, on line, magnetic tape and CD-ROM. The other notable tenant is Travelers of Ireland Ltd, a subsidiary of the Travelers Corporation, an insurance and financial services giant. world leaders in insurance and financial services. Located in the International Business Centre is the Remote Programming Facility, which is engaged in the development and enhancement of data processing applications for the parent company, and the Pension Services Division, which processes and maintains pension data for the US market. Communication to Travelers in the US is done via a 64 kb digital private circuit carrying voice and data.

Plassey Enterprise House and Enterprise Centre

4.33 Start up space is provided at Plassey Enterprise House. Nearby, second stage space is available at the larger Enterprise Centre. Both sites are nearly at capacity.

Other features

Seed capital

4.34 Plassey Seed Capital fund has recently been established on the Park by Shannon Development and private sector investors with an initial capitalization of IL.5 million. Venture capital is in desperate supply in Ireland; there is only one other seed capital fund which is based in Dublin. The Plassey Seed Capital fund will invest in small high technology companies and it will take a very hands on approach. It has not made any investments to date, although there are five projects under review at present. The Fund has had difficulty in getting its initial capital in place from the private sector because of a national lack of interest in equity investment. This culture will only change with greater financial incentives and demonstrations of the gains in equity. The Fund manager believes that science parks across Europe should be supporting seed capital funds as an integral part of fostering new technology-based firm development.

Amenities on the Park

4.35 The NTPP is well resourced in terms of the amenities on site, which includes the four star Castetroy Park Hotel and Conference Centre which is used extensively by the companies and the University. All tenants on the Park can take out membership of the University Club, which is an expensive but elegant dining club and meeting place. In general, the University Club is used by the large companies on site. There is also a new Concert Hall in the Foundation Centre, a Plassey Park Creche and a golf course nearby. All tenants have access to University library, swimming pool, track and playing fields. The Park is surrounded by an appropriate housing estate and schools.

Park Tenants

4.36 On the Park, there are several types of organisations located: foreign multinational branches and subsidiaries, indigenous high tech companies, R&D organisations, education and training organisations and other service organisations (both public and private). In practice, the indigenous high tech companies are quite small and involved in development, manufacturing (the more mature companies), and sales. The foreign multinationals are involved in either manufacturing or data processing. Both IT and electronics characterize the industrial focus of the Park.

Foreign multinationals

4.37 Several foreign multinationals have set up manufacturing or processing sites on the NTPP. Johnson & Johnson, the US health care giant, will be establishing operations on the Park shortly. This investment is part of the Park's strategy to diversify into new industries. This group includes:

- Wang — a US company which carries out computer systems integration and distribution; software manufacturing and computer hardware services on site
- AST — a US company in manufacture of computer products which has just set up on the Park
- Cabletron Systems — a subsidiary of a US company which manufactures network interconnection products to enhance communication capability of computers
- Aster — a US company which carries out R&D and manufacture of fibre optic systems on the Park
- ISI — a subsidiary of the US JPT Publishing Group Company
- Travelers — a subsidiary of insurance and financial house, Travelers US.

Indigenous high tech companies

4.38 Most of the indigenous companies on the Park are technology-based companies and are quite young and small. There are a few larger companies, such as Calibration Specialists, which provides electrical calibration services for a wide range of test and measurement equipment. However, the majority are at an early stage in their development and are located in the Enterprise House or the next stage space, Enterprise Centre.

Optopos

4.39 Optopos is a small company (staff of three full time and one part time) which manufactures pointing frames including turnkey systems for public information systems. An example of the company's work is the multimedia kiosk which provides information for the London Underground at London Heathrow Airport. With a touch screen, visitors to London can get directions to where they want to go on the Underground.

4.40 The company has been in business for two years and is located in the Innovation Centre (where it started). One hundred percent of their business is exported, while 90% of their inputs are sourced locally. Optopos has also participated in an EC research project. The founder of the company is not from Ireland originally, but was attracted to locate in Ireland and in the Mid West because of the local environment. The company will stay in the Innovation Centre because it is a supportive, albeit expensive environment. Optopos use the Business and Technical Information Service (BTIS) available on the Park for market and technical intelligence.

4.41 Optopos is currently using a dial-up access to EIRPAC and Eurokom for E.mail and file transfer to partners in the EC research project. In fact, they identified their partners for the project through the Eurokom network. The company's customers are strictly telephone and fax based. As Optopos is a multimedia company, it will need to have an ISDN access to be able to send files to other collaborators and eventually customers. When ISDN becomes available in May 1994, the company will pay for ISDN installation at the Innovation Centre.

4.42 Optopos believe that it should be part of the ethos of a science park or innovation centre to provide technologically up-to-date interconnectivity via telematic access. Good communications will be a necessity for high tech firms in the near future. Furthermore, in this context access means "on the desk" access; otherwise companies will not use telematics effectively because it cannot become part of the organisation's core activity.

Mindware

4.43 Mindware designs, develops and markets computer-based training programmes for computer networks and telecommunications. They also carry out contract development for DOS and Windows. The company employs 12 and was established in 1988 in Dublin. After a management changeover, Mindware moved to the Mid West and to the Park in 1990. The Park was chosen as an appropriate site because of its profile and its facilities. Mindware uses the Business and Technical Information Service which it finds to be very good at market intelligence and specific company details. The company has also hired four staff from the University since its relocation to Plassey.

4.44 The business is largely with clients outside of Ireland, including the UK, continental Europe, the US and Canada. One of their clients is Deutsche Telecom, which has had an important developmental impact on Mindware through assistance in accreditation and a push to use ISDN. At present, Mindware uses only conventional means of communication but they will pay for ISDN when available in order to work with clients like Deutsche Telecom.

4.45 Mindware is also interested in access to the Internet as a potential medium for distance training. It is currently working with another Park company, Plassey Management and Technology Centre Ltd, on distance learning programme for training in telecommunications and network support. Other new areas for development include disk-based training, Eastern European markets and multimedia training in the long term.

4.46 The company would be interested to know what companies are located on other science parks to consider new customers or strategic alliances. Mindware staff attend conferences like CEBIT, but other than that they know about other training companies and new training technologies through trade journals.

R&D organisations

4.47 There are several contract R&D organisations on the Park as well as centres under the National Software Directorate's Programme in Advanced Technology (PAT). In the consultation programme, two of the most important organisations were interviewed.

The National Microelectronics Applications Centre Ltd (MAC)

4.48 The National Microelectronics Applications Centre Ltd (MAC) was established in 1981 to actively improve competitiveness in Irish industry via applications of information technology and electronics. The MAC which has a staff of 12 undertakes contract development of new and improved electronics, software, telematics and information technology products and processes.

4.49 The MAC has three main areas of business: technology development support for small business, contract R&D for large companies and service contracts for the public and private sector. Approximately 50% of the MAC's business is with small companies and start ups, for which the MAC provides technical advice and commercial strategy in the exploitation of new and improved technology from the pre-feasibility stage through commercialisation. Within this package of services, the MAC provides pre-feasibility consultancy, technical and commercial viability studies, sourcing strategies, design consultancy, patent searches and production methods assessments. For large companies, the MAC has provided contract R&D in process automation and ISDN teleworking consultancy. Service contracts include participation in several EC research projects as well as the contract to be the sales agent for DIALOG in Ireland. In addition, the MAC supports an on-line Minitel VISTAR bureau, which allows firms to cost-effectively commercialise their PC-base or ASCII applications on the Minitel network. In addition. the VISTAR Irish Business Information and Public Procurement Intelligence service offers information consultancy and DIALOG training.

4.50 Approximately 90% of their business is based in Ireland, with 40% based in the Mid West. The MAC is located in one of the university buildings and is near to the electronics and computer engineering departments to encourage collaboration and technology diffusion. Of the small companies or start ups which have been supported by the MAC, very few have come from the academic staff at the University of Limerick although a fair number have come from the University students. The MAC plays an important role on the Park and is involved in many of the activities and discussion groups which take place. The MAC is represented on the Innovation Board for the Park, which will be discussed in 4.73.

4.51 At present, the MAC has an ISDN link as well as several dial-up links to communicate with its larger customers and its EC research partners. Smaller companies prefer personal contact or telephone and fax communication at most. The MAC has itself reviewed the information needs of small to medium enterprises in the Mid West for one of the EC research projects (ESPIN). In this study, they determined that the information needs of small companies were closely related to day to day problems. Communications channels tend to be informal and satisfied by telephone calls to personal contacts. These firms expressed an interest in accessing other, more formal sources of relevant information, but felt limited in their ability to define their own information requirements effectively and to carry out a thorough search.

4.52 The MAC drew an important distinction between encouraging use of advanced telematics in companies for which these technologies will bring an incremental improvement to the functioning of the firm and in companies for which advanced telematics technology is fundamental to the business (multimedia companies, remote service companies). In their view, supporting the latter group of companies will lead to a step change in international industrial competitiveness, and this should be a feature of science parks in Ireland.

Multimedia Centre

4.53 The Multimedia Centre is one of the software PATs. It was established in 1992 at two locations: Trinity College, Dublin and the University of Limerick. The Centre's remit is to develop and maintain a leading edge in multimedia applications and to foster the growth of the Irish multimedia industry, which is a cottage industry at this stage. Part of its responsibility is to encourage technology transfer from university competence in multimedia (at Trinity College and the University of Limerick) to industry, both the multimedia industry itself and other industries which can gain from the technology (the communications industries - publishing, media and advertising).

4.54 The Multimedia Centre, which has a staff of 12, has to walk a difficult line between supporting the Irish multimedia industry and earning revenue to maintain its existence. The Irish Government policy is that PATs must be more commercially based and partially (if not wholly) self-financing. The Centre therefore provides a number of fee-earning services in contract research (which provides 20% of the Centre's budget) and equity investment in multimedia companies (none yet). Although the Centre has developed multimedia applications for several tourism agencies and leisure facilities, an important element in the contract research fees is funding to participate in EC research projects.

4.55 In fostering multimedia, the Centre has sponsored several awareness raising conferences and seminars for industries which will benefit from multimedia technology. They have also helped to establish the Irish Multimedia Group, which currently has 50 member companies and three of which are located on the Park. The companies are international in focus, and they recognize the need to network and share skills for successful multimedia applications. Multimedia is an interdisciplinary technology by definition. The Multimedia Centre strives to "fill in the gaps" for these companies in trying to bring a multimedia application to commercialisation.

4.56 As the Centre is at the forefront of multimedia applications, provision of telecommunication services will always be a problem. The Centre will always require more capacity and sophistication in its telecommunications than other users. Its applications will already overwhelm the newly established ISDN lines. This Centre requires broadband communications and is currently lobbying for a spur to Limerick from the Dublin MAN.

Education and training organisations

4.57 Naturally, the University of Limerick is the principal education and training organisation on the Park. It is also an increasingly important research organisation as will be discussed.

University of Limerick

4.58 The University of Limerick is a technology HEI and as such is intended to respond positively to the needs of industry in terms of skills provision and technology transfer. The University has the largest College of Engineering in Ireland, with a corresponding extensive suite of engineering and science laboratories. Over time, the University has successfully provided highly trained and industrially relevant graduates but only recently has it developed more of a capacity for technology transfer. There have been very few spin outs from the University and comparatively less research contracts with industry than other leading Irish Universities. Nevertheless, there is currently a 61,500 ECU research contract with a company on the International Free Zone and more such contracts on the horizon.

4.59 A partial explanation for this lag in technology transfer is long process of maturing into a research university. Until much research is done, there are less occasions for technology transfer to emerge. It is also possible that little technology transfer is recorded because the beneficiaries of this process are not notifying the University. At present, the University has a very diffused model of linkages with industry in which there is little to no central accounting of staff direct contracts with industry. Things are likely to change in the future with the appointment of the previous Park Director to the newly established position for university-industry linkages.

4.60 The University has had an important impact on the companies located on the Park which have benefitted from a steady supply of highly skilled graduates to recruit. The University and students have also benefitted from the proximity of these companies. Students are required to complete a six month project with industry in order to graduate, and many will complete these projects with companies on site (occasionally leading to full time positions upon graduation).

Plassey Management and Technology Centre Ltd (PMTC)

4.61 The Plassey Management and Technology Centre (PMTC) was established in 1977 by Shannon Development, the University of Limerick and FAS as part of the overall regional development programme in the Mid West. The PMTC provides training in key areas of management and technology for companies and for post experience students. At present, the PMTC employs 20 full time staff and has over 300 associate trainers which are drawn from the University of Limerick, other Irish HEIs and industry. In 1992/93, training was provided to over 3,200 students. The PMTC's catchment area was the Mid West initially but now includes the whole of Ireland and possibly the UK in the future.

4.62 The PMTC has four training products: organisational development (specific in-company training), open learning courses, day courses and evening courses. Of these, the open learning courses have become the most significant representing nearly one-third of all students. The PMTC has had close links with the UK Open University in the development of the open learning courses over the past 11 years. At present, open learning students receive written materials, video presentations, telephone tutorials and a Minitel set for E.mail. Unfortunately, the Minitel service has not been used as expected, and the PMTC will evaluate the experience to consider other alternatives.

4.63 New challenges for the PMTC include the development of a distance learning course in telecommunications management for people without a technical background in telecoms. The course is being development with NCC of the UK. The PMTC is also working with Mindware on further developments of this course. In addition to training, the PMTC has developed a consultancy arm to carry out research projects. It is involved in EC research projects under FORCE, which the company carried out with Digital and a quality assurance consultancy located on the Park, and for DG V, for which the PMTC is reviewing small firms impact on employment.

4.64 The PMTC is a member of ENTER, the European Network for Training Providers, which has a membership of 85 organisations throughout the Union. ENTER plays a role in supporting networking across training providers through meetings and communications, but it also has an accrediting role.

Service organisations

4.65 There are several service organisations on the Park but the most recognized service organisation is the Business and Technical Information Service.

Business and Technical Information Service (BTIS)

4.66 The Business and Technical Information Service (BTIS) was established by the University of Limerick in 1991. Before establishing BTIS, the University commissioned the present manager of BTIS to undertake market research to identify areas of interest and to design and appropriate service. What emerged from that research were two key issues:

- companies generally had a limited knowledge of what information was available and how to use information to best effect

- a wide range of companies showed interest in the service.

4.67 The BTIS has been developed in line with the results of the market study, and it now employs 1.5 full time staff and a University student on work placement. The service is now self-financing, generating an income of 43,000 ECU. Companies pay a membership fee of 160 ECU annually and 50 ECU per hour plus the costs of research for an intelligence report. The BTIS has over 100 clients now from around Ireland, and nearly 70 purchase research time in advance.[3] Approximately one-third of clients are based on the Park, with block subscriptions through the Innovation Centre and the Entrepreneurs Programme. Clients also include half of the top 50 Irish companies.

4.68 This business has been built up through a marketing process of introductory seminars and mailshots followed up by telephone calls and personal visits. In some cases, it is necessary to give a free trial of the service to demonstrate the benefits to the company. The BTIS has access to a wide range of networks: Internet, DIALOG, DataStar, FT Profile, ECHO, ESA, STN and Derwents. In the future, they would like to develop a database of information with a multimedia interface for companies that would like to access data directly, but lack the skills to deal with these frequently complex databases. Without question, a prerequisite for companies in the effective use of business and technical information is appropriate training. The BTIS has begun to address this need and hopes to go further with this (potentially with public funding).

4.69 The BTIS is a member of EIRENE, the European network of Information Brokers, which produces the I'M Guide to information services in Europe. EIRENE members have developed a code of practice. Brokers which break the code of practice lose membership in EIRENE, and thus EIRENE has an accreditation function. In addition, the BTIS has participated in a EC research project under COMETT for distance training. In total, EC research projects contribute 10% to the BTIS' funding.

Networks

Local linkages

4.70 Local linkages feature strongly at Plassey in terms of interest and development. Because of the involvement of Shannon Development across the board, many linkages are already in place through the Shannon development umbrella. However, the Park Management company recognizes the need to further strengthen local linkages through new initiatives and improved existing fora.

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[3] There is a discount for purchasing research time in advance.

Policies for connecting and communicating

4.71 The Park Management company commissioned a study from Dr Liam Bannon of the Department of Computer Science and Information Systems of the University of Limerick to address improved means for connecting and communicating on the Plassey site. The report, titled "Connectivity and Community", is to serve as a guide to the Park Management company's own development activity.

4.72 The study was in part a follow up of the 1990 study by MAC on interconnectivity on the Park, which was more of a technology push strategy and looked specifically at telecommunications investment for the Park. The 1990 report recommended a backbone fibre optic integrated broadband communications network and managed data network services for the Park. The present study addressed user needs, requirements and responses to existing and projected services in the area of information sharing and communications within the Plassey site. The study plan was discussed with a project Advisory Group which was comprised of representatives from tenant companies, Shannon Development and the University of Limerick.

4.73 The present study indicated that while the level of interaction between tenants firms themselves was not at a suboptimal level (although more informal activities should be promoted), linkages between the tenant firms and the University could be greatly enhanced. The study came up with specific recommendations on the mechanisms for improving the sense of identity ("membership") for the Park, communication and collaboration between different actors.

4.74 While it is not appropriate to go into detail about these recommendations, they address a number of weaknesses noted through the consultation programme. In some cases, companies were not familiar with neighbouring companies and were less aware of new developments at the University in their field unless they had a personal contact. It was clear through discussions that relatively low cost initiatives such as improved information on Park companies and the research activities of the University (which has been addressed in part by the new Park Directory) and special interest group meetings could have great impact. The report makes some very simple and powerful suggestions which would have value for many other science parks in Europe.

Innovation Board

4.75 The Innovation Board is not an executive body but rather an open forum for discussion, coordination and lobbying in matters related to innovation support and technology diffusion. The board has broad regional representation: the Park Management company, Shannon Development, the University of Limerick, the MAC, Telecom Eirann and industry. Many of the Board's recommendations are taken up by other executive agencies.

4.76 While an important forum for innovation, the Innovation Board is relatively unknown amongst the beneficiaries of any such policies - the high tech SMEs, entrepreneurs and researchers in the Mid West and most notably those on the Park. In addition to the Innovation Board, there is a Physical Planning Committee which is chaired by the Management company and is concerned with the physical environment and services on the Park.

Science Park Associations

UK Science Park Association [UKSPA]

4.77 As there is no Irish science park association, the Park Management company decided to become an associate member of the UK Science Park Association (UKSPA). They have to accept associate membership because manufacturing is allowed on the site. In their view, even if more science parks were developed in Ireland, there would be too few to relate to within Ireland alone.

4.78 UKSPA is a useful group to share experiences and develop axes of cooperation. Unfortunately, many members of UKSPA are "purists" in terms of the acceptable models of science parks, which have been based on the UK development of the earliest science parks which are owned and dominated by the universities. Potential a subgroup will develop, including the NTPP, Snowdonia Technopole and the West of Scotland Science Park. These three share regional similarities and challenges in transforming rural regions and fostering high tech industrial sectors.

International Science Park Association [IASP]/Association of University Related Research Parks [AURRP]

4.79 The NTPP has been a member of AURRP, which as an association of science parks includes various models and brings together parks established as regional development tools as well as the research parks. AURRP provides good quality materials with relevant information. At the last AURRP meeting, there was a pre-conference business planning seminar which was very useful to new science park directors. In the seminar, they considered the objectives of the Park in addressing the process of business planning.

4.80 A European group of science parks would be most relevant and interesting to the Park Management company for more frequent involvement, with worldwide meetings taking place less frequently. There is a view that through a European association, two logical strengths come into play: smaller groups are more effective and European Union policies affect them all.

Relevant linkages for firms

4.81 Companies interviewed had several customers and research partners abroad. In finding customers, they had researched their markets through trade journals, trade fairs and through other customers. In finding research partners, some had found suitable companies through their European industrial association while a few had identified partners through a telematics network. There is no formal network of tenants on site, although a few have come together on business projects, on Park committees or through research areas.

4.82 Companies in Ireland need to export to reach high growth levels as the local market is too small for many high tech products and services. All of the companies interviewed in this fieldwork exercise voiced a strong interest in learning about more opportunities to sell abroad and to learn more about companies on other science parks in Europe. While the European market is of great interest, companies are nevertheless equally interested in the US market and would look for support in reaching both markets.

Relevant University linkages

4.83 The University has developed strong linkages in Europe, and as such it has in place a European Liaison Manager. This post is part funded from COMETT and was established in 1987. As part of her duties, the Manager coordinates an exchange of Irish students for work placement in Europe and vice versa. Approximately 1/3 of all University of Limerick students go for the six month work placement in Europe. Over 50 companies in Ireland (15 in the Mid West and 30 from elsewhere in Ireland) have taken on foreign students through their subscription to this service. As part of the service, the European Liaison Manager sends newsletters and does a few days consultancy for companies on the training grants, training courses and student exchange placements available through Commission funds. The Manager has very good personal contacts in Brussels from when she worked in DG XVI and for the Irish Industrial Association, and she believes that she provides more value added in this information service than the Value Relay Centre or the European Information Centre, both of which simply provide a rehash of the Official Journal without any interpretation.

Wider linkages

4.84 There has been a traditionally strong link with the US which relates to the whole of Ireland but which has been strongly developed in the Mid West. Historically, the Mid West was the "jumping off" point to the US and it still is the most westward looking region. The region looks to gain from the fact that one-fifth of the US Fortune 500 CEOs are Irish Americans through programmes like the University of Limerick Foundation, which seek contributions from these national ties. Regional inward investment has involved primarily American companies, a trend which is replicated around Ireland but appears to be particularly evident in the Mid West. Both the Park Management company and the Innovation Centre have had membership in the respective US science park and incubator associations and would like to maintain these linkages. However, both managers would now like to strengthen their ties in Europe.

Communications

Park Directory

4.85 A very useful Directory has been produced and published in November 1993 which provides brief descriptions and contact details for the following areas:

- general information about the Park with a detailed map
- manufacturing, trading and commercial R&D companies located on the Park
- service support entities
- the University of Limerick, associated organisations and research centres
- index.

4.86 The Directory covers all aspects of the Park and surrounding community, including all of the research centres in the University, the local school, the local church and other such organisations. Some of the details included in the Directory are also available on the NTPP database available on the Minitel service. However, this Minitel service has not been much used. The Directory itself could be revised to include further detail regarding companies on-site and it needs better distribution within the Park as several consultees had not seen it. There is some interest in having the Directory on-line, but as the Minitel service has had little success, a new medium would have to be identified.

Other Park communications

4.87 Two other publications keep Park tenants informed of new developments: the Park Bulletin and Park Newsletter. The Park Newsletter has a much wider distribution and both are also available on the Minitel network together with the NTPP database. The Park Bulletin, which was a bottom-up development, is available via fax and E.mail.

Advanced telecommunications

4.88 Shannon Development has been very progressive in its use of E.mail. All internal communication is sent by E.mail through a VAX system. The system is cheap and functional, although it is not particularly elegant and cumbersome for getting access to outside networks. All Shannon Development staff were trained to use E.mail. University of Limerick has an advanced local area network with access to HEANET and thus Internet. There is interconnectivity between the University and Shannon Development networks, but it is not very straightforward and staff will use other means to contact each other.

4.89 At present, there is no computer-based link among Park companies and the wider University and Park Management. In the recent study on connecting and communicating, there was a clear separation between the foreign multinationals which were less interested in a wide area network for the Park and the small indigenous companies which were more interested. Clearly, these larger companies have their own networks in place; the added value would be for small companies which would like to have access to better communication on the Park and off site.

Summary points

4.90 A number of key points emerge which are relevant to the Mid West and to the NTPP and others which have a more national importance. Where messages have a more national impact, they are listed in Chapter 6 of this report. Park specific points include:

- **The Park's main weakness in that it is not a core part of the University's structure and focus.** The University of Limerick has not really taken ownership of the Park, and this relationship needs further development.

- **This is a new stage for the National Technological Park Plassey.** The Park has been a slow starter, but it is now reached a level of maturity in which it can build on its strengths. This has been related in part to the relatively small innovation base in place when the Park was first established; this innovation base has grown with the Park.

Linkages

- **There is a widespread acceptance of the importance of local linkages.** Although linkages may be patchy, there are some strong lines of cooperation in place already. In part these are due to the necessary linkages between organisations which are all part of the umbrella body, Shannon Development. However, linkages between Shannon Development organisations and the University of Limerick and Park tenants are also evident.

  One example of these linkages is the extensive repackaging and combining of existing facilities and services to suit the needs of different groups. For example, the Women Business Development Centre and the Wood Technology Centre draw on the existing services and facilities of the Innovation Centre and the University of Limerick. Another example is the PMTC, which draws its trainers and collaborators on new training projects from the University of Limerick, the Multimedia Centre (PAT) and the Park tenants.

- **There should be a staff member dedicated to developing these linkages, much as there will be at the Dublin Science Park.** The Park Management company would like to have an additional staff member dedicated to developing linkages and supporting technology diffusion. The company is now too understaffed to consider this role seriously, and Shannon Development is unable to extend positions because of the hiring freeze imposed by the Government.

- **The Innovation Board should widen its audience** and its constituency through better channels to the innovative SMEs, entrepreneurs and researchers in the Mid West.

- **There is a good framework for action now available.** The recommendations of the Connectivity and Community study commissioned by the Park Management company and carried out by Dr Liam Bannon of the University of Limerick indicates some clear lines for action which will help bring about greater success on the Park.

- **Networks can play an accrediting role.** Several of the organisations consulted belong to relevant European associations which perform two functions: 1) to assist networking and cooperation and 2) accreditation of members. These organisations are part of industries which are still immature and for which there are no easy comparisons across companies (training, information brokers). To some extent, the same could be said of science parks and BICs and although in both EBN and the Science Park Associations there has been some effort to define and thus to partly "accredit" member organisations, there is no code of practice and the definitions appear to be lacking.

- **There is a duality in perceptions between different companies and perhaps between companies and intermediaries about the value of networking.** Many intermediaries believe that SMEs are cynical of benefits of networking with other companies locally and internationally. And reportedly these SMEs are still a little intimidated by Europe. One intermediary noted that most companies using the VISTAR procurement Intelligence service were more interested in Irish announcements than EC announcements. However, all of the companies interviewed during this study were already strong exporters with partners abroad. It is always a limitation in fieldwork that the sample may not be representative in all aspects. If so, there is an opportunity to encourage Park tenants to share experiences and advice about the role of networks in business.

Communications

- **The proximity of large companies which are heavy users of advanced telematics yields positive externalities for the smaller companies and the science park in general.** The PTT will not invest in advanced telematics provision without a appropriate demand structure in place. These large companies ensure a basic amount of business which will attract the PTT to provide top end services. This has been the pattern for the NTPP.

Other features

- **Everybody is at least in part surviving because of EC research funds.** Consideration must be made at this stage about long-term viability.

Chapter Five

NORTHERN IRELAND (Antrim Science Park)

5.1 Northern Ireland is made up of six counties and is comparable in physical size and degree of governing powers to the regional autonomies in Spain. As such, the province as a whole is the correct frame of reference for local actors. Some regions within the province have suffered more economic decline than others, but as a whole the features of industrial stagnation and long term unemployment hold for all. Belfast is the dominant region within the province in terms of population and economic contribution, followed by Londonderry. As such, the two universities of Northern Ireland are shared between the two leading cities: Queen's University in Belfast and the University of Ulster in Londonderry.

5.2 Science parks have not held the interest of industrial development agencies in Northern Ireland as they have in other regions in Europe. To date, only one science park has been established (in rural Antrim) and with apparently minimal success as a tool for economic development. However, the interest in science parks may be renewing itself with the opening of a new development in Londonderry, the Ulster Science and Technology Park.

5.3 The Ulster Science and Technology Park is associated with Magee College and the North West College of Further Education. The scheme has been sponsored by these institutions as well as a private developer, Peninsula Securities. The IDB has also made a property investment on the Park. In early 1994, the first building of 150,000 square feet was opened for immediate occupancy, with room for further expansion in the growing city of Londonderry. The Park site has 15 acres of serviced land available for development.

5.4 Antrim itself has a population of 25,000 and has been traditionally a rural area. In recent years, the IDB has made several investments in industrial estates to support the economic development of the region. Two notable investors in the Antrim area which have brought a lot of attention are Daewoo and Myvan. Although the area is very pleasant, it is only now beginning to develop the types of cultural amenities and quality housing areas which help to develop the quality of life associated with science park communities. This new trend is related to these major investments rather than the science park itself as will be reviewed in the next section.

The Antrim Science Park

5.5 The Antrim Science Park was opened in 1986 with funding from the IDB. The 32-hectare park was built to cater for the needs of technology based industries, particularly in the fields of IT, electronics and light-engineering. It was built as a green field development and great care has been taken to preserve the natural beauty of the area. The park lies 20 miles to the north of Belfast, which was considered an advantage in attracting inward investment. There was a view that some investors had been put off by the political troubles in the province which many associate with Belfast in particular. In fact, the park is only 10 minutes from Belfast International Airport and is easily accessible by train or by car.

5.6 In property terms, the science park has been nominally successful. All of the tenants interviewed had selected to be on the Park in part because of its attractive landscaping, its flexible rental space and its proximity to the airport. The high quality telematics provided on the Park was no significant advantage as telecoms throughout Northern Ireland are very good. The park has an occupancy rate of nearly 80%. Nevertheless, only one-third of the land available has been developed. It was anticipated that 1,000 jobs would be based at Antrim instead of the 279 currently on site because of this underdevelopment of the Park. Furthermore, the Antrim Science Park has not succeeded as a science park but as a high quality business park which provides space to some interesting high tech companies. The failure to become a science park lies in the orientation and strategy of the park.

<u>Promotion of the park</u>

5.7 The IDB was an active promoter for the Park in the early years, providing significant grants (up to 50% for R&D projects) and encouraging inward investors to locate on the site. This enthusiasm has since died down.

5.8 Criteria for tenants was similar to those applied for science parks in the UK such as Heriot Watt or Warwick Science Park. In fact, these criteria proved to be too rigorous for the development, and eventually these criteria were broadened to improve interest in the Park. At this stage, the Park is nearly 80% full but there are no plans to develop the Park further.

Associated universities

5.9 Initially, both Queen's University and the University of Ulster sat on the Steering Group for the Antrim Science Park. When it became clear that the Park was to be situated at a distance from both universities, their enthusiasm for the Park also waned. In the Antrim Science Park publications, both universities and their commercial arms and particularly the Northern Ireland Technology Centre (located at Queen's) are described at length. It is indicative that one of the contact numbers is incorrect and both contact names are significantly out of date. In practice, very little communication or networking takes place between the science park and the universities, although a few of the tenants have established their own links.

5.10 Brief discussions were held with the heads of the commercial arms, QUBIS Ltd and Ulster Industrial Liaison Unit. Both emphasised the lack of linkages between the Antrim Science Park and the universities. Instead, the Ulster Industrial Liaison Unit is more interested in developing linkages with the wider industrial community and potentially the Ulster Science and Technology Park which is sponsored by Magee College.

Management of the park

5.11 The management of the Antrim Science Park is strictly a property management activity. The management team, which is part of IDB, is comprised of four individuals including the groundskeeper. The Park Manager devotes only 45% of his work effort to the Park; the remainder is devoted to other IDB property concerns in the North East of the province. This Manager is not in close contact with the Park tenants other than to collect rents and deal with property matters. In fact, the Manager is not supposed to get involved with the business support needed by any of the tenants; should any needs for assistance arise, they will be handled by off-site IDB and LEDU client executives. In the IDB's view, the roles of Park Manager and Innovation/Business Support Adviser should be kept as separate.

5.12 The Management team is soon to change, with the role of Park Manager becoming an even lower priority position. The present Manager is not certain what level of IDB staff member will take his place, but it may be likely that a more junior IDB staff member will take over. The Park Management team is not motivated nor empowered to make more of the Antrim Science Park. This position seems likely to worsen in the short to medium term.

Facilities on the Park

5.13 Tenants have access to a high quality conference suite with catering facilities. There is also now a sandwich bar within the conference suite building, but none of the tenants interviewed were aware of this. The Park was also furnished with an Advanced Software Centre, which has state of the art broad band communications including a ground receiving station. This Centre was built when there was significant foreign interest in the Park. It is now leased to European Satellite, which sells satellite purchasing systems (eg on-line shopping). In fact, all of the Park has access to a high bandwidth fibre optic network.

Networks

5.14 Local and international networks related to the Antrim Science Park are virtually non-existent. No such network exists with the associated universities; little contact has been made with other local industry (Daewoo and Mylan) and there is minimal intra-Park networking activity. Linkages with the IDB and LEDU are also ineffective as any contact between these agencies and tenant companies occurs without reference to the Park. The Antrim Science Park is a member of the UK Science Park Association (UKSPA), however the Park Manager does not attend the meetings. Instead, another IDB executive (the Head of Property) will attend the meetings and inform the Manager of any significant details. In fact, the UKSPA Directory is not even held at the Antrim Science Park, but rather is held at IDB offices in Belfast.

Tenants

5.15 There are only eight companies on the Antrim Science Park, and half of these were consulted during the fieldwork programme. A significant proportion of tenants are foreign-owned. What is striking is that most of these companies are quite high tech and very interested in creating a science park community on the Antrim Science Park. The four interviewed reflected a higher interest in company networking on-site and real linkages with the NI universities than other science park tenants interviewed during the fieldwork programmes in Ireland and Portugal.

Du Pont Nemours

5.16 One of the Software Centres for Du Pont is located on the Antrim Science Park, and it was one of the first tenants on the Park. The Software Centre employs 20 staff and is responsible for the corporate software development. By software, we refer to the software driving the computer controlled production systems characteristic of DuPont. The Centre is a service provider for the DuPont worldwide group; as such, their client is the worldwide DuPont family of companies with which the Software Centre is adequately networked. The company was attracted to Northern Ireland as a low cost location within the UK and the supportive grants offered through the IDB.

5.17 Any new linkages would be in the area of supply. The Software Centre keeps an eye on new technological developments. An important element in this process is the ***Software Industry Federation***, which is the key software development network in Northern Ireland. The Du Pont Software Centre is an important member of this group, which performs an information, lobbying, user group and sourcing function. The Federation has a current strategy to accelerate linkages with software companies and institutions in the RoI.

5.18 Although informal linkages with the other tenants would have made the Park more pleasant, they do not expect that it would have had much commercial interest for them. Likewise with the associated universities. However, they are interested in contacts with other software development companies in other science parks elsewhere in Europe. Such contacts could yield new technology or even country specific information about related software issues, which the Software Centre needs to assist Du Pont companies in other countries. The Centre is also interested in improved access to business information services. At present, they interrogate commercial databases infrequently and find them expensive and peculiar. They would value a shared subscription service with some support in information searches.

5.19 At present, the Software Centre is well provided for in advanced telematics. They have a 64 kb dedicated line for their communications within Du Pont. They will be getting an ISDN line shortly, but this will be used as a back up facility. As part of Du Pont, they cannot use public networks to send certain files nor allow an unauthorized gateway into the Du Pont computer network. The Du Pont factory in Londonderry has a video conference suite. In the past five years, the Software Centre has used it once. If a video conference suite was on the Park, they may be interested in using video conferencing more but it is a marginal gain.

Sensotronics

5.20 Sensotronics is a new commercial joint venture which is a part of the much larger Schrader corporation, a US company with sales of 118 million ECU and 2,000 employees in the US and ultimately the Arvon Industries Group, with total sales of 1.5 billion ECU and 17,000 employees worldwide. Sensotronics will be developing and manufacturing sensors for tyres. They have been on the Park since 1991 carrying out other electronics activities, but this venture has been foreseen for some time. In total, Sensotronics should be employing 110 staff by the end of 1994 (an increase of 70 jobs this year). Of these, 14 are part of an R&D unit in electronics and sensor technologies.

5.21 Sensotronics came to the Park because of the quality of the site and its proximity to the airport. However, they also assumed that the Park would facilitate linkages with the universities and the other companies on site. The company has been very disappointed with the lack of networks and community activities which were promised in the marketing details. Sensotronics were hopeful that their engineers would develop linkages with other engineers on site and thereby extend the company's knowledge base and supplier contacts. At one stage, they were looking for software engineers and were convinced that such engineers were on site, but were frustrated in that there was no way of finding out about other companies nor how to get in touch with them. In the end, the company took the easy option of recruiting new software engineers from their existing sources. Sensotronics is also interested in developing better linkages with the universities. Already, they have taken on four students from the electronics engineering department of one of the universities for their year out programme. They are now interested in a marketing specialist and they will have to go through the same 'hunting' activity as before.

5.22 Communications are not a problem for Sensotronics. They are considering investing in video conferencing depending upon the requirements of Schrader head office. The company will purchase an ISDN line shortly; at present, they communicate with their partners and customers via modem. Without question, their customers demand on-line communications.

5.23 The failing point of the Antrim Science Park for Sensotronics is the lack of critical mass on the Park itself. With only eight companies, it is difficult to develop any sense of community.

Fujitsu Fulcrum

5.24 Fujitsu Fulcrum was established in Northern Ireland in July 1992. It is a trading division of Fujitsu Fulcrum, which is a UK company that is majority owned by Fujitsu. The division employs 35 at present but this number will increase to 70 within a year. Their market is the PTTs, and at present this is entirely British Telecom although several other PTT customers are in the pipeline. Fujitsu Fulcrum (NI) provides a refurbishment and repair service for BT of telecommunications equipment (particularly transmission systems). The company devotes 19% of turnover to R&D, and the R&D unit is based in Birmingham.

5.25 The company came to Northern Ireland in order to take advantage of the lower cost base to do these refurbishment activities. The advantage of Antrim Science Park was its proximity to the airport and ferry, the fact that a ready made unit was available and the possibility for a 150% expansion on the site (which was one of the criteria set by Fujitsu). In the future, they may go on to manufacturing on the site.

5.26 Fujitsu Fulcrum (NI) benefits from the shared conference suite, which allows them to maximise their own space. Video conferencing would be an attractive option. However, the company's telecommunications are already highly advanced. They use an ISDN line to test the equipment they refurbish and repair, and they have two dedicated circuits to their main offices in Birmingham. The company as a whole is very telematically advanced; E.mail is a well-used feature of this system.

5.27 The company is committed to cross-border trade links with RoI. They are also developing wider linkages in Northern Ireland. The company is already using QUBIS to assist them in recruiting software engineers. Fujitsu have even agreed to sponsor a NI post graduate who will be seconded to Japan. Fujitsu Fulcrum (NI) would like to have more common areas on the Park to develop more informal linkages with the other tenants. There is no sense of community; people drive in to the Park at 9:00 and drive out again at 5:30 without any interaction. This lack of interaction is not facilitated by the layout of the Park itself, which is several stand alone buildings grouped as a wheel with the Park management office in the centre.

TASK Software

5.28 Task Software was established in 1984 in Belfast. It moved to Antrim Science Park when the Park was formally opened in order to benefit from the high profile, the space to expand, its central location within Northern Ireland and its proximity to the airport. The company employs 25 staff, of which two are dedicated to software development. Roughly 80% of its business is within Northern Ireland with the remainder equally divided between the UK and RoI.

5.29 Task provides software and training services for local government, which as a market has grown significantly with the trend of contracting out. At present, their main products are financial software and an environmental management package. The company is now working with a UK partner on a subsequent project. The companies became partners after Task identified it as a potential customer. Task itself has a sales office in the UK.

5.30 The company's strategy is to grow the company by expansion into new markets with improved software and training for local government. To some extent, this will limit them at the start to countries with similar local government systems to the UK. Task would like to develop contacts with similar companies in other countries; their preferred method of breaking into a new market is through local cooperation.

5.31 They are not very aware of other tenants nor wider developments on the Antrim Science Park. In fact, their activity on the Park is very self-contained. While this was not causing them any commercial harm, there was an interest in having a greater awareness about one another as well as central facilities where staff can mix.

5.32 Task is considering investment in ISDN in the near future as a means to develop software applications and train clients. It would also provide an advantage in dealing with the UK office through interactive working, as well as the development of teleworking which suits the ethos and products of Task. The barrier to ISDN thus far has been the cost.

Summary points

5.33 **Without a change of attitude of the IDB and indeed the other founders of the Antrim Science Park, it is unlikely that the Park will develop into a meaningful science park.** Eventually, it may lose some of the tenants it now has. Necessary changes for the Antrim Science Park include the following:

- **a revamped management team** with a remit for developing linkages at the local, national and international level and involvement in innovation support together with the representatives from IRTU, IDB and LEDU. Management staff can provide a daily oversight role, drawing in specialists as needed.

- **renewed linkages with the two universities** in terms of frequent contact and discussion with QUBIS Ltd and the University of Ulster Industrial Liaison Unit as well as other research, education and training providers

- **a more formal connection to IRTU and the LEDU Innovation Programme,** defining the role of science parks in Northern Ireland and making them part of the integrated innovation support package.

5.34 **Outside linkages may help to change things.** It is possible that improving linkages with science parks across Europe will help to strengthen the profile of Antrim Science Park within Northern Ireland.

5.35 **The tenants on the Park are interested in building local and international linkages.** They want the science park community they thought they were moving into. In order to achieve this, changes in the role and responsibilities of the Park management company as outlined above must take place. One should also consider the need for a 'critical mass' of companies on site. Eight companies alone cannot generate the linkages and spirit of community found on other science parks. As the site has room to expand, the science park founders should reflect on the Antrim Park experience and decide how to proceed. If there is interesting in nurturing a true science park community, these organisations should consider the need to expand the Park.

Chapter Six

SUMMARY AND RECOMMENDATIONS

6.1 The science park movement has not been very influential on the island of Ireland to date, but it appears to be undergoing a renaissance. This provides a unique opportunity to learn from past mistakes, evaluate the future carefully and plan a strategy in cooperation with all interested parties.

Objectives of science parks

6.2 It is essential in the development of science parks that public sector backing is unwavering. These projects take many years to mature, but they will never achieve success if they are neglected by the bodies that first established them.

6.3 Science parks in Ireland (island) have broadly the same objectives: to develop indigenous knowledge-based industry and to attract appropriate high tech foreign companies. However, the second of these two objectives has received the most attention (considering the experiences of the two existing science parks) where there is clearly more need to focus on the former. Without suitably strong indigenous capacity in high tech sectors, there will never be effective technology transfer between these high tech foreign companies and the Irish industry base. Instead, these multinationals become islands of innovation unto themselves.

6.4 Manufacturing is allowed on science parks in Ireland (NI and RoI) and this is a positive development. Science parks and their promoters have recognized the value in integrating R&D with the production process, which is the source of a large and valuable part of the innovation process, the application of R&D to production processes.

6.5 There is a level of critical mass on a science park that must be reached before local linkages have much meaning and a science park community can form. The instance of shared interest or opportunity to collaborate goes up exponentially and in direct relation to the number of actors. Eight companies on a site are too few for the development of interesting linkages. There is also likely to be an upper limit to the number of actors beyond which a science park ceases to be a community.

6.6 The renaissance of the science park movement in Ireland has drawn some concern from the Irish government. Agreeing to a science park in Dublin may open the door to several new bids for science parks elsewhere in the RoI. The Irish Government believes that there is a saturation point for any country, and they believe that it is at two science parks for Ireland. Other research does indicate that an economy can only integrate a given number of science parks at any one time, and this should be evaluated more carefully in considering any new proposals for science parks in Ireland.

Human network requirements

6.7 The science parks and business innovation centres of the RoI are integrated. Networks between business innovation centres (the EuroBICs), on the other hand, seem less effective. Clearly, there is a different in outlook and conduct, but there is an opportunity being missed to link the EuroBICs with the incubators of the third level institutions as well as the science parks.

6.8 Competition will develop between the science parks in the RoI should the Dublin Science Park be approved, particularly in the area of inward investment. Every effort should be made to try and coordinate the strategies and activities of the Parks, perhaps considering areas for specialisation or other methods of differentiation. However, in an all-out battle for new tenants, Dublin Science Park will win as it has the city advantages on its side. Timing may ease this situation as the Plassey expansion is currently underway, while the Dublin Science Park has not yet been approved and is therefore unlikely to be ready for commercialisation until 1996 at the earliest.

6.9 Any relationship between the two parks will be built from a point of weakness. The National Technological Park Plassey is considered by many to fail the criteria of a science park. In an article in the Irish Times, the Dublin Science Park was dubbed the "first science park in Ireland". Apparently this quote had been taken from one of the Dublin Science Park promoters, but it nevertheless raises an important issue. Inappropriate and restrictive criteria has been exported from one country to another without any regard for the local economic strengths and requirements. A Community-wide discussion should take place to replace this overly simplistic and narrow view of science park with something that has more flexibility and meaning for the diversity that typifies the European Union.

6.10 The university innovation centres should be drawn into appropriate international networks. The question arises in discussing which association would be most appropriate. These innovation centres have a lot in common with the St Johns Innovation Centre, which is part of the science park associations (UKSPA, IASP). However, they also have areas in common with the innovation centres of Germany which belong to the German Association (ADT) and an incubator association (NBIA). Incubators/innovation centres highlight the loss of two related associations operating in parallel, as it is for this category of innovation support body that there is the clearest overlap. Measures to create a linkage between these two associations are imperative.

6.11 Any international networks of science park managers should be of a sensible size to allow a productive level of discussion and activity. Such a network should allow managers of parks with similar objectives and challenges to find out about each other more easily. Better training in terms of day to day support and materials targeted to real needs is necessary, especially for new park managers (of which there will always be a group). Furthermore, compensation for travel from peripheral regions is rarely taken into account and it should be.

6.12 The recommendations of the Connectivity and Community study commissioned by the Park Management company and carried out by Dr Liam Bannon of the University of Limerick address the essence of what a science park should be - a community of innovation orientated organisations - and how to seek to develop such a community. The lines for action suggested would have value for other science parks in Europe, and thus the Plassey Management company should be invited to outline the study, its recommendations and its relevance to the Park's development at an appropriate forum.

Telematic network needs

6.13 Telematic networking or communication needs were not concerning. In fact, most consultees were using advanced telematic services like E.mail frequently. The one exception was the need for a local area network on the science park itself and particularly related to the smaller companies to provide them access more cost-effectively. As in other regions, the development of effective telematic applications and training are the foremost barriers to further use.

Support for local firms

6.14 There was a significant amount of interest in improved access to business and technical information as a service. Firms were also interested in learning about firms at other science parks but only if sufficient detail is provided. In learning about companies on other science parks, there is a minimum level of information required about one another - who they are, what is their product, what are their markets. Any description must be given at a level meaningful to the firm. For example, companies should not be described as part of the "software industry" but more specifically addressing "multimedia applications for the printing industry". Firms have commented that huge databases which are poorly classified are cumbersome and not effective.

6.15 Any mechanism to bring firms together will fail if it does not reflect real needs and real value. A conference without specific objectives and clear deliverables is a lost cause. Even if the Commission were to pay all fees for a science park business day, companies will not want to waste their time.

6.16 There needs to be added value in providing information to companies. A suggestion was made by intermediaries that it would be preferable to let science park managers who know their companies well to discuss opportunities for cooperation or trade with other science park managers as a "first cut" to partner searches. It is not likely that companies would rely wholly on that process, but it may improve the process.

Ireland

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LITERATURE REVIEWED

A significant amount of literature from the science parks, government agencies, companies and others consulted has been reviewed. Acknowledgement must be made of the following documents:

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GLOSSARY

BERD	-	Business expenditure on R&D
FAS	-	Irish Training Agency (Department of Employment)
IDA	-	the Irish Industrial Development Authority
HEI	-	higher education institution
NBIA	-	US National Business Incubator Association
NI	-	Northern Ireland
NTBF	-	new technology based firm
PAT	-	Programme in Advanced Technology
RoI	-	Republic of Ireland
Shannon Development	-	the South West Regional Development Agency

ITALY

Country report - ITALY

General framework

During the recent years, a trend towards a bipolar world, shared between the ones who produce innovation and the ones who make products, became evident. The Scientific and Technological Park, a territorial concentration of research activity and innovative production, is considered in Italy as one of the tools of an economic policy aiming at supporting applied research and especially transfer of research to and within the industry. In the Italian industrial framework, especially in the so called "Third Italy" made up by a predominant share of small and medium sized enterprises, the prevailing model of park is the one big enough to give hospitality to researchers and companies, in order to facilitate the meeting and cooperation between scientific laboratories and industry researchers. At the same time, networked or multipolar parks, aimed at narrowing the distance between sources of information, research labs and existing companies seems to be an interesting model as well.

The Italian industrial sector

The more relevant industrial sectors are the so called "made in Italy" traditional sectors like food, textile and apparel, ceramic industries; engineer sectors like machine tools, mechanical components, office equipment; and chemical and pharmaceutical industries. In these sectors, several companies were able to adopt innovative production processes, and new organization structures which resulted in an increasing competitiveness and in the increase of the extent of their market. Many studies focused on the so called "Italian model", which could be synthetically described as a production system based on several areas in which concentrations of SMEs participate in the production of the same products, acting both as competitors and as cooperators one with the other. These aggregates of SMEs, referred to as industrial districts, or local industrial systems or costellations of firms, generated a beneficial Marshallian industrial atmosphere, allowing producers, machinery providers, distributors and service providers to share the basic technological knowledge appropriate to the industrial sector concerned.
A relevant share of the companies is represented by small and medium-sized enterprises, as shown in the following table.

Lingotto Torino and Bicocca Milano are initiatives devoted to the regeneration of the inner city economy, based on real estate facilities renewing and restructuring fir the rationalisation of the urban structure.

The third generation of Parks is represented by the projects of Calpark and NEST Veneto, both strongly concerned about the regional development.

The human network between SPs and universities is quite developed and tends to be reinforced also towards private research labs. In several cases, local and regional authorities take part in the development of the Parks and act towards the involvement of the various institutional and economic actors of the region.

As to telecommunications networks, an insufficient diffusion in the use of telecom networks and services can still be noticed. The scientific telecom network provides well performing services but it is still not fully utilised especially by the industrial companies.

Business and Innovation Centres in Italy

The national framework for enterprises creation in Italy is characterised by the Law no. 44/86 limited to Southern Italy until recently when it was extended to the whole country, and initiatives in areas objective 2 and 5b.

Three typologies of BIC are identified:

- BIC structurally linked with STP organisations
- BIC created independently from the STPs, but cooperating with the STP
- BIC completely autonomous

A further transversal separation is possible, between those BICs which are focused on the industrial and technological sector in which the SP is specialised, and those others which support new enterprises in almost all the business sectors, with the only condition of viability of the business project. These two types of BIC can coexist in the same town or area, as it happens in Bari, where the BIC in the park is devoted to supporting new companies in the electronics and information technology sector, while the autonomous BIC concentrates on the support to existing small firms in various business sectors.

Another category of initiatives devoted to the creation of new enterprises is represented by the incubators which are not member of EBN, one of which is analysing the possibility to create a network of incubators in some way alternative to EBN.

Given the common aim of BICs and incubators, there should be the opportunity for the EC to extend the support initiatives accessible for BICs also to incubators which are not member of EBN, and also to integrate and coordinate the several already existing

actions concerning regional development, creation of enterprises, like the programme NOW, actions within PIMs, or other actions promoted by EC DGXVI.

List of STP and of BIC in Italy

Parks	BIC
Lingotto (PST di Torino)*+	BIC Piemonte °+
Science Park Raf (PST di Milano) *§+	
Polo Tecnologico Milano Bicocca *+	Incubatore Tecnologico Bicocca §+
Area Science Park (PST di Trieste) *§+	BIC Trieste °+
Veneto Innovazione *§+	
Consorzio Bologna Innovazione (Polo tecnologico di Bologna) *§	BIC Emilia-Romagna
Centuria PST Cesena	
Consorzio Leonardia (Polo Tecnologico di Piacenza) *	BIC Liguria °§
PST dell'Elba	
PST della Toscana Occidentale §	BIC Livorno-Piombino °§
Tecnomarche	BIC Marche °§
Parco Tecnologico Agroalimentare dell'Umbria *§	EURO-BIC Piceno Aprutino
PST d'Abruzzo	EURO-BIC Abruzzo
PST del Molise	
Parco del Lazio unificato	BIC Lazio
PST Area metropolitana di Napoli *	
PST di Salerno	
Basentech (PST della Basilicata) *	BIC Potenza °§
Tecnopolis Csata Novus Ortus (PST di Bari) *§+	Incubator, Tecnopolis +
Cittadella della ricerca Mesagna (BR)	BIC Puglia Sprind
Calpark (PST della Calabria) *§+	BIC Calabria
Consorzio Ventuno (PST della Sardegna) *	BIC Sardegna °§
PST della Sicilia	BIC Sicilia Orientale

Legenda:

*: member of APSTI
°: member of EBN
§: filled questionnaire
+: case study

Legal framework

Unlikely the other European countries, In Italy the concern about science parks and innovation centres started to be relevant only recently. This is one of the reasons why no specific law supporting the creation and funding of these initiatives exist.

In 1990, an interministerial agreement was signed on Mezzogiorno, the Southern part of Italy. It provides for a funding of 1,100 billion Lire for scientific parks in Southern Italy on the basis of the submission of projects to the Ministry of Budget, Ministry of Scientific Research (MURST) and Department of Mezzogiorno.

31 projects were submitted and evaluated by an appropriate Commission.

In the meanwhile the referent Ministry became the one of Scientific Research. Out of the 31 proposals, 11 new ones were retained and two developing plans for already existing parks were accepted. From the regional point of view, besides the objective 1 regions, also areas in objective 2 regions were considered, like Lazio e Marche.

The MURST guidelines for the projects are the followings: focus on applied research or on technology transfer to small and medium sized firms, create a strong linkage with the local industrial system.

The initial 1,100 billion lire were reduced to 600 for the South, and the remaining 500 would go to Northern and Central Italy. The first 300 billion will be taked from the Fund for Applied Research of Law 46/82.

APSTI (Associazione Parchi Scientifici e Tecnologici Italiani) prepared a law proposal on STP which has not yet been discussed by the Parliament.

Projects retained by MURST
by the end of 1993

MURST finally approved the funding of 13 projects on the 1 of April 1994.
This decision represents hopefully the increased involvement of the Italian Government in the development of science parks. The following table presents the amount of funding for each region and initiative.

Destination	Funding of innovation projects (billion lire)	Funding of education training and projects (billion lire)
Abruzzo	18.8	2,9
Calabria	21.9	3,6
Brindisi Puglia	44,4	4,5
Molise	12.4	2,1
Napoli Campania	54.9	7,2
Salerno Campania	22.9	3.3
Sardegna	20.6	3,4
Sicilia	55	7,1
Bari Puglia	47	6
Val Basento Basilicata	25	3.5
Lazio Meridionale	17.6	2.8
Isola D'Elba Toscana	22.3	3.3
Marche	22.3	3,2
Total	**385.1**	**52.9**

National laws in favour of innovative enterprises

The following national laws supporting innovation were used or could be use:

- Law 317/91 (Interventions in favous of innovation in SMEs);

- Law 1329/65 (Measures for the acquisition of new machine tools);

- Law 46/82 (Interventions for sectors of the economy which are nationally relevant);

- Law 10/91 (Standard for national energy plan on rational use of energy, energy saving and renovable energy sources development).

Regional laws in favour of innovative enterprises

PIEMONTE

- Regional Law 56/86 Creation of a fund for innovation devoted to the funding of projects for technological innovation adoption.

LOMBARDIA

- Regional Law 34/85 Incentives for innovative companies

FRIULI

- Law 19/91 Business activity development in Friuli and neighbouring areas. Law 19/91, indicated under the Friuli region is a national law, limited geographically to North East Italy (Veneto too).
- Regional Law 26 Fondo Trieste which provides funding for fixed investments and on research expences

VENETO

- Regional Law 16/93 Interventions for the creation of centres providing services to the enterprises

EMILIA-ROMAGNA

In the early '90s, the regional government prepared a law project which is now under redefinition.

In the early '90s. the regional government prepared a law project which is now under redefinition.

PUGLIA

No regional law exists in favour of innovation in the enterprise.

Proposals for next steps

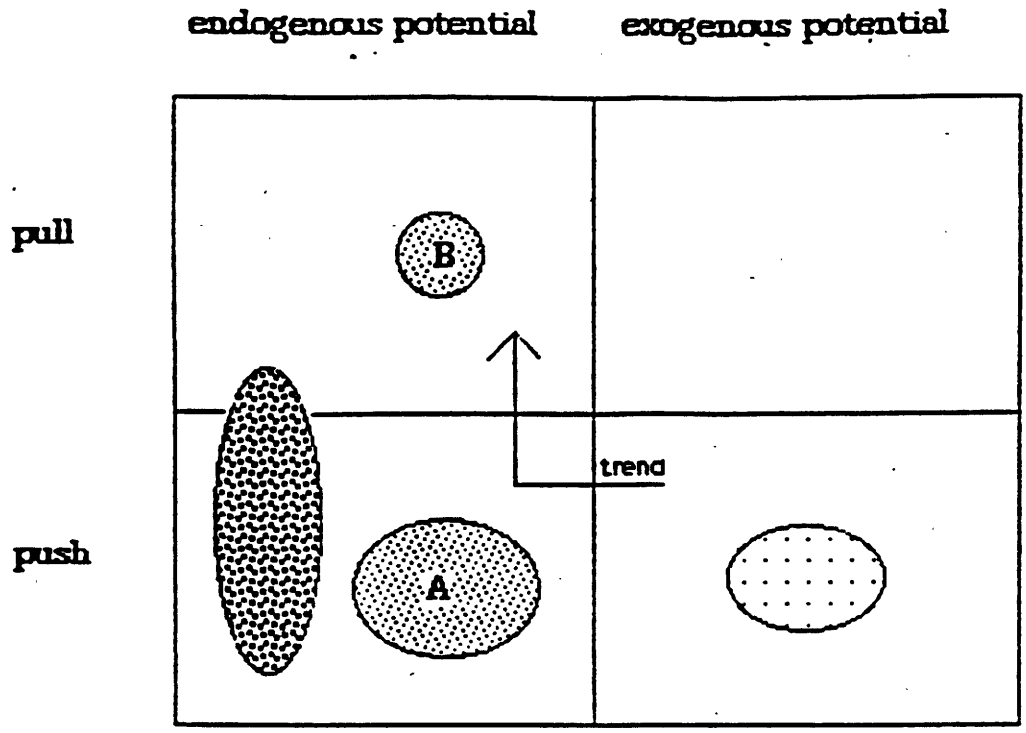
In addition to the conclusions illustrated for the Italian case, we indicate some potential next steps both for analysis and actions, in order to contribute to the discussion with the other partners of SP-NET project and with EC officers.

- one first analytical work could focus on the **evaluation of SPs as enterprises**, looking at the managerial aspects, at the financial entity and sources with respect to the local and regional positive impact of their activity.

- a second step could concern the put in place of an action supporting the implementation and strengthening of the **tutor-student relation between pairs of SPs**, with the aim of transferring successful experience and effective management from one SP to another.

- a third initiative focuses on a **training action** of managers and the other people operating in the SP, concerning in the first place the following topics: use of sources of technology, promotion of the activity and services of the SP, increase in the effectiveness of the SP management, support to tenants in order to increase their competitiveness.

Matrix of the strategic leverages of Science Parks in Italy



first generation of Science Parks : early '80s
Tecnopolis CSATA Novus Ortus (Valenzano-Bari)
Area Science Park (Trieste)

second generation : mid-80s
A : Bicocca Technology Pole (Milano) - Lingotto (Torino)
B : San Raffaele Science Park (Milano)

third generation : 1990-1994
Planned Science Parks

pull : demand-driven through leading companies

push : supply-driven through public (national and EU) funds

Tab. 4a - Establishments by industrial sector and by size in terms of employees, (percentage by row)1993.

Business sector	E. <10	*NO.EMP.*	E. 10-99	*NO.EMP.*	E. 100-499	*NO.EMP.*	E. >500	*NO.EMP.*	E. EMP.NA	*TOT. EMP.*	TOT. E.
Chemical, glass and ceramic products	56,19	*15,03*	14,93	*36,41*	1,42	*26,60*	0,19	*21,96*	27,27	*100,00*	100,00
Metal products and industrial machinery	63,73	*25,20*	11,46	*40,58*	0,61	*18,72*	0,09	*15,49*	24,12	*100,00*	100,00
Food, textile, wood, furniture et alii	63,83	*33,63*	9,80	*46,48*	0,37	*15,13*	0,02	*4,76*	25,98	*100,00*	100,00
TOTAL	63,27	*28,01*	10,72	*42,92*	0,52	*17,97*	0,05	*11,09*	25,43	*100,00*	100,00

Source: CERVED, Chamber of Commerce, Industry, Agriculture and Handicraft database, 1994.

Legenda:
E.: establishments (by size in terms of employees)
NO. EMP.: number of employees referring to the establishments indicated the previous column (in italics)

Tab. 4b - Establishments and employees by industrial sector, (percentage by column) 1993.

Business sector	*Employees*	Establishments
Ferrous metals	2,68	0,71
Non ferrous metals, glass and ceramic goods	5,64	4,56
Chemicals	4,04	1,55
Man-made fibres	0,30	0,02
Metal products	0,00	0,00
Mechanical enginering	15,59	16,65
Electrical and electronic engineering	8,77	6,68
Transport equipment	8,57	6,20
Instrument engineering	5,76	4,41
Food, drink and tobacco	7,54	10,88
Textile and clothing	8,12	8,02
Leather	1,61	1,89
Footwear	11,95	13,12
Wood processing and furniture	8,09	14,70
Pulp and paper	5,06	4,89
Rubber and plastics	3,97	3,46
Other manufacturing industries	2,29	4,25
TOTAL	100,00	100,00

Source: CERVED, Chamber of Commerce, Industry, Agriculture and Handicraft database, 1994.

PIEMONTE. Italy

1. - Regional background

Tab. 1 - General regional data

		value	% on Italy
Surface (skm.)		25.398.94	8,4
Population		4.290.412	7,6
University students		84.199	5,7
Employees		1.804.000	8,3
Regional employees on Italy by macrosector	%		
- agriculture	6,7		
- industry	41,3		
- other sectors	52		
	100		

Source: ISTAT, *Le regioni in cifre*,1993, Roma.

Tab. 2 - R&D expenditures by typology of R&D, 1990
(millions.of Italian Lire)

base research	77.794	2,6%	
applied research	835.988	27,7%	
development	2.102.668	69,7%	
Total	3.016.450	100 %	(22.4 % on Italy)

Source: ISTAT, *Le regioni in cifre*,1993, Roma.

Tab. 3 - University graduates in scientific disciplines, year 1991-92

	graduates
Mathematics, Phisics, Biology	696
Engineering	644

Source: ISTAT, *Le regioni in cifre*,1993. Roma.

Tab. 4a - Establishments by industrial sector and by size in terms of employees, (percentage by row)1993.

Business sector	E. <10	*NO.EMP.*	E. 10-99	*NO.EMP.*	E. 100-499	*NO.EMP.*	E. >500	*NO.EMP.*	E.EMP.NA	*TOT. EMP.*	TOT. E.
Chemical, glass and ceramic products	71,37	*16,61*	16,57	*16,61*	1,89	*33,42*	0,20	*12,77*	9,98	100,00	100,00
Metal products and industrial machinery	74,77	*21,55*	13,57	*21,56*	0,88	*19,69*	0,15	*22,74*	10,63	100,00	100,00
Food, textile, wood, furniture et alii	76,86	*28,69*	10,93	*28,69*	0,74	*22,19*	0,07	*11,01*	11,41	100,00	100,00
TOTAL	75,61	*24,09*	12,43	*24,09*	0,86	*21,82*	0,11	*17,11*	10,98	100,00	100,00

Source: CERVED, Chamber of Commerce, Industry, Agriculture and Handicraft database, 1994.

Legenda:
E.: establishments (by size in terms of employees)
NO. EMP.: number of employees referring to the establishments indicated the previous column (in italics)

Tab. 4b - Establishments and employees by industrial sector, (percentage by column) 1993.

Business sector	*Employees*	Establishments
Ferrous metals	*2,26*	0,87
Non ferrous metals, glass and ceramic goods	*2,90*	3,22
Chemicals	*2,62*	1,27
Man-made fibres	*0,24*	0,03
Metal products	*21,70*	23,66
Mechanical enginering	*9,22*	8,71
Electrical and electronic engineering	*10,18*	7,80
Transport equipment	*8,36*	1,28
Instrument engineering	*1,35*	3,98
Food, drink and tobacco	*7,42*	9,88
Textile and clothing	*9,43*	5,36
Leather	*0,58*	0,83
Footwear	*5,31*	7,80
Wood processing and furniture	*4,58*	11,57
Pulp and paper	*4,81*	4,42
Rubber and plastics	*6,24*	3,73
Other manufacturing industries	*2,79*	5,60
TOTAL	*100,00*	100,00

Source: CERVED, Chamber of Commerce, Industry, Agriculture and Handicraft database, 1994.

II. Case studies

LINGOTTO PARK, Torino

Interviewed persons:

Park management

- Prof. Bottiglieri (director of the Park).

Regional institutions

- Mr. Guazzetti (manager of Finpiemonte);
- Ing. Patrissi (director of CO.RE.P.).

Since the production system of the Turin area is very much dependent on a few large companies, the local context is very peculiar. Such companies impose development trends and productive choices that bring to the creation of dedicated "filières". This brings to a lack of both a diversified industrial system - as it exists in different regions - and of an independent one. R&D expenses represent 2.6% of regional GDP and 25% of the national R&D expenses.

1. Tenants of the Park

The Lingotto building is one of the old FIAT plants whose production activity was moved to other plants more than a decade ago. A project of exploitation of the real estate value of the building was examined by FIAT which gave start to a new company, the Lingotto srl, with the participation of the Municipality of Torino, and two banks and two insurance companies.

The Lingotto Park is located in and is part of a metropolitan area. It is a one site technological park, articulated in a complex way, in which two main pillars can be identified:

i) one which is devoted to the fair centre and that has already been realized;

ii) a second one - which is still under implementation and that should cover an overall area of 250000 square meters - that will locate the Congress Centre, the Commercial area (70000 sm.), the Faculty of Sciences and, linked to it but independent, Laboratories that can be spread into two groups: 3 Labs for the Faculty of Sciences and 3 Labs for the Polytechnic.

Links with already existing private research centres of large companies have been foreseen.

Morcover the realization of an incubator (10000 sm.) has been forecast with services activities provided by the Park.

2. Strategic objectives of the Park

Aim of the Park is the transfer of technological research results achieved by large companies - such as FIAT, STET, RAI, Olivetti - to those companies that show a potential interest, located in both the regional and the national territory.

The transfer of knowledge and expertise produced and cumulated by the research activity of large companies shows an ambitious goal. Such a goal is based on the believe, although no evidence is given - that large companies are available to transfer the results of their research efforts which are not strategic for them.

The structure of the Park is built on a central core, with a high real estate value, which will interact with already existing universities and company research labs.

The project of the Park goes back to 1988 whilst the realization of it comes through different implementation steps that, on the basis of the economic expectations, focus on the restructuring of those areas addressed to:

1)fairs, 2) congress centre, 3) Labs and incubator.

The main goal is the exploitation of those research results achieved by large companies through the intermediation of professional consultants. These consultants, preferably foreign ones, will be invited to move to the Lingotto in order to implement marketing activities for technology research achievements.

The Lingotto location is part a territorial area which is included within objective 2 areas of Community Structural Funds.

3. Science park management role toward tenants and linkages

It is early so far to identify the need for the creation of links with other Parks, unless real advantages can be truly seen. The creation of new companies, in particular addressed to young managers is one of the activities foreseen for the Park.

New companies will not be located within the Park but in external establishments, in those ones left empty due to the closure of many manufacturing activities.

4. Telematics

Since the Park is still in a first phase of implementation and no activity or company is there yet, it is not possible to analyse the use of telematics structures, exchange of information and human resources networks.

The Park management believes that those companies and Laboratories that will exist within the Park - as well as those centres of research of large companies and Universities that will be linked with the Park itself - have already access, or will be able

to chose the more adequate endowment for. to telecommunication networks and services, in order to satisfy their needs.

5. Linkages/networking

As already underlined, no need has been identified so far for links with other structures.

6. Support for linkages

In front of a lack of evaluation elements, no advise can be given so far.

7. Potential for improved networking/linkages

Again, the lack of evaluation elements in this sense implies that no considerations should be done.

BIC PIEMONTE

Interviewed persons:

Mr. Bertone (director of BIC Piemonte);

BIC Piemonte is one of the Business and Innovation centres associated to EBN (European Business and Innovation Centres Network). It provides and coordinates integrated and real services to the enterprise.
It was created in 1990 and began to operate in 1991. This structure has 35 shareholders (they are public and private components, like Chamber of Commerce, local authorities, entrepreneurial associations and credit institutions). Its purpose is to increase the value of the entrepreneurial capacity in the region and to support small and medium sized enterprises the implementation of projects for differentiation and development of production processes and products. It is a network structure with a large number of branches in Piemonte (Alessandria, Asti, Biella. Cuneo, Ivrea, Novara. Torino, Verbania, Vercelli).
The company's capital is about two billion Lire.
BIC has seven employees, and constantly turns to a wide set of specialized experts.
The assistance of BIC Piemonte is onerous for the project proposer, in that, ones the initiative is considered positively, BIC involves itself in its implementation. The initial phase of valuation that is carried out together with the entrepreneur is free of charge. Since BIC begins to draw up the business plan and oversees its realization: it requires from the proposer a contribution of 50% of the costs that BIC has to bear for such an activity.
BIC, as counterpart for these advanced charges and its starting up assistance, asks for a commission on the variable turnover between 0,75 and 1,5% for a period of 3-5 years according to the typology of the company. In this way BIC is jointly interested in the success of the project, and in a rapid growth of the company.

The services provided in the initial phase are:

- valuation of the feasibility study of the entrepreneurial proposal
- draw up of "business plan" of the initiative together with entrepreneur
- predisposition of financial plans
- assistance in the organization of financial funds
- assistance for setting up and/or activation of the enterprise plan

In the implementation phase:

- development of market analysis
- company check up regarding strategic outline
- company check up regarding organizational outline
- company check up regarding financial outline
- management training
- development of prototype, qualification and certification of products and processes
- applied researches and studies for technology transfer
- setting up of company development projects aimed at finding financial, commercial or production partners
- draw up of research and development projects
- draw up of company plan
- financial planning and design
- guidelines for access to the EC community's directives

The support for financial instrument for the enterprises is provided by INNOINVEST PIEMONTE. This society is engaged in the creation and development of small and medium sized enterprises, and providing funds for the start up of the companies.
BIC offers funds and guarantees to the participants. The financial intervention lasts for three years.
The starting phases for the evaluation of the involvement in a project are the entrepreneurial capacity and business plan which result from a careful evaluation of several aspects of the market in which the new entrepreneur will operate.
The new enterprise has to base on a project for achievement of significant innovations in products, processes, technology and markets.
The continuous innovation of the project and consequently the expected survival and success of any initiative, represent an essential requirement.
Through INNOINVEST PIEMONTE one can accesses to contribution of risky funds and provision of financial partners, as well as to information and consortia creation for the participation to EC Programmes like INTERREG and SPRINT. Since now, BIC developed 21 plans of intervention in the various business sectors. The percentage of accepted projects compared with the proposed ones is 7,3%.

LOMBARDIA. Italy

I. - Regional background

Tab. 1 - General regional data

		value	% on Italy
Surface (skm.)		23.858,69	7,9
Population		8.831.264	15.6
University students		215.277	14,5
Employees		3.860.000	17,8
Regional employees on Italy by macrosector	%		
- agriculture	3,1		
- industry	43,3		
- other sectors	53,6		
	100		

Source: ISTAT. *Le regioni in cifre*,1993, Roma.

Tab. 2 - R&D expenditures by typology of R&D, 1990
(millions.of Italian Lire)

base research	165.569	4,2%	
applied research	2.052.693	53 %	
development	1.657.005	42,8%	
Total	3.875.267	100 %	(28.8 % on Italy)

Source: ISTAT. *Le regioni in cifre*.1993. Roma.

Tab. 3 - University graduates in scientific disciplines. year 1991-92

	graduates
Mathematics, Phisics, Biology	1.694
Engineering	1.659
Pharmaceutical	402
Medicine and Surgery	1.573

Source: ISTAT, *Le regioni in cifre*,1993, Roma.

Tab. 4a - Establishments by industrial sector and by size in terms of employees, (percentage by row)1993.

Business sector	E. <10	*NO.EMP.*	E. 10-99	*NO.EMP.*	E. 100-499	*NO.EMP.*	E. >500	*NO.EMP.*	E. EMP.NA	*TOT. EMP.*	TOT. E.
Chemical, glass and ceramic products	41,75	*10,68*	15,62	*35,63*	2,00	*32,74*	0,22	*20,96*	40,11	*100,00*	100,00
Metal products and industrial machinery	48,00	*16,76*	9,31	*32,28*	0,70	*21,34*	0,15	*29,61*	41,84	*100,00*	100,00
Food, textile, wood, furniture et alii	56,11	*26,67*	11,36	*47,87*	0,54	*19,41*	0,03	*6,06*	31,95	*100,00*	100,00
TOTAL	53,30	*21,87*	11,37	*42,56*	0,71	*22,11*	0,07	*13,45*	34,56	*100,00*	100,00

Source: CERVED, Chamber of Commerce, Industry, Agriculture and Handicraft database, 1994.

Legenda:
E.: establishments (by size in terms of employees)
NO. EMP.: number of employees referring to the establishments indicated the previous column (in italics)

Tab. 4b - Establishments and employees by industrial sector, (percentage by column) 1993.

Business sector	*Employees*	Establishments
Ferrous metals	*3,53*	1,18
Non ferrous metals, glass and ceramic goods	*2,82*	2,77
Chemicals	*5,51*	2,48
Man-made fibres	*0,51*	0,04
Metal products	*17,58*	19,88
Mechanical enginering	*10,96*	9,51
Electrical and electronic engineering	*9,79*	8,92
Transport equipment	*3,08*	0,88
Instrument engineering	*1,75*	3,24
Food, drink and tobacco	*4,81*	5,44
Textile and clothing	*11,63*	6,60
Leather	*0,87*	1,43
Footwear	*8,14*	10,46
Wood processing and furniture	*6,38*	12,07
Pulp and paper	*6,20*	6,25
Rubber and plastics	*4,61*	4,56
Other manufacturing industries	*1,84*	4,26
TOTAL	*100,00*	100,00

Source: CERVED, Chamber of Commerce, Industry, Agriculture and Handicraft database, 1994.

II. Case studies

Science Park RAF, HSR Ospedale S. Raffaele Milano.

Interviewed persons:

Management of the Park

- Ing. Bettini (director of the Park);
- Ms. Franchi (External relations manager);
- Mr. Colombo (Information services manager);

Tenants

- Mr. Adorini (ROCHE Lab. director);

- Ing. Pietrabissa (Bioengineering department of Milano Polytechnic);

- Mr. Mambretti (ASSOBIOMEDICA director);

- Ing. Zanotti (SNIA Research).

1. Tenants of the Park

The building framework of the Park is structured into four main blocks:

- The Institute for Hospitalization and scientific Care S. Raffaele Hospital;
- The DIBIT - Dep. of biological and technological research;
- The DIMER Dep. of rehabilitative medicine
- The recreative/congressional area and guest quarter, at the Malghera building.

In the functional organization of the floors, the DIBIT mainly groups research laboratories, service areas with technological and scientific content, congressional and didactic areas located in the two basement floors realized under the parking area in front of the main entrance, while in the two other floors (out of earth) comprising the courtyards, it locates in equal parts the didactic areas, the administrative offices and the logistic and financial services. The remaining floors are devoted to research areas offered to private companies. At present one big company, Roche, is there, dealing with problems related to diabetes.

2. Strategic objectives of the Park

The Scientific Biomedical Park S. Raffaele Milano East can be defined as "an organic system of scientific and technological competencies and resources, aiming at supporting local development of advanced industrial initiatives in the biomedical sector (with the role of industrial incubator), at contributing to the diffusion of the updating process of the National Health System and at helping the development of specialized training programmes (pre and post-graduate)".

The main guidelines are:

- creation of high technology business
- centre for the reception of existing companies.

The activity of the park started relatively in recent time.

The peculiar structure and the typology of activities carried out inside a hospital certainly facilitate the relations between the park and the companies there operating. Many interactions exist between the Park and its users, which lead to a positive synergy, with interesting stimuli and progress in the typical biomedical activities.

Inside the park there are universities' and private structures' laboratories operating in sectors connected to the hospital 's activity.

As far as the relations with external structures, it must be said that strong connections exist between the park and the universities of the area of Milano; with a publisher information bulletins and scientific publications are produced.

The basic object of helping interaction between public and private sectors, firms and promotional organizations is part of the project aiming at a "four-dimensions" support: to research, training, communication and "incubator of new business".

The Park is continuously evolving and there is the intention of comprise inside it other companies, mainly private ones.

3. Science park management role toward tenants and linkages

In the examined case, taking into consideration the activities connected to the specificity of a hospital and the relevance of research activity, the trading activity is not one of the main activities, however considering the marketing and the promotion of the images of companies operating inside the hospital, it already exists thanks to the growing importance of the structure.

The incubator, which is going to be the main tool for technology transfer to businesses, is still not fully operating, therefore an advisory service concerning business plans for the companies is still not offered.

Many common structures are available for the companies and laboratories operating inside the hospital, among which the telematic support is particularly important.

A demonstrative centre of technologies is located inside the park and it is to be considered rather relevant for the promotion and support of the technology transfer activity, one the main objects of the Park.

4. Telematics

S. Raffaele Hospital has got a large telematic structure, mainly used by laboratories operating inside the Park. An effort of unification of the whole structure has been made: the GARR network is used and is connected to the four networks of the area of Milan. The internal architecture is an IBM 9000/500 with 100 G-byte and 35 Mbps; 1200

terminals are connected to it. 45 persons are employed in the EDP department: 2 out of 3 are dealing with the assistance and 1 out of 3 with the implementation of new applications. INTERNET is used for the electronic mail, there are no problems of connection and at the moment it is used for file transfer. A standard communications protocol is used. The operating system is UNIX and it permits the interface with IBM PC and Macintosh; the choice of UNIX depends on the fact that it is the most diffuse one.

There are no problems of connections with the other parks because all of them use standard systems.

In a short period of time, the access to the ISDN network will be available, which will permit videoconference, particularly important for transoceanic connections.

The telematic facility is not systematically promoted and the choice to use it or not depends only on the practical needs of the companies and laboratories operating inside the park: it is a spontaneous non guided phenomenon.

5. Linkages/networking

The presence of diverse activities and structures in a limited physical area facilitate relations between them. Moreover the Park is monosectorial and deals with biotechnology, therefore frequent exchange of information is compulsory.

As far as the relationships with external structures, each company and research institute located in the Park exchanges information with external labs and partners; there are not linkages between different tenants with the exception of Roche group, which operate continuously with laboratories inside and outside the park, and with the laboratories of the universities.

6. Support for linkages

-

7. Potential for improved networking/linkages

It is not easy to understand the potentialities of development of these activities because the activities carried out inside Park result from human and telematic connections. As far as the parallel activities carried out by the park, the benefits deriving from the human and telematic connections inside the park and with external structures are certainly evident.

Nothing relevant has been made for promoting the development of information networks by local territorial referents. Their start up and development depends on a spontaneous phenomenon, based on the needs of the interested structures themselves.

The role of telematics is relevant but non decisive: human relations are of basic importance for the activities developed inside the park, therefore it is more correct to talk about communication networks in the widest sense.

BICOCCA PARK MILANO

Interviewed persons:

Management of the Park

- Ing. Pascucci (director of Polo Tecnologico Bicocca);

Tenants

- Mr. Giorgio Bonamini (manager ALTAIR, company of the Bicocca Incubator);

- Mr. Salvatore Bianco (manager UNION V, company of the Bicocca Incubator);

- Ms. Annamaria Lorefice (manager PRECOPRESS, company of the Bicocca Incubator).

INCUBATOR

- Arch. Fossati (director of the Bicocca Incubator).

The Milano area activity is very similar to the one of the other North European big towns on the quality of life point of view (tourist interest, cultural and entertainment activities, health service, traffic, shopping, work atmosphere) and on the point of view of advanced facilities, infrastructures and services (R&D laboratories, university system. Stock Exchange, meetings, exhibitions, data banks access, marketing services): On the other hand the town is heavily penalised by general conditions for the settlement in the area (space availability, space costs, wages, cost of living, national bank costs, logistics and distribution, industrial relations) and by the quality and availability of base facilities, infrastructures and service (air and railway links, urban transport, phones, mail service, public service).

1. Tenants of the Park

The technological pole Milano-Bicocca is located in one area of more of 70 hectares (which includes the Albania, the Bicocca and the Segnanino ones).

Located tenants are more than 30: among them software houses, pharmaceutical, publishing, services, sport facilities industries and so on.

The most of them are large companies.

Inside the Park there is the University seat and, at the end of 1994, there will also be the Milano CNR offices (National Research Council).

2. Strategic objectives of the Park

The characterising elements of the Park of Bicocca is its multidisciplinarity, whose different research sector activities are linked one with the other.
The mix and integration of exact sciences, economic and social sciences is pursued and the attention is focused on the technologies overcoming, more than on their improvement.
The activities have been divided into seven themes, a global engagement of 3500 people (500 for each of the seven sectors). There are some strong elements and others to be reinforced: they both have strong relations with the territory. First of all there is the innovation concept as result of the exchange among the various activities, such as research, development, production of prototypes and services for building, environment, telecommunications, airspace, biotechnologies, robotics, and artificial intelligence. In addition the themes have been divided into three levels of complexity as to the themes: materials, components, systems.
Inside the Park some programmes are developed, such as training, which is by the way carried out either by the University or by the firms. In addition, the University will also duplicate some faculties (Sciences, Law, Business Administration and Commerce) creating a second seat of them inside the area.
The training activity is also carried out inside the Incubator (located in the Park too).
The creation and the promotion of the company development has a significant importance: this is the role of the Incubator, which offers a range of services generally given by a BIC and for this reason this makes the structure complete. The "rising companies" are looked after till the moment when the can "walk on their own": only at that moment they leave the Incubator, and let their occupied space available for another idea, that is for another company.

The Bicocca Park groups:
house building;
centre equipped with sport facilities;
area equipped with the essential services and trade activities;
university and post-degree training centre;
management training centre;
available space for hi-tech companies working inside the Park;
incubator for new companies;
centre for university labs and for public/private research labs.

The people - more or less 40 - who are responsible for the structure, also give real estate services.

Only 7-8 persons deal with the management of the Park in a continuous way inside Milano Immobiliare.
In the near future, in 1995, a society for the Park management will be created.

Even if the project was worked out several years ago, the real start of the activities carried out inside the Bicocca is recent, too recent to give evaluations about the work of the various structures inside the Park.
Inside the area there is an always bigger space available to allow, besides the University, to a greater number of companies, either small or big, to work.
Because of the lack of cooperation culture between the public and the private sector, there are not significant interactions between them, even if the Park management works as a promoter. However it is to be underlined that among the companies themselves there are relations due to the common interests deriving from activities carried out in similar or linked sectors.
On the other hand, there are relations between the park organization and the University - which is present in the area with several scientific and not scientific faculties - , and between the companies and the Universities, inside and outside the Park.
As regards the choice of destination of parts of available area, it has been decided to reduce the foreseen for the services and the shops in favour of an enlarging of the residential zone.
The available area is more and more extending, with the creation of structures of services and commercial activities, to increase the potential of the whole zone.
On the other hand, as regards the carried out activities inside the scientific Park, we can notice that, in spite of the relative youth of the structure, very advanced research programmes are realized - together with the Universities - and university and entrepreneurial training programmes.

3. Science park management role toward tenants and linkages
The Polo was born thanks a real estate operation, as this was the only way to self-finance.
Real estate properties were sold to the interested societies, once they have been rented to the firms. In this way it is possible to go on, thanks to the capital realization, in the building of other real estate immovable.
The promotion activities performed by the Park administration are not limited to the lease of the structures to the interested companies, and the supply of linked services: new initiatives turned to support the development of the communication exchanges among Parks, companies Incubators and firms have been developing.

In particular a project - called "Cooperation Technological Parks (CPT)" - is under exam. The project deals with a telecommunication system and data base which links each other all the participants connected to the network. Technological Parks. Incubators and entrepreneurial system which includes outside companies and the related entrepreneurial associations.
The base system source is the data-base which includes requests and offers for all types of cooperation and of business/agreements: marketing partnerships, know-how and technology exchange, joint ventures, venture capital and so on.
In this way CPT links together all the member partners in an international network, providing a great number of contacts and potential partnerships.
It is very interesting to notice the relation between the Technological Park and/or the Incubator and the companies system as a whole: that is the condition for the possibility to activate reciprocal cognitive flows of great use for everybody.

Inside the Park there is the Incubator, which has the role to guide the birth of new companies or the development of those which were recently founded (maximum two years); In this case, the Park staff provides assistance to the business plan, to the definition of the focus activity of the rising company, in addition to the supply of a range of services, from the location facilities through the technical to the advice ones.

As regards the shared sources, the Park offers a range of services:
- a meeting centre;
- a library for the exact and social sciences;
- a residence for students and professors;
- sports facilities.

It is also foreseen the realization of a light underground in a distance of 1,5 Km to link the area of the Park with the already existing public transport services.

In the Incubator, as regards telecommunication, a local network (hardware and software components) is used for office automation (fax, electronic mail, and so on) and access to the data bases and centralized EDP services.

4. Telematics

The park does not devote resources to promotion activity supporting the use of telecommunications services. The choice to use them or not is spontaneous.
Two big companies working inside the Park are linked through a fiber optic leased line to a teleport near the Park and use the video conference.

In addition, there is a project which foresees the creation of and internal telecom network with an interface towards the outside, linked with the CSCS (Swiss Centre for the Scientific data processing)

5. Linkages/networking

A project underway aims at creating a permanent link between the Parks in the Mediterranean. In the project, not only the telecommunication network but also the human one is taken into account for its importance.

6. Support for linkages

The Consorzio Milano Ricerche is delegated to diffuse information on to European initiatives.

The final goal of the Park is to obtain the necessary instruments regarding not only the scientific knowledge of the problems, but also the economic ones strictly connected, as well as the juridical ones which are the means to put into practice the projects.

7. Potential for improved networking/linkages

The cooperation project among Incubators, parks and entrepreneurial associations, based on the implementation of a network, contains potential benefits either for the managers of the single structures or for the tenant and incubated companies. The success degree for this initiative depends on the ability to identify the suitable interlocutors, i.e. those subjects whom the research of answer to common problems is shared with.

The project is still in a preliminary phase and it could receive useful inputs through the comparison with similar initiatives studied by other European Parks.

VENETO. Italy

I. - Regional background

Tab. 1 - General regional data

		value	% on Italy
Surface (skm.)		18.364,56	6,1
Population		4.363.157	7,7
University students		100.057	6,7
Employees		1.851.000	8,5
Regional employees on Italy by macrosector	%		
- agriculture	7,3		
- industry	41		
- other sectors	51,7		
	100		

Source: ISTAT, *Le regioni in cifre*,1993, Roma.

Tab. 2 - R&D expenditures by typology of R&D, 1990
(millions.of Italian Lire)

base research	78.682	14,8%	
applied research	260.144	49,1%	
development	191.347	36,1%	
Total	530.173	100 %	(3.8 % on Italy)

Source: ISTAT, *Le regioni in cifre*,1993, Roma.

Tab. 3 - University graduates in scientific disciplines. year 1991-92

	graduates
Mathematics, Phisics, Science	393
Engineering	588
Agriculture	132

Source: ISTAT, *Le regioni in cifre*,1993, Roma.

Tab. 4a - Establishments by industrial sector and by size in terms of employees, (percentage by row)1993.

Business sector	E. <10	*NO.EMP.*	E. 10-99	*NO.EMP.*	E. 100-499	*NO.EMP.*	E. >500	*NO.EMP.*	E.EMP.NA	*TOT. EMP.*	TOT. E.
Chemical, glass and ceramic products	65,68	*16,12*	21,67	*42,48*	1,26	*24,87*	0,14	*16,53*	11,25	*100,00*	100,00
Metal products and industrial machinery	71,73	*25,38*	15,25	*46,21*	0,80	*20,56*	0,06	*7,85*	12,16	*100,00*	100,00
Food, textile, wood, furniture et alii	69,77	*27,22*	16,92	*54,32*	0,52	*13,87*	0,03	*4,59*	12,76	*100,00*	100,00
TOTAL	70,16	*25,38*	16,67	*50,22*	0,66	*17,38*	0,05	*7,02*	12,45	*100,00*	100,00

Source: CERVED, Chamber of Commerce, Industry, Agriculture and Handicraft database, 1994.

Legenda:
E.: establishments (by size in terms of employees)
NO. EMP.: number of employees referring to the establishments indicated the previous column

Tab. 4b - Establishments and employees by industrial sector, (percentage by column) 1993.

Business sector	*Employees*	Establishments
Ferrous metals	*1,84*	0,50
Non ferrous metals, glass and ceramic goods	*5,73*	5,16
Chemicals	*3,06*	1,16
Man-made fibres	*0,19*	0,02
Metal products	*14,55*	17,17
Mechanical enginering	*7,76*	6,62
Electrical and electronic engineering	*7,66*	5,49
Transport equipment	*2,06*	0,99
Instrument engineering	*2,68*	3,95
Food, drink and tobacco	*5,49*	7,06
Textile and clothing	*7,69*	4,96
Leather	*2,41*	2,24
Footwear	*17,18*	15,84
Wood processing and furniture	*11,04*	17,57
Pulp and paper	*4,21*	3,92
Rubber and plastics	*3,38*	2,98
Other manufacturing industries	*3,05*	4,35
TOTAL	*100,00*	100,00

Source: CERVED, Chamber of Commerce, Industry, Agriculture and Handicraft database, 1994.

II. Case studies

The Veneto industrial structure is characterized by two main aspects: The predominance of SMEs and a policentric territorial articulation of the industrial and urban settlements. In Veneto, like in Emilia-Romagna, Tuscany, Marche and in some other sub-regional areas of Italy, industrial districts - a concentration in the same area of SMEs cooperating and competing in the same industrial sector (filière), interlinked as suppliers and commissioners, and benefitting from the stimulating Marshallian "industrial atmosphere" feeded by the concentration itself - can be identified.
The industrial policy aims at favoring the introduction of new technologies in mature industries, attracting innovative companies, creating and enlarging new innovative sectors, creating incubators for innovative companies, give rise to centres of excellence for the development of frontier technologies.

While, in the last decade, in Italy as a whole the industrial activity decreased, in the Veneto region it almost does not change. The averadge size of the enterprises is 7,4 employees, against the 7,7 of Italy and the 9,0 of the North-West regions of Italy. The tertiary sector during the '80s increased more than the Italian averadge.
The NEST project referres to an industrial map drawn for the region which identifies four areas of industrial typology, namely:
- areas with a differenciated traditional structure (clothing industry among others)
- areas with a dependent structure (low tech with prevailing clothing industry)
- areas with adifferenciated modern structure (enginnering and machinery industries)
- areas with a specialized structure.(highly specialized and mono production areas like four areas for the furniture, three for shoes, 23 communes for glasses.

The more represented industrial sectors in the regional area, in which innovation processes and new mix product-market are visible, are the followings: shoes, goldsmithry, glasses, textie clothing, tanning, ceramics, wood and furniture. Other sectors are expected to have some potential, like farmaceutical, plastics, marble, building materials and artistic glass, cakes, cool industry, machine tools, etc.

Interviewed persons:
Mr. Adriano Rasi Caldogno, Director Veneto Innovazione

1. Tenants of the Park

NEST is the project of a multipolar scientific and technological park. It will be based on three main poles (Venezia, Padova and Verona) and ten nodes (Treviso, Vicenza, Rovigo, Longarone-Cadore, Feltre-Valbelluna, Portogruaro-Veneto orientale, Oderzo-Pedemontana orientale, Cittadella-Alta padovana, Monselice-Bassa padovana, Thiene), all located in the Veneto region. The project phase is now completed and the put in place phase will start soon. So, we can learn from this case something from the approach more than from the experience.
Universities, entrepreneurial associations and Chamber of Commerce, together with the regional development agency Veneto Innovazione, are members of the management committee of NEST.

2. Strategic objectives of the Park

The main strategic objective of the Park is technological trasfer, both towards the local industry and for attracting companies from other areas. Other objectives are the creation and development of new high tech companies, the creation of research centres devoted to technological development in advanced sectors, the inward attraction of investments in R&D and the strenghthening.of the linkages and interaction between the economic system, the social and urban system, the education and training institutions and the tertiaty sector. These aims will be pursued through the building of links between private and public research centres and the implementation of shared and cooperative activities between the scientific and industrial bodies of the regional area; the support to the diffusion of innovation and the adoption of new technologies also in traditional and mature industries; the creation of incubators for the development of innovative companies: the management of the telematic network which will support the cooperation between the parks and nodes of NEST.
The multipolar structure of NEST is devoted on one hand to spread out the actions and facilities in order to reach easier the contact with potential users of the Park, on the other hand to focus and specialize each park and node on the sector and related technology which is more relevant for each regional area.

The nodes are innovation centres collecting activities as training, information provision, consultancy, services to the enterprises. The poles are settlement structures articulated

in the territory, located near the university sites. Both poles and nodes are sectirially qualified and specialized on the basis of the industrial specialization of each area or industrial district. The whole project takes into account the previous initiatives put in place or feasibility studies in the research field, such as Agripolis in Legnaro (Padova) focused on agricultural science, veterinary medicine and zootechnics, and the dairy industry institute in Thiene (Vicenza), or the plan for the Padova Science and Technology Park and the Venice Science and Technology Park (Marghera industrial zone and dockyard).

So, each of the three poles and ten nodes will be specilized in one or some technologies, but at the same time, a strong coordination and the NEST telematic network will bring each of them to share the knowledge with the others, or to look for technological information by the neighbouring node. In this scheme, universities and training schools as well as private research labs will cooperate with all the sites of NEST which require specialized contribution.

The sectoral specializations of the two poles of Padova and Venezia, which in several disciplinary areas are complementary, are the followings: electronics, information technology, industrial automation, office automtion, energy, environmental technologies, building and restoration technics, molecular engineering, new materials, biotechnologies and biocompatible materials, agroindustrial and nutrition technologies, health, biomedical, telemedicine, sea technologies, clean production processes technologies.

The third pole, Verona, will focus on: chemical and farmaceutical tecnology, information technology and microelectronics, measurement nd precision instruments, transport means and components,ricycling of mterials, machinery and plant control systems, EDP and software.

Once completed in about ten years, the NEST project should involve 10.000 employees in production and research activity with a turn over of 3.000 billion Lire. The amount of investments in instrumental capital required during the decade is estimated at 800-10000 billion Lire.

The NEST project is articulated in four different and integrated dimensions: telematics, settlement, contractual and organization aspects, regulation and guidance.

3. Science park management role toward tenants and linkages

The NEST project is based on a strong, continuous and coordinated cooperation and exchange of information between institutional, research and economic actors, as well as between different areas of the region which share the same specialization. At the same

time. the project aspires to strenghthen the linkages of the Veneto region with other European regions. The promoters of the project are aware of the need to make all the named actors to contribute to the same aim of developing and diffusing technological knowledge in the economic system.

4. Telematics

A project of telematics network for NEST is already well defined and it is more similar to the INTERNET network than to the commercila networks.

This network should trasmit both video, voice, data, give each member of NEST the ability to use or provide resources, to have access to international networks and to receive from them, and finally to allow all the Veneto companies to access this network. The main backbone will connect the three poles of NEST; the experimentation of dedicated links with INTERNET and EUNET is foreseen for enlarging the geographical coverage of the NEST network.

5. Linkages/networking

The preliminary conditions for success are visible in the content of and in the participants to the NEST study recently completed. All the interactions and cooperations between institutions, research labs and industrial firms are described and could be set up on the basis .....

6. Support for linkages

Given the structure of NEST and the participation of various different actors in the planning and starting phase of NEST, a strong attitude towards frequent and substantial communication betwen the participants and between the various sites surely exists. In addition. the management of Veneto Innovazione, the major promoter of NEST, already indicated both areas of interest and organisations on and with which communication and cooperation would be highly appreciated.

7. Potential for improved networking/linkages

Any European Union support to networking/linkages between parks would be welcome by NEST management, mainly in order to improve the quality of the services provided to the tenants of the Park. Critical areas in which an external help would be useful are the access to specialized databases, the creation of demonstration centres, the use of telecom networks, the access to EU information.

The park model for this region aims at merging the territorial concentration of operators. needed to cross fertilize and to reach economies of scale in the research activity and in the related services, with the need to provide services and opportunities

as close as possible to the industrial sites of the region. The model tries to face the technological, organisational and institutional challanges identified in the regional economic system and present also in many other areas of the country: to increase the potential of the basic research through the cooperation and continuous transfer between research institutions and industrial companies; to diffuse the cumulated knowledge and information on new technologies both towards advanced and traditional industrial sectors; to facilitate the internationalization process of the production system, through comparison and imitation with other regional areas and countries; to build a new and richer relation between the industrial system and the financial institutions, the universities, policy-makers, and the human society.

FRIULI. Italy

I. - Regional background

Tab. 1 - General regional data

		value	% on Italy
Surface (skm.)		7.844,13	2,6
Population		1.193.520	2,1
University students		27.143	1,8
Employees		475.000	2,1
Regional employees on Italy by macrosector	%		
- agriculture	5,4		
- industry	31,3		
- other sectors	63,3		
	100		

Source: ISTAT, *Le regioni in cifre*,1993, Roma.

Tab. 2 - R&D expenditures by typology of R&D, 1990
(millions.of Italian Lire)

base research	14.254	6,6%	
applied research	149.442	69 %	
development	53.018	24,4%	
Total	216.714	100 %	(1.6 % on Italy)

Source: ISTAT, *Le regioni in cifre*,1993, Roma.

Tab. 3 - University graduates in scientific disciplines, year 1991-92

	graduates
Mathematics. Phisics. Biology	216
Engineering	117
Pharmaceutical	59

Source: ISTAT. *Le regioni in cifre*,1993. Roma.

Tab. 4a - Establishments by industrial sector and by size in terms of employees, (percentage by row)1993.

Business sector	E. <10	*NO.EMP.*	E. 10-99	*NO.EMP.*	E. 100-499	*NO.EMP.*	E. >500	*NO.EMP.*	E.EMP.NA	*TOT. EMP.*	TOT. E.
Chemical, glass and ceramic products	67,7	*17,1*	17,25	*43,27*	1,4	*18 97*	0,3	*20,66*	13,35	*100,00*	100,00
Metal products and industrial machinery	72,53	*20,72*	14,12	*37,52*	0,93	*20,88*	0,14	*20,88*	12,28	*100,00*	100,00
Food, textile, wood, furniture et alii	74,46	*28,97*	13,44	*46,13*	0,83	*21,87*	0,03	*3,02*	11,24	*100,00*	100,00
TOTAL	71,91	*24,02*	13,68	*41,64*	0,89	*20,95*	0,09	*12,32*	13,43	*100,00*	100,00

Source: CERVED, Chamber of Commerce, Industry, Agriculture and Handicraft database, 1994.

Legenda:
E.: establishments (by size in terms of employees)
NO. EMP.: number of employees referring to the establishments indicated the previous column (in italics)

Tab. 4b - Establishments and employees by industrial sector, (percentage by column) 1993.

Business sector	*Employees*	Establishments
Ferrous metals	*3,01*	0,48
Non ferrous metals, glass and ceramic goods	*4,63*	4,32
Chemicals	*1,2*	1,19
Man-made fibres	*0,04*	0,01
Metal products	*14,31*	17,63
Mechanical enginering	*11,78*	5,72
Electrical and electronic engineering	*12,49*	8,68
Transport equipment	*2,57*	1,25
Instrument engineering	*2,33*	5,22
Food, drink and tobacco	*8,21*	9,94
Textile and clothing	*3,83*	2,22
Leather	*0,65*	0,69
Footwear	*3,15*	7,32
Wood processing and furniture	*21,96*	24,2
Pulp and paper	*5,41*	4,34
Rubber and plastics	*2,1*	2,3
Other manufacturing industries	*1,25*	2,61
TOTAL	*100,00*	100,00

Source: CERVED, Chamber of Commerce, Industry, Agriculture and Handicraft database, 1994.

II. Case studies

AREA SCIENCE PARK, Trieste

Interviewed persons:

Management of the Park

- Mr.. Sancin (general manager of Consorzio per l'Area di Ricerca di Trieste);
- Ing. Gatti (planing and development director);
- Ing. Russo (EDP, network and documentation department director;

Tenants

- Prof. Franciosi (TASC Lab, Consorzio INFM director);
- Mr. Nardelli (TASC Lab, Consorzio INFM);
- Mr. Sancrotti (TASC Lab, Consorzio INFM);

- Mr. Mariotti (POLY-BIOS Lab director);

- Mr. Zanchi (INSIEL software development Lab director);

- Prof. Falaschi (ICGEB director);

- SINCROTRONE;
- Prof. Stalio (C.A.R.S.O. Lab president);

Regional bodies

- Mr. Calandra (regional industry department manager);
- Mr. Francescato (regional European Unit department manager);

BIC

- Mr. Francesco Zacchigna (BIC Trieste general manager).

Management	3
Staff	45

Background data

Analyzing the territorial system of Friuli Venezia Giulia region from the competitiveness point of view, one of the features that clearly stands out is represented by the high level of training, research and innovation activities.

In this region the two universities of Trieste and Udine are operative, with the detached departments of Gorizia and Pordenone; a large number of laboratories of national research organizations, such as CNR Consiglio Nazionale delle Ricerche (National Research Council), INFN Istituto Nazionale di Fisica Nucleare (National Institute for Nuclear Physic), and other regional, national and international training and research institutes.

On the whole there are some thousands of researchers dealing with science and technology leader sectors, from physics of high energies to neuroscience. from biotechnology to materials sciences, from chemistry to information technology. The results coming from this network of laboratories are knowledge that could be transferred to enterprises; training of technicians and graduates and consequently qualified human resources; international relationship, from the near European countries to the American or the Far East ones, which are in a flourishing economic growth.

1. Tenants of the Park

In 1982 the activities of Trieste Area have been set up, thus representing the first Scientific Park in Italy.

The main one is the research activity. There is a huge number of laboratories and public and private organizations operating in forefront sectors of scientific and technological research, advanced equipment, advanced facilities and services for research. All of this constitutes the first Italian multidisciplinary technological park and the meeting point of national and international activities and experiences.

In the Park, research activities regard the following sectors: biotechnology and genetic engineering; physics of materials and surfaces; information technology; microelectronics; base and applied chemistry; science and technology of natural polymer; advanced tools for earth and space optics; evaluation of biomedical equipment; technological innovation in small and medium enterprises; neuroscience.

About twenty enterprises are operating: laboratories of national research bodies; international Centres; public and private companies, consortia between public bodies or between Universities and enterprises.

Their activity is connected with a continuous information and promotion and diffusion activity, based on the publication of papers in national and international scientific reviews.

Finally, since the beginning, training programmes and seminars have been organized.

The direct employees are about 800, dealing with research activities and connected services.

The services: technical, logistic and technological services; information services (EDP dept., local, national and international telecommunication network, data base connections); services supporting the centres and the laboratories in the identification of financial resources and in technology transfer; meeting centre.

The meeting centre is going to be enlarged with new meeting rooms, in order to satisfy the growing need of spaces devoted to seminars, congresses and training courses.

About the informative services, the Centro Calcolo Reti and Consortium Documentation, that links all the Park laboratories to the scientific network of the town

and to the national research network (GARR), will be provided with a new "infobrokering" service. This service will allow to obtain on line, information available before its printing (preprints), and also several public domain software products, that have often a better quality than the software distributed at commercial level.
Furthermore it is in progress a significant project aimed at providing advanced informative services to scientific and industrial users, in order to favour their participation in national and international research and technology transfer programmes.

2. Strategic objectives of the Park

The Trieste Park is revising its approach: moving from the prevailing development of research activity, not necessarily connected with the local market, it is now starting to focus on the objective of creating constructive cooperation between its own research and development centres and the industry.
Hence it follows that the orientation for the future is aimed at favouring settlements for industrial application and at promoting the link between research and high tech companies.
The increase of the commissioned research activity for small and medium enterprises is inserted in this development guideline.
A project for the realization, in the Scientific Park, of an enterprises incubator is going to be completed, aimed at developing high tech entrepreneurial initiatives. The project is to be managed in cooperation with the BIC of Trieste, whose institutional activity is to be an incubator of enterprises.

3. Science park management role toward tenants and linkages

The guideline chosen by the management is to create cooperation between companies operating in the Park, favouring the contacts and turning them to benefits for the whole Scientific Park.
Consequently, the Park plays a leading and coordination role of the initiatives. This methodology has just brought good results. In fact there are a lot of research programmes managed by the Area centres in cooperation with industrial and academic organizations at national and international level.
Furthermore, there is a close relationship with the local institutions, such as regional bodies: with them initiatives that had required the intervention of territorial representatives have been set up. It is worth pointing out that the sponsors of Trieste Park are mainly public ones (operating with special contributions and national and international focused contributions and through research organizations): what follows is a constant necessary contact between the two realities.

4. Telematics

A fiber optic local network (100 Mbps) links all the research labs with EDP and telecommunication equipment endowments. In 1989, the academic scientific community network GARR (Gruppo Armonizzazione Reti Ricerca) was created through the merging of the existing scientific networks. It now has 12 nodes in the whole country, one of which is in the Park, to which also the Udine University is linked. It is supported by the Ministry of University and Scientific and Technological Research. GARR services are distributed in the urban area through a metropolitan network based on leased lines at 2 Mbps with distribution lines at 64 Kbps.

In 1989, a five year agreement was signed between the Park and a private company for the project, installation and assistance of an information system based on Unix, on which software is shared between the users. The project is now completed and the Park EDP Department is providing and selling data processing services.

The Department provides also documents, international libraries texts, data base inquiry services, mainly on scientific and technological themes.

5. Linkages/networking

The Science Park Area takes part in a network including the Park of Bilbao, Groningen, Edinburgh. It is not only a telematic network, but also and mainly a human network. In fact the Park aims at setting up relationship with other similar realities, in order to exchange experience on common topics, and if it is possible, in order to communicate "good practice" cases, related to relevant aspects for both partners.

It is still early to evaluate the Science Park Area activity.

6. Support for linkages

The Park activity aimed at extending the communication links to other countries has started recently, even if similar activities managed by enterprises operating in the Park had already been set up.

The activity managed by the enterprises and by the laboratories in the Park has represented a driving force for the kind of objective pursued by the structure's management.

Basically, at the beginning of its activity, the roles were inverted: the companies and institutions in the Park got in contact and set up cooperation with external enterprises and laboratories spontaneously, also with foreign countries; Park became aware of that and fitted its structure in order to favour these contacts.

The sectors in which tenants of the Park are operating, always requested continuous relationship, needed and physiological, with similar experiences.

Afterwards the management started to coordinate these activities.

7. Potential for improved networking/linkages..

As far as the willingness of the Park management to be availmable for participation in common programmes is concerned, it is worth to mention a direct role of the Park organization, which presented its candidature in a SPRINT programme for the planning of an enterprises incubator, the participation of almost all the Park tenants in several EC programmes, such as IMPACT, BRITE EURAM, TEMPUS, AIM, SCIENCE, BRIDGE, LINGUA, HUMAN CAPITAL & MOBILITY.

PROJECT OF A BIC IN THE TRIESTE PARK

Main aim: create new firms to foster the entrepreneurial development.
The approach is that of creating small firms able to adapt, through their innovations, the scientific know how to the needs of the customers and to fill the gap existing between research and industrial world.
In the case of involvement of a small firm, the link between research and industry would not take place in the form of "consultancy projects", but more likely in the form of "provision relations" to be proposed on the basis of the model "supplier" and " purchaser".
The global aim is that of creating, through a Venture Cluster, a small district of innovative firms: the concentration of firms with interdisciplinary technical and market know how which often lead to the creation of a "cluster" of firms having important synergy of product and of market.
This is particularly important for high tech firms. The concentration of firms and services is another key factor for investors.
The incubator is a tool which allows to create the brain-companies: support the technological and scientific know how of the researcher/entrepreneur with a range of services like the participation to international networks of industrial cooperation, marketing, management, financial consultancy, training and technological tools.

Therefore we can identify a path to generate industrial follow ups for research activities:

- spin off of new entrepreneurs from the research centres
- creation and support to firm which use the resources of Scientific Parks;
- creation of firms specialized in the maintenance and in the improvement of scientific instruments.

This project has the aim of gathering different roles played by different actors towards a single strategy. Namely:

- tuning of the research activities towards the applicability of the results;
- assessment of possible uses of the results deriving from research activities and in the drafting of the business plan, with the aim of supporting new entrepreneurs;
- start up of the incubation phase, with the creation of new companies;
- start up of the firm, outside bf the incubator and search for supporting capitals .

The aim of the project foresees and implies the involvement, beside AREA and BIC, of other socio-economic actors either public or private, namely Universities and Research Centres, industry, new firms, banks and financial institutions, regional, national and European authorities.

BIC TRIESTE

The BIC of Trieste is located in the industrial area of Trieste and is completely separate from the Area Science Park; it was funded in 1989 thanks to the support of the regional government, to assess and set up new entrepreneurships able to strengthen the productive tissue with SMEs competitive on the market.
The shareholders include:

SPI (74,30%);
Friulia (21,25%);
Others (4,45%).

It has a total stock of 5 billions of Lire.
It covers an area of 12.000 sm. and has premises of 8.500 sm. divided as follows:

- 40 workshops for a total of 4.500 sm.
- BIC offices for 500 sm.
- Common services for 2.500 sm.
- Other common facilities for 1.000 sm.

The BIC provides all members with the premises where their activities are carried out and in addition the following "services package":
logistic, feasibility studies, training, consulting activities, administration and control, secretarial services and namely:
- project analysis;
- business plan;
- entrepreneur and staff training;
- administrative management;
- budget management and control;
- balance sheet and annual income tax return;
- tax and fiscal consultancy;
- VAT statement;
- legal and company consultancy;
- specialized consultancy: marketing, insurance, patents.

The BIC provides also financial consultancy to obtain funds, in the framework of special agreement with financial institutions.
The financial tools provided by the BIC to its members are:

- Law 26 - Fondo Trieste, which guarantees contribution in stock account on fixed investments and of 50% in accounting period on running costs;
- Regional Law 45/86, which guarantees contributions of 20% on stock account on fix investments and of the 50% in accounting period on running cots:
- SPI interventions with funds up to 5.000 millions of Lire:
- FINFIDI interventions which supply with guarantees on investments:
- EC contributions on stock accounts.

All those who have a valuable entrepreneurial project and would like to realize it could address to the BIC (professionals and employees; researchers and university professors, artisans, cooperatives, etc.)

The experts of the BIC analyze and assess the project together with the proposes. Main requirements are: skills and capabilities of the proposers, technical, market, financial and company aspects .

A business plan is drafted, which should lead, in three years, to the autonomous location of the firm on the territory external to the BIC. The "BIC project" could be divided in 5 phases:

1) Analysis of the territory and promotion of entrepreneurial projects.
An accurate analysis is carried out, with the aim of identifying areas of entrepreneurial opportunities and of promotion of the BIC, also outside the regional area.

2) Preliminary evaluation of the proposals. The BIC provide assistance to every initiative regarded as interesting and valuable, for the drafting and assessment of feasibility analysis which are the basis for the entrance into the Centre.

3) Start up and incubation of firms in the BIC.
The incubation is the period in which the entrepreneurs define their project, producing prototypes, assessing the market and starting to sell. At the same time they provide for the organizational, financial and logistic aspects required to start up successfully the firm outside the BIC.

4) Start up of the full operational phase, outside the BIC, start of the production phase and location on the territory.

5) Final consolidation. The project does not end with the creation of new micro firms: the final aim of the BIC is of course that of guaranteeing the most effective follow up on the economic tissue of the territory in which it operates.

The phase of location of the firm outside the BIC (start up) is one of the most critical and with high probability of failure. The high tech firms are those who run the major risks, since they need financial and human resources not easy to be found in weak industrial areas.
Nonetheless, the firms should necessarily start the production and full operational phase outside the BIC.
The location inside the Centre should be limited in time so to offer this resource to the largest number of proposers.

Since the activity of the BIC Trieste has begun only recently and according to the fact that the firms remain within the Centre 3 years, it is difficult to provide detailed information concerning the level of integration of the latter in their outside location, owing to the fact the process of delocation is starting now.
Until today, the firms active in the incubator are 30, and there were no cases of failure, at least in the first phase in the Centre.
It is possible to increase the space available for each firm when necessary.
Anyway the exit of the firms is necessary since the expansion inside the BIC could be considered only a temporary solution but cannot substitute the final location which should definitely take place outside.
Furthermore the architecture of the incubator is not apt to manufacturing activity, since the production spaces are limited therefore they hinder the accomplishment of economies scale.

PUGLIA, Italy

I. - Regional background

Tab. 1 - General regional data

		value	% on Italy
Surface (skm.)		19.357,13	6,4
Population		3.986.430	7
University students		92.908	6,3
Employees		1.280.000	5,9
Regional employees on Italy by macrosector	%		
- agriculture	16,3		
- industry	24,5		
- other sectors	59,2		
	100		

Source: ISTAT, *Le regioni in cifre*,1993, Roma.

Tab. 2 - R&D expenditures by typology of R&D, 1990
(millions.of Italian Lire)

base research	25.006	12,4%	
applied research	159.524	78,8%	
development	17.777	8,8%	
Total	202.307	100 %	(1,6 % on Italy)

Source: ISTAT, *Le regioni in cifre*,1993, Roma.

Tab. 3 - University graduates in scientific disciplines, year 1991-92

	graduates
Mathematics, Phisics, Biology	614
Engineering	259

Source: ISTAT, *Le regioni in cifre*,1993, Roma.

Tab. 4a - Establishments by industrial sector and by size in terms of employees, (percentage by row)1993.

Business sector	E. <10	*NO.EMP.*	E. 10-99	*NO.EMP.*	E. 100-499	*NO.EMP.*	E. >500	*NO.EMP.*	E. EMP.NA	*TOT. EMP.*	TOT. E.
Chemical, glass and ceramic products	65,64	*13,04*	12,30	*19,63*	0,62	*10,38*	0,17	*56,95*	21,27	*100,00*	100,00
Metal products and industrial machinery	70,05	*31,13*	6,27	*28,61*	0,36	*17,02*	0,11	*23,24*	23,21	*100,00*	100,00
Food, textile, wood, furniture et alii	64,80	*39,33*	7,97	*46,56*	0,16	*8,68*	0,02	*5,44*	27,04	*100,00*	100,00
TOTAL	66,29	*31,99*	7,79	*36,36*	0,25	*11,34*	0,06	*20,30*	25,62	*100,00*	100,00

Source: CERVED, Chamber of Commerce, Industry, Agriculture and Handicraft database, 1994.

Legenda:
E.: establishments (by size in terms of employees)
NO. EMP.: number of employees referring to the establishments indicated the previous column (in Italics)

Tab. 4b - Establishments and employees by industrial sector, (percentage by column) 1993.

Business sector	*Employees*	Establishments
Ferrous metals	*11,00*	0,43
Non ferrous metals, glass and ceramic goods	*5,56*	5,00
Chemicals	*2,57*	1,01
Man-made fibres	*0,02*	0,02
Metal products	*11,91*	14,84
Mechanical enginering	*4,83*	4,14
Electrical and electronic engineering	*8,24*	3,74
Transport equipment	*2,06*	0,60
Instrument engineering	*1,02*	3,95
Food, drink and tobacco	*9,44*	15,86
Textile and clothing	*4,36*	5,40
Leather	*0,44*	0,67
Footwear	*23,66*	18,79
Wood processing and furniture	*7,42*	15,49
Pulp and paper	*3,81*	3,68
Rubber and plastics	*2,61*	3,24
Other manufacturing industries	*1,05*	3,13
TOTAL	*100,00*	100,00

Source: CERVED, Chamber of Commerce, Industry, Agriculture and Handicraft database, 1994.

II. TECNOPOLIS CSATA NOVUS ORTUS - BARI, ITALY

Interviewed persons:

Ing. Umberto Bozzo, (General Manager of the Park)
Ing. Mario Marinazzo, (Planning and Evaluation Director of the Park)
Mr. Giovanni Vessia, (Marketing Director of the Park)
Ing. Paolo Zupa, (Telecom Manager of the Park)
Ing. D'Erasmo, (Telecom Dept. of the park)
Ms. Anna Maria Annichiarico, (Director of the incubator BIC)

Two new companies of the incubator and one tenant: Top Rel, Ing. Larizza, spin off company Medea

Mr. Dell'Atti, (Regional Industry Dept. Manager of Puglia Region)

Organization staff: 240, of whom 18 managers and 25 manager assistents or project managers.
Annual budget 14 MECU.

1. Tenants of the Park

The Science Park was created in 1984 as evolution of CSATA, an organization which had been working for fifteen years in research and technology transfer, training and service provision for SMEs of the region in information technology. It operates in a objective 1 region.

Tenants located in the Park are 35 - of whom 15 are newly created enterprises -, while more than 170 companies, research institutes, public bodies use the services and facilities provided by the Park.

Industrial tenants located in the Park are some research departments of large enterprises and mainly SMEs. The business sector of these companies is the electronic, computer, software and telecommunications one; one third of the activity is devoted to business services and consultancy.

2. Strategic objectives of the Park

Strategic objectives of the Park are: attraction of R&D investments, technology transfer, creation of new enterprises. The Park is focused on the electronic, computer, software and telecommunications sector. It has been working on the qualification and improvement of the knowledge, in the training of human resources and in the diffusion of knowledge in this field.

The management of the Park has been deeply involved in activities and projects based on the build of permanent/stable linkages between various sets of actors. One of these - IATIN - was developed at the sub-national level, in Southern Italy. Within the STAR project, the Park established a permanent cooperation with consortia born in other Southern regions of Italy, inspired by the CSATA approach. These are: CORISA in

Sardinia, CRAI for Calabria and Molise, CRES in Sicily, CRIAI for Campania and Abruzzo. Through these centres, linked to Tecnopolis (which within IATIN covers Puglia and Basilicata) and between them by IATINet a private telecommunications network, demonstrations and services implemented with the support of the STAR/PROGRED programme were diffused in all the eight regions.

Each of the five Centres provides communications services (archives transfer, e-mail), information services (data banks inquiry, sectoral electronic bulletins), training, videoconference. The Centres, which are still providing these services, reached 1.300 enterprises during the life of the STAR programme, involved 75 supplying companies, two thirds of which located in Southern Italy.

A more capillary coverage of the Puglia region was and still is reached through the cooperation with entrepreneurial associations, both of industrial, SMEs, artisan companies, which host demonstration centres and access points to the services provided on IATINet.

The Park is one of the four organizations involved in the EC project AMBAR.

3. Science park management role toward tenants and linkages

The major attractive element of the Park is represented by highly qualified and specialised research and analysis laboratories, with an endowment of sophisticated equipment and highly qualified technicians, covering the basic disciplinary research areas for electronics, information technology, telecommunications.

These laboratories are permanently used by the companies located in the Park and frequently also by companies of the area; in some cases, researchers have direct access to the equipment, in others, the companies relay on the technicians of the Park, whose time is booked and paid together with the use of the laboratory.

Training (mainly in information technology aspects), consultancy (both in technology and in business planning and management), and also although still less critical, telecom facilities, represent the other ingredients of the Park. The local, regional, national and international relations and linkages are used in order to provide support to the tenants in their activity, to collect information on technology, on markets and on potential partners.

In 1989, an **incubator**was created within the Park, oriented to the creation of new enterprises in the same sectors in which the Park is specialized. These will be innovative and technology oriented companies, some of which will be created as spin off of the Park itself. The new enterprises will use in the first place the services and equipment provided by the Park, and will pay for their use. For this aim, a new building devoted to provide a location to the new companies was raised, in an area besides the laboratories and offices of the Park.

The activity of the incubator is completely integrated with the Park. The main services provided by the incubator are data processing, telecommunications, testing and certification of software products, procurement, testing and certification of electronic devices, research, training and consultancy in the technical, managerial and financial areas, electronic editing and secretariat.
Both the location and the services are payed by the new enterprise. The incubator is not yet filled by new enterprises, so no companies were asked yet to find a new location out of the incubator.

4. Telematics

At the local level, the Park is linked to the main local actors - local government and public service, university, polytechnic, polyclinic, fair, telecom carrier, industrial area - through an optical network linking various LAN, and providing applications like LAN links at 2 and 34 Mbps and broad band videoconference.
At the regional level, the private network Tecnopac performance is 64kbps; it has seven access nodes and it is linked to IATINet and GARR.
At the Southern Italy level, the private network IATINet performance is 64kbps, with thirty access nodes.
At the national level, the Park is one of the nine primary nodes of the GARR network, the 2Mbps network for the scientific, academic and industrial community promoted in 1988 by the organizations of GARR (Harmonization Group for the Research Networks), accepted by the Ministry for Research and linked with some of the major international scientific networks such as EARN, Internet, HEPnet, IXI, SPAN, EASINet.

5. Linkages/networking

The more important communications of the Park are the ones with the tenants, both in-site and off-site, with the entrepreneurial associations, at the local, regional and national level, and with other companies especially at the regional and national level. Also the communications with government bodies, at the local, regional and EC level and with universities and research institutes are quite important. Relations with other Scientific Parks and with their tenants exist at the national, EC and for SP at the extra EC level.

6. Support for linkages

The Park actively participated in the AMBAR project, a three year EC supported project involving the Bari, Montpellier, Valentia and Sevilla Science Park. The most relevant results of this experience are, on one hand, the cooperation between managers of the Parks and the exchange of information between tenants of the parks, on the other hand, the increase of effectiveness of the workshops and discussions made through

CALABRIA

Section 1: Regional background

Calabria is a Southern-Italian region inhabited by slightly over two million people, that is 3.6% of Italian population. The economy of this region is little developed, the per head gross product averaging approximately half of the Italian GNP. This low level is due above all to scarcity of productive activities, especially the industrial ones. Low demand of labor from the industrial sector contributed to the creation of a large and growing number of unemployed: 200,000 people, mostly youth and women, with the total of employed of over 600,000. Another factor contributing to unemployment is a demographic growth higher than in the rest of the country, and the end of emigration of labor force towards more developed areas, in- or outside Italy.

Historically, the peripheral location of Calabria and the very morphology of her territory posed powerful limits on the dimension and rhythm of economic development of the region. Indeed, 90% of its territory is composed of mountains and internal highlands, with low natural productivity, while the plains cover only 10% of the territory. The transportation and communication within the region and with outside areas, and consequently commercial exchanges, have thus always been difficult.

The dominant economic sector is the tertiary. It accounts for 75% of the income produced and for approximately 60% of total employment concentrated mostly in public administration and in traditional commercial services. Industry contributes to 20% of both the employment and income formation, while agriculture employs 20% of labor force and produces a little over 6% of regional income (the discrepancy in numbers indicating low average productivity of labor in this sector).

Last two decades, however, have witnessed some important and radical transformations in the region's economy, both qualitative and quantitative. The levels of per head consumption, fueled indirectly by public funding and by emigrants' savings, have been slowly approaching average national values. The increased public investment in providing the region with infrastructural endowment resulted in a definitive overcoming of its historical physical isolation. Today, Calabria can be considered largely integrated in the national economy, while the flow of commodities and people within the region has grown considerably.

The density of regional highways, 2 linear km. for 100 square km., corresponds to the national average. The network of ordinary roads is more developed than the national average, while that of railroads -- due also to physical obstacles to its expansion -- is still by one fifth less dense than the national one. Calabria

has three airports, Sant'Eufemia-Lamezia, Reggio Calabria and Crotone (the first of these international) and eight sea-ports, some of which with a high cargo capacity. Finally, there exist some twenty equipped industrial zones with 4,000 hectares of territory. In large part, these have been endowed already with the necessary infrastructure, but are under-utilized in terms of the number of industrial establishments effectively operating.

Calabria has two public universities, one in the area of Cosenza and one in Reggio Calabria, and a branch of the former in Catanzaro. Università della Calabria, with a large campus outside Cosenza, founded in 1972, has five divisions (facoltà): Science (mathematical, physical and natural), Engineering, Economy, Humanities and Pharmacy. The University of Reggio Calabria, founded in 1982, has six divisions: Agriculture, Architecture, Law, Engineering, Medicine and Pharmacy. Besides universities, Calabria has a number of research centers, both private and public, that operate in different areas of application. In particular, the university hinterland of Cosenza has developed a thick network of research centers, some of which of national importance, in information technology and telecommunication sector and in distance learning. Overall, the region has reached already an adequate level of a good quality technological infrastructure, well distributed over the territory. Also the telecommunication infrastructure has achieved a good level: the national digital network Itapac (X-25), quite diffused through the nodes located at the universities and the above mentioned research centers, allows easy access to national and international networks. Besides, in the Cosenza zone, the University, research centers, and distance learning consortium are already connected by optic fibre cables. It is possible, in a foreseeable future, to endow the whole region with a new telecommunication infrastructure with optic fibre cables. It would be an achievement of a great importance, given the expected diffusion of networks between the Scientific and Technological Park of Calabria and other Italian and European parks, as well as among enterprises inside and outside the region.

Also from the strictly economic point of view Calabria has been showing a marked tendency towards change. The agricultural sector has shrunk as to extension, but at the same time has undergone a significant transformation in quality, especially in the plains with the highest potential for development. The largest plain of the region, the Sibari-Crati one in the province of Cosenza, has been witnessing a growth of a number of technologically advanced agricultural enterprises that export almost all their product (fruits and vegetables) to other European countries. In the same area there is a number of innovative food processing industries, some of them the leading ones on the national and international market. The same trend, towards the emergence of innovative and dynamic enterprises, can be noticed in industry and in the tertiary sector. The latter counts now a growing number of modern enterprises, oriented towards added value and production services.

As of today, Calabria's entrepreneurial system is composed of approximately 100,000 operating enterprises, with the density of 50 enterprises per 1,000 inhabitants as compared to the national average of 65. The lag does not result from a low entrepreneurial birth rate -- that, on the contrary, is systematically higher than the national average --, but rather from the high infant mortality of the enterprises and from their short life cycle, which, in turn, does not allow them to take roots in the local economy. Another result of this rapid turn-over is the unbalanced preponderance of small enterprises, as so many of them die before they can grow in size. Thus, the region's economy is characterized by a myriad of micro-enterprises dispersed over the territory and by a very small number of medium and large ones. Calabria is in fact the only one among the twenty Italian regions with no industrial enterprise of more than 1,000 employees and only one of more than 500, the Pertusola Sud that produces zinc and its byproducts. Overall, there are only some ten industries with more than 100 employees; they operate mostly in the primary industrial sector (concrete making, chemical, wood, metal carpentry) and are owned by national corporations, public or private. On the other hand, small industries are all owned by local entrepreneurs, operate in the light traditional field (food processing, furniture, construction materials, cloth and textile) and are oriented almost exclusively towards local markets. Moreover, unlike most Italian industry, productive cycles in small enterprises in Calabria are characterized by a very strong vertical integration which hinders productive, technological and functional interconnections among various units of the local system. The isolation and vertical integration result, on the one hand, in high costs of transaction and, on the other, in a relative contractual weakness on the market, and thus, as a consequence, in unsatisfactory economic and managerial performances. Finally, the weakness of entrepreneurial networks limits significantly the multiplier effect of an enterprise; a success remains confined to the enterprise itself with scarce induced effects on other enterprises and on the local economy.

For all these structural reasons (and despite the above mentioned recent trend towards innovation) the entrepreneurial world of Calabria has so far expressed a rather modest explicit demand for technological and economic and managerial innovation. Because of the fragility of inter-business connections, such explicit demand for innovation that is being expressed, is too low and too atomized to stimulate the birth and growth of local structures of supply of advanced services. Thus, very often, the specific demand for innovation coming from Calabrian businesses, is met by Northern Italian or foreign supply centers.

Clearly, the lack of integration constitutes one of the main obstacles to the economic development of the region and to the diffusion of innovation in the local system of enterprise. In order to activate mechanisms of local economic development, the priority goals must be: thickening of the inter-business

matrix, integration and completion of pre-existing productive networks, specialization and agglomeration. Up till now, economic policies, both on the national and regional level, have been "disorganic," discontinuous and oriented exclusively towards an increase in supply of innovation services. These policies have failed in triggering endogenous processes of economic growth, favoring stabilization of local enterprises and opening the regional economic system to larger market circuits. The Scientific and Technological Park of Calabria can become a powerful instrument for changing the conditions of insufficient entrepreneurial development in the region in virtue of the fact that the Park wants to constitute "an organization and integration pole" for policies, activities and functions that contribute to the development of innovative processes in the economic system of the region.

SECTION 2: Description of the Park

The Scientific and Technological Park of Calabria (Parco Scientifico e Tecnologico della Calabria, PSTC) has as its strategic objective to stimulate the region's economic development through the planning and experimentation of technological research projects and of innovation transfers. The globality of its activities is oriented towards an extension of the entrepreneurial matrix and towards an improvement of the competitive performance of pre-existing enterprises.

The PSTC is meant to act as an instrument of industrial policy, an "organization and integration pole" of factors and actors, institutional and entrepreneurial, that contribute to stimulate innovative developmental processes in the economic system of the region. Therefore, the PSTC sets for itself the following priorities:
-- to offer support to regional and sub-regional institutions in their function of coordination of public policies and instruments oriented towards the diffusion of innovation and of the technology transfer;
-- to increase the rate of cooperation and interdependence among local enterprises, between those and the outside ones, among the region's universities and research centers, between those and similar national and international institutions, and finally, between universities and research centers and local small and medium enterprises;
-- to plan, experiment and monitor a model of intervention that would allow to remove obstacles, both endogenous and exogenous, to the diffusion of innovative processes.

In the past, the goal of increasing the rate of implemented innovation was pursued mostly through public policies aimed at the strengthening of supply centers. The strategy of the PSTC, vice versa, is centered around the potential and explicit demand, that is, around the actual bottleneck of local entrepreneurial and economic growth. The demand expressed by regional economic subjects thus becomes, for the PSTC, the principal variable towards which research and service centers should be oriented, and, in general, which should determine the whole of the innovation supply. However, given that in the region there does not exist as yet a diffused demand for technological and managerial innovation and experimentation, the PSTC is planning to implement, in the first three-year start-up period (1994-96) an executive strategy oriented toward meeting the demand of the most structured and dynamic sectors. Such a strategy can be implemented by strengthening local research and service centers as well as by appealing to extra-local centers. In the short and medium term, the Park will focus its activities in those economic sectors and sub-regional contexts that promise, comparatively, the quickest pace of development; leaving to a later period an intervention in the areas and

sectors with lower potential for growth. Therefore, a model for intervention to be applied in the first three-year period has been elaborated both to achieve the maximal social and economic impact in the pilot areas and sectors, and to try, and verify the validity of, original policies and instruments of intervention that in future could be effectively applied to stimulate and support innovation development in other economic and geographical contexts.

The preliminary analyses carried out during the work of preparation and definition of the Master Plan for the PSTC for 1994-96, allowed to delimit a territorial and a sectorial basin of experimentation. The former is located in the Cosenza province, from the capital through the Middle Valley of Crati till the whole Sibari Plain. The latter includes two sectors: the regional farm and food production network, and the information and telecommunication one. The Sibari Plain and the Middle Valley of Crati (SiCra) is a sub-regional area that has undergone, in the last two decades, a radical transformation, and has become the most dynamic productive environment in the whole Calabria. The formation and consolidation of a significant group of large agricultural enterprises, innovative and opened to distant markets, together with their capacity to aggregate the agricultural supply through associations, are the most important ingredients of the area's success; and there still exist potentials for a further qualitative and quantitative expansion. There beats the heart of the region's most advanced agriculture and that's where the most important food processing industries are located. With an intelligent appreciation and integration, the district can assume larger national relevance.

The SiCra area is delimited in the South by the urban area of Cosenza-Rende (CoRe) which in the last twenty years, thanks to the founding of the University of Calabria, has experienced an unprecedented urban, demographic and scientific growth. At present, there are numerous research centers and consortiums offering advanced services, some of the most important in the region. At the same time, a number of initiatives in the field of information and telecommunication has been growing, giving birth to an interesting technological proto-network with a high potential for further growth.

The two networks, the farm and food production one and the information and telecommunication, overlap largely in territorial terms, thus allowing important spacial and sectorial synergies as well as non indifferent economies of agglomeration and interconnections of scale. Furthermore, these pilot sectors, though concentrated in the Cosenza province, have already a number of inter-provincial ramifications; thus, the Park activities will necessarily have an economic and territorial impact much larger than its original experimental areas.

At present, the PSTC is in its initial stage. The CALPARK Inc., a share-holding consortium responsible for the management of the Park, was formally

constituted in 1992. Its social capital amounts to 1,100 million liras and its substantial increase is expected soon. The Company has now 37 partners; among those are the two public universities of Calabria, almost all the research centers, the largest local bank, several business associations, regional development Board, the only local BIC (Business Incubation Center), several Calabrian industrial and service firms, and occasionally an outside firm such as Olivetti. The majority of partners are small size enterprises, with less than 50 employees, and six firms with more than 50 employees.

December 31, 1993, the CALPARK Inc. submitted to the Italian Ministry of University and Scientific and Technological Research, a three-year Master Plan, composed of nine strategic projects for an estimated investment of approximately 42 billion liras. The nine points of the Plan are:

1. Planning and testing the "Park enterprise;"
2. Planning and testing the Park's telecommunication system;
3. Testing an innovation system aimed at improving the competitiveness of the farm-and-food-producing network;
4. Testing innovation services to be offered to software producing companies;
5. Planning and starting a Center of Cooperation University --Research Centers -- Enterprises;
6. Generating new innovation enterprises;
7. Planning and developing of a DSS (Decision Support System);
8. Research and technological innovation applied to the production and packaging of frozen vegetables;
9. Planning and developing a Laboratory of innovation in the fields of learning, methods, and instruments of evaluation and certification.

As of today, the executive management of the Park is composed of the Chairman of the CALPARK, a consulting business administration engineer and a financial-fiscal advisor, while the strategic planning remains in the competence of the CALPARK Board of Trustees of 12 members appointed by the partners. One of the main priorities of the CALPARK Inc. at this moment is to carry out as soon as possible an ad hoc study to plan and realize its own organizational structure, taking into account the experience of other Italian and foreign parks.

For the moment, the CALPARK is located in service in a space offered by one of its partners, the CRAI (Consortium for Information Research and Application.) This location permits the CALPARK to take advantage of technological infrastructure and telecommunication networks with which the CRAI is endowed, such as telephones, fax, E-mail services, access to databases, video-conferences, access to national and international telecommunication networks (LAN, WAN, MAN and the optic fibre connection with the University and other local research centers).

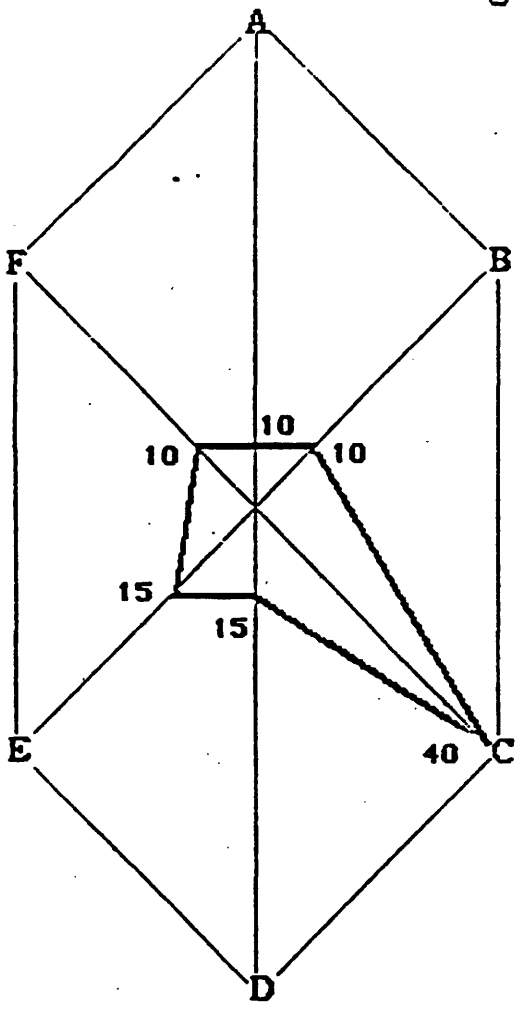
SECTION 3: Summary and Conclusions

The pulverization over the territory and the lack of specialization of the local enterprise system had so far hindered the economic development in Calabria. Public policies realized till now, both national and regional, had not been able to break the conditions of the relative backwardness of local economy, even if they had permitted the consolidation of several productive structures. The presence of University research centers and of service companies has not been sufficient to create, within the region's economy, any significant network of technologically advanced firms and to favor the diffusion of innovation, mainly because of the scarcity of functional connections to local businesses.

The PSTC is pursuing the aim of regional economic development through two main methods: full realization of the pre-existing firms' economic and market potential, and the functional integration among the enterprises, and between those and research centers. The operative strategy of the PSTC is to start with those economic sectors and geographical areas that express already the highest and most qualified demand for innovation, and then to gradually extend the already tested models and policies to the more refractory areas. Given the small size and low technological and management profile of most of Calabrian firms, the Park will direct its intervention above all towards stimulating the creation of inter-firms networks. This should help, at least partially, in compensating the dis-economies due to small size with economies of agglomeration and cooperation. The Park will also intervene in specific cases when such an intervention is considered useful to improve the economic performance of a firm. At the same time, the Park will realize interventions aimed at increasing the degree of strategic coordination among the region's various research centers, public and private, and, most importantly, between those and local businesses, so that the innovation production can be consistent with the goal of increasing the competitiveness of the endogenous productive structures.

The PSTC considers of a great importance the ties to other Italian and European Parks. In particular, such connections should allow to share organizational and managerial models and executive experience in the field of stimulation of developmental processes based on enterprise networks. Still in its initial phase, and without a well defined and stable management, the PSTC is deeply interested in learning the story and management options adopted by those Parks that had been successful in overcoming the start-up stage. At the same time, the PSTC is interested in establishing contacts with the management of the Parks that have similar objectives and operate in similar conditions of relative backwardness, both to avoid useless overlapping as well as to take advantage of their accumulated experience.

The diamond of Science Park's strategic aims.



Legenda :

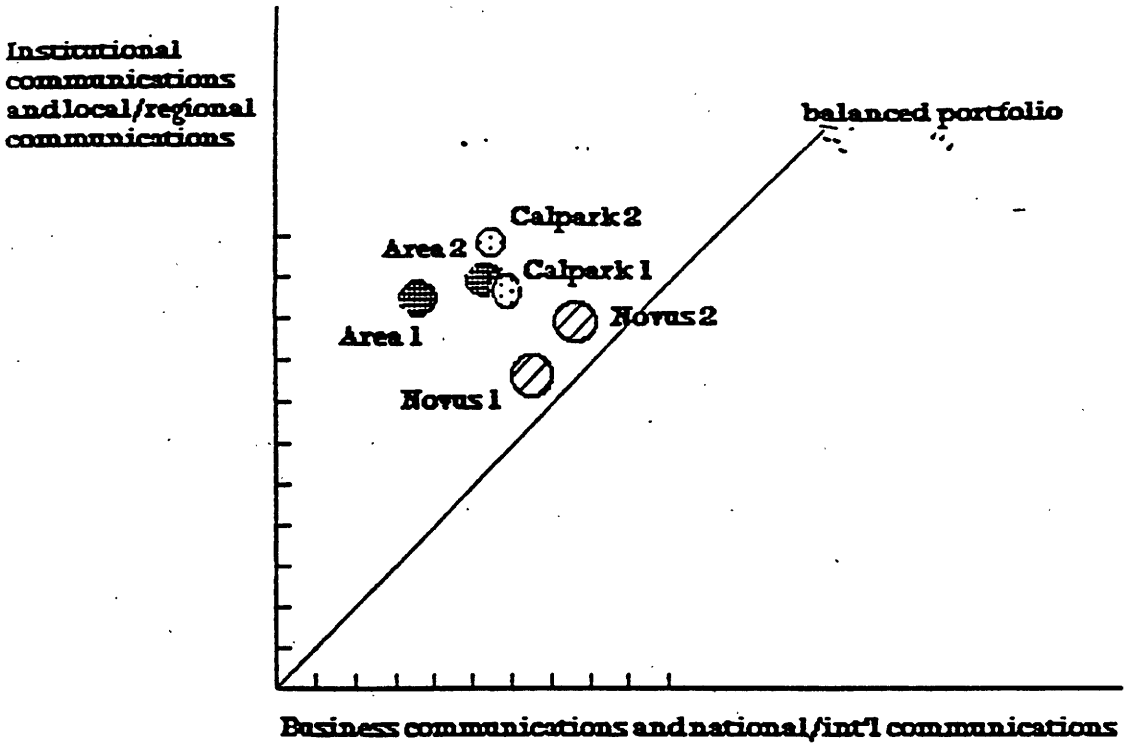
——— **CALPARK- Calabria's Science Park**

Key strategies :
A - Establish and develop new technology based firms
B - Encourage technology transfer to establish new firms or industries
C - Encourage technology transfer to existing local industry
D - Attract mobile private sector R&D investments
E - Encourage the inward investment of public sector R&D investments
F - Attract inward investment more broadly

% values - total answers = 100%

Source : Segal Quince Wicksteed International , *Science Park Networks. Italian case studies* ,1994

Science Park's portfolio of current communications[a]



Legenda :
1-Institutional and business communications

Institutional communications : universities/research institutes; government organisations/development agencies;representative organisations;financial community.

Business communications : companies & organisations on the science park;companies & organisations on other science parks; other companies.

2-Local/regional and national/international communications

Area Science Park (Trieste) **Calpark-Calabria's Science Park**
Tecnopolis CSATA Novus Ortus

(a) Current communications based on their importance on a scale 1 (no importance) to 10 (very important).

Source : Segal Quince Wicksteed International, *Science Park Network. Italian case studies* ,1994