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TECHNICAL WORKING PAPER SERIES

**SMALL AND MEDIUM
ENTERPRISES BRANCH**

Working Paper No. 9

**HIGH-TECH INCUBATION SYSTEMS
AS DRIVERS OF INNOVATION**

**The Case of Central European
Transition Countries**

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AS DRIVERS OF INNOVATION**
**The Case of Central European
Transition Countries**

by

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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FOREWORD

The competitiveness of a country's industries in the global economy is closely linked with its ability to gear the science and research systems towards enhancing productivity. This in turn calls for special attention to two aspects: the application of science results in products and processes and the growth of entrepreneurship among – especially – young scientists. The European countries with economies in transition created a strong science basis during the central planning era, but due to the nature of their economies there were many weaknesses in the links between science and its industrial applications. These countries are now coming to grips with the challenge of making the transition in science, turning their great scientific potential into a key factor of innovation-led economic growth.

As the UN's specialized agency for industrial development, the UN Industrial Development Organization (UNIDO) has over the years gained a wealth of experience in the field of technology development and transfer. One of the successful UNIDO projects which are helping countries with economies in transition to address this development issue was US/RER/95/145 'Regional Programme for the Establishment of High-Tech Incubation Systems at the Academies of Science in the Czech Republic, Hungary, Poland and Slovakia', supported by the Government of the Netherlands through Senter, the agency for international cooperation of the Ministry of Economic Affairs. The results are summarized in this brochure.

The project contributed to innovation-led development at several levels:

- It increased the awareness of the importance of industry-science links and the need for an innovation policy;
- It provided the basis for business development in high tech areas and helped create a number of new, innovative enterprises;
- It strengthened cooperation on innovative industrial projects among the countries;
- It served as a catalyst to technology transfers between the participating and other countries;
- It created practical, business-oriented local support capacities.

Through the latter, the UNIDO project has prepared/anticipated and later also complemented EU efforts: the support capacities allow the participating countries to make better use of the EU programmes for accession, especially those that target innovation. As EU membership will soon expose the countries to both the full force of European competition and the full range of market opportunities, this makes the project even more important. The lessons learned in the course of this project will also be useful to other countries whose science sector is making the transition to a new role: that of a driving force in innovation-led development.

Wilfried Luetkenhorst
Director
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SUMMARY

This publication describes the development and outcomes of UNIDO project US/RER/95/145 'Regional Programme for the Establishment of High-Tech Incubation Systems at the Academies of Science in the Czech Republic, Hungary, Poland and Slovakia'. The project, which ran from 1996 to 2002, was financially supported by the Government of the Netherlands through Senter, the agency for international cooperation of the Ministry of Economic Affairs.

Science and innovation play a key role in determining the competitiveness of a country's industries. The transition countries created strong science sectors during the central planning era, but these sectors are inadequately prepared for their role in a market economy; their problems are compounded by budget cuts. The project addressed both problems by stimulating the commercialization of science results. It created two instruments for this purpose: incubation systems for innovative start-ups and technology transfer mechanisms, both managed by one partner in each of the countries.

Through UNIDO, the participating countries had access to an international network of expertise. The Zernike Group B.V., an outgrowth of Zernike Science Park in Groningen, the Netherlands, became the main expertise supplier. The training by the Zernike Group, which relied heavily on interaction among participants and with the trainers, provided the support units created under the programme with basic know-how for their operations.

After some early changes, the participants were:

- The Czech Republic: the Technology Centre linked to the Institute of Chemical Process Fundamentals at the Academy of Sciences in Prague.
- Hungary: Innostart in Budapest, an EU-supported business and innovation centre with incubation facilities.
- Poland: The Information Processing Centre (OPI) under the State Committee for Scientific Research in Warsaw.
- The Slovak Republic: the Business Innovation Centre Group in Bratislava (BIC Group), a private non-profit agency with a minority public sector shareholding by the Slovak Academy of Sciences.

The project was designed in two phases: development of country concepts for creating high-tech incubators at the science academies, and subsequently the actual establishment of incubation facilities in each country. By 2000, the concept-building phase had been completed successfully and work was progressing on practical issues: technology brokerage, creating of databases for R&D marketing, preparation of manuals and increasing the range of support services for R&D commercialization. Some problems had however emerged: most academies of science found it hard to adapt to the market economy, funding for start-ups did not materialize, and the rapid developments in the transition countries made project management difficult.

The programme was therefore overhauled and re-directed after a mid-term evaluation, and project management streamlined. During the remaining years, the focus was on sustainable development impact, which could be achieved with modest resources and synergies resulting from closer cooperation and information sharing among the four participants. Two major, mutually supportive activity areas were identified:

- (i) High-tech business incubation in terms of virtual and/or physical facilities; and
- (ii) Technology transfer and partnership building for in-flowing and out-flowing technology arrangements, as a promising activity across the entire project region.

The thrust directions of activities during 2000-2002 can be summarized as follows:

Project thrust→ Country ↓	HIGH-TECH INCUBATOR	TECHNOLOGY TRANSFER	JOINT WORKSHOPS
Czech Republic	Expansion existing incubator, including funding mechanisms	Technology brokerage unit (TBU) upgrade	Technology brokerage
Hungary	Incubator establishment	TBU operation	High-tech incubation
Poland	Incubator system and analysis	TBU database and marketing	Technology transfer
Slovakia	Incubator establishment	Benchmarking and publications; TBU training	Benchmarking

Incubation takes place in both physical and virtual incubators. The latter use the Internet to provide support services to enterprises, which could not be located in the limited physical space available for start-ups. The advantages of virtual incubation are evident: infrastructure costs were much lower and the 'reach' of the incubators was nationwide. But the physical incubators continue to provide useful services to a number of small firms, and virtual incubation is often complemented by the personal contacts, which play such an important role in the traditional physical incubation process. Firms are only accepted after a strict selection procedure. Services range from the standard office support services in the physical incubators, training and various management support services to international partner search, intellectual property rights and 'post-graduation' support for firms leaving the incubators and provide the valuable opportunity to share experiences and build alliances with firms facing the same start-up difficulties.

Technology brokerage offers the complete range of services related to technology transfer, from raising awareness of the importance of new technologies for competitiveness, the preparation of technology transfer manuals and database creation to technology audits, during which marketable technologies were identified, and negotiations with foreign partners.

The joint workshops planned for all four participants were held in each of the countries in turn, and a final workshop was organized at UNIDO headquarters in September 2002. But the range of joint activities with foreign partners soon became much wider. A few examples:

- The REGILOn network of universities and technology transfer/commercialization facilitators in Austria, the Czech Republic and the Slovak Republic was created;
- The Technology Centre worked with German, Dutch and UK partners on regional innovation strategies for the Czech Republic,
- Innostart has participated in Hungarian-French and Hungarian-German technology brokerage events;

- The OPI incubator cooperates with the Ostrava Science and Technology Park in the Czech Republic as well as several Dutch partners;
- The BIC Group is developing a joint venture for SME funding with a Dutch firm and has been instrumental in bringing about a technology agreement between Belarus and the People's Republic of China.

The project has had positive results at several levels:

- The physical and virtual incubators have provided or are providing services to some 160 start-ups and small firms;
- Over 200 technology audits have taken place, and several dozen technology transfer agreements have been concluded or are under negotiation;
- Databases for technologies and their commercial applications have been set up, and handbooks have been published;
- Hundreds of people have attended meetings and training courses and gained awareness, knowledge and contacts;
- A contribution has been made to better understanding between the business and science communities;
- Cooperation among the partners in the project and with other countries has grown beyond all expectation;
- Technology transfer activities across borders have expanded.

It is too early to assess the long-term contribution to innovation-based industrial development – this can only be measured by, for example, patents awarded in due course to (former) incubator clients or a steadily growing volume of outward technology transfers. Longer-term development will require action in several areas, including further improvements in the overall business environment and the formulation plus execution of national innovation strategies as a joint activity of governments, the business community and universities and research institutes. Among the major components of such a strategy would be the creation of funding mechanisms for innovative start-ups and ensuring the financial viability of the innovation support systems for small enterprise (which are unlikely to become fully self-supporting even in the best scenario – they must be regarded as investments in the future). EU funds could contribute to the realization of such strategies

UNIDO's role in achieving the results can be summarized in a few words: the organization has helped the partners in the project to cross intellectual and physical borders through its international experience and presence at the right time. For an innovative future, UNIDO will continue its catalytic role through its Technology Foresight programme, which is helping to create strategic capacities for the design and implementation of innovation policies.

SAMENVATTING

Deze publicatie beschrijft de ontwikkeling en de resultaten van het UNIDO project US/RER/95/145 'Regional Programme for the Establishment of High-Tech Incubation Systems at the Academies of Science in the Czech Republic, Hungary, Poland and Slovakia'. Dit project werd financieel ondersteund door het Ministerie van Economische Zaken via Senter.

Wetenschap en innovatie spelen een sleutelrol in het bepalen van de concurrentiepositie van de industrie van een land. In de voormalige socialistische landen zijn destijds sterke wetenschapssectoren gecreërd, maar deze zijn niet goed voorbereid voor hun rol in de markteconomie en budgetverlagingen hebben hun problemen vergroot. Het UNIDO project heeft beide problemen aangepakt door de commercialisering van wetenschapsresultaten te stimuleren. Met dit doel voor ogen heeft het twee instrumenten gecreërd: incubatorsystemen voor nieuwe innovatieve bedrijfjes en technologieovername mechanismen. Beiden worden in elk van de landen gemanaged door één project partner.

Via UNIDO hadden de deelnemende landen toegang tot een internationaal netwerk van expertise. De Zernike Group B.V., voortgekomen uit het Zernike wetenschapspark in Groningen werd de belangrijkste bron van die expertise. De training door de Zernike Group was gebaseerd op interactie tussen de deelnemers en met de trainers, en voorzag de dienstverlenende eenheden die onder het programma werden opgezet met basiskennis voor hun activiteiten.

Na enkele veranderingen had het programma de volgende deelnemers:

- Tsjechië: het Technology Centre verbonden aan het Institute of Chemical Process Fundamentals in de Academie van Wetenschappen, Praag.
- Hongarije: Innostart in Budapest, een door de EU ondersteund dienstverlenend centrum voor het bedrijfslevel met incubator faciliteiten.
- Polen: Het Information Processing Centre (OPI) verbonden aan het Staatscomité voor Wetenschappelijk Onderzoek, Warschau.
- Slowakije: het Business Innovation Centre in Bratislava (BIC), een privé non-profit organisatie waarin de overheid een minderheidsaandeel heeft.

Het projectontwerp had twee fasen: ontwikkeling van concepten voor het creëren van high-tech incubatoren in de academies van wetenschap in ieder van de landen en daarna het opzetten van die incubatoren. In 2000, was de eerste fase succesvol afgesloten en was voortgang geboekt met diverse praktische aspecten: technologie brokerage, het opzetten van databanken voor de R&D marketing, het schrijven van handboeken en het verbeteren dienstverlening die het commercialiseren van R&D ondersteunt. Er waren echter enkele problemen gerezen: de meeste academies vonden het moeilijk zich aan te passen aan een markteconomie, er werden geen financieringsmechanismen voor nieuwe kleine bedrijven gevonden, en het projectmanagement werd bemoeilijkt door de snelle ontwikkelingen in de vier landen.

Het programma werd daarom grondig gereviseerd en het management werd verbeterd. Tijdens de laatste twee jaar lag de nadruk sterk op langdurige bijdragen aan de ontwikkeling die met bescheiden middelen bereikt konden worden en het bevorderen van intensievere samenwerking en informatieuitwisseling tussen de vier deelnemers waardoor ze elkaars activiteiten zouden ondersteunen. Er werden twee elkaar versterkende werkvelden gekozen:

- (iii) High-tech incubatoren;
- (iv) Technologietransfers, een veelbelovende activiteit in dit deel van Europa.

De richtingen waarin de activiteiten zich tijdens 2000-2002 ontwikkelden kunnen als volgt worden samengevat:

Projectrichting →	HIGH-TECH INCUBATOR	TECHNOLOGIE TRANSFER	GEZAMENLIJKE WORKSHOPS
Land ↓			
Tsjechië	Uitbreiding bestaande incubator, inclusief financierings- mechanismen	Verbetering technology brokerage unit (TBU)	Technologie brokerage
Hongarije	Opzetten incubator	TBU operaties	High-tech incubatoren
Polen	Incubator systeem en analyse	TBU databank en marketing	Technologietransfer
Slowakije	Opzetten incubator	Benchmarking en publicaties; TBU training	Benchmarking

Er werden zowel normale, 'fysieke' als virtuele incubatoren opgezet. De laatsten bieden hun diensten via het Internet aan, en kunnen zo bedrijven bereiken die in de beperkte ruimte van een fysieke incubator niet onder te brengen zijn. Virtuele incubatie heeft duidelijk voordelen: de infrastructuur kost minder en de incubatoren kunnen de vraag in het hele land dekken. Maar de fysieke incubatoren blijven een nuttige vorm van dienstverlening voor een aantal kleine bedrijven, en virtuele incubatie wordt vaak aangevuld met persoonlijke contacten, die in het traditionele incubatieproces een belangrijke rol spelen. Er is een strikte selectieprocedure voor bedrijven. Het dienstverleningspakket varieert van het ter beschikking stellen van de gebruikelijke kantoorfaciliteiten in de fysieke incubatoren, training en verschillende administratieve en informatiediensten tot hulp bij het zoeken van internationale partners, intellectueel eigendom en 'nazorg' voor bedrijven die de incubatoren verlaten.

Onder technologie brokerage wordt een volledig pakket technologietransfer diensten aangeboden, vanaf het bewustmaken van het belang van nieuwe technologieën als concurrentiemiddel, het schrijven van technologietransfer handboeken, het opzetten van databanken, bedrijfsonderzoek naar marktrijpe technologieën en onderhandelingen met buitenlandse partners.

De gezamenlijk workshops voor de vier deelnemers werden beurtelings in ieder van de vier landen georganiseerd. Een afsluitende workshop vond in September 2002 op het UNIDO hoofdkwartier plaats. Het aantal activiteiten met buitenlandse partners groeide echter heel snel. Enkele voorbeelden:

- Er werd een netwerk opgezet van universiteiten en organisaties die zich bezig houden met technologietransfer en het commercialiseren van technologie: REGILOn (deelnemende landen: Oostenrijk, Tsjechië en Slowakije);
- Het Technology Centre werkte met Nederlandse, Duitse en Britse partners aan regionale innovatiestrategieën in Tsjechië;

- Innostart heeft deelgenomen aan Hongaars-Franse en Hongaars-Duitse technologie brokerage evenementen;
- De OPI incubator werkt samen met het technologiepark van Ostrava in Tsjechië en met verschillende Nederlandse partners;
- The BIC Group is bezig met een Nederlandse firma een joint venture voor de financiering van kleine en middelgrote ondernemingen op te zetten en heeft ook meegewerkt aan het tot stand brengen van een overeenkomst voor technologische samenwerking tussen Witrusland en de Volksrepubliek China.

Het project heeft op verschillende niveaus positieve resultaten bereikt:

- Meer dan 60 nieuwe en kleine bedrijven maken gebruik van de diensten verleend door de fysieke en virtuele incubatoren, of hebben die gebruikt;
- In meer dan 200 bedrijven is onderzoek naar marktrijpe technologieën gedaan, en er zijn onderhandelingen afgesloten of gaande over enkele dozijnen technologietransfers;
- Er zijn databanken opgezet voor technologieën en hun commerciële toepassing, en er zijn handboeken uitgegeven;
- De bijeenkomsten en trainingscursussen zijn door honderden mensen bezocht;
- Er is een bijdrage geleverd aan het verkleinen van de kloof in de mentaliteit tussen bedrijfsleven en wetenschap en van de kloof tussen de generaties in de wereld van de wetenschap.
- De groei van de samenwerking tussen de partners in het project en met andere landen heeft alle verwachtingen overtroffen;
- De internationale technologietransfer activiteiten zijn gegroeid.

Het is nog te vroeg om een oordeel uit te spreken voer de lange-termijn bijdrage van dit project aan innovatieve industriële ontwikkeling. Deze kan alleen worden gemeten aan de hand van, bijvoorbeeld, patenten toegekend aan (voormalige) klanten of een gestaag groeiend aantal technologietransfers naar het buitenland. Voor ontwikkeling op de langere termijn moet er onder andere op het gebied van het bedrijfsklimaat in de vier landen nog een en ander gebeuren, en er zijn ook nationale innovatiestrategieën nodig die door de overheid samen met het bedrijfsleven en de wetenschapsinstuties gedragen worden. Financieringsmechanismen voor innovatieve nieuwe ondernemingen zouden onderdeel van zo'n strategie moeten zijn, evenals maatregelen die het financiële voortbestaan van de ondersteunende dienstverlening garanderen (zelfs in het beste geval is het is onwaarschijnlijk dat dit een zichzelf bedruipende activiteit zal worden – het moet als een investering in de toekomst gezien worden). EU fondsen kunnen aan de realisering van zulke strategieën bijdragen.

De rol van UNIDO bij het bereiken van de resultaten kan in een paar worrden worden samengevat: de organisatie heeft door haar internationale ervaring en aanwezigheid de partners in het project project geholpen grenzen te verleggen of te overschrijden - mentaal, intellectueel en fysiek. UNIDO's 'Technology ForeSight Programme' helpt bij het creëren van de capaciteiten voor een toekomst gebaseerd op innovatie.

ACRONYMS

BIC	Business Innovation Centre
CUN-PAN	Centre for Science Advancement of the Polish Academy of Sciences
EBN	European Business Innovation Centre Network
EU	European Union
ILO	Industrial Liaison Office
IPR	Intellectual Property Rights
OPI	(Polish) Information Processing Centre
R&D	Research and Development
SME	Small and Medium Scale Enterprise
TBU	Technology Brokerage Unit
UNIDO	United Nations Industrial Development Organization

1. THE ORIGINS AND INITIAL PHASE OF THE PROGRAMME

1.1 Central Europe: the development potential of science

Science and technological innovation play a key role in determining the competitiveness of a country's industries. During the central planning era, all three – pure science, technological innovation and manufacturing – received strong boosts in the Central European countries. Academies of Science acquired a very prominent position. In the absence of competitive pressure, however, the links between fundamental research and industrial applications were relatively weak, nor were these links based on commercial principles; technological innovation in most cases did not reach the level of sophistication in market economies.

The transition to the market economy had two effects:

1. Most domestic industries were suddenly exposed to strong competition by superior products, in whose success close links between research and commercial applications played a decisive role.
2. Governments limited their role and made drastic budget cuts. As a result, the Academies lost much of their support.

To help their manufacturing sectors operate successfully in the global economy, the Central European transition economies had to change the way they managed their strong scientific and technological potential, bridging gaps between research and its commercial application, and creating a symbiotic relationship between science and business, whereby science results help to increase the competitiveness of products, so that investing in research becomes profitable to business. EU support is available for science and its practical applications, but local capacity has to be built up first for using it efficiently and effectively. As domestic expertise for the transition in science was lacking, the Czech Republic, Hungary, Poland and the Slovak Republic requested UNIDO's support.

1.2 The role of UNIDO and other international assistance

As the UN's specialized agency for industrial development, UNIDO has over the years gained a wealth of experience in the field of technology development and transfer¹, with incubator development as a special activity within this framework. Incubators are of basic importance in the process of establishing links between research and business: they provide support services in a temporary 'sheltered environment', enabling young entrepreneurs with a scientific background to build up an their business management know-how and develop their innovative businesses.

Among the results of UNIDO work were particularly two experiences of high relevance to the present issue. One was the publication '*Technology Transfer Manual and Practical Guidelines for Business Incubation Systems*', which was instrumental to introduce the subject in the Central and East European context. The other was a project in the Central European region: UNIDO had implemented 'High Level Advisory Assistance on the Establishment of a Technology Innovation Centre in the Czech Republic' in 1993-1994. In this project, UNIDO worked with the Academy of Sciences of the Czech Republic to improve the utilization of chemical know-how for production purposes and to earn income from this

¹ One recent UNIDO initiative, 'Technology Transfer: Assessing needs – Promoting Action' has been launched at the 2002 World Summit on Sustainable Development. The UNIDO – Technology Transfer Framework gives an overview of UNIDO documentation, printed publications and software tools (see www.unido.org)

activity. The result, an incubator with eight enterprises, was the seed from which the present project germinated.

Through UNIDO, the participating countries also had access to an international network of expertise. After initial unsatisfactory experiences with some suppliers of such expertise, the Zernike Group B.V., an outgrowth of Zernike Science Park in Groningen, the Netherlands, became the main supplier. This is an internationally operating company in the field of technology transfer, facility management, patenting and licensing, engineering, and consultancy. The Group is a shareholder in various companies in the field of technology and technology transfer.

The training by the Zernike Group provided the units created under the programme with basic know-how for their operations. Having been involved in over 200 successful start-ups since 1990, the Group has great experience in this field. The course subjects included a general introduction to the operational methods of the Group, the structures and dynamics of the market economy, building up organizations and networks, improving the business environment for SMEs, technology assessment, evaluation of start-up projects for venture capital funding, international patenting and licensing, technology transfer networks – types and requirements, and the incubation process. The funding mechanisms of the Zernike Group were studied as well.

It is important to point out that the Zernike approach to training relied heavily on interaction between participants and teachers, and among participants. The training, however, was only a starting point: developing a good sense of what is commercially interesting, which is essential for the success of incubators, would have to be achieved in practice, over a long period.

The project was financially supported by the Dutch Government through Senter, the agency for international cooperation of the Ministry of Economic Affairs; recipient countries shared in the costs of the programme.

1.3 The first years of the programme

In 1995, it was decided to use the experience gained in the project for the Czech Academy of Sciences for a follow-up programme supporting the transformation of science academies not only in the Czech Republic, but also in Hungary, Poland and the Slovak Republic. The similar economic and political backgrounds of these countries were expected to result in synergies in programme design and execution, and the exchange of experiences among countries was expected to result in additional synergies.

The overall objective of the programme was to create high-tech enterprises using the know-how generated in national research institutions to contribute to the development of the countries. It was designed in two phases:

Phase I: Development of country concepts for the establishment of high-tech incubation systems at the science academies. Outputs: a country survey, a study tour for high-level officials and detailed implementation proposals, including the creation of an advisory group, a steering committee and a management team for the incubator.

Phase II: Establishment of a high-tech incubator in each of the academies, with the potential of development into a science park. Outputs: a business incubation facility in each academy with five functioning enterprises (20 in the Czech Republic), a pilot system for R&D product development and a plan for expanding the incubator into a science park.

The counterpart institutions were:

- The Czech Republic: the Technology Centre linked to the Institute of Chemical Process Fundamentals at the Academy of Sciences in Prague.
- Hungary: the Faculty of Chemical Engineering at the University of Veszprem (which took over the Chemical Research Institute of the Academy of Sciences). Later, Innostart in Budapest, an EU-supported business and innovation centre with incubation facilities, took over the management of the Hungarian component.
- Poland: an agency at the Centre for Science Advancement of the Academy of Sciences, later the Information Processing Centre (OPI) under the State Committee for Scientific Research (which supervises the Academy of Sciences) in Warsaw.
- The Slovak Republic: initially the Academy of Science, later the Business Innovation Centre in Bratislava (BIC), a private non-profit agency with a minority public sector shareholding, created with EU support.

Project activities started in 1996. By 2000, the programme had achieved the following:

- All four counterparts developed a clear understanding of incubation systems through local and foreign training.
- Technology brokerage training helped to create a system for marketing of domestic R&D abroad in all four countries.
- Zernike staff had twice visits all the participating countries, cooperating with the participating units on project evaluation, visiting firms and helping them to lobby for the project.
- In Poland, the database for R&D marketing was to a large extent completed.
- Preparatory work was done for manuals on benchmarking and due diligence methodology² in the Slovak Republic, to provide know-how on basic standards for technology transfer, and the benchmarking methodology was tested in the Slovak Republic.
- In general, the range and quality of services available for R&D commercialisation had been improved.
- The four countries were now able to use relevant EU support programmes effectively.

Not all results were directly related to planned activities, but they were all relevant to the long-term goal of creating high-tech enterprises.

However, it became evident that achieving sustained effects (particularly in terms of successful enterprises) would take much longer. A general problem was that the business environment in the four countries still needed much improvement. This had an impact on two problems, with a direct impact on project outcomes. One was that, contrary to expectations, financing for technology start-ups did not materialize. Another was that most of the academies of science found it hard to adapt to the realities of the new era of rapid change (this was the main reason for the changes in counterparts).

² A method for designing an investigation of a business to find all facts, to the extent that is reasonably possible, that would be of material interest to an investor in or buyer of a business.

1.4 The outcome of the mid-term evaluation

A mid-term evaluation of the programme was held in 2000, midway through Phase II. A number of very useful lessons were learned from the problems encountered in the first few years. The most important were:

- Building up high-tech incubation systems in countries where such systems have never existed takes time (much more than the initially planned two years), and the process must be broken down in easily manageable stages with clearly measurable results for each stage.
- The contribution of Zernike and the improvements in project performance after the changes in local partners proved how important the right choice of partners is; performance can be further enhanced through closer cooperation and experience sharing among partners.
- Learning to respond to the unprecedented developments in the transition economies is a process of trial and error for UNIDO as much as for any other organization. Dealing with the complex, fluid situation and the resulting numerous changes in activities is a great challenge for project management.

The evaluation concluded that, to be continued successfully, the programme needed:

- A focus on outputs that would combine sustained development impacts with a modest demand on resources;
- Stronger coordination among activities and cooperation among counterparts, to increase synergetic effects;
- Improvements in project management at UNIDO headquarters.

In consultation with the counterparts, the programme was therefore drastically overhauled.

2. THE REORIENTED PROGRAMME - FOCUS, ACTIVITIES AND RESULTS

2.1 The new focus of the programme

The reorientation process identified two major, mutually supportive activity areas:

- (v) High-tech business incubation proper; and
- (vi) Technology transfer, as a promising activity across the entire project region.

Within these umbrella activity areas, each of the four countries adopted its own country-specific approach toward achieving the objectives. At the same time, the programme explicitly aimed at exploiting synergies among the countries by creating an operational multi-country regional network in support of advancement of the high-tech business sector.

To ensure more effective work and cooperation, an identical work programme was drawn up for all four countries, which emphasized mutual contacts, and programme management at UNIDO headquarters was improved. Continuity at headquarters was ensured, which among others made it possible to have frequent personal contacts and to organize problem-solving sessions when needed. In the recipient countries, the shift to new partners outlined above - the Technology Centre of the Academy of Sciences, Innostart, OPI and BIC Bratislava - had created adequate institutional capacities with enthusiastic young staff. Table 1 presents the main directions of programme activities after the reorientation.

Table 1 Main project thrust directions for 2000 – 2002

Project thrust→ Country ↓	HIGH-TECH INCUBATOR	TECHNOLOGY TRANSFER	JOINT WORKSHOPS
Czech Republic	Incubator expansion including funding mechanisms	Technology brokerage unit (TBU) upgrade	Technology brokerage
Hungary	Incubator establishment	TBU operation	High-tech incubation
Poland	Incubator system and analysis	TBU database and marketing	Technology transfer
Slovakia	Incubator establishment	Benchmarking and publications; TBU training	Benchmarking

2.2. Programme execution and results by country

2.2.1 *The Czech Republic*

High-tech incubation

The existing incubator in the Technology Centre, known as the Business and Innovation Centre, was developed further, and an integrated package of services was developed for SMEs outside the incubator. The programme also developed incubation systems using the

Internet, so this incubator will be called a *physical incubator*, to distinguish it from the virtual incubator, which will be discussed below.

The incubator has been certified by the Ministry of Industry and Trade, which means that it qualifies for Government support, and as a member of the European Business Innovation Centre Network (EBN) it is supported by the EU's Phare programme for the Central European transition countries. Rents and utilities are subsidized for a period of three years at a decreasing rate.

Because the Centre's 800 sq. m. are now insufficient to meet the demand for incubator space, a complete renovation plus expansion - for which Government support would be available - has been planned. This would more than double the available space to 2000 sq. m. For operations on a fully economic basis, however, 3-4000 sq. m. is thought to be the minimum. The option of creating a science park for graduating firms, with a focus on biotech, was also studied. The investment would be around US\$ 2 million. Meanwhile, a satellite incubator has been established in a technology park in the town of Chomutov.

The tenants of the incubator have access to all the services of the virtual incubator. In addition, there is a package of services ranging from security to telecommunications and hazardous waste disposal, and they can benefit from the international technology transfer contacts of the Technology Centre.

The incubator has since 1993 housed a total of 21 enterprises in the fields of biotechnology, information technology, environmental technology, materials and food chemistry. Of these, 14 matured and left the incubator, three stopped their activities and four were to leave the Centre by the end of 2002. Of the firms that graduated, the fastest growth was recorded by a firm in the field of genetic manipulation which has found German counterparts: its staff grew from 2 to 25.

As in other countries, the concept of a *virtual incubator* was introduced to meet the demand for some of the services using electronic means. This can be done with modest financial and organizational resources - the virtual incubator worked with seven staff in late 2002. The target group are young, technologically innovative SMEs. On the basis of interviews with prospective clients, three categories of business services were identified as being important:

- Business services: business plans, project design, marketing and intellectual property rights (IPR).
- Research and technology transfer services: outsourced research, collaborative research, technology transfer.
- (Advice on) financial services: business angels, seed capital, venture capital, soft loans, grant funding.

As indicated, the services are usually provided through the Internet, but there is face-to-face contact when needed. Introductory consultations are provided free of charge. Specialist advice is then available with a 60 per cent subsidy for firms with less than 10 employees and a 40 per cent subsidy for firms with 10-250 employees. Entrepreneur training also receives a 60 per cent subsidy. For analysis, strategy formulation and development projects, there is a 45 per cent subsidy, with a ceiling of CZK 80,000/year/company. The UNIDO project and Phare have provided financial support for these activities. Longer-term support is available through a consultancy support programme for SME, launched by the Ministry of Industry and Trade in 2002, for which the Technology Centre qualifies.

Firms are selected on the basis of an analysis of their activities and capacity to develop. The incubator started off with 10 clients and had 14 clients by the end of 2002. Most of the firms are active in the environment and energy field.

Services are marketed via the Technology Centre bulletin and website (www.tc.cz), awareness events, and through personal contacts made by the Centre in the course of other activities, such as technology transfer and EU programmes.

In the absence of sufficient interest on the part of venture capitalists, the original idea of preparing start-ups for private equity financing through the incubation process was abandoned. The firms were too small, it was difficult for venture capitalists to share in the management, and small Czech high-tech firms are often afraid to lose their independence to a majority shareholder; they also seem reluctant to expand beyond a level where academic life and business can be combined. The human and financial resources saved by the reorientation of the programme were used to strengthen the technology transfer operations.

Technology transfer

The TBU developed a service package, which so far focuses on the first four steps of the process:

- Awareness: increasing the understating of the importance of new technologies for competitiveness through information seminars, training and printed information.
- Auditing: identifying technology needs or the marketable technologies of a firm or organization.
- Search: identifying sources of technology solutions or application opportunities through databases, brokerage events, searches in cooperation with the EU's Innovation Relay Centre, etc.
- Negotiation: helping technology suppliers and buyers to conclude mutually beneficial agreements.

A pool of external experts is available to support the five staff of the unit. The intention is to expand the range of services to include advice on funding, business planning and IPR.

Promotion of TBU services focuses on research institutes of the Academy of Sciences as well as SMEs active in advanced technological fields. For the Czech Republic, research and discussions with firms show that these are to be found in engineering, chemicals, food processing, textiles, ceramics, energy and information technology. Promotion tools include information events and materials (in printed form and on the website), as well as meetings between researchers and entrepreneurs.

The TBU now has a database with over 1,500 firms, developed an auditing method and proved its practical usefulness in 129 technology audits. It is also used to ascertain the suitability of firms for virtual incubation. Awareness building has taken the form of a number of technology seminars, information days, training workshops, etc., which have drawn hundreds of participants. TBU organized or co-organized 10 technology brokerage events during 2001-2002, on subjects ranging from renewable energy to automotive technology and nano technologies. These were attended by several hundred participants and have so far resulted in six technology transfer agreements between Czech and EU companies (see Box 1 for examples).

Box 1: Cooperation through technology brokerage

Environmentally safe dyeing in the textile industry

Most of the traditional dyeing processes in the textile industries harm the environment. The Technology Centre identified a new non-toxic technology in Germany, and initiated negotiations between the German firm, Hydrotex, and the Czech firm Inotex a.s. An agreement was then signed for extensive pilot plant tests in the Czech Republic.

Quality assessment in automotive and machinery supply chains

In the automotive and machinery industries, product quality norms are very strict. This can be a limiting factor in the penetration of Czech companies in the European market. The Czech company CS-Project s.r.o. and the French company Nef Sud have reached an agreement about collaboration on quality assessment of Czech suppliers. The collaboration is the direct result of a French mission to the Czech Republic organised by the Technology Centre in cooperation with other local partners.

2.2.2 Hungary

High-tech incubation

Most of the incubators operating in Hungary are mixed incubators, which means that no synergies are achieved among firms working in the same field. By focusing on high-tech activities, the Innostart incubator, launched in 2001, is a step forward from these. It *combines virtual and physical incubation*. The virtual incubator operates via www.innostart.hu/bic/http.

A promotion campaign has made innovative SMEs aware of the services offered. The tools used were information brochures distributed at relevant events and as a supplement to the newsletter of the Hungarian Innovation Association. In addition, Innostart has on several occasions presented the activities in the press and on radio and TV.

A 1,300 sq. m. physical incubator was completed at the Innostart Innovation Park in 2002, but already in 2001 three firms were operating on the premises. Incubation mainly relies on a network of outside experts. The Innostart Innovation Park is part of the Infopark Science Park, which provides two project managers and creates a potential for synergies with the innovative firms located there, including global firms such as IBM and Panasonic. The Central Hungary Regional Development Council will support the Innostart Innovation Park financially during 2002-2004.

The process of selection is based on UNIDO guidelines and the experience of incubators elsewhere. Important selection criteria are:

- An innovative idea, technology or product with good market prospects;
- Screening of literature and patents to assess the innovative character (novelty scan);
- The attitudes of the manager (the effectiveness of cooperation is a key factor in incubation);
- Profitability of the firm;
- Content and quality of the business plan.

The incubator's focus is on information technology (software and hardware), biotechnology and medical technology, environmental protection and material technology.

By the end of 2002, there were two firms in the physical incubator and four in the virtual incubator. In addition, the on-line database had about 130 registered users. In future, 6-8 new projects are to be selected every year for incubation: 2-3 for the physical incubator, 4-6 for virtual incubation (see Box 2 for examples). Firms are expected to become independent in 2-3 years. Rent and service fees are progressively increased over the incubation period.

Box 2: Supporting firms through the Innostart incubator

EasyScan Ltd. (www.scanguru.com and www.easyscan.hu) has been using the services of the physical incubator since August 2001. This small firm, set up by a young scientist, has developed an award-winning, fast, low-price **three-dimensional scanning tool**. Innostart has identified a market niche in three-dimensional CAD/CAM systems for the footwear industry. Through the services of Innostart, the firm found an informal investor.

The Földi company is developing a **self-cogged ploughshare** in Innostart's virtual incubator. With the help of Innostart, the firm has received substantial (HUF 6 million) financial support from the R&D department of the Ministry of Education, in the framework of its Tech-Start programme. This will make it possible to produce a prototype and conduct tests.

On the basis of a national survey of start-up and SME needs, Innostart created the following package of infra-structural and professional services:

Operational services for the incubator:

- Serviced office space and common spaces such as meeting rooms;
- General office services.

Professional services:

- Training courses and on-the-job training;
- Business information services;
- Preparation of proposals, monitoring of tenders and funding opportunities;
- Investor and partner search;
- Domestic and foreign public relations;
- Networking (expertise, membership of international professional organizations);
- IPR consultancy;
- Accounting and tax advice;
- General business advice;
- Business tools (such as sample contracts) and guidelines;

- 'Post-graduation' support to firms that have left the incubator, and general advisory services to small firms in Hungary.

The latter is facilitated by the on-line provision of most of the professional services. With the exception of an initial free consultancy of two hours, all services provided to enterprises selected for the incubators must be paid.

Work benefits from the good relations Innostart has built up with professional associations, the Hungarian patent office, universities and research institutes. Innostart is using its contacts in the business world to establish a Business Angel Club, which organizes meetings between promising innovative SMEs and potential investors. Members include funds such as the Hungarian Venture Capital and Private Equity Association and prominent professionals. Negotiations with several funds investing in informatics were underway at the time of writing.

With the universities and research institutes there is a mutually advantageous relation: they serve as sources of expertise and Innostart in turn helps them to identify innovative projects with a commercial potential. With the Budapest University of Technology and Economics, there is an agreement whereby 3-4 students work as trainees at Innostart every year. There are regular meetings with the University's Innotech Innovation Park to discuss innovation trends and harmonize strategies. With the West Hungarian Research Institute, Innostart is developing a regional innovation strategy for the West and Central Trans-danubian regions.

Technology transfer

The TBU has three employees who were trained by the Zernike Group. The service package of the TBU consists of:

- A manual on technology transfer explaining its main elements: preparing for a technology transfer, the preparation and content of a licensing agreement, and the role of the broker. This document complements the benchmarking and due diligence manuals prepared by BIC Bratislava (see section 1.3).
- Technology audits. So far, these have been carried out, after rigorous selection, in 27 enterprises with innovative ideas. The non-confidential results have been added to:
- A database for partner and investor search (also available as part of the incubator service package), partly based on the database design of OPI in Poland;
- Brokerage activities. These are based on thorough assessments of technology offers and requests. This service is also provided to firms in the incubator, and the most promising proposals are circulated among the other partners in the programme as well as among EU contacts. Firms are assisted throughout the process, to the point where an agreement between the partners can be concluded.

TBU has organized several events to promote its activities and train SMEs. An EU information day attracted more than 50 SMEs interested in partnerships; many of these then attended a seminar where practical skills for drafting project proposals and participating in tenders were transferred. A workshop on support mechanisms for innovation was attended by 40 participants and brought together major industrialists and researchers, SMEs and technology transfer organizations. An innovation brokerage training – which also covered related entrepreneurship issues - in October 2002 attracted 20 participants. Cooperation with the Budapest University of Technology and Economics also extends to technology transfer.

2.2.3 Poland

High-tech incubation

OPI decided to concentrate basically on creating a *virtual incubator*, to minimize capital investment requirements. The 'backbone' of the virtual incubator is a coordination centre at OPI. The location facilitates contacts with the main types of customer in academia. Incubated firms located in various research institutes and universities, (there is ample space as a consequence of the low research budgets in recent years), are linked to the coordination centre by the Internet, fax and telephone. Staff consists of a manager, an information specialist and a technology broker. There are good links with external experts in banking and legal services as well as the Polish patent office. After the project's end, it is expected that financial support will be provided by the State Committee for Scientific Research, the Centre for Science Advancement of the Polish Academy of Sciences (CUN-PAN), as well as sponsors. OPI will contribute 45 per cent of the funds needed; it is expected that 25 per cent of the operations will be financed from fees for services.

OPI has done extensive research into the character and needs of science-based business in Poland as well as into Polish and international incubator practice. This research showed that there is a market niche for a virtual incubator between the many business incubators and technology centres already operating in the country, and the few science parks, which have been emerging in recent years.

The research has also been useful in focusing the activities. The service package developed for the incubator by OPI helps member companies to:

- Explore business opportunities and cooperate in making joint bids (for which incubator clients have access to all the technology transfer services described below);
- Exchange information (on technologies, markets, property rights, etc.) and develop information systems;
- Learn how to optimise resource use and generally increase technical and business know-how.

In addition, the following standard services are offered:

- Internet and telephone access;
- Marketing and quality control;
- Accounting and controlling;
- Legal advice;
- Electronic interchange with the banking system.

The selection of firms (for which the OFFER database was used – see below) has concentrated on the Warsaw area. By late 2002, there were 10 firms in the incubator. In addition, OPI has clients among other innovative SMEs, firms providing industrial services and large national and international enterprises.

Box 3: Innovative activities in the OPI incubator

The Net.Sprint company has developed a **new search engine** for retrieval of Internet information. It worked on this product with an incubator in Cracow, which however could not provide the full scope of support services. Net.Sprint then joined the OPI incubator. Net.Sprint agreed to offer software services to other firms in the incubator. OPI then helped the firm to find a German partner.

The Electrotechnical Institute in Wroclaw is working on **composite insulator tubes** for overhead power lines with a voltage of up to 24 kV. They help to reduce transmission losses, are much lighter and more resistant to decay and vandalism than the existing insulator materials, and have already been certified for use in Poland, where there is a large potential market for replacing existing insulation and insulating new cables.

A **diagnosis system for skin cancer** has been developed by a company - spun off from the army's health institute under the Ministry of Defence. It is accurate, cheap and non-invasive, reducing discomfort for patients. The project is now at the market survey stage. Hospitals have already shown a great interest in this new system.

OPI has explored the possibilities of expanding physical accommodation to accommodate the needs of the growing number of start-ups, for example by at least providing facilities for meetings. But financially, this type of expansion is not feasible, and the research institutes still have enough space to offer to new firms. As the model for future funding has shown, external funding will remain essential even for the future operations of the virtual incubator.

Technology transfer

Staff of the incubator also takes care of technology transfer. Services were developed on the basis of analyses of the demand for high-tech solutions, the characteristics of SMEs in the Warsaw area, previous attempts to establish technology transfer systems and the national policy environment. The services offered are:

- Selection, evaluation and marketing of promising products and services;
- Assisting companies in preparing business plans;
- Monitoring of enterprise development;
- Promotion of cooperation between firms in the incubator and other firms;
- General advisory, information and project management services;
- Organization of conferences and training.

An example of the latter was a TBU training programme in 2001, attended by 39 trainees, young scientists and some owners of SMEs. It gave participants a basic understanding of the methods and available tools for the establishment of innovative enterprises in Poland. The workshops were also used to investigate the opinions of scientists and enterprise owners about the usefulness of the incubator, the general climate for innovation and the impact of EU accession. The results can be summarized as follows:

- There is still a wide gap in outlook between the scientific and business worlds, which is an obstacle to the commercialisation of science results.

- The expectations with regard to the range of services expected from the incubator were unrealistic;
- The small firms have few resources to do their own marketing or market research;
- The regulatory, administrative and financial systems in Poland are a major obstacle to the development of innovative enterprises.
- There are mixed feelings about joining the EU: there will be more opportunities, but also more competition.

Generally speaking, the answers confirmed that there are no doubts about the usefulness of the services offered, even though expectations among entrepreneurs may be unrealistic, especially given the fact that the overall environment for innovative SME growth still need much improvement. So far, almost all transfers have been inward. There were some cases of outward technology transfer in, among others, the software (see above), plastics and pharmaceutical industries; a joint Polish-Dutch anti-graffiti solution project was launched as well; the Dutch company is a spin-off from the Zernike Group.

Box 4: Exporting boats to the Netherlands

Polifaktor is a small manufacturing firm in Northeast Poland. It produces **recreational water vehicles** such as kayaks, rowboats and water bikes. Through the OPI-Zernike link, market research campaign was carried out in the Netherlands. This included interviewing all potential professional users. As a result, Dutch company was found which is interested in acting as sole distributor for the Netherlands and North Germany. In addition, with the heavy competition in the EU markets in mind, recommendations were formulated to improve the way in which the Polish firm manages its production and communication.

An important factor enabling transfers is the upgraded OPI database OFFER, facilitating the information exchange between R&D establishments offering novel products and/or technologies, and manufacturing enterprises, mainly SMEs, seeking technologies for practical application in the economy. The database is international and multilingual, and can be used after completing a simple registration form on-line (see www.opi.org.pl).

Promotion of the technology transfer services is aimed not only at scientists and entrepreneurs, but also at economic and scientific policy makers and local government, regional innovation having been identified as a major development instrument by the Ministry of Industry and Trade. Apart from the Internet presence and printed material, promotion instruments also included the mass media, conferences and trade fairs. From 2003 onwards, two brokerage events are to be organized every year. In 2003, the focus will be on biotechnology and chemistry, two very dynamic areas in Poland. Proximity to UNIDO's Investment and Technology Promotion Office, located in the same building, facilitates international contacts. OPI has also been instrumental in finding an English buyer for the chemical company Prochem.

2.2.3 The Slovak Republic

The incubator

The *virtual incubator* was created on the basis of the response by SMEs to an awareness campaign. Successive screenings of prospective clients led to an initial selection of four companies. While the virtual incubator only started functioning in 2001, its activities have expanded across the border. With Innostart and the BIC in Austria's Burgenland (on the border with Hungary and the Slovak Republic), BIC Bratislava has initiated Project ISTER, in the framework of an EU programme for setting up innovative firms. The clients are not only academic spin-offs but also existing SMEs. One of the final aims of the project is multiplication in similar European regions. Experts will complement the virtual incubator services with personally delivered services (which is why BIC prefers to speak of 'incubator without a roof' rather than virtual incubator).

The services target the following areas:

- Support to exports;
- Technology transfer;
- Cross-border acquisition of financial resources;
- Utilising applicable EU tools and programmes
- Other activities in support of cross-border business activities.

By the end of 2002, ISTER had five Slovak, five Hungarian and 10 Austrian firms. The main areas of activity are consulting, software/multimedia and real estate/construction (the latter firms are all Austrian). There is one promising engineering project. It is obvious from the presence of the real estate sector that much of the activity not high-tech – what is innovative is the set-up which encourages small firms to work across borders. (See website www.bic.sk).

The *physical incubator* was set up on the premises of the Academy of Science, with an initial size of 240 sq. m. After the development of an integrate service package, the incubator started operations in September 2001. There were six firms in the incubator in late 2002, one of them off-site. The services offered are:

- Business consulting;
- Loan mediation;
- Risk and venture financing;
- Grants: signposting and mediation;
- Support to technology transfer.

These are mainly provided by the BIC Group; the Academy institutes where the incubator firms are located provide logistic support. The incubator has links with incubators elsewhere in the country. Services are subsidized through the EU's Innovation Relay Centre programme.

In addition to the services mentioned above, a study was made of financial resources and other support for SMEs in the Slovak Republic, which are heavily dominated by EU funding, and suggestions for improvement were made.

Technology transfer

A total of six TBUs and industrial liaison offices (ILOs) promoting cooperation between research and industry were established in Bratislava and the regions during 2001. Some of these work with clients throughout the country. A technology transfer fund established by the Slovak Government is providing crucial financial support.

Activities have so far included:

- Company visits to gather technology data and analyse technology needs. By mid-2002, 74 SMEs with a potential for international partnership had been visited, most of them in the machinery, chemicals and automotive branches. This led to a project covering outsourcing and technology transfer among companies in the USA, Czech Republic and the Slovak Republic, mainly in the machinery industry.
- Meetings and workshops. Workshops have so far covered various aspects of R&D/industry cooperation, technology brokering, benchmarking and the role of EU programmes. Several workshops had an international character (see section 2.3.1). These meetings, which drew several hundred participants, were also used to collect additional relevant data on technology needs and offers from participants. This was also done during a number of other technology transfer events organized by the BIC Group outside the context of the project.
- The benchmarking and due diligence manuals on which work had started during phase 1 were issued in printed and electronic form (CD and www.bicgroup.sk/benchmarking). The benchmarking methodology was tested in three Austrian companies, with a focus on CAD/CAM and economic performance. An additional benefit of working with Austrian firms was the creation of new cross-border contacts.
- Publication of a brochure on intellectual property rights. The general public were also informed about the importance of the activities through a media campaign.

By the end of 2002, 15 agreements for inward transfers of technologies had been concluded between foreign and Slovak companies, and 12 negotiations were in progress. With the help of the TBU, several engineering companies were able to obtain financial support from the Government.

The BIC Group has been very active in the creation of networks. It took the initiative for creating a Slovak Association of Industrial Liaison Offices whose aim is to develop cooperation between education and research and the industrial sector. Several universities have joined the Association, which currently has 16 members. The technology transfer package has been offered to the Technical University and the business and innovation centre in Košice in East Slovakia, an area with both considerable potential and serious structural obstacles to industrial development. The Group also took the initiative for the international REGILO network, which is described in section 2.3.2. Finally, BIC is a member of the Innovation Relay Centres (IRC) Network of member and associated states of the EU, which was specifically created to encourage technology transfer to SMEs.

2.3. Working with partners

2.3.1 Joint workshops of the programme partners

Four targeted workshops were organized, (mainly) organized by the local counterparts and attended by representatives of the other countries:

- 'Technology Transfer', 23-24 April 2001, Warsaw, Poland. The main topics were: investment and technology policy in Poland, introducing the virtual high-tech incubator, technology transfer, information processes in and databases on technology transfer. The workshop among others made it possible for participants to share thoughts information processing methods.
- 'Technology Brokerage Units', 13-14 June 2001, Brno, Czech Republic. This was accompanied by a brokerage event: 'Automotive industry: technology-cars-contacts 2001', which resulted in some technology transfer negotiations.
- 'Exchange of Experience in the Field of Technology Transfer in EU Countries and CEE Countries', 30-31 August 2001, Piestany, Slovak Republic. A wide variety of technology transfer methods and practical experience was presented at this workshop.
- 'Incubation', 13-14 September 2001, Budapest, Hungary. The focus was on virtual incubation systems and related matters, and among others discussed the continuation of cooperation after the end of the UNIDO project.

**CLOSING WORKSHOP: Project US/RER/95/145 'Regional Programme
for the Establishment of High-tech Incubation Systems at the Academy of Sciences
in the Czech Republic, Hungary, Poland and Slovakia'**



From left to right. Back row: Rudolf Stefec; Jan Stirelecký; Roman Linczenyi; Jan Grega; Pawel Gierycz; Andrzej Puskiewicz.

Front row: Karel Klusáček; Judith Szilbereky; Ouseph Padickakudy; Véra Gregor; Vladimir Kozharnovich; Patricia Mérei.

A final workshop was organized by UNIDO on 26 September 2002 in Vienna, Austria (see above photograph of participants). During this workshop, the four countries presented their experience with the programme, after which plenary discussions took place and recommendations for future work were formulated. Chapters 3 and 4 of this publication are partly a reflection of the discussions at this workshop.

2.3.2 Other joint activities

The project helped to initiate networking among the four partners and collaboration will continue now that the project has ended.

In addition to the ISTER activities described above, BIC Bratislava, Innostart and the BIC in the Austrian province of Burgenland were stimulating cooperation among innovative SMEs through information days, trilateral meetings in Bratislava and Eisenstadt, Burgenland, and circulating firm profiles among the three organizations to help matchmaking. An international information and communications technology brokerage event was organized in Bratislava in December 2002. The BIC Group also initiated the REGILOn network of universities and technology transfer/commercialisation facilitators in Austria, the Czech Republic, Hungary and the Slovak Republic (see Box 5)

Box 5: The REGILOn network

The REGILOn network encourages academic spin-offs, technology transfer and innovation. At the end of 2002, it consisted of 12 partners:

Country	University	Facilitator
Austria	Vienna Technical University	Technologie Impulse GmbH
Czech Republic	University of Technology Brno	Business Innovation Centre Brno
Hungary	Szechenyi University Győr	--
Slovak Republic	Slovak University of Technology	BIC Group Bratislava

The OPI incubator works closely with the Ostrava Science and Technology Park in the northeast of the Czech Republic, to encourage the creation of high-tech start-ups a region going through a difficult restructuring process. The OPI database methodology has been useful for other partners in the design of their own database set-up. The Czech and Slovak programme partners, finally, have undertaken joint technology audits.

Box 6: Partners in technology brokerage

The Agricultural Biotechnology Centre (ABC), a Hungarian public-sector research institute for genetic engineering and cellular techniques, has developed the DS2 promotor, suitable for engineering drought-tolerant crops. Innostart is helping ABC to find partners for this project, among others through the partner organizations in the UNIDO programme and through the Zernike Group. By late 2002, negotiations about licensing the technology were taking place with six partners.

The counterparts shared all information about project results, all project publications were circulated among the partners and databases are linked. Apart from increasing the

awareness of the potential for future cooperation among the countries, the sharing of results has also helped to improve reporting standards.

2.3.3 Cooperation with other European countries

Apart from Austria, the project partners had established contacts with a number of other European countries by the end of 2002:

- Czech Republic: In 2001, the Technology Centre developed innovation policies for the Prague and Plzen regions with Dutch, German and UK partners. The EU supported these projects. Contacts were established with the RAND Corporation subsidiary in Leiden, the Netherlands, for the international marketing of advanced technologies.
- Hungary: In 2002, Innostart has participated in Hungarian-German and a Hungarian-French brokerage event. The latter concentrated on biotechnology, renewable energy and ICT. The Hungarian – German technology brokerage event was organized in the framework of a cooperation agreement with the German *Land* Brandenburg. A letter of intent was signed with the German Max Planck Institute for joint work on the development of a multiscope – a kind of three-dimensional microscope.
- Poland: Apart from continuing cooperation with the Zernike Group, OPI is working with Advanced Research in Chemistry B.V., Amsterdam, on projects in the chemicals industry, and is discussing cooperation with TNO Industrial Technology in Eindhoven, the Netherlands.
- Slovak Republic: The BIC Group is in contact with several Dutch firms. One of the projects is the creation of a joint venture with a Dutch firm, K-plus, for capital venture funding of SMEs. The British Council has supported several workshops on technology transfer and marketing of scientific know-how. The Group has been instrumental in bringing about a technology agreement between Belarus and the People's Republic of China, which is to result in the establishment of a joint science and technology park in China's Yunnan province and a joint research centre in Belarus. UNIDO will support this project through improvements in the business environment in Belarus in the areas of innovation policy, venture capital and intellectual property rights. On the latter issue, there will be cooperation with WIPO.

3. SUMMING UP AND LOOKING FORWARD

3.1 The development of the project

Apart from the development impacts discussed above, the way in which the project itself developed was important.

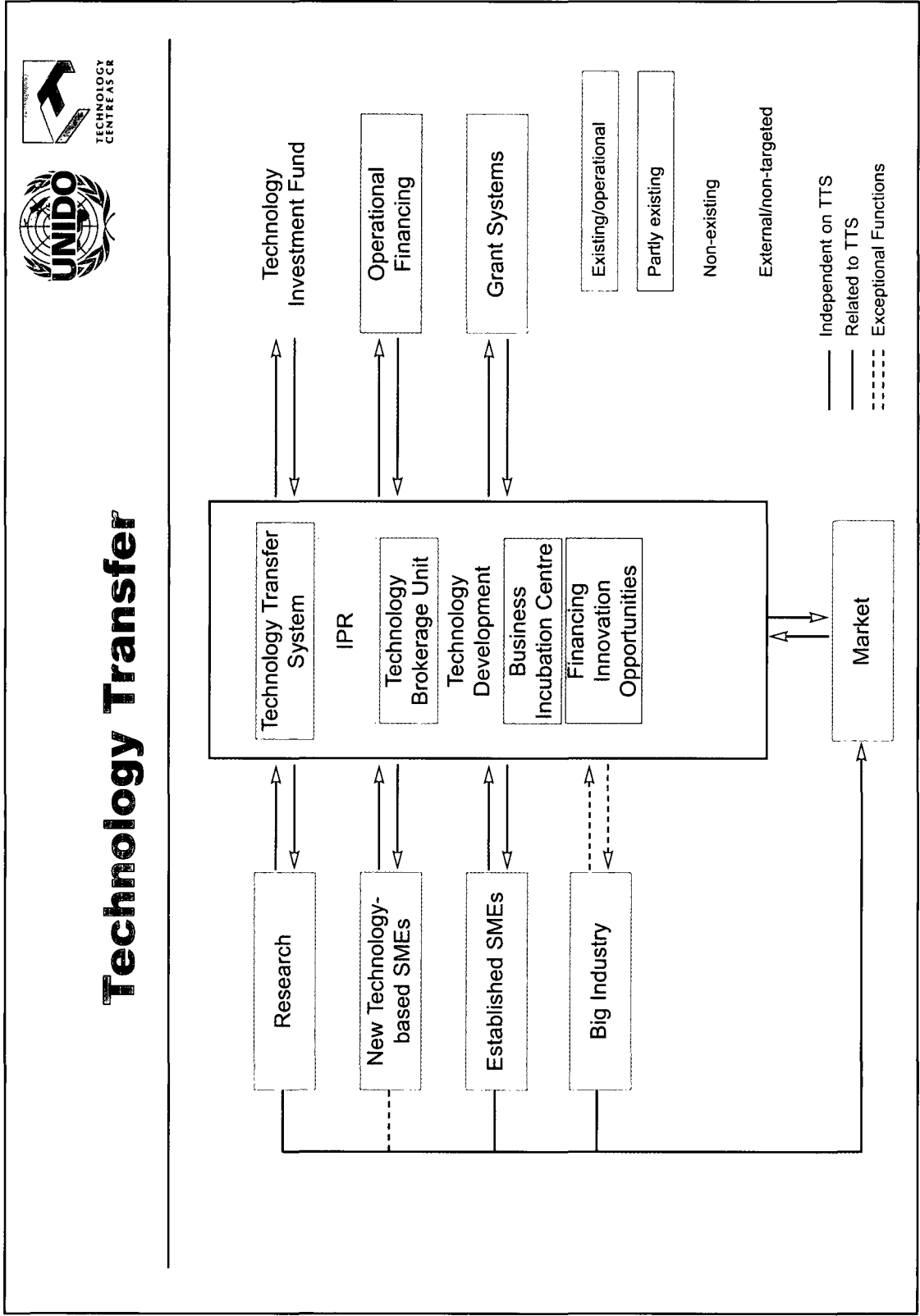
In a sense, some of the unrealistic expectations of the first phase helped to lay the basis for the success of the second phase. Because the actual situation in the four countries rendered many original assumptions about the project invalid, the project partners were forced jointly to find a radically different approach – which was successful.

The factors responsible for this dramatic improvement were primarily:

- (i) Improved communication among all parties, resulting in full acceptance of the recommendations of the mid-term evaluation, and:
- (ii) Formulation of realistic objectives;
- (iii) Weeding out ineffectual counterparts and back-up institutions;
- (iv) A clear work programme, identical for all counterparts, stressing cooperation, but leaving:
- (v) Sufficient leeway for country-specific outputs in a competitive environment;
- (vi) Stable UNIDO project management and additional UNIDO support e.g. for making business plans for incubators;
- (vii) Consistent willingness of all to solve problems with each other; and
- (viii) Continued donor support.

Mutually supportive activities benefit development. Project experience has shown that a comprehensive, integrated package of services is essential for the growth of start-ups and increases the viability of the support schemes, as successfully graduating firms are the best form of publicity. Diagram 1 shows the range of actual and foreseen links in Czech technology transfer support services.

Diagram 1: Czech Republic: activity links in technology transfer



Source: Technology Centre AS CR

3.2 Results: intended and unintended, immediate and long-term

The context for the development of advanced SMEs has improved much as a consequence of the project. But apart from the intended results related to incubation, technology transfer and networking among the four countries, SMEs are also benefiting from a number of unintended results.

The most conspicuous of these was cross-border cooperation, which grew beyond expectations and *has become a process feeding on itself*, as among others the many initiatives of BIC Bratislava show. This has among others helped to reduce the differences, which existed among the partner organizations in the four countries: the fact that *all* have been able to make progress is partly a result of cooperation among the 'clients' of the project.

The planned outcomes have been measured by such indicators as number of training courses and promotional events, incubator floor area, number of companies being incubated and graduating, and number of technology transfer deals (virtually all of which were *inward* transfers). These indicators of immediate results measure the effectiveness of the project in terms of achieving its intended outputs, and the efficiency of the mediator's operations. But they do not measure *long-term* effectiveness in terms of innovative contributions to industrial development. Success indicators for this purpose would include:

- Patents awarded to client companies;
- Innovative products/processes sold by client companies;
- Number and volume of outward technology transfers;
- The increase in the client company's business volume attributable to incubation;
- The survival rate, or better: the commercial success of companies, once they have left the incubator.

Such indicators are partly influenced by factors in the external environment over which the project has little influence, and in any case it is too early to measure the activities of the incubators and TBUs in this way. But the project set-up has a major impact on longer-term effects. Section 3.7 outlines the major elements of such a project set-up.

3.3 Closing the gap

An early problem of the project was the gap between the academies of science and the emerging market economy. The main problem confronting the project was not the stagnation of research in the academies as a result of budget cuts, but a mentality gap linked to a generation gap: a large part of the younger generation of scientists left the academies for more rewarding careers, which strengthened the pure science orientation of the academies, now predominantly staffed by scientists of the older generation who are often unable to make the mental transition to the commercialisation of science results. The problem is in some cases compounded by old regulations that hinder research-business links.

The project has to an extent been successful in overcoming this gap. One-third of the Polish start-ups, for example, originated in the Academy of Sciences, which in addition has added technology transfer to its key activities. But the new generation of scientists-entrepreneurs does not always have a clear concept of entrepreneurship and management yet. Symptoms include a lack of interest in preparing business plans, a reluctance to discuss the business plans that have been made, being content with making a living rather than expanding one's business, and a reluctance to leave the incubator. The scope of this type of project was too

limited to solve these mentality problems. A broad introduction to business (both theoretical and practical) is needed at universities if applied science is to become a major force in development - and a source of income to support research. (At the same time, action is needed to overcome the scarcity of business plan know-how, to bring down the often prohibitive cost of external business plan development for small enterprises).

Many of the firms using the services of the incubators and technology brokers are not high-tech, and most of the brokerage concerned *inward* transfers of technology. What the services do is to help firms realize their potential in an innovative way - through technology development, but also through innovative products based on mature technologies, new management techniques (considered more important than new technologies by the Slovak partner in the programme) and the exploration of new markets. The question how *outward* transfers can be stimulated is an important one for many transition economies, because of their science potential. To an extent - there were several cases in Poland - innovative 'medium-tech' can result in technology exports. However, before outward transfers can become a major income source, imported knowledge will be needed to start a learning and exploration process leading to cutting-edge technological innovations.

3.4 Investing in the future

At the end of the project, the demand for incubator services had been clearly demonstrated: hundreds of candidates had been screened by the incubator management in each of the countries. With the limited resources, the number of firms that could be incubated was only a fragment of the number of serious candidates. Can an incubator ever reach an economic size, given the fact that start-ups will not be able to pay the full price for the services provided? Obviously incubators - including virtual incubators - will need long-term financial support in order to continue functioning and to meet the demand. Such support can be seen as an investment: if enterprises are created that indirectly recoup the investment by becoming commercially successful, then there is a net gain to the national economy. There is a parallel to subsidies for local libraries and primary schools: at the local level, the basis for the knowledge economy is created.

What will the sources of incubator finance be? In the interest of long-term development, funding innovative start-ups and SMEs should be a national policy issue - the next section will outline the main elements of a national innovation policy. A coherent national approach is also essential to benefit from EU programmes, which have become a very important source of funding for the Central European countries (generally speaking, international aid will continue to play a vital role for some time to come).

The problem of enterprise funding could not be solved by the project. The interest rates on bank loans are usually too high. The Hungarian business angels club is an innovative idea, but it is too early for this initiative to have concrete results yet. Before the economic transition is over, private venture/seed capital is unlikely to become available in these countries on a large scale. However, expatriate businessmen might become an important source of such funding. Another possibility - which has a parallel to loans to students with good grades - would be to establish a national fund for newly independent enterprises with a good track record, with a maturation scheme, to help them establish themselves firmly in the market.

Even with long-term sources of external funding, the rule that resources should be used in a way that maximizes their productivity would assign a key role to virtual incubators, as they minimize investments in hard infrastructure and have a wide reach. This will allow concentration of resources on hard infrastructure where this is really needed - there is a role for serviced premises where start-ups have direct access to support services and personal advice. The importance of virtual incubators for the future is underlined by the fact that

Innostart was commissioned by the Hungarian Government to make a study of their role in the e-economy.

3.5 The need for a coherent strategy

Solving the problems of stimulating and funding innovative enterprises will require a long-term vision as well as a broad perspective. Innovation is more than technological development. The large number of applicants and the presence of non high-tech firms in the programme indicate that many innovative, enterprising people still lack basic support for creating new businesses. Even though incubators are available, enterprises that are not science based usually do not have the same extensive networks, awareness of international development and access to special funding.

A coherent, broad-based national innovation strategy is therefore needed. Such a strategy will help to among others improve the environment for high-tech incubators (and science parks). It should:

- Involve all key public and private sector stakeholders.
- Identify key national strengths on which to concentrate efforts.
- Develop a long-term vision, with stages for its realization.
- Create an institutional support infrastructure³.
- Review regulations that still form an obstacle to cooperation between science and business.
- Identify ways of maximizing development effects by exploiting local potential⁴.
- Explore new funding mechanisms, using public and private resources.
- Build on an important result of the present project: cooperation with neighbouring countries, sharing their problems and experiences.

Some of these issues are addressed by UNIDO's Technology Foresight initiative (see below). The Czech Technology Centre has meanwhile coordinated the first national technology foresight exercise aimed at identification of priority areas of research likely to yield the greatest economic and social benefit to the country, and is involved in the preparation of national follow-up foresight activities.

3.6 Crossing borders: the role of UNIDO

Apart from providing in-house expertise, UNIDO played a very important role in activities across borders, and could continue playing an important role in this respect:

³ While there is no actual innovation policy yet, a Ministry of Science and Information is to be created in Poland in 2003. It is to cooperate with the Ministry of Economics on innovation issues.

⁴ The Czech Republic and Poland have already designed regional innovation strategies; such strategies are also being formulated for four Hungarian regions. OPI intends to promote networking among local firms as an instrument to promote innovation.

- The organization linked the four countries to Dutch know-how and training. This proved to be of great value and paved the way for contacts in the Netherlands from which future development of the incubators and technology brokerage will benefit.
- With the know-how transferred, the project partners were able to formulate sound plans for their activities, qualifying for Government support.
- Its global experience and presence has enabled UNIDO to formulate a project that was both country-specific and a stimulator of cross-border initiatives. There was little tradition of voluntary cooperation among the countries. The integration of information exchanges as an activity in the second phase triggered off intensive networking among the project partners. BIC Bratislava, which has already become very active in this respect, now wants to create a network of TBUs and industrial liaison offices across borders as well. The final report for the Polish component of the project specifically points out that further cooperation will enhance 'the effectiveness and operational abilities' of the facilities.
- The East-East link involving the Slovak Republic, Belarus and China is an activity that could be encouraged on a wider scale by UNIDO, using its international presence and neutral status to identify opportunities, provide contacts and ensure that cooperation agreements are advantageous to all partners. The Central European countries, having developed capacities to stimulate innovation in a market economy, can serve as bridges to transition economies that do not have an effective way of coping with this issue yet.
- Through the UN system, the project partners had a link with the World Intellectual Property Organization in Geneva (www.wipo.org). The recognition of ownership of inventions and creative works, one of the main tasks of this organization, is crucial for stimulating further inventive and creative activity which, in turn, stimulates economic development.
- Section 3.5 pointed to the importance of innovation policy in providing a context for the future development of high-tech incubators and technology brokerage. UNIDO's regional initiative Technology Foresight for Central and Eastern Europe – Newly Independent States (for details, see www.unido.org/foresight-cee-nis) is creating capacities for the design of policies and strategies that exploit the technological potential of these countries, with a focus on areas such as biotechnology and chemistry, in which these countries have strong traditions. The initiative also has an explicit multi-country focus: among others, it creates virtual regional networks of stakeholders.
- UNIDO's Small and Medium Enterprises Branch not only works with partners in transition economies to stimulate the development of high-tech SMEs, but has a wide experience in establishing support infrastructure for these enterprises, and can therefore help to realize the broad-based approach to incubation discussed above.

The UNIDO project, finally, has complemented EU efforts by creating practical, business-oriented local capacities which allowed the countries to derive greater benefits from the EU programmes for the accession countries, especially those that target innovation.

Box 7: Designing an incubator support project - main points

Using the experience of this project, the following main issues can be identified which must be addressed when designing a support project for high-tech incubators and technology transfer to SMEs:

1. A thorough assessment of the environment in which the project's outcomes will be put to the test is essential. In the present case, foreseeing the developments in the transition countries was in many ways impossible. Therefore, the project set-up must be flexible, possibly based on alternative scenarios. This will also allow a project to exploit the unpredictable opportunities offered by the very openness of the market economy.
2. The flexible set-up must be mirrored by flexible, 'front-line oriented' project management; at the same time a stable management structure is needed to ensure continuity. For the same reasons the incubator itself will need a solid management structure as well, and a sound business plan.
3. Mechanisms must be built in that encourage cross-fertilization and a long-term view, well beyond the formal end of the project. This could among others involve the creation of an 'after-sales service' to solve minor problems and long-term tracking of results (which can provide ideas for new projects). For a support institution, the latter should be part of an institutional memory building strategy, which again is an essential component in the continuous institutional learning process needed to stay abreast of developments.
4. International skill, know-how and technology transfers are impossible without well-developed international communication skills. It may be necessary to include English, the *lingua franca* of science and business, in the training programmes of support and enterprise staff.
5. A project can only fully satisfy local needs and be robust enough to deal with unexpected local developments if the recipients of support – a term implying a passive role - are active partners in the project.
6. For long-term commercial success of an incubator's firms, it is essential that the start-ups are viable in the first place. This assumes strict selection procedures and helping candidates to formulate sound business plans, which again requires thorough training of support staff.
7. A long-term approach allowing for unexpected developments will have to be reflected in the way project results are measured. Measuring predetermined outputs is easy; but how does the evaluation of results deal with unintended outputs, the viability of firms or institutions beyond the end of the project, or a process that been set into motion?
8. The project's impact will be increased if it is linked to or part of a national innovation strategy. This will also make it easier to mobilize funds. Intellectual property issues – often neglected in transition and developing countries - must be given full attention.

UNIDO support for projects of this kind would focus on four areas:

- (i) raising awareness on the importance of innovation;
- (ii) building capacity and creating mechanisms for effective experience sharing and other synergies;
- (iii) building capacity for policy/strategy formulation; and
- (iv) promoting

Annexes

Annex 1 **Profiles of project partners**

Annex 2 **References to selected UNIDO materials on incubation and
technology issues**

Profiles of Project Partners**Czech Republic**

Technology Centre AS CR www.tc.cas.cz

The Technology Centre is the host and co-ordinating organization of the Czech Innovation Relay Centre, a member of the European network of Innovation Relay Centres. Apart from the high-tech incubation and technology transfer functions discussed in this document, the Centre also serves as the national information monitoring and training centre for the EU's R&D Framework Programmes, and co-ordinates projects focused on prospective strategic needs of the country and its regions in the field of technology and innovation.

Hungary

Innostart www.innostart.hu

Innostart's activities are organized around the National Business and Innovation Centre (NBIC) and the Innovation Park. The NBIC offers the full range of professional services to start-ups, spin-offs and SMEs, including those described in Chapter 2. The Innovation Park accommodates 44 firms with 450 employees, with information technologies and electronics among the main industry branches. Innostart partners include ministries, public sector agencies, chambers of commerce and financial institutions; it also serves as an EU liaison office.

Poland

Information Processing Centre (OPI) www.opi.org.pl

The statutory tasks of the Information Processing Centre include:

- Accumulation, storage, processing and dissemination of scientific information from Poland and abroad;
- Providing information services for research and R&D projects;
- Conducting projects on technology transfer, marketing in science, high tech in the SME sector, education of R&D staff, information systems and their development;
- Organization of seminars, exhibitions and the like.

In addition to undertaking the activities described in this document, OPI is active in a wide international network of similar institutions.

Slovak Republic

BIC Bratislava Ltd. www.bic.sk

BIC Bratislava Ltd. is the host organisation for the Innovation Relay Centre (IRC) Slovakia and one of the co-founders of the SPICE (Science Parks and Innovation Centre Expert) Group and of the Slovak Association of Business and Innovation Centres and Regional Advice and Information Centres. BIC acts as an expert and contact organisation for the EU's Sixth Framework Programme. The incubation and technology transfer activity are part of a package of services, which also includes financial, investment and regional development consulting as well as project management.

Annex 2**References to selected UNIDO materials on incubation and technology issues**

UNIDO Practical Guidelines for Business Incubators in Central and Eastern Europe, 1995, 1999

UNIDO Good Practice in Managing Technology Transfer Networks, 1999, 2002

UNIDO Guideline for the Preparation of a Business Plan for the Establishment and Operation of a Business Incubator, 2001

UNIDO/UNDP/OAS Business Incubators in Economic Development, 1996

CAPTECH (Capital Investment Evaluation for Technology Upgrading and Capacity Building for Technology Absorption) (technology needs assessment package)

Improving Productivity and Competitiveness, November 2001

Innovative Technology Transfer Framework Linked to Trade for UNIDO Action, 2002

Manual on Technology Transfer Negotiation, 1996

Technology Bureau for International Industrial Partnerships, Report 1999-2001 (project US/IND/98/071, India)

Training Package on Investment and Technology Promotion

UNIDO and its Role in Technology Transfer, Contributions for the Expert Meeting on International Arrangements for Transfer of Technology, Geneva 27-29 June 2001

UNIDO Technology Management Activities in the Context of the Investment and Technology Promotion Programme, presentation by J. Caldas de Lima at the 8th International Conference on Management and Technology, Cairo 2000

On the UNIDO homepage, www.unido.org:

Asia-Africa Investment and Technology Promotion Centre

Investment and Technology Promotion Offices

Knowledge Network for Industrial Technology Transfer (KNITT) Under the Kyoto Protocol

Regional Conference on Technology Foresight for CEE and NIS Countries: Background Information

Service Module Descriptions, Investment Promotion and Technology Branch, Small and Medium Enterprise Branch

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