

RESTRICTED

ODG/R.14

27 October 1999

UNITED NATIONS

INDUSTRIAL DEVELOPMENT ORGANIZATION

ORIGINAL: ENGLISH

US/GLO/94/009

IN-DEPTH EVALUATION OF SELECTED UNIDO ACTIVITIES ON
DEVELOPMENT AND TRANSFER OF TECHNOLOGY

Component 3

**Technology Business Incubators
and Technology Parks**

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Acronyms

BI	- Business Incubator
EBN	- European Business Innovation Center Network
RTD	- Research and Technology Development
TBI	- Technology business incubator
TP	- Technology parks

1. INTRODUCTION

1. Economic development depends heavily on small businesses. In the United States, SMEs account for almost half of the private work force and produce almost half of gross domestic product¹. European studies show similar results. The European Commission published ² that between 1988 and 1993, SMEs in the EU were responsible for a net employment increase of 2.6 million jobs; the large enterprises lost in 1992 and 1993 the same number of jobs as they created in 1998-1991 (1 million). In the United Kingdom, SMEs account for 50 per cent of non-government employment and 29 per cent of turnover³. Data for the whole EU indicate⁴ that small enterprises, that is with less than 10 employees (93 per cent of all enterprises), generate 32.8 per cent of jobs and 25.4 per cent of turnover.⁵

2. In transition economies of Central and Eastern Europe (CEE) the movement from a centrally planned to a market economy is being accompanied by a rapid development of the private entrepreneurial sector. However, no matter if in the EU or CEE, most small businesses fail within their first five years of operation due to under-capitalization and/ or lack of proper management skills. Several studies indicate⁶ that business incubators significantly enhance the chance of SMEs to overcome their initial and critical stages of development. The typical lower cost of operating a new business in an incubator facility is conducive to a more rapid growth and maturity into a viable business enterprise. The same studies document that business incubators increase their tenant companies' chances of success to between 80 and 93 per cent compared with 20 per cent in the general economy. Incubators of various sorts, particularly when consuming considerable subsidies, may respond to broad economic and political objectives. This was the case in the reunification of Germany where technology centers were seen as an appropriate tool, even at a high subsidy cost, to meet the challenge of industrial restructuring including the closure of the research institutions of the Academy of Sciences. In some parts of the Russian Federation, business incubators afford a safe haven for legitimate entrepreneurship development in areas where crime is a constraint on business (OECD, 1999)

3. Technology business incubators (TBIs) constitute a special type of business incubator specializing in new technology-based companies. The primary mission of a TBI is not to create jobs or to develop a region but to facilitate the commercialization of research results as well as the acquisition and use of state-of-the-art technologies, which would promote domestic resource exploitation and improve the international competitiveness of national industry. Therefore TBIs constitute an explicit instrument for the transfer of technology. A recent survey of the National Business Incubator Association (USA) shows that there are more than 550 business incubators operating in North America and that between 20% and 30% of them, depending on the counting, are technology-oriented. The number of incubators is growing by almost 10% per year. An average per firm of the aggregate revenues reported in the fiscal year 1996 is \$4.3 million for firms served in-house with additional \$2.8 million for affiliated companies. Of the business incubators established in developing and transition countries, very few are technology based and those are located in the more advanced countries (such as Brazil and China).

¹ Small Business Administration, 1998 [Online] Available at: <http://www.sba.gov/>

² Brouwer S., Financing SMEs: an area of growing interest for PHARE East Link No. 6, Brussels: European Commission, 1995.

³ Enterprise Panel, Helping companies to generate wealth and create jobs through business incubation Sheffield: Slater Print, 1996.

⁴ Pike J.S., EBN Seminar for CEOs of BICs, Waterloo, Belgium, February 1997.

⁵The above data is not fully comparable since definitions of SME differ according to the source. Figures are provided only to give an approximate idea of the weight of the sector.

⁶ Allen D.N., McCluskey, R., Entrepreneurship theory and practice Hankamer School of Business; Baylor University, Texas, 1990.

4. Technology parks (TP) belong more to the real estate initiatives. They have much longer time horizons of development, often counted in decades. The gestation of incubators is short, usually about three to five years and costs of their establishment is three orders of magnitude lower than technology parks. The building of a real technology park requires a high level of national technical infrastructure, human resources and tradition in technology-oriented entrepreneurship. Today, for developing countries and countries in economic transition, the general type of incubator projects (not necessarily technology-oriented) appears to have a wider application. Incubators can help to develop necessary management skills, entrepreneurial potential and related infrastructure. After an initial period which can be decades, a technology park may be opened in the neighborhood of the technology incubator. In that respect, a TBI represents a first phase of the development of a TP.

2. TECHNOLOGY PARKS AND TECHNOLOGY BUSINESS INCUBATORS

2.1. The typology of business incubation systems

5. Several authors ^{e.g.7} have defined a typology of various business incubation and support systems in detail. The following overview shows short definitions of business incubation in general and of the two systems that are relevant to the context of this study.

6. **Business Incubator (BI).** BIs constitute real estate operations with buildings, where new businesses are housed for a fixed period of time and are provided with a variety of services to help them start and grow. The incubator has a management who oversees the real estate operations as well as the service system, collective and individual, to the enterprises. Incubators are usually associated to a number of incentives which relate to the rent paid as well as of a fiscal and financial type. Business incubators may address a special type of clients. If the businesses to be housed are technology intensive, then the incubator may be denominated technology business incubator.

7. **Technology business incubator (TBI).** TBIs aim explicitly at incubating enterprises with a high or advanced technology content. A typical TBI provides its clients with a comprehensive range of services, not only the rental space at an affordable price but also a full range of business and specialized services aimed at intensifying technology utilization. TBIs generally have strict admission and exit criteria and the set of business support services is designed to include those that facilitate technology transfer and commercialization of new technologies. TBIs have usually close ties with a research base and the primary task of TBIs is not to create new jobs but to commercialize new technologies through innovative entrepreneurial ventures.

8. **Technology park (TP).** TP is a property-based initiative, which provides businesses with high-quality premises on a site in close proximity to a knowledge base (university or a complex of research institutions). These businesses are generally either start-ups established by researchers or academics wishing to commercialize their research or spin-offs to larger industrial companies. Usually, but not exclusively, the companies located in a technology park started their entrepreneurial activities in a TBI, which can be an integral component (“a nursery”) of the TP. The main difference between technology parks and industrial parks is that the latter are large sites providing land and common facilities for the establishment of factories. They are usually designed for well established businesses that are engaged in manufacturing activities not necessarily interconnected.

2.2. Synergy of technology parks and incubators

⁷ Lalkaka, R. Small enterprise development, Intermediate Technology publications, Vol.5 No.3 September, 1994.

9. TBI and TP are two potentially interconnected facilities that may exist either alone or co-operate in one locality. TBI accommodates newly created enterprises as tenant, and helps them to grow into fully-fledged businesses within 3-5 years. After this initial period, the mature businesses leave the TBI and move to the competitive market environment in the TP, freeing space in the TBI for new innovative start-ups. Obviously, a close co-operation of TBI and TP and their location in the same area is highly desirable. Entrepreneurs, TBI, TP (and consequently the community) all may benefit from a proximity of both facilities: The advantages can be termed as follows:

10. Entrepreneurs (small businesses)

- S after moving from a TBI to the neighboring TP, they will easily maintain the previously established exchange with the knowledge base;
- S they may share unique equipment and information sources of research organizations, otherwise unavailable or unaffordable;
- S they can easily continue in further research and development of their products and services in co-operation with the research organizations;
- S after relocation, their clients will find them practically at the same address.

11. TBI and TP

- S they may define and follow complementary strategic targets;
- S allow for easy monitoring of maturation and post-maturation development and success of companies;
- S close neighborhood will help to develop a more efficient and larger network at the national and international levels.

12. Integration of the TBI into the TP creates also some additional positive effects:

- S companies associated to or servicing a graduated company remain located nearby;
- S local “business angels” and venture capital operators prefer an involvement in fast-track businesses staying in the area of their interest.

13. An incubator, as the first building block of a longer-term technology park development has a notable potential to contribute to the overall success of the park by providing apparent evidence of business development relatively quickly and at low cost. As tenants graduate from the incubator they could be relocated to larger premises in the park. The interaction between park and incubator has the potential of significant synergy and the park-incubator linkage constitutes an interesting economic tool.

14. In practice this graduation does not occur so smoothly. Either the firms stay in the incubator longer than expected because they have nowhere to go, in other words, they cannot survive under purely commercial real estate conditions. In the case of British Steel (industry) , three quarters of the enterprises in its Business Innovation Centers did not grow sufficiently to move, so B.S. (industry) was obliged to sell its mature centers to real estate companies and use the proceeds to build new business innovation centers, so the cycle could start again.

2.3. Facilities and services of technology parks and incubators

15. Both TBIs and TPs should provide their clients (tenants) with a comprehensive range of facilities and services. Due to the distinct roles of TBI and TP, their services differ although they may overlap to some extent.

16. Technology business incubator

- S *Incubator space*, either in the form of offices, workshops, laboratories or halls available at low cost. The location of TBI near industrial estates or technology parks may be useful to help tenants find permanent premises as they graduate (usually after 3-5 years).
- S *Common services*, which may include secretarial support, telephone, fax, Internet, LAN (local area computer network), security services, reception and mailing facilities, access to office equipment, meeting rooms, conference facilities, exhibition space and catering.
- S *Enterprise counseling*, namely assistance to the elaboration of business planning, access to accounting, legal, marketing, licensing and financial expertise.
- S Access to *financial resources*, namely early-stage financing (seed funds, venture capital funds), soft loans and grants.
- S *Technology counseling and RTD (Research and Technology Development) services*, namely in choosing innovative technologies, providing access to research specialists, matching with partners from universities and research organizations, improving productivity, quality control and maintenance.
- S *Networking services*, encouraging business relations inside the TBI and providing information on networking possibilities with business actors outside the TBI nationally and internationally.

17. The following table illustrates the services provided by European incubators in 1995⁸.

Service	Percentage of incubators providing service
Training	78%
Technology assistance	86%
Marketing consultancy	100%
Business planning consultancy	100%
Providing rental space for enterprises	78%
Shared logistical services	83%
Providing venture capital financing	46%

18. Technology parks

Technology parks provide space to fully-fledged companies that do not need many of the nursery services provided to start-ups in TBIs. However, a technology park should provide its clients:

- S Good access possibilities, particularly vicinity of an international airport and railway/ highway

⁸ Source: European Business Innovation Centre Network, 1996.

systems.

- S An excellent infrastructure, e.g. utilities, communication, data networks, catering, conference facilities, and exhibition rooms.
- S A reservoir of qualified labor power, represented by educated people with high level of necessary skills residing nearby the TP.
- S Prestigious address, particularly a good image of the locality, good landscaping and proximity to leisure and recreation possibilities.
- S Further development possibilities for future expanding, particularly reasonably priced land and/or buildings. Financial incentive schemes for development (lease, loans, mortgages or rent).
- S Vicinity of a research organization which can carry out co-operative research and provide information sources. A prestigious university or research center can increase the reputation of the TP (e.g. Cambridge – Cambridge Science Park, Oxford – Oxford Science Park, University of North Carolina – Triangle Park). On the other hand, the TP project can enhance the university's image as an institution actively involved in technology transfer and converting research findings into commercial products.

2.4. Links of technology parks and incubators to knowledge and technology sources

19. Technology parks and incubators, by definition, focus on specific objectives such as the promotion of scientific research and commercialization of technology. The location near a technical university or a cluster of technical research institutes provides a significant attraction to important technology-based larger companies, which can outsource part of their pre-competitive research tasks and use the accumulated knowledge as an expert base. The relationship with a university or research center is one of key prerequisites for their establishment and successful development.

20. While proximity of knowledge (technology) source means an advantage for technology parks, it is a must for technology business incubators. When a technology focus is required, a location adjacent to a source of knowledge and new technology creates several interesting opportunities:

- S university professors and senior researchers have a possibility to initiate new businesses based on their research;
- S access of entrepreneurs to university facilities, information sources, specialized equipment and services;
- S access to accumulated knowledge, possibility of consultations and intellectual exchange of ideas; and
- S offer of graduates as potential employees.

21. Beyond the tangible benefits, the relationship with the know how source contributes to the prosperity of young entrepreneurial venture. Generally, business start-ups lack a reputation and the association with a university or research institution may provide an improved standing in the business environment.

Box 1

An example from the Netherlands – University of Twente

*From when it was founded, the University of Twente (UT) has always seen the interaction between science and development as fundamental. The UT plays an important role as a catalyst in the re-industrialization of the region following the collapse of the textile industry. The UT closely co-operates with the **Business and Technology Center (BTC)** – an incubator for small knowledge-intensive companies needing accommodation close to the university and with centralized facilities. The main characteristics of the BTC are:*

established in 1982 - 83

3 000 m² net office space

1 500 m² net production space

total number of enterprises: 65

total number of enterprises during 15 years: 228

total number of university spin-offs during 15 years: 50

*In the immediate surroundings of the UT the **Business and Science Park** (a TP) was created to strengthen the transfer of knowledge and technology to the marketplace. About 20 hectares is available with possibility of additional 20 hectares for expansion.*

22. UNIDO has tried to develop mechanisms to bridge the gap between universities with industries through the UNISPAR - University-Industry - Science Partnership Programme - which is part of a memorandum of understanding on areas of cooperation between UNESCO and UNIDO. In practical terms, this programme has not achieved results and is presently dormant.

2.5. Financing of technology parks and incubators

23. Technology parks are largely real-estate businesses, therefore, they should be able to generate profits. However, for the success of a project of a technology park, indirect financial measures on the national (regional) level are essential – particularly incentives provided by governments usually related to: duty free zones, tax exemptions, symbolic price of land and infrastructures, subsidized prices of new premises. Incentives to hire local people and to use a national research base may also be important.

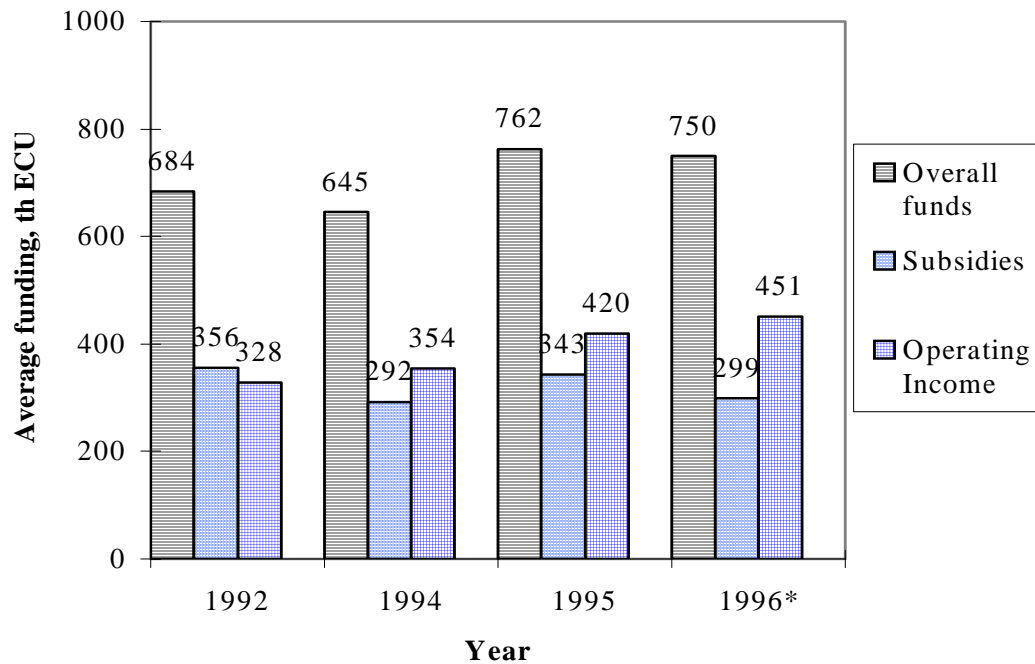
24. Financing of technology business incubators is a more complicated issue, particularly in its early stages. Although a self-financing concept of TBI is frequently postulated, there is a fact that the government, regional authorities, university or other incubator promoters require the TBI to work under some goals and constraints. The TBI should facilitate the technology transfer through the creation of small innovative companies that are established thanks to the provision of space and quality services which are attractive to newcomers because of their accessibility and because they are below market prices. In this respect, a government, region or university is a client asking the TBI for a social service, which should be reasonably supported. This does not necessarily mean a support in cash but, for instance, suitable premises may be provided for free to the administration of the TBI, which then will be able with it to create sufficient income.

25. In the European Union, governments and regional authorities developed various schemes to support the establishment and development of TBI (or business incubators in general). For instance, the European Commission (Directorate General XVI) provides to selected incubators in member and pre-accession countries, a financial subsidy of 50% of their operational costs for 2 years (up to 3 years in less developed countries or regions). During this period, an incubator has to achieve financial self-sustainability or to attract

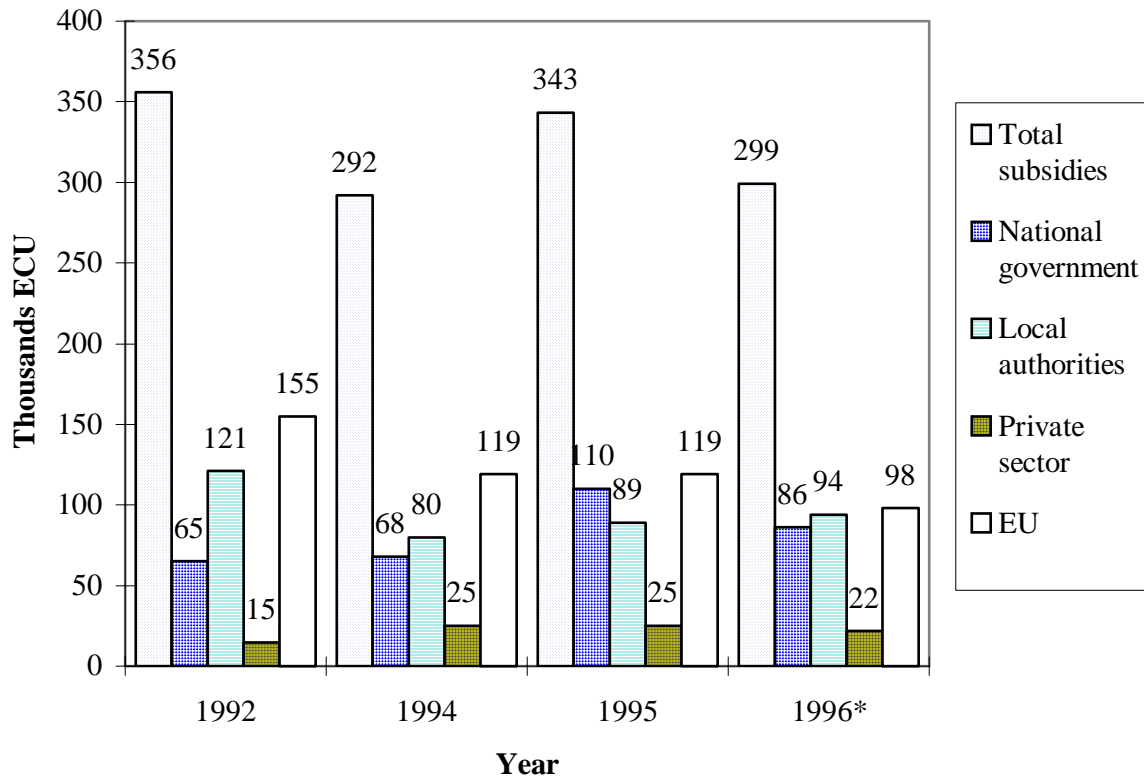
sufficient local (national) subsidies. Usually it is the latter.

26. The European Business Innovation Center Network (EBN)⁹ published that in 1995, the average overall funds available to one of its 140 members were 762 thousand ECU. With subsidies of 343 thousand ECU and operating income of 420 thousand ECU, this represents a ratio of operating income to overall funds of 55%. The development of funding over the period of 4 years is shown in the following picture (* - year 1996 estimated):

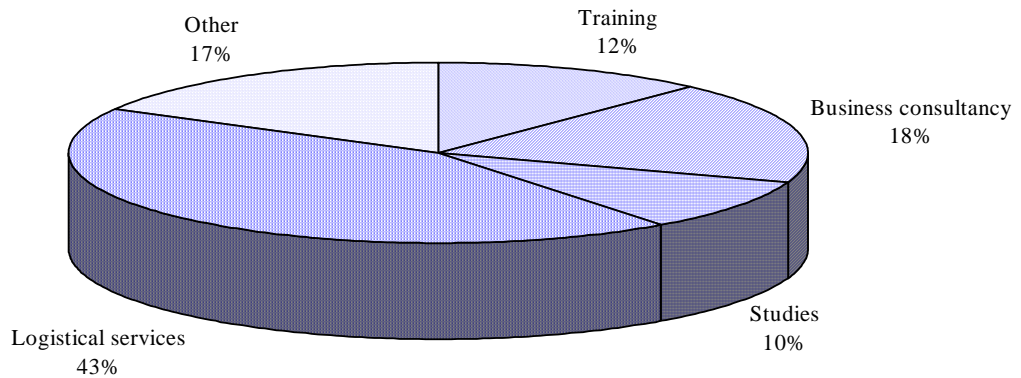
27. The average structure of subsidies is shown in the next figure. Subsidies from national governments have increased substantially and those from the European Union declined.



⁹[Http://www.cordis.lu/home.html](http://www.cordis.lu/home.html)



28. The structure of operating income remains practically stable, the two most remunerative activities contributing to operating income are shared logistical services and business consultancy. The breakdown of operating income (343 thousand ECU) of EBN members in 1995 is shown in the figure below:



29. The incubator projects in the EU countries provide helpful frames of reference for transition economies and developing countries as they are generally established in regions where knowledge exists but the entrepreneurial spirit is not well developed and need a systematic governmental support to put that knowledge to use. In countries with economies in transition, incubators may help in the development of entrepreneurial spirit often damaged or even wiped out by previous decades of centrally planned economy. In transition economies applying to adhere to the EU, various pre-structural funds can be exploited for the financing of incubator projects.

Box 2
Business incubators in China

A 1995 UNDP/UNIDO/OAS review of business incubator programmes in China determined that after 3 years there were 70 incubators with more than 2 000 enterprises. Results in typical incubators were:

Tianjin: 9 000 m² incubator with 50 high-tech tenants and 7 graduating companies. Sales value of their products was \$8.3 million, a five fold increase over three years.

Chengdu: 6 000 m² incubator with 39 tenants and 9 graduates. In addition there were about 100 affiliated companies outside the incubator and equity investments in 5 companies.

2.6. Real estate issues

30. A frequent dilemma for TBI managers is to choose between constructing a new building or refurbishing an old one. The answer depends on the local situation. Typical advantages of new building are: flexibility, better location, optimal design and lower maintenance costs. A major problem is the higher cost and sometimes, a good location for a new building in proximity of a knowledge source is difficult to find. Renovated buildings e.g. in existing university campus, may have some advantages as well a lower cost, a shorter time needed to start operation and an easier building and construction permission from local authorities.

31. Regarding the size, the experience shows that the total floor area of TBI, including 15% of common space, should be at least 4,000 m² of mixed space – offices, workshops, laboratories and small production units in a ratio of about 40% / 25% / 10% / 25%. A detailed description of real estate issues related to the business incubator projects may be found in the literature¹⁰.

2.7. Performance indicators

32. Systematic evaluation of business incubator systems is usually absent¹¹. However, performance of the TBI should be regularly monitored and evaluated to determine impact in accordance with the objectives pursued, to justify the project investments and to establish the background for motivation and rewarding of the management. In the case of technology oriented incubators, evaluation will allow for an

¹⁰ Sfiligoj A., van Driem G.A., Oscari R.: Premises and Common Services in BIC Network, EBN Study, 1992.

¹¹ Business Incubation, International Case Studies, OECD, Paris, 1999.

objective determination of the technology used/ transferred to the enterprises established. The main performance indicators for monitoring and evaluation purposes, using EU terminology ,are:

<u>Category or level</u>	<u>Performance indicators</u>
Operational efficiency	the number of enquiries for entry received by the TBI; number of new start-ups and subsequent failure rate; reasonable turnover of tenants.
Financial performance	the level of operating income and expenditure; positive cash flow measured against original forecasts;
Research and technology transfer	value of achieved technology transfer agreements; research RTD projects granted to tenants; value of contracted research; royalties paid to stakeholders.
Business development	new jobs created and turnover development in tenant companies

33. The prime objective of the TBI is to produce stable small innovative companies. Therefore, one of the most important performance indicators is the failure rate, i.e. percentage of collapsing start-ups. Experience has shown that in average the business incubators increase the chances of companies to survive and develop up to about 90 per cent compared with 20 per cent in the standard market environment.

34. Sometimes, the necessity to cover costs or even survival may cause the conversion of the incubator to a pure real-estate operation or increase the share of real estate type of operations. That situation may happen particularly in developing countries with weak sources of knowhow and non-existence or under-developed state support programmes. In such situations, it is one of key tasks for the incubator management to keep a balance between economic survival and incubation functions. A compromise solution exists when part of the incubator is short-term leased to matured companies at market conditions but at least some space is always available for the start-ups.

2.8. Risks and dangers

35. Several categories of risks are part of any incubator project. Some dangers are related to the incubator itself, some concern the enterprises. Each project has its own specific dangers, however, some risks are quite general:

<u>Risk description</u>	<u>How to minimize the risk</u>
Promoters may lose their interest in the project	Frequent awareness actions, information days, open-door days and publicity of success stories.
Low commercial results from technology transfer.	Co-operation with experienced licensing agency, active marketing and international networking.
Problems with financing of start-ups	Initiating of small seed fund operated by TBI. Corporate venturing and foreign investment.
Lack of premises for graduated tenants	Initiating the technology park project.
Becoming real estate operation	Initiating governmental support programmes for business incubators, incentives for industrial sponsors.

Box 3

Reasons for failures of US business incubators (1990-95)

It is estimated that the US market can accommodate about 600-650 incubators and this target should be achieved in the beginning of next century when failure rate will be compensated by new start-ups. The US National Business Incubator Association (NBIA) reports the main factors that have influenced the closing of incubator programmes or their omission from the NBIA Directory of Members during 1990-95:

<i>Reason for closure</i>	<i>Programmes in percentage</i>
<i>Offering real estate only</i>	<i>20-27%</i>
<i>Lack of funding</i>	<i>19-26%</i>
<i>No information available</i>	<i>18-25%</i>
<i>Sponsor priority changed</i>	<i>10-14%</i>
<i>Became incubator w/o walls</i>	<i>6 - 8%</i>

3. USERS OF TECHNOLOGY BUSINESS INCUBATORS

3.1. Assistance needed during the incubation period

36. Business incubators help start-up businesses with growth potential to succeed. Given the fact that most of newly started companies go bankrupt due to lack of business experience, access to capital, marketing capacity, etc. within the first 3-5 years, even in cases of promising businesses, the TBI principal task is to nurture and secure the survival of start-ups. What help do new firms need during the incubation period? The factors which determine the ability of small business to survive and develop, concern **two key issues**:

- Quality of management
- Access to finance.

37. The possibilities of assistance provided by incubator both in management and access to finance will be discussed in the following sections.

3.1.1. Management

38. The type of management structure of the firm, combined with the personal characteristics of management is important. The banks and other investors experienced in the financing of young enterprises are much more concerned with the qualities of the management team and the ability to generate new sound ideas and products than with the projects themselves.

39. Surveys¹² of the reasons for the failure of small enterprises show that two thirds could have been avoided if action had been taken to improve the management team. Inefficient business planning and reluctance to accept external advice were the most frequent causes of business failures. Small firms need a range of managerial skills to develop. The following hints were advanced by these surveys:

- S Start-up enterprises are either product/technology driven or market driven. To survive and grow they need to develop a balance between product and marketing skills.
- S Rapid growth represses an in-house development of people. A fast growing business needs to develop its own human resources and to find externally the additional skills appropriate to its stage of development.
- S The company needs to continue the development of its products and technology. Therefore, a continuous search for new and better products and markets must be entertained.
- S As it grows, the enterprise needs to develop more a formal organizational structure necessary to sustain growth while maintaining the firm's entrepreneurial drive.
- S Managers of the enterprise, particularly if they are the founders, may have difficulties with delegation of responsibilities. A suitable system of delegation, motivation and rewarding has to be developed.

40. In particular, the skills required to grow a new business are radically different from those for the management of larger companies. Existing management theory and courses have largely been developed

¹² Enterprise panel, Helping Companies to generate wealth and create jobs through Business Incubation, Latter Print, Sheffield, 1996

for established corporations.

41. High-tech business demands a pool of technically skilled people, people who understand both the technology and the markets. Unfortunately, most educational or training institutions cannot react quickly enough to provide courses to upgrade the skills required by entrepreneurs. This is the area where business incubator family-type of environment can help. Biweekly group meetings with the executives of high-tech companies would help firms solve common problems and learn from each other's successes and failures. Many high-tech firms are not competitors and those that are still have much to learn from each other. By simply providing a meeting space and bringing in guest speakers, incubator management can help to develop good management practices in its technology-based companies.

42. Monitoring the ongoing success of companies is an excellent way to encourage good management and is one of the most cost-effective strategies that incubator management can use to help high-tech start-ups. However, the matured companies are often reluctant to be monitored after leaving the business incubator.

3.1.2. *Access of enterprises to finance*

43. Naturally, the problem of access of enterprises to finance is not limited to TBIs. The type of finance a business needs depends very much whether it is a start-up or an existing business and whether it has a marketable product or needs to undertake further development work. As a rule, mature businesses do not need the government to facilitate access to capital. If the business is successful and it is a good investment, there will be no shortage of potential lenders or investors. If it is not a good investment, then there is not much the government can do to change things. The government involvement in financing of mature companies is counter-productive and it creates competition with venture capital funds, distorting the financial markets. The same case can be made with business loans to mature companies. If the government makes or guarantees a business loan, again it is competing with private sector lenders and it is gambling with public funds by trying to "pick winners". Consequently, any subsidy or facilitating of access of mature companies to capital means interference with market rules.

44. On the other hand, there is a huge unsatisfied demand and an economic case for early-stage enterprise financing. The primary reason for this is that there is no supply or interest for this capital. Most businesses coming to the business incubator are started with accumulated savings or other small amounts of capital from friends or family ("adventure" capital). Sooner or later they need money to develop the product, to manufacture a prototype or to conduct market research. Different types of financing may be available, outside the entrepreneur's personal funds:

loans – often backed by the government guarantee schemes;

equity finance – e.g. venture capital, "business angels", seed capital funds;

grants – non-commercial sources, subsidies for further development of products and services;

subsidy of operational expenses – help to pay bills for rent and utilities.

Loans

45. In general, start-ups are bad investments. Banks almost never make unsecured loans to start-ups, similarly, venture capital firms almost never make equity investments in start-ups.

46. Lending money to start-ups is almost never cost-effective, because the high failure rates would require hostile interest rates. However, it should be emphasized that in some countries (e.g. the Netherlands, UK), banks consider the companies housed in business incubators as less risky clients because they are monitored and cultivated in a professional environment and consequently their survival rate is higher. Generally, equity participation is a better type of investment in case of start-ups because in a portfolio, successful investments can make up for the less successful.

47. Mutual guarantees are “a self-help” source of financing for thousands of businesses, particularly in Italy and Spain. Small companies establish associations in which they all undertake to guarantee the loans of individual members. There remains a considerable scepticism about such schemes, however, a number of organizations in Europe is interested in developing similar systems. These organizations group small businesses to guarantee the loans of individual members. This type of association is becoming particularly popular in the U.K.

Equity finance

48. There is a broad opinion that venture capital operators usually invest in start-ups. In fact, venture capital firms almost never do so, instead choosing to provide second and third stage financing. The only start-ups that can get venture capital funds are those that are managed by teams with very strong track records.

49. Here is an open space for the TBI. However a word of caution to what is said in this and the following paragraph is needed. There is little experience and evidence of success of non-financial organizations (such as incubators) in the direct operation of equity schemes. Direct provision of venture capital is a specialized field and it can be questioned whether it belongs to the range of services to be provided by the Incubator management. Nevertheless it can be envisaged that, experimentally, the incubator could operate a small seed-capital fund, which would only be available to TBI tenants, and preference to be given to those who had successfully participated in the management training programmes organized by the TBI. The fund should be established with the help of government, regional (local) sponsors, “business angels” and strong private lenders. Proposals would be evaluated by business and technical personnel and awarded solely on merit. The purpose of the fund would be to develop a product and conduct a marketing trial. After that point, the business would go to outside sources for any required capital. The award for the TBI would be in the form of equity participation.

50. The risk of the TBI in operating such an equity scheme would be reduced in several ways. First, preference would be given to companies which are located in the TBI, therefore not complete unknowns. Secondly, the amount of awards would be relatively small, at most (a few) hundred thousand dollars, in developed country conditions. In developing countries this amount could be around ten times smaller. Thirdly, company management would participate in the group management assistance sessions and would provide ongoing status reports to the TBI management. The equity arrangements would allow the TBI to generate returns on its initial investment if the company does well.

51. In the EU and accession countries a further possibility for attracting additional private finance for young enterprises is to encourage the development of venture funds, which are (partly) specialized in financing of innovative start ups and are complemented (or subsidized) by European funding schemes. Currently, the European Commission is undertaking an international study to analyze first experience in this area (programme I-TEC). Another example is the guarantee of the European Investment Fund provided to

the venture fund established by Scottish Enterprise. There is a good chance for accession countries to benefit from similar schemes during their integration into the EU.

52. Special sources of finance for innovative start-ups are “business angels” – wealthy individuals investing into promising young businesses. One possibility, how to improve the flow of funds from angels is to encourage the creation of angel networks (angel groups). While some angels prefer to act alone, other prefer the comfort of investing as members of a group with people they know and respect. Activities of business angels could be further encouraged by extending tax benefits to angel syndicates who pool funds for investment in seed capital opportunities. Business angels are very active in United States where they represent a significant investor’s sector in the area of start-ups. The European Commission recently launched several activities to support the development of the still weak business angels involvement in its member countries. In the transition economies of Central and Eastern Europe that type of investment practically does not exist.

Grants

53. Again in the EU, there are many grant systems at the national or European level, e.g. Framework Programmes of European Commission for international R&D. Some programmes are specifically focused on encouragement of participation of small enterprises in inter-country research and development projects (particularly the programme CRAFT). Small companies’ benefit from these programmes is (at least) twofold – EU funding shares the costs of product development and companies internationalize their activities, which is one of essential prerequisites of success in technology-based businesses. More than 12,000 small companies participated between 1994-98 in EU-funded research and development projects.

Subsidy of operational expenses

54. Besides finance for company development, there is often a need to subsidize operational expenses (working capital) of young enterprises. Several schemes were developed to support rent and costs of utilities and services in business incubators. For instance, in the Czech Republic, the Ministry of Industry and Trade subsidizes rent and utilities of companies located in certified incubators at the following decreasing rates:

1 st year	50%
2 nd year	40%
3 rd year	30%
4 th year	15%
5 th year	no subsidy.

In this way, the government helps to companies in the most critical stage of their existence. The only requirement is that companies are located in the certified incubators where strict admission criteria regarding the viability of business plan and quality of management are applied to tenants.

3.2. Profile of potential users of the technology business incubator

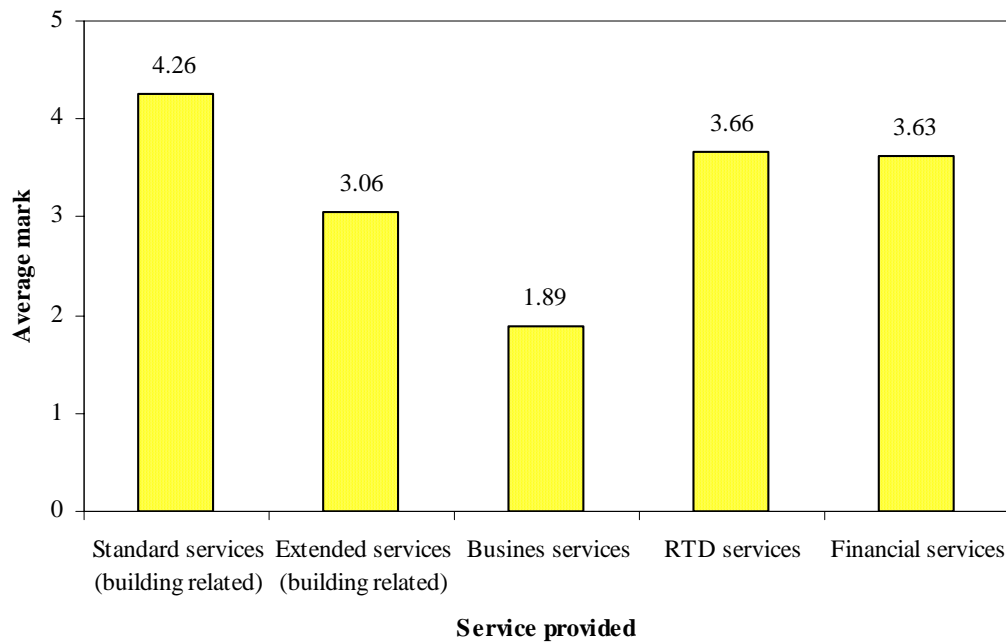
55. In a recent study¹³, 22 respondents (12 companies + 10 individual potential entrepreneurs) in the Prague region were interviewed to identify an “average profile” of potential user of the TBI. Respondents were questioned regarding their need of business and specialized services – in other words “what do they expect to find in the TBI ?”.

56. During the interviews, the entrepreneurs were asked to assign marks of importance to individual services in the TBI. The marks ranged between 1 (lowest importance) to 5 (highest importance). The services were grouped into 5 categories:

- S **Standard services (building related):** utilities (gas, water, energy), telephone, fax, PC, Internet, local area network (LAN), copy machine, housekeeping, security, safety, gardening, catering, air conditioning and waste disposal.
- S **Extended services (building related):** reception, meeting rooms, conference rooms, showrooms/ exhibition space and hazardous waste disposal.
- S **Business services:** business plans, project compilation, marketing, legal assistance, bookkeeping, patents & licensing, and library & information.
- S **Research and technology development (RTD) services:** further research, and technology brokerage.
- S **Financial services:** seed capital, soft loans, venture capital, and grants.

57. There were practically no differences between answers of potential entrepreneurs and that of managers of existing companies.

¹³ Klusacek K. Establishment of a Technology Business Incubator, MBA Dissertation, Business School of the Sheffield, Hallam University, Sheffield, 1998.



58. The highest priority (average mark = 4.26) was assigned to standard (building related) services. Because technology-oriented companies were selected for interviewing, the average mark for RTD services was also high (3.66). The low average mark for business services (1.89) was rather unexpected and it is caused by the low average marks given for assistance with business planning and project compilation.

<u>Service (assistance) provided</u>	<u>Average mark</u>
Business plans	1.50
Project compilation	1.28
Marketing	3.46
Legal	1.00
Bookkeeping	2.18
Patents & licensing	1.28
Library & information	2.51

59. Very low average marks for assistance with business plans and projects elaboration are quite surprising and consequently lowered the total average mark for the whole category of business services. Detailed discussions with entrepreneurs showed two possible reasons:

- Entrepreneurs consider their business plans as their secrets and are not willing to discuss them openly or they do not have any business plan in writing but just some fragments regarding the basic business orientation, market research and (sometimes) a very rough financial forecast.
- In well functioning market economies with a developed support system for entrepreneurship, companies need to present their business plan frequently to sources of funding. The Czech Republic, where supporting measures (e.g. soft loans, equity financing, etc.) are still underdeveloped, the companies are not forced to prepare their business plan and that is still considered as a company secret and something not available for external discussions.

60. It could be expected that the situation would change, as the supportive system for entrepreneurs

will develop. Entrepreneurs assumed to use some services of external specialists (outside the TBI) - this is a reason for very low average marks for in-house legal assistance (1,00) and patents & licensing (1,28) services.

3.3. Corporate venturing

61. Corporate venturing is one of measures on how to help young companies to grow. Essentially, it is a partnership between large companies and small businesses, which can be independent or spun out of the large corporations. The corporate venturing aims at:

- sharing risk associated with innovations;
- optimal use of skills and resources of small and large company;
- achieving business objectives of both parties more quickly and more effectively.

62. There are several ways how corporate venturing can help, e.g.:

- direct investment by a large company into a small independent business;
- indirect investment through a venture fund (eventually operated by the TBI);
- spin-out of distinct business activities or technology from a large company, which retains ownership or becomes a minority investor in the new business attracting interest of a third party investor.

63. Establishing a good relationship between large and small companies is a promising tool for small business to succeed but some problems may arise. These are mainly caused by the different cultures of large and small companies and between the core business and that part responsible for corporate ventures. Large companies tend to be more conservative, with slow decision taking and may have some difficulties to deal or to react to the radical and innovative attitude of small company. However, potential problems are substantially outweighed by the benefits, particularly in transition-economy countries where a lack of early-stage financing schemes exist.

4. HOW TO ESTABLISH A TECHNOLOGY BUSINESS INCUBATOR

64. The principal requirements required to establish the feasibility of a technology business incubator and the structure of the implementation plan are briefly outlined in the following two sections, more details may be found in the literature¹⁴.

4.1. Principal requirements

65. There is no single way to develop a technology business incubator. To an extent, each incubator is unique as it reflects its economic environment and its own individual objectives. However, there are some general conditions required for a TBI establishment and development:

- S ***Government policy for support of entrepreneurship.*** Government should have a favourable framework for the creation and development of SMEs, e.g. national programmes for SMEs promotion, supportive financial mechanisms (e.g., seed funds, soft loans, guarantee schemes) and information infrastructure.
- S ***Commitment of government.*** The project of establishment of a TBI should follow the government policy and development strategy. If the project lacks the government support, it may fail despite a positive feasibility.
- S ***Private ownership and competitive market economy system.*** The concept of TBI is developed on the basis of two key prerequisites of the market mechanism: principles of competition and private ownership.
- S ***Commercial and private property laws.*** The market economy system requires certain legislative framework to promote and guarantee fair market competition, e.g., private property law, commercial law, anti-trust law, etc.
- S ***Entrepreneurship.*** The area to be served by the TBI should have a high entrepreneurial potential in high-tech innovative businesses.
- S ***High level of science and technology.*** The knowledge-based businesses require a certain level of science and technology environment including advanced research institutions located in the area of the planned TBI.
- S ***Project champion.*** The experience show that a “project champion”, fully dedicated to the project is needed. The champion should have political, financial and personal influences to mobilize people and financial resources.

¹⁴ Practical guidelines for business incubators in Central and Eastern Europe UNIDO: US/RER/95/145 Attachment to Project Document, 1995.

4.2. Structure of the implementation plan

66. Issues that have to be addressed when setting up an implementation plan are:

- S ***Mission statement¹⁵ and strategic objectives***, defining the goals of the TBI.
- S ***TBI design and feasibility study***, namely TBI type, location, site and premises, service system, technology resources, co-operation with research organizations, national and international networking.
- S ***Legal structure***, defining legal status and type of ownership (public / private / semi-public).
- S ***Fund raising***, governmental contributions, private investment, financing vehicles for tenants, non-financial contributions (such as buildings and infrastructure).
- S ***Project organizational structure***, Steering Committee and project team.
- S ***Human resources implications***, management team and support staff of the TBI, responsibilities and reporting, motivation and rewarding.
- S ***Financial planning***, particularly identification of financial resources, estimation of capital investment needed, operating expenses, income structure, pricing policy and cash flow forecast.
- S ***Promotion of the TBI and client detection***, dealing with promotion tools, definition of key client sectors and marketing strategy.
- S ***Rules for admission and exit of tenants***, defining the conditions for selection and departure of tenants.
- S ***Implementation plan and timing***, summarizing steps that should be taken to set up the TBI including time scale and responsibilities.
- S ***Monitoring and Evaluation of the TBI activity***, including the design of criteria (indicators) needed for the evaluation of TBI performance and the monitoring of TBI activities.
- S ***Risk analysis***, dealing with analysis of potential risk factors (strategy, financing, space capacity, and management), how to cope with difficulties and to minimize risks.

¹⁵ Example of the Mission Statement: “To accelerate and intensify the transfer of scientific knowledge and inventions to the marketplace and enhance the industrial base through the creation and development of small innovative enterprises, particularly university spin-offs or companies with high potential for co-operative links to university research projects.” (Technology Business Incubator at the Czech Academy of Sciences)

5. OTHER STUDIES ON BUSINESS INCUBATION

67. The evaluators perused a number of publications and studies on the subject which are quoted through this report. Of special importance because of their comprehensiveness in terms of countries covered and their recent date are two reports which we would like to comment separately.

5.1 The OECD study on local development and business incubators

68. OECD conducted during 1997-99 a study on business incubation in the context of job creation and local development. The study reviews current experience in business incubation in Australia, Germany, Italy, the United Kingdom and the United States. It culminated in a publication issued in September 1999¹⁶. The findings of the study, although not limited to technology incubators and parks, do not differ substantially from ours. The OECD study reports on the diversity of incubator types, analyses inter alia the issues of subsidies, progression of tenant firms, support services and interactions with sources of technology. It concludes that there has been a positive impact in terms of higher firm survival rates compared to national averages and the cost per job created compares favourably to other public job creation programmes. For instance the cost to the Australia's government per direct job created through incubators was \$4,000. A 1997 study by the University of Michigan puts at \$1,100 subsidy per job created in a sample of incubators programmes across the country¹⁷.

69. Despite these encouraging signals, the study indicates that the economic rationale for public investment in incubation needs careful consideration and that the justification should refer also to positive external effects not sought by the private enterprise

70. However, the study continues, total employment through business incubation may be too small to make significant inroads into major problems of depressed areas, major plant closures, etc. The study also indicates that business incubation is a medium to long term undertaking and therefore unsuitable to respond to short term employment crises.

71. The study concludes with the remark that business incubation is still a relatively recent policy tool for local economic and employment development and that additional research is needed to properly access the economic benefits of incubators. It further derives policy recommendations to be followed by policymakers and sponsors promoting business incubators. However, most instruments of economic development are open to the same remarks.

5.2 The UNIDO working paper on business incubation

72. An unpublished working paper on business incubators was prepared in UNIDO to provide a preliminary overview of the role (if any) that UNIDO could play in developing business incubators in developing countries. This paper was prepared after the first draft of the present evaluation report was completed but we did not find it necessary to change the contents of the present study because the findings are along the same lines. The UNIDO paper dwells with business incubators in general, not necessarily with a technology orientation.

¹⁶OECD, Op. Cit.

¹⁷To make a comparison, an industrial project established during this period in Portugal, namely the Ford/Volkswagen plant for SUVs had a combined (EU, Central and local government) subsidy of \$300,000 per direct job created. The modernization of the Rover plant in the UK seems to have even higher subsidy costs (Our footnote).

73. The paper addresses some basic questions on performance and cost-effectiveness and one of the answers provided is in line with the findings of the present evaluation. “There is much evidence that business incubators do produce substantial numbers of new businesses, that they have higher success rates than other new businesses, that they create new jobs, and that **they successfully commercialize technology**” (our emphasis). However the paper still leaves open questions on the effectiveness of incubators as economic development tools, especially for developing countries.

6. THE UNIDO PROGRAMME

74. Since its inception, UNIDO has devoted attention to the development of small and medium enterprises either through supporting studies and analyses or through technical cooperation activities. Such activities were mainly oriented to but not limited to the least developed countries, often combined with elements of rural industrialization, women entrepreneurship or poverty alleviation, which gave such activities strong social overtones. Examples of each type of activities (supporting and field) are: a thematic evaluation carried out in 1987 of Rural Small Industrial Enterprises¹⁸ and various technical cooperation projects in support of industrial estates and/or institutions to provide extension services to SMIs. Two orientations for UNIDO support to SMIs emerge. Firstly the target groups are usually at the lower scale of industrialization level and therefore far off the theme we cover under the present evaluation. Secondly the aspect of technology rarely emerges in such activities, at least in an explicit manner.

75. It has become rather difficult to establish a clear picture of the development of UNIDO’s activities both operational and supporting in the field of business incubation because the subject has been dealt with simultaneously by different and competing organizational units and the various Secretariat re-organizations reallocated the activities several times without concentrating them in one unit.

76. The first UNIDO project on business incubators was established in Mexico in 1983 and referred to support to an existing technology business incubator. Around 1987, UNIDO started a more systematic development of technical cooperation projects in support of business incubation but it was more recently, namely in 1995, that results started to show. The development of the programme was supported by a component of the Italian financed project US/GLO/95/145¹⁹ - UNIDO/Italy Joint SMI Programme for the establishment of international Incubation systems and by components on business incubators of other SMI projects, the most significant being DP/RER/87/033 - Entrepreneurial small and medium sized industries in urban and rural areas (with the budget of \$324,000). As a result of the two above mentioned projects, a number of publications and tools were prepared during 1993-96 as follows:

- Practical Guidelines for Business Incubators (in E, F and S)
- Separate version for Central and Eastern Europe
- Business Incubation Audit (in E and F)
- Financial Software for project sponsors to prepare cash flow projections
- Software for the Business incubator management reporting and monitoring (on a yearly and monthly basis)
- Software database for first advice to incubator’s clients

77. The publications are well prepared and their usefulness to business incubators (not only technology oriented) is evident. They received a wide distribution although they were never formally published by UNIDO. Since they were prepared long ago they will need updating if it is decided to publish them.

¹⁸Thematic evaluation of technical Cooperation in Support of Rural Small Industrial Enterprises, Government of the Netherlands, ILO, UNDP, UNIDO. UNIDO, Vienna. 1987

¹⁹This project still continues and has presently a budget of \$619,00. According to its document it covers three countries: Tunisia, India, the third country never having been identified.

78. A component of the second project also enabled UNIDO to participate with UNDP and OAS in a project entitled “Assessment of the Impact of business Incubators on economic development and venture creation in emerging economies” which undertook a number of training activities in Arab countries and culminated in a publication²⁰. This publication has been quite useful in clarifying the issues surrounding the subject under evaluation and its applicability to UNIDO recipient constituency. The publication seems to be the only one covering business incubation in developing countries and has been frequently quoted since all the other literature on business incubation relates exclusively to OECD countries.

79. UNIDO has also developed a website on business incubation (<http://www.unido.org/stdoc.cfm?did=300456>) which provides *inter alia* a link with several associations, particularly the largest one: the US National Business Incubation Association. During March to July 1999 this website had a monthly average consistent 93 external hits, which is at the lower end of number of external accesses for all UNIDO URLs.

80. We have taken 1 January 1991 as an arbitrary cutoff date for the analysis which follows on UNIDO activities in the field of technology oriented business incubation, although previous to this date a small number of projects on business incubators had been already developed. The projects developed after this date can be separated into two categories. Those which have some degree of technology orientation, and the second which includes projects of business incubation of a generic type, without an explicit technology orientation and therefore outside the scope of this evaluation. Within the second group there are projects which seemed, from the title, to have a technology orientation, but upon closer analysis they were found to be of a generic type. There are of course a number of pipeline projects on this subject, some of them components of integrated programmes but there is obviously no experience with them.

81. The first group comprises eight projects with a total external contribution of around \$1,934,000, 80% corresponding to one project alone.

1. SI/CZE/92/803* Establishment of a high-tech business incubator. \$50,000.
2. US/RER/95/145 Regional Programme for the establishment of high tech business incubation systems at the Academies of Sciences in the Czech Republic, Hungary, Poland and Slovakia. \$1,578,000 (financed by the government of the Netherlands).
3. NC/BYE/97/010 Preparatory assistance: elaboration of a project proposal for the establishment of a *technopark* in Belarus. \$29,650.
4. XP/GLO/97/001* More appropriate use of Science Parks as an industrial development tool in developing countries and countries in transition. \$104,400.

²⁰Business Incubators in Economic development; an initial assessment in seven industrializing countries, UNDP, OAS. UNIDO. UNDP. NY 1996

5. XP/INT/95/005* Formulation of guidelines for the establishment of industrial Estates and Science/Technology Parks with a view to enhancing their role in industrial development of developing countries. \$59,826.
6. SI/DOM/95/802* Assistance in the development of a national strategy to upgrade the technological level of SMEs through the provision incubation services. \$49,000.
7. SI/PAK/95/802* High level advice to prepare a strategy for the establishment of Business Incubators in Pakistan. \$48,000.
8. SI/ECU/95/803* Development of technology based enterprise incubators. \$15,500.

* *Projects financed by UNIDO own funds.*

82. An analysis of each of these projects shows the following:

- S Project 2. This project, which is still ongoing, has suffered considerable implementation delays. Furthermore, it was reoriented at the outset from business incubation to technology brokerage. Only one of the original counterparts remains as counterparts. The future scope of the project is presently under reconsideration.
- S Projects 4 and 5 are really not field technical cooperation activities since they deal with analytical and methodological work in support of the publications indicated above.
- S Projects 7 and 8 have little technology content. Furthermore, very few of the enterprises established under project 7 are technology intensive.
- S Only two of the above projects were financed by sources external to UNIDO which may indicate a low interest of such sources in the subject.

83. The second group comprises nine projects (not listed here) of general type of business incubation projects, with a total external contribution of around \$1,261,000, half of which refers to methodological work (US/GLO/95/145).

84. From an analysis of these two groups of projects, the following emerges:

- The total programme in support of business incubation is modest in size and the number of projects with an explicit technology orientation is even smaller.
- A considerable amount of funds were devoted to methodological and support work (difficult to quantify precisely but estimated at well over 50%, if project US/GLO/95/014 is included) which has not led to a significant programme of field technical cooperation.
- The manuals produced had not been formally issued by UNIDO.
- The projects are located mostly in the more developed of the developing countries and economies in transition. The concept does not seem to find acceptance nor application to the lower strata of industrialization.
- The projects were or are backstopped by various officers (a total of eleven) and organizational units of UNIDO which is not conducive to synergy.

85. UNIDO has also been active in another instrument of private business development, namely the Business Centre concept which constitutes a sort of business incubator without walls or virtual incubator. There are some successful examples in Eastern Europe. However, because of lack of explicit technology orientation, these do not form part of this evaluation.

7. CONCLUSIONS

7.1 General Conclusions

86. It should be recalled that this exercise does not cover business incubation in general but only those aimed at the creation or development of technology intensive enterprises.

87. Technology business incubators are recognized as a competent instrument for rapid and successful development of innovative start-ups to fully-fledged businesses in leading economies. Creation and successful development of small knowledge-intensive innovative companies with strong interactive links to research institutions is widely understood as an effective tool for bridging the gap between the creative world of science and the competitive world of business and consequently putting this knowledge to work for productive purposes, a clear case of technology transfer. However, Business Incubation unless so oriented, does not necessarily contain noticeable elements of Transfer of Technology.

88. Some general conclusions for TBIs may be formulated:

- Technology business incubators (or business incubators in general) help starting businesses with high growth potential to succeed. Survival rate of companies in incubators is about 90% compared to 20% in a standard market environment. (The question of the subsidy cost needs further analysis for each specific case to determine whether it is worth while and whether there are other more economic alternatives.)
- Technology business incubators are an effective tool for technology transfer, innovation, generating skilful jobs and for local economic development.
- Technology business incubator combines several basic elements required for successful business development:
 - * suitable space and infrastructure at affordable prices;
 - * comprehensive range of advanced services;
 - * access to a technology and knowledge source;
 - * management assistance and training;
 - * seed capital fund for early-stage financing;
 - * networking.

89. Space occupation in Technology business incubators and Technology parks is not exclusively dependent on a company being involved in high technology but is often driven by income generation considerations. In the UK a survey showed that 35% of space was occupied by service companies-accountants, insurance companies and financial institutions. The percentage is too high to justify the service nature of such companies to the other tenants.

7.2 Applicability to developing conditions

90. The applicability of the technology business incubator model to developing countries requires considerable reconsideration and modifications.

91. Undoubtedly, due to high importance of relationship between incubator and the knowledge base, the country should have a fair level of research activities including the relevant research infrastructure. There is no need to promote exclusively high-tech businesses but “good-tech” businesses dealing with technology corresponding to world levels.
92. As many developing countries have to solve urgent nutrition problems while agriculture represents a major underdeveloped sector, incubator projects focused on agro-food industry and selected biotechnologies may be the most suitable for the country’s development.
93. Due to the non-standard business environment and lower starting level, the incubation period of business start-ups may be longer than that in industrial countries.
94. Under conditions where financial resources are severely limited, the necessity to cover costs of incubator operation may cause the conversion of incubator to a pure real-estate business for a while. In such a situation, it is one of key tasks for the incubator management to keep balance between economic survival and incubation functions. A compromise solution exists when part of the incubator is provided to matured companies at market conditions but at the same time, at least some space is always available for the start-ups.
95. Where a project of a technology park is under consideration, the feasibility of such a project should be validated by a successful incubator operation in a first phase. In average, an investment cost of the incubator establishment is three orders of magnitude lower than that of technology park. Incubators can help to develop necessary management skills, entrepreneurial potential and a related infrastructure. After an initial period, a technology park may be opened in neighbourhood of the incubator if the latter project proved to be successful.
96. Applicability of technology-oriented business incubators and technology parks concepts to developing country conditions is limited to relatively more advanced conditions (in a country or a region of a country). A feasibility analysis followed by a project tailored to the country needs may lead to a TBI as an effective tool for economic development. In other words the TBI, and eventually a subsequent TP, will be good tools for the stimulation of the private entrepreneurial sector albeit in areas where knowhow/technology sources exists, together with a relatively tight and advanced industrial fabric. In those cases where appropriate conditions exist, TBI in a first phase and TP in a second are adequate mechanisms to ensure commercialization of available technology and to assist in the start up and development of technology intensive enterprises.