

Critical role and screening practices of European business incubators

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Abstract

Business incubators guide starting enterprises through their growth process and as such constitute a strong instrument to promote innovation and entrepreneurship. In this article we sketch the European business incubator landscape. Then we describe screening practices by European business incubators in 2003 and compare these results with the American incubators in the eighties. In the last phase a cautious link between screening practices and performance, measured in terms of tenant failure, is established. Most incubators do not screen potential tenants on a balanced set of factors, but concentrate either on the characteristics of the tenant's market or on the characteristics of the tenant's management team. However, we found that the tenant survival rate is positively related to a more balanced screening profile. Based on our study results, we propose some recommendations for the main stakeholders in the field: authorities, incubators and innovative entrepreneurs.

Keywords

Business incubator, tenant screening, performance, tenant failure

JEL classification

L84, L85, M13, O31 and O32

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1. Introduction

As the famous Austrian economist Joseph Schumpeter underlined already in the early thirties of the previous century, an economy will only be able to survive if its entrepreneurs keep following the path of continuous innovation (Schumpeter, 1942). Today, the belief that innovation drives competition is spread all over the world (see e.g. Debackere and Veugelers, 1999). The European Union aspires to become the most competitive economy in the world and intends to achieve this aim through innovation (Commission of the European Communities, 2000). However, it is clear that Europe still has a long way to go to rival the United States and Japan, the two world leaders in innovation (Commission of the European Communities, 2004a; European Commission, 2005).

Start-up companies constitute an important dimension in the innovation process. The encouragement of the establishment and growth of innovative companies is one of the priorities in the policy of the European Union (Commission of the European Communities, 2000). Nevertheless, the start-up failure rate is rather high according to a study of the OECD (2002). On average, one on three new European enterprises fails before the second year of its existence. 50 to 60% never survives the seventh year... ⁽¹⁾ Moreover, the current economic situation does not add to the attractiveness of the risky business of establishing new companies. When the economy falters, potential investors are hesitant and reluctant to invest in uncertain and risky high-tech projects (Sauner-Leroy, 2004).

One instrument to promote innovation and counter this high start-up failure rate is the business incubator (see e.g. Lalkaka, 2003). Business incubators constitute an environment, especially designed to hatch enterprises. They provide their tenant companies with several facilities, from offices space and capital to management support and knowledge. This allows the start-up to concentrate on the business plan and raises the success rate. The benchmark study of the European Commission (2002) revealed that the survival rate of incubator tenants was significantly higher (80 to 90% still exists after five years!) than the business success rate amongst the wider SME community.

The success of an incubator depends on the performance of its tenants and thus an incubator benefits from limiting the tenant failure rate. One way of minimising the number of tenant failures is to subject potential 'clients' to a severe screening process. This allows the incubator to evaluate the presence of characteristics that are deemed essential to develop sound enterprises (see e.g. Merrifield, 1987; Lumpkin and Ireland, 1988; Peters et al., 2004;

¹ These percentages are based on data about West-Germany, France, Finland, Italy and Portugal in the nineties.

Hackett and Dilts, 2004). These qualities differ, according to the incubator (Lumpkin and Ireland, 1988).

If the European Union wants to boost the innovation level, it is important to understand the incubator business and conduct a policy that encourages both incubators and start-ups. This paper studies the screening practices of business incubators within the European context. Hence, it tackles the following research issues:

1. A profile of the European business incubator landscape;
2. A description of screening practices by European business incubators;
3. A cautious link between screening practices and performance.

The remainder of the text is organised as follows. The second section guides the reader through the relevant literature. The third section describes the methodological framework of the empirical part of our study. In the fourth section the findings are reported and encased in the academic literature. The last section summarises our conclusions and leaves some space for recommendations to the main stakeholders in the innovation networks: incubators, innovators and governments.

2. Literature study

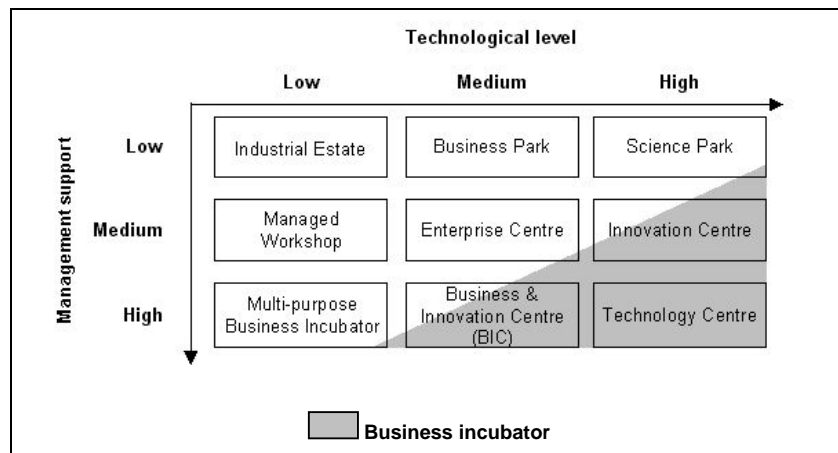
In this section we describe the academic background of each research issue as set out in the introduction. After the clarification of the phenomenon of a business incubator we review the literature on screening practices. We conclude with an overview on how incubator performance has been measured throughout the literature.

2.1. The phenomenon of a business incubator

The first incubator was established in 1959 in Batavia, New York in the United States. Charles Mancuso rented space in his Batavia Industrial Centre to small and starting companies and guided them through their growth process (Mancuso Business Development Group, 2005). Until the seventies, this concept was unique. The focus of incubator predecessors was either on the technological or on the management aspect; an incubator combines both. The typology represented in figure 1 was elaborated by the European Commission (2002). In an *Industrial Estate* (in the upper left corner of figure 1), the level of support is very low and limited to renting space for the entrepreneur. The European Commission (2002) adds a non-selective intake and the absence of specific criteria with regard to business activities and technology content to the characteristics of this organization type. When we follow the vertical axe downwards, we encounter the *Managed Workshop* at

the medium level and the *Multi-purpose Business Incubator* at the high level of management support. If the technological level is raised, we first arrive at the *Business Park* and then at the *Science Park*. The Enterprise Centre combines both medium levels. The *Technology Centre* applies “highly selective admission criteria, provides hands-on management support and has a highly specialised technology focus” (European Commission, 2002, p.6). In the right-hand lower corner (shaded area), the European Commission groups the *Innovation Centre*, the *BIC* and the *Technology Centre* under the single denominator of *Business Incubator*.

Figure 1: Position of the business incubator



Source: European Commission, 2002. Benchmarking of business incubators, Brussels, p.6.

From the seventies onward, business incubators have spread out all over the world (Albert and Gaynor, 2001). Estimates indicate that today their number worldwide rises to 3000: one third is located in North America; 30% in Western Europe and the rest is dispersed over the Far East (20%), South America (7%), Eastern Europe (5%) and Africa, the Middle East and other regions (5%) (European Commission, 2002).

The European Commission favours the further development of the business incubator sector. The European Charter for Small Enterprises was signed by EU leaders at the Santa Maria da Feira European Council in June 2000. One of its main targets is to create top-class small business support systems, which are easy to access and understand and relevant to the needs of business (European Commission, 2000). The 2004 and 2005 progress reports on the implementation of the Charter show improvement, but at the same time reveal issues that need careful attention (Commission of the European Communities, 2004b and 2005).

Numerous studies have been conducted to analyse the innovation system and the incubator business. Hackett and Dilts (2004) give a systematic overview of academic business

incubation research along five primary research orientations. First, incubator development studies describe incubators. Second, incubator configuration studies analyse the components of the incubator system and their mutual coherence. Third, tenant development studies try to clarify how tenants develop within the incubator. Fourth, incubator-incubation impact studies investigate whether the incubation concept influences tenant (and incubator) success. The fifth orientation comprises studies theorizing about incubators-incubation. Our study is positioned in the second and fourth orientation: the tenant selection process is part of the incubator system (configuration study) and incubator/tenant success measures belong to the orientation of impact studies.

Albert and Gaynor (2001) grouped the existing incubator literature around three dimensions: descriptive, prescriptive and evaluative works. Descriptive research covers the definition and classification of incubators. Prescriptive analysts try to describe the role of incubators in economic development and to set out best practices, based on research on key features of successful incubation programmes. The aim of evaluative works is the establishment of metrics to evaluate incubation programmes and to assess the impact and effectiveness of incubation programs. It is clear that this study will mainly be limited to a description. Only a small part will be devoted to prescriptive analysis.

An important element in the descriptive research is the *business incubator continuum*, developed by Allen and McCluskey (1990). The authors point out the spectrum from a focus on real estate to the capitalisation of investment opportunities and the fostering of new enterprises. The academic incubator is located in between. All types co-exist, but time has shown a shift from a focus on real estate to a focus on enterprise development over incubator generations. Incubators of the first generation emphasised job creation and real estate appreciation. Tenants were offered office space and a number of shared facilities. In the nineties, these services were expanded to consultancy services, training sessions, network access and venture capital. This was the second incubator generation. The third generation started in the late nineties and concentrates on promising start-ups in the ICT and high tech sector (European Commission, 2002; Hackett and Dilts, 2004). In our study we try to substantiate the presence of the business incubator continuum.

2.2. Screening profiles

Several scholars pointed out that tenant screening is an important component in the incubation process (see e.g. Hackett and Dilts, 2004; Kuratko and LaFollette, 1987; Lumpkin and Ireland, 1988; Merrifield, 1987). Kuratko and LaFollette (1987) concluded that variability

in the tenant screening and selection process may lead to the selection of tenants that are too strong or too weak to be hatched in an incubator, which in turn may lead to tenant or even incubator failure.

Merrifield (1987) and Lumpkin and Ireland (1988) investigate the screening process more in detail and postulate important screening factors. Merrifield (1987) described the tenant selection process in a three-step decision tree. In the first phase, the incubator evaluates the potential tenant on six criteria: sales profit potential, political and social constraints, growth potential, competitor analysis, risk distribution and industry restructure. In the second phase the fit between the potential tenant and the host is evaluated, again on six criteria: capital availability, manufacturing competence, marketing and distribution, technical support, component and materials availability and finally management. The combination of the business attractiveness and fit factors determines the probability of commercial success and thus the potential added value the tenant has to offer to the incubator. Merrifield (1987) admits that no analytical scheme can guarantee 100% success, but careful tenant selection can definitely increase the probability of tenant –and thus incubator– success.

Based on a survey of US incubator managers Lumpkin and Ireland (1988) identified three groups of screening criteria. A first group is labelled “experience of the management team” and contains management, marketing, technical and financial skills, experience and growth rate projection of the management team. The second group, “financial strength”, includes profitability, liquidity, price earnings, debt and asset utilisation, personal investment of the management team and current size of firm. The written business plan, references from others, persistence, marketability of product/service, creativity, uniqueness of product/service and age of the management team are grouped under the denominator of “market and personal factors”.

They also observed that, in the late eighties, a vast majority of the American incubators submitted their potential tenants to severe screening practices. Cluster analysis identified four types of incubators, each with a specific screening pattern. Table 1 summarises the findings of the cluster analysis performed in the study of Lumpkin and Ireland. About 45.5% of the American incubators screened thoroughly on market and personal factors. This group obviously wanted to create synergy between the internal capacities of the tenant (personal characteristics of the management team) and external opportunities in the market (market factors). A second cluster (15.2%) consists of no-screening incubators. The third cluster (24.2%) had a strong financial emphasis. The last cluster (15.2%) screened principally on personal factors.

Table 1: Four types of incubators based on tenant screening practices, in the U.S., 1988

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
	45.5%	15.2%	24.2%	15.2%
Experience of the management team	+	0	+	++
Financial strength	+	0	++	0
Market and personal factors	++	0	+	+
Legend:	0 no screening	+ some screening	++ thorough screening	

Adapted from Lumpkin, J.R., Ireland, R.D., 1988. Screening practices of new business incubators: the evaluation of critical success factors, *American Journal of Small Business* 12(4), p72-73.

A study of Kakati (2003) reveals that entrepreneur quality, resource-based capability and competitive strategy are the critical determinants of a start-up's viability and achievement. The screening practice of the first cluster (thorough on market and personal factors) seems best to be able to distinguish between successful and unsuccessful starting enterprises.

Efficient screening procedures are vital for an incubator and Lumpkin and Ireland (1988) identified dimensions that play a role. The next question then becomes: who is in charge of the screening process? Hackett and Dilts (2004) state some incubator policy prescriptions, based on their literature review. They conclude that the complexity of the tenant selection process impels an advisory board, both for economic (understanding of the market and new venture formation) and political (e.g. secure subsidies) reasons.

2.3. Performance indicators

The link between screening practices and best practices is often very difficult to study. Some attempts are made by Kuratko and LaFollette (1987), who conclude that differences in screening practices are linked with incubator and/or tenant failure. In this article, we will also try to establish an exploratory link between the screening practices and incubator performance.

There is no clear cut standard to measure incubator performance (Phan et al., 2005). Allen and McCluskey (1990) extract different measures from their literature review: tenant employment, incubator period, tenant success rate, local retention of graduates and added value of incubator services. In their study they evaluate incubator size and occupancy rate, jobs created and firms graduated. Mian (1996) assesses university technology business incubators in the US by exploring their value-added contributions to technology-based start-ups. Mian (1997) groups incubator assessment research around four approaches in the management literature: (1) goal approach, (2) system resource approach, (3) stakeholder

approach, (4) internal process approach. He introduces four dimensions in his assessment framework on the performance of university technology business incubators: (1) program growth and sustainability, (2) tenant survival and growth, (3) contributions to sponsoring university's mission and (4) community-related impacts. Also the scope and effectiveness of the facility management policies and the provision of services are assessed. The European Commission (2002) emphasises that survival rates are one indicator of the performance of incubators but that the extent to which incubators can contribute to the accelerated development of innovative, high-growth firms and their capacity to create new jobs are of more importance. Löfsten and Lindelöf (2002) examine the added value of science parks to tenant performance by employment growth, sales growth and profitability. Bhabra-Remedios and Cornelius (2003) urge for the incorporation of organisational theory concepts in the evaluation of incubators and propose a framework that incorporates both the actors (incubator sponsors, managers and tenants) and the earliest stages of new firm development from idea to start-up. Abetti (2004) bases his performance evaluation research on the elements that Molnar published and evaluates new venture creation, job creation, cost effectiveness, growth and regional unemployment. Ferguson and Olofsson (2004) analyse science park performance based on survival and growth of the tenants compared to non tenant new technology-based firms. Survival is measured as continued legal existence of the firm; growth is based on changes in employment and gross sales. Rothaermel and Thursby (2005) assess the impact of university–incubator firm knowledge flows on tenant performance, measured by revenues, total funds raised, venture capital funding obtained and whether the firm graduated, failed, or remained in the incubator.

Once the decision is made on which variable(s) will be used to measure incubator performance, the next step is to decide on the unit of comparison that enables the researcher to validate the outcome of the performance measure. Sherman and Chappell (1998) warn that direct comparisons with non-tenants' survival rates may not be meaningful as the use of selection criteria in admitting tenants to the incubator results in a selection bias. Also Phan et al. (2005) argue that the rate of firm survival (or failure) has little construct validity because of endogeneity, since incubators are specifically designed to maintain and increase life span. They suggest comparing survival rates among different incubators: the tenant survival rate.

3. Empirical study

To find an answer to the research questions stated in the introduction we conducted a survey. This survey was conducted in 2003 through a self-administered online questionnaire.

The questionnaire was elaborated based on scientific literature and more specific on the Benchmarking report of the European Commission (2002) and the study of Lumpkin and Ireland (1988). It was refined and finalised after a pre-test interview². The questionnaire consisted of two parts. The first part was related to general characteristics of the incubator (to analyse the first research issue) and the second part focused on the relationship between the incubator and its tenants, from the incubator point of view (to investigate the second and third research issue).

A set of 654 European business incubators was identified through the incubator database of Cordis³ and internet searches. Personalised cover letters were e-mailed to these incubators and they were asked to surf to the online questionnaire and fill out the questions. Because of incorrect contact details, the final sample consisted of 581 organisations. The response rate was 27.7%, i.e. 161 reactions, of which 140 were useful⁴.

The Cordis database has not been subject to any ‘quality control’. When we examined the database more closely, it appeared that not all organisations in the database were real incubators⁵. That is why we first had to impose some ‘quality conditions’, before we could start processing the data. This extraction was carried out on the basis of the definition of a business incubator we earlier described in this article (see figure 1): an incubator operates in a high tech sector and offers a high level of management support (European Commission, 2002). So-called incubators involved in other sectors than high tech production, ICT, R&D, biotechnology, pharmaceuticals, the medical or agricultural sector and knowledge based industries were left out to select on the technology level. The level of management support was derived from the services that are offered to tenants. We presented a list of 23 services to the incubators. Only incubators that offer more than 5 services were preserved. These two conditions lead to a reduction of the sample group from 140 to 107 (i.e. 18.4% of the organisations that were contacted).

Because of differences in the datasets we could not copy the clustering techniques that Lumpkin and Ireland (1988) applied. We applied descriptive statistics to distinguish between screening practices and constituted a ‘screening index’.

² Personal interview at UBCA (Universitair BedrijvenCentrum Antwerpen), a Belgian incubator.

³ The Community Research and Development Information Service. This database (publicly available on <http://www.cordis.lu/incubators/>) is expanding rapidly. At the moment of our last consultation [August 3, 2005] the number of registered incubators amounts to 795. A remark is that ‘Europe’ in this database is considered to be a very broad denominator that also includes Israel, Switzerland, Malta, Bulgaria,...

⁴ A number of reactions had to be removed from the final dataset because of missing data.

⁵ The distinction between science parks, BICs, research parks, technology parks,... often is blurred.

The scores that the incubators gave to the screening factors in the list form the basis of the screening profile. They were asked to rank the 5 most important factors that are evaluated during the screening process of a tenant. 7 observations were deleted because the screening question was left blank (thus: N(obs)=100). 3 incubators explicitly indicated that they do not screen the tenants on any criterion.

We converted the screening factor ratings into three scores: 1 score for each group of screening practices that Lumpkin and Ireland originally defined. The factors are presented in table 2.

Table 2: Three groups of screening factors, based on Lumpkin and Ireland (1988)

x_i	Description
Financial Ratios	
1	Liquidity
2	Profitability
3	Asset Utilization
4	Price Earnings
5	Debt Utilization
Personal Characteristics of the Management Team	
6	Age
7	Sex
8	Technical Skills
9	Management Skills
10	Financial Skills
11	Marketing Skills
12	Aggressiveness/Persistence
13	References from Others
Market Factors	
14	Current Size
15	Growth Rate
16	Uniqueness of Product/Service
17	Marketability of Product/Service
18	Written Business Plan

The scores on financial (F), team (T) and market (M) factors of incubator j were calculated as follows:

$$F_j = \frac{\sum_{i=1}^5 x_{ij}}{\sum_{i=1}^{18} x_{ij}} \quad T_j = \frac{\sum_{i=6}^{13} x_{ij}}{\sum_{i=1}^{18} x_{ij}} \quad M_j = \frac{\sum_{i=14}^{18} x_{ij}}{\sum_{i=1}^{18} x_{ij}} \quad \Rightarrow \quad \forall i, j : F_j + T_j + M_j = 1$$

The sum over all incubators ($N(\text{obs})=97$; the three non screening incubators are left out) for each score indicates the average importance of the factors for our population of European business incubators.

From the scores F, T and M, we derive the screening profile of each incubator, based on the following reasoning: an incubator is

- a ‘financial screener’ if $(F > T + 0.05)$ and $(F > M + 0.05)$;
- a ‘team screener’ if $(T > F + 0.05)$ and $(T > M + 0.05)$;
- a ‘market screener’ if $(M > F + 0.05)$ and $(M > T + 0.05)$;
- a ‘balanced screener’ if none of the above equations holds.

We will link tenant failure rate to the screening practices. Therefore we calculate a Herfindahl-index (Hirschman, 1964) of the screening scores F, T and M: $S = F^2 + T^2 + M^2$. This S(screening)-index is limited to values between 0 and 1. A high value indicates a high concentration on one single screening dimension, or in other words, an unbalanced screening practice. Our database contains information on the tenant failure rate during the tenants’ stay at the incubator (categorical variable). The obvious analysis technique to analyse the impact of the S-index on our performance measure would be an ordered probit model. However, small samples –as we have here– may bias the estimation results. Therefore we will rescale the failure rate variable into the categorical averages and estimate linear regression models. We will estimate several models with the following specifications. The dependent variable will always be the failure rate during the stay at the incubator. The independent variables we will use in the several models are the S-index, the size of the incubator (in terms of the logarithm of the number of squared meters⁶) and dummy variables for the most important incubator mission statement: job creation, contributing to the competitiveness of the local economy, stimulating entrepreneurial spirit, supporting specific sectors and supporting SMEs. These mission statement control variables will allow us to extract some exploratory links with the *business incubator continuum* (Allen and McCluskey, 1990).

⁶ We take the natural logarithm of the size to smoothen the size-variable, because the distribution is very skewed. The natural logarithm evens the distribution. The squared value of the size variable is included in the regression to test the linearity of the relationship.

4. Findings

This section shows the results of our analysis. First, the descriptive statistics are presented to map the European business incubator landscape. Second, the analysis of the screening practices is elaborated. The last part links the screening practices to performance.

4.1. The European business incubator landscape

In this section, we mainly discuss the specialisation of the incubator, the type and number of services offered to tenants and the financing of European incubators. But before we go into these matters, we first have a glance at some general characteristics of a European business incubator, based on the answers of the 107 'real incubators'.

We observed that the average European incubator is operated by twelve full time equivalents and covers about 7000 m². This enables the incubator to support about 220 tenants. Most incubators have a very high occupancy rate: 48% of the incubators is occupied for 90% or more; only 13% is occupied for less than 70%.

The majority of the European incubators (70%) was established between 1990 and 2000. Since 2000, the number of new foundations has declined dramatically: only 7% of the present incubator population was founded after 2000. This seems to indicate that the incubator sector was severely damaged by the weakened economic situation. We will come back to this issue later in this article.

4.1.1. Incubator specialisation

Most incubators specialise in one or a limited number of sectors. The most popular sector is the ICT business: three quarters of the respondents operate in this sector. Next on the list are the knowledge-based industries -new economy industries such as e-commerce and B2B services- (59%), R&D (52%) and the financial sector (44%). Least present are sales, marketing and distribution (21%) and agriculture (10%).

Hansen et al. (2000) already pointed out that specialisation is the best strategy. Incubators with a high degree of diversification face the same problems as traditional concerns. It is true that tenants have to overcome the same start-ups problems and can learn from each other, but next to that, there is hardly extra added value created in a diversified tenant portfolio. Ray et al. (2004) conclude from their research that having plenty of resources at one's disposal does not pledge an increase in performance. It is rather by benchmarking the resource endowment and identifying, exploiting, developing and protecting critical resources that a company can

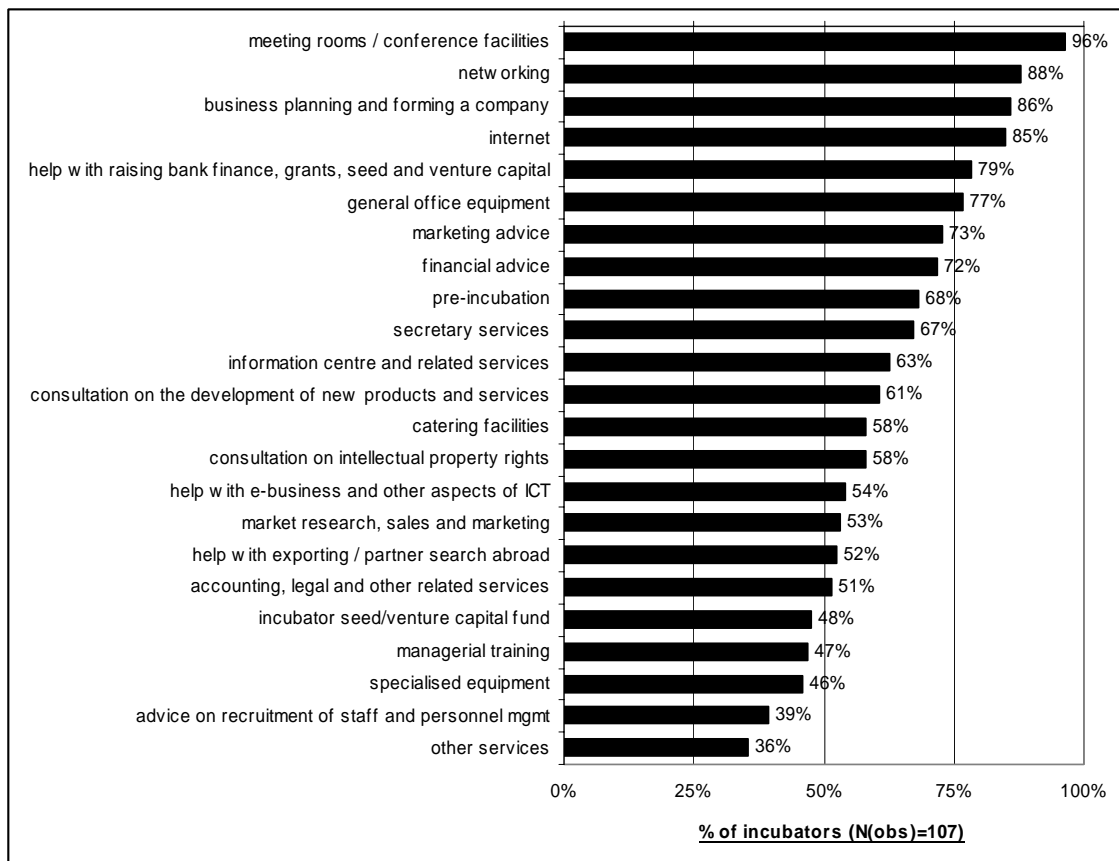
capture a competitive advantage over its competitors. Chan and Lau (2005) found that sharing technical resources among firms is only profitable if the incubator specialises in a specific technology field. Concentration on a specific sector increases the expertise of the incubator personnel and the value of the incubator to the entrepreneurs (Cordis, 2002). The drawback however, is the increased incubator vulnerability. If the sector in which the incubator focuses its activities suffers, the incubator will suffer as well...

The high proportion of incubators that operate in the ICT sector stands out. However, the European Commission (2002) investigated the tenant activities and also found that a high proportion is engaged in activities relating to ICT (34% when the activity sectors are considered to be mutually exclusive).

4.1.2. Service offer

Tenants of European incubators have a wide range of services at their disposal. An incubator seldom (4%) is not equipped with a meeting room or conference facilities. Most incubators (88%) offer a network of business relationships to their tenants. The majority (86%) assists tenants with the elaboration of a business plan and the further development of the company. Help with fund raising is often (79%) offered, as well as general office equipment (77%) and marketing (73%) and financial (72%) advice. Pre-incubation comprises “the support to future entrepreneurs before they start up their business” (European Commission, 2002). Many incubators (68%) offer this service. Figure 2 gives a clear picture of these and other services offered to tenants.

Figure 2: Services offered to tenants



Many authors agree that networking is an essential success factor for start-ups (e.g. Freel, 2003; Hansen et al., 2000; Johannisson, 1988; Tse, 2002). The incubator network lowers the transaction cost for the tenants, through reducing resource and/or information costs (Williamson, 1975). Moreover, the network allows start-up companies to achieve economies of scope, arising from the sharing or joint utilization of inputs (Panzar and Willig, 1981; Bailey and Friedlander, 1982). Ford et al. (1998) stress the importance of the network to exploit technologies fully and transform technologies into marketable solutions. George et al. (2002) analysed the impact of business–university alliances on innovative output and financial performance in the biotechnology sector and their data showed that companies with university linkages spend less on R&D activities, but attain higher levels of innovative output. As such, it is not very surprising that most incubators offer a network of business relationships to their tenants.

4.1.3. Incubator financing

The most important institutions that have given rise to European incubators are the national and regional governments. Seventy-one percent of the respondents could count on their support at the moment of establishment. For 62%, universities or other R&D organisations were fundamental in the incubator set-up process. Enterprises, banks and other private institutions supported 54% of the incubators in their start-up phase. A minority of the European incubators (merely 29%) works for profit. Nevertheless 80% is self-sufficient.

The most important income source comprises the tenants themselves: 81% of the incubators raises its funds from the rent and the tenant service fees. Both national and regional governments cover a great deal of incubator costs: they financially support 63% of the incubators. One third of the incubators is sponsored by the EU or other international organisations. A remarkable fact is that universities and other R&D organisations rarely participate in incubator sponsorship (13% of the incubators), though they play a decisive role in the establishment process.

Another interesting finding is that seemingly few incubators believe fully in their tenants' potential: not even one fourth (24%) possesses tenant shares and only 17% of the incubators indicates that tenant dividends and royalties are a source of income...

European practical evidence confirms the *business incubator continuum* of Allen and McCluskey (1990). Incubators that focus on real estate appreciation and job creation (the majority of the European business incubators) are on one side. On the other side, we find incubators that concentrate on enterprise development. Allen and McCluskey (1990) state that the latter group typically holds shares of the tenants: through tenant investments these incubators try to cover the operating costs with the revenues that over time are generated by dividends and royalties. In the population of European business incubators, the continuum is clearly unbalanced to the left side if we look at the financing, although policy makers clearly prefer the enterprise development (right) side of the continuum to increase the innovative capability of companies. In the study of Allen and McCluskey (1990) also find that especially this real estate side of the continuum is accentuated in their sample of 127 American incubators.

4.1.4. Mission statement

There is a broad spectrum of objectives that are stressed in the mission statement of European business incubators. At present, the most important aims –allowing multiple

answers– are contributing to the competitiveness of the local economy (78%) and stimulating the entrepreneurial spirit (76%).

This was not always the case. As we mentioned before, the first incubator generation focused on job creation (European Commission, 2002; Hackett and Dilts, 2004). We only measured the most important objective of the incubator at the time of our survey, but we see that stimulating the entrepreneurial spirit is a very important goal. Also technology broking, i.e. bringing together different enterprises to stimulate the creation and elaboration of new ideas ('cross fertilisation'), is a considerably favoured (43%) mission statement and seems an evident starting point of innovation⁷.

The growing weight of these incubator objectives (stimulating the entrepreneurial spirit and technology broking) seems to indicate that incubators are more and more considered to be an instrument to promote innovation. There is a significantly (at 10%) positive relationship between technology broking being included in the mission statement and the fact whether the incubators holds shares in the tenant companies. Again this confirms the presence of the *business incubator continuum* (Allen and McCluskey, 1990) in our population. Compared to our conclusion based on the financing, we can now be somewhat more optimistic as we see that mission statements that relate to enterprise development and innovation are considered to be very important. The next step for European incubators is to translate these favoured mission statements in terms of share holding and investments.

4.1.5. Situation after 2000

We already showed that the popularity of the incubator business has declined since the deterioration of the economy in 2000. Only 28% of the respondents indicates the current economic weakness does not influence their activities. However, the majority (69%) of the population experiences a very negative influence.

They point out several reasons. The main reason is the stop in the investment flow: investors go for certainty and hold back to finance high tech industries and starting and risky enterprise. Furthermore, creativity is less emphasized, because it entails uncertainty. Less people are interested in setting up a company. Moreover, entrepreneurs that are prepared to

⁷ The OECD (1997) defines innovation as technological product and process (TPP) innovation This comprises "the implementation of technologically new products and processes and significant technological improvements in products and processes".

take the risk occupy smaller units in the incubator. All these factors result in a falling occupancy rate.

4.2. Screening practices of business incubators in Europe

In this section we will discuss the findings of the screening practices analysis. Most incubators (76%) have a selection committee for the admission of new tenants. In 24% of the incubators that apply screening, however, the selection decision rests on the judgement capability of one person.

$$\sum_{j=1}^{97} M_j = 52,52$$

The market () is the most important screening factor on average. The second

critterion is the management team ($\sum_{j=1}^{97} T_j = 32,72$). The financial factors are least important

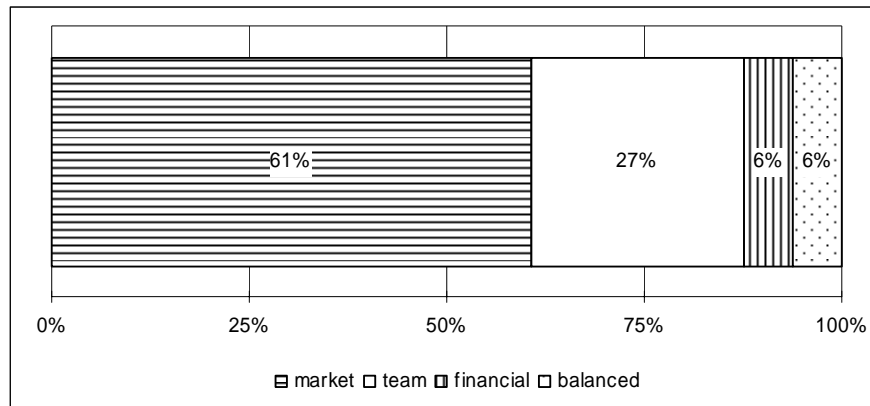
$$\sum_{j=1}^{97} F_j = 11,77$$

().

The big differences in the total scores for each factor already seem to indicate that incubators screen their tenants in an unbalanced way. The next step is to zoom in on the distribution between screening factors. As we mentioned before, we distinguish between financial, team, market and balanced screeners.

Figure 3 presents the screening practices graphically. As we already pointed out, 97% of the incubators uses a set of screening factors to evaluate potential tenants. In the population of screening incubators, the market seems to be a very important screening factor (61%). The management team of the tenant is also important (27%). The number of financial screeners is very limited (6%). Incubators that screen on a balanced set of screening factors are exceptional (only 6%), though this seems to be the most healthy screening practice. We could not establish significant relationships between the screening practices and the incubator characteristics we described before (e.g. age, funding, service offer,...). We could not detect any significant relation between the screening profile and the fact whether the incubator operates for-profit or non-profit nor the self-sufficiency nor the fact whether the incubator holds shares in its tenants. This is remarkable, because it is plausible that shareholding incubators submit potential tenants to a considerable and balanced evaluation. However, it appears that even in this group, only 6% screens potential tenants in a balanced way...

Figure 3: Screening practices of European business incubators (N(obs)=97)



Kakati (2003) indicates that “successful entrepreneurs develop multiple resource-based capabilities to backup multiple-strategies to push their products through the market. Furthermore, it is concluded that it is not the unique products relative to competitors that brings success rather it is the firm’s ability to meet the unique requirements of customers that bring success”. In this view, the team’s capabilities are most important to a new enterprise’s success rate. Our practical evidence largely confirms the assumption of Lumpkin and Ireland (1988) that incubators evaluate their potential tenants on a set of required qualities.

We observed some differences but also similarities between the American incubator population in the eighties and the actual European incubator population today. Both studies indicate that most incubators screen candidates on a(n unbalanced) set of criteria. The main difference between the American and European incubator policy seems to be the focus on financial criteria in the U.S. versus the more ‘soft’ criteria as the management team and market fit in Europe. A possible explanation could be found in differences in national culture. Hofstede (1980; 1991) concludes that US based firms are typically individualistic, masculine (assertiveness, achievement, materialism and performance are important values) and short term oriented (resulting in a lot of companies quoted at the stock market). European firms on average are more team and long term oriented and put a high value on feminine values (nurturance, people and altruism). Nakata and Sivakumar (1996) investigate the relationship between new product development and national culture. They propose that a high degree of individualism has a positive impact on the initiation of new product development but a negative impact on the implementation stage. High degrees of masculinity promote the implementation stage of new product development, but negatively affect the initiation stage.

Long term orientation promotes new product development while short term orientation impedes new product development (both in the initiation and implementation stage).

Of course we have to bear in mind the time difference between both studies. During the last fifteen years, the limited scope of purely financial data has repeatedly been demonstrated⁽⁸⁾.

Incubators that screen on a balanced set of screening factors are still exceptional (only 6%), though this seems to be the most healthy screening practice (Merrifield, 1987; Hackett and Dilts, 2004). In the next section we will substantiate this relationship between balanced tenant screening and performance.

4.3. Screening practices and performance variability

In this section, we establish an exploratory link between the screening practices and incubator performance. The dependent variable in the linear regression model will be the tenant failure rate during the tenant's stay with the incubator. As mentioned in the methodology, ordered probit regression estimates may be biased in the case of small samples. Therefore we rescale the tenant failure rate. Table 3 gives the histogram of the discrete values of the failure rate and the distribution of the rescaled variable. The distribution of the S-index and the control variables (size and mission statements) is presented in table 4 and figure 4.

Table 3: Tenant failure rate during the stay at the incubator (N(obs)=95)

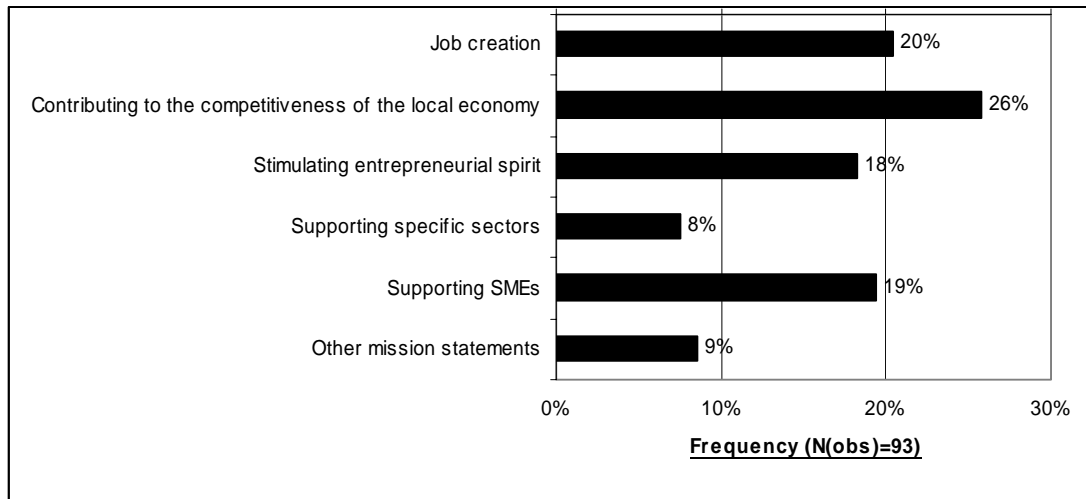
Frequency	Original variable (discrete values)	Rescaled variable
47	less than 10%	0.05
31	between 10 and 20%	0.15
5	between 20 and 30%	0.25
7	between 30 and 50%	0.40
3	between 50 and 70%	0.60
2	over 70%	0.85

Table 4: S-index and control variable size

	Percentile					N(obs)
	10%	25%	50%	75%	90%	
S-index	0.37	0.46	0.56	0.68	0.88	97
Size	5.01	6.21	7.31	8.52	9.80	75

⁸ See for example Kaplan and Norton, 1996.

Figure 4: Control variables: mission statements



The first linear regression model (A in table 5) shows a significantly positive relationship between the tenant failure rate and the S-index. This means that a high concentration on one screening dimension (financial factors, team or market) is related to a higher failure rate. This seems to indicate that balanced screening practices enable incubators to select more viable tenants from the pool of potential tenants.

In the second model we control for the incubator size (B and C in table 5). The coefficient of the S-index remains significant and we see that the size variables are together significantly linked with the failure rate. The significant positive coefficient of the size variable and the significant negative coefficient of the squared variable indicate a non-linear, inverted U-shaped relationship between failure rate and incubator size.

From table 4 we can see that the number of observations for the size variable is low. To avoid loss of data in the regression model, we set the missing values equal to zero and introduce a dummy variable that captures this. The estimation results (D in table 5) remain the same.

The last model (E in table 5) includes both size and mission statement control variables. The estimates show that stimulating the entrepreneurial spirit and supporting SMEs are significantly negative related to the failure rate. Incubators that aim at these goals have a significantly higher tenant survival rate.

Table 5: Linear regression models

	A	B	C	D	E
Dependent variable = tenant failure rate during stay at incubator					
S-index	0.168** (0.084)	0.185* (0.100)	0.195** (0.096)	0.182** (0.082)	0.187** (0.089)
ln(size)		-0.007 (0.009)	0.064*** (0.023)	0.064*** (0.023)	0.061** (0.027)
(ln(size))²			-0.005*** (0.002)	-0.005*** (0.002)	-0.005** (0.002)
Control variable for missing(size)				0.140* (0.080)	0.102 (0.080)
Job creation					0.022 (0.051)
Contributing to competitiveness of local economy					-0.001 (0.041)
Stimulating entrepreneurial spirit					-0.079** (0.035)
Supporting specific sectors					0.029 (0.074)
Supporting SMEs					-0.073** (0.028)
Intercept	0,053 (0.049)	0.098 (0.086)	-0.122 (0.104)	-0.115 (0.097)	-0.086 (0.118)
N(obs)	95	73	73	95	91

Standard errors (between brackets) are heteroscedastic consistent

*** (**, *): significant at 1% (5%, 10%)

The non-linear, inverted U-shaped relationship between failure rate and incubator size can be explained as follows. Small incubators can closely follow up the tenant companies and personally guide them through their growth process. A limited number of tenants leaves more space for feeling and informal support. Next to a close relationship between tenant and incubator, a small incubator creates opportunities for strong personal ties among tenants. Hu and Korneliussen (1997) analysed the social instruments of cooperation between small competing firms and the effects of social factors on the effectiveness of such cooperation. They found that the effect of personal ties on performance is significant.

A big incubator on the other hand can often offer a large network to its tenants and develops a professional culture; economies of scale become significant (Williamson, 1975). Medium size incubators cannot supply tenants with neither of these advantages and on average is characterised by a higher failure rate.

Stimulating the entrepreneurial spirit and supporting SMEs as incubator mission statement are positively linked with the tenant survival rate in our model. In the *business incubator continuum* these mission statements are located on the right hand side of the continuum

“business development”. This may support the hypothesis that incubators to the right hand side of the continuum outperform incubators on the left hand side. However, our dataset does not allow further testing of this hypothesis.

5. Conclusion and recommendations

In this article we have sketched the incubator landscape in Europe and went more into the details of incubator screening practices. The European incubator sector is clearly well developed, but there are plenty of improvement opportunities. An incubator is a powerful instrument and the sector deserves considerable attention to assure its soundness and competitive strength. In this last section, we summarize our findings and propose some recommendations for the main stakeholders in this field: the authorities, the incubators and finally the innovative entrepreneurs.

It appears that the efforts of the EU to promote the use of incubators as an instrument of innovation are being rewarded: technology broking and stimulating the entrepreneurial spirit get considerable attention in the incubator mission statement. However, we also observed that there is still a long way to go: the *business incubator continuum* (Allen and McCluskey, 1990) is unbalanced: merely the minority of the incubators invests in the tenants and provides real support. Nevertheless, this is exactly what Europe needs to encourage innovation. Our study indicates that national and European governments are frequently involved in incubator financing. As such, a great deal of government funds is directed towards the structural support of the innovation system. Governments should realise that it is important that mainly incubators that deliver a lot of added value to the tenants and concentrate on enterprise development receive financial support or other privileges.

We pointed out that it is advantageous for an incubator to concentrate on a limited number of sectors. Governments could encourage this by rewarding ‘specialists’ and thus lessen the number of ‘generalists’. However, attention should be paid to the introduction of early warning systems to reduce the vulnerability that is associated with specialisation.

The incubator sector suffers from the bad economy: the number of establishments has collapsed and the existing incubators are severely hit. It could be interesting to explore the path of counter-cyclic support: in a recession, stimulating creativity, innovation and entrepreneurship –and thus offering more and better support to entrepreneurs– is crucial. This can be realised in two fields: on the one hand the government can encourage incubator establishment and, on the other, support the existing incubators (though with a clear preference of added value).

Incubators constitute an important link in the innovation system. Another interesting path to innovation is expanding the relations between incubators. This closely resembles the argument of Porter (1998) that clusters are a key factor in the competitive strength of a region or country. Their success lies in the geographical concentration of mutually connected enterprises and institutions operating in certain fields. One could also consider an incubator as a cluster, more specific for start-ups. Moreover, if the incubator specialises in a limited number of sectors –as the majority does– it constitutes a real ‘Porterian’ cluster. Furthermore, Porter emphasises the importance of a ‘thickener’ between the clusters as this stimulates innovation even more. Neither in the incubator business can the relations between incubators be neglected. Currently, the EU is working on a best practice benchmarking process in the incubator sector (European Commission, 2002) but there still is a long way to go.

Besides this benchmarking process, the introduction of a quality label, administered by an independent and reliable organisation, could be beneficial to the incubator business. This label can be introduced both on national and international level. A start-up company will have more faith in an acknowledged and high-quality incubator. In times of recession, this guarantee could make the difference between ‘go’ and ‘no go’ for potential entrepreneurs.

Our study clearly indicates that European incubators do not screen their potential tenants on a wide and diversified set of criteria. Some incubators use approximate data, as for example the business plan and the composition of the team. This evolution is noteworthy, but the value that is attached to these indicators should not be exaggerated. Balanced screening practices ought to be the main target because the tenant failure will be lower as a consequence.

For innovators and entrepreneurs starting a business, it is beneficial to be aware about the existence of different incubator clusters regarding screening practices. Entrepreneurs can more carefully, efficiently and effectively prepare their candidacy if the screening practices are known in advance. Innovative entrepreneurs should not be frightened by demanding incubators. In the long run, these incubators will be able to deliver a higher added value to them. In analogy to the relationship of a balanced set of screening factors to performance shown in this study, it is suggested that *any* entrepreneur (future tenant or not) performs a self-diagnosis using a balanced set of assessment criteria.

This study on business incubators is not the first and definitely not the last one. The incubator business covers a very wide research domain and yet it is only a small link in the innovation system, which leaves even more research space... To successfully promote

innovation, the incubator business should be tuned to other elements in the system, like venture capital and the entrepreneurs themselves. We focused on incubators, but tenant research could definitely also result in interesting conclusions and intensify our understanding of the incubator business (⁹). Furthermore it is useful to go more into the details of incubator performance data and investigate the relation between the several performance measures and screening practices. However, objective and direct performance indicators are very hard to gather. A last topic that certainly deserves further research is the situation in America. Which screening practices are at present being applied in the U.S.? Can we distinguish between the same clusters as in the E.U.? Or does the current situation mainly resemble the situation in 1988? It is clear that the last letter on this topic is far from being written...

⁹ Some studies already focused on this subject. See for example the report 'Benchmarking of business incubators' of the European Commission (2002) report or the work of Colombo and Delmastro (2002).

References

- Abetti, P.A., 2004. Government-supported incubators in the Helsinki region, Finland: infrastructure, results, and best practices, *The Journal of Technology Transfer* 29(1), 19-40.
- Albert, P., Gaynor, L., 2001. Incubators: growing up, moving out - a review of the literature, *Cahiers de Recherche*, Arpent.
- Allen, D.N., McCluskey, R., 1990. Structure, policy, services and performance in the business incubator industry, *Entrepreneurship, theory and practice* 15(2), 61-77.
- Bailey, E.E., Friedlander, A.F., 1982. Market structure and multiproduct industries, *Journal of Economic Literature* 20(3), 1024-1048.
- Bhabra-Remedios, R.K., Cornelius, B., 2003. Cracks in the egg: improving performance measures in business incubator research, Paper for the Annual Conference of Small Enterprise Association of Australia and New Zealand.
- Chan, K.F., Lau, T., 2005. Assessing technology incubator programs in the science park: the good, the bad and the ugly, *Technovation* 25(10), 1215-1228.
- Colombo, M.G., Delmastro M., 2002. How effective are technology incubators? Evidence from Italy, *Research Policy* 31(7) 1103-1122.
- Commission of the European Communities, 2000. Innovatie in een kenniseconomie.
- Commission of the European Communities, 2004a. European Innovation Scoreboard 2004: comparative analysis of innovation performance.
- Commission of the European Communities, 2004b. Report from the Commission to the Council and the European Parliament on the implementation of the European Charter for Small Enterprises, (COM(2004)64).
- Commission of the European Communities, 2005. Report on the implementation of the European Charter for Small Enterprises, (COM(2005) 30 final).
- Cordis, 2002. Growing companies, Innovation & technology transfer (July).
- Debackere, K., Veugelers, R., 1999. Can technology lead to a competitive advantage? A case study of Flanders using European patent data, *Scientometrics* 44(3), 379-400.
- European Commission, 2000. European charter for small enterprises.
- European Commission, 2002. Benchmarking of business incubators, Brussels.
- European Commission, 2005, Key figures 2005 on science, technology and innovation – Towards a European knowledge area.
- Ferguson, R., Olofsson, C., 2004. Science parks and the development of NTBFs - Location, survival and growth, *The Journal of Technology Transfer* 29(1), 5-17.
- Ford, D. (Ed.), Gadde, L., Hakansson, H., Lundgren, A., Turnbull, P., Wilson, D., Snehota, I., 1998. *Managing business relationships*, John Wiley and Sons Ltd, Chichester.
- Freel, M.S., 2003. Sectoral patterns of small firm innovation, networking and proximity, *Research Policy* 32(5), 751-770.
- George, G., Zahra, S.A., Wood, D.R., 2002. The effects of business-university alliances on innovative output and financial performance: a study of publicly traded biotechnology companies, *Journal of Business Venturing* 17(6), 577-609.
- Hackett, S.M., Dilts, D.M., 2004. A systematic review of business incubation research, *The Journal of Technology Transfer* 29(1), 55-82.
- Hansen, M.T., Chesbrough, H.W., Nohria, N., Sull, D.N., 2000. Networked incubators: hothouses of the new economy, *Harvard Business Review* 78(5), 74-84.
- Hirschman, A.O., 1964. The paternity of an index, *American Economic Review* 54(5), 761-762.
- Hofstede, G., 1980. *Culture's consequences: International differences in work-related values*, Sage Publications, London.
- Hofstede, G., 1991. *Cultures and organisations: software of the mind*, McGraw-Hill, London.

- Hu, Y., Korneliusson, T., 1997. The effects of personal ties and reciprocity on the performance of small firms in horizontal strategic alliances, *Scandinavian Journal of Management* 13(2), 159-173.
- Johannisson, B., 1988. Business formation - a network approach, *Scandinavian Journal of Management* 4(3/4), 83-99.
- Kakati, M., 2003. Success criteria in high-tech new ventures, *Technovation* 23(5), 447-457.
- Kaplan, R.S., Norton, D.P., 1996. *The balanced score card: Translating strategy into action*, Harvard Business School Press, Boston.
- Kuratko, D.F., LaFollette, 1987. Small business incubators for local economic development, *Economic Development Review* 5(2), 49-55.
- Lalkaka, R., 2003. Business incubators in developing countries: characteristics and performance, *International Journal of Entrepreneurship and Innovation Management* 3(1/2), 31-55.
- Löfsten, H., Lindelöf, P., 2002. Science parks and the growth of new technology-based firms—academic-industry links, innovation and markets, *Research Policy* 31(6), 859-876.
- Lumpkin, J.R., Ireland, R.D., 1988. Screening practices of new business incubators: the evaluation of critical success factors, *American Journal of Small Business* 12(4), 59-81.
- Mancuso Business Development Group, http://www.mancusogroup.com/services_business_incubator.html, [last accessed on July 14 2005]
- Merrifield, D.B., 1987. New business incubators, *Journal of Business Venturing* 2(4), 277-284.
- Mian, S.A., 1996. Assessing value-added contributions of university technology business incubators to tenant firms, *Research Policy* 25(3), 325-335.
- Mian, S.A., 1997. Assessing and managing the university technology business incubator: an integrative framework, *Journal of Business Venturing* 12(4), 251-285.
- Nakata, C., Sivakumar, K., 1996. National culture and new product development: an integrative view, *Journal of Marketing* 60(1), 61-72.
- OECD, 1997. *The measurement of scientific and technological activities: proposed guidelines for collecting and interpreting technological innovation data: Oslo Manual*.
- OECD, 2002. *Small and medium enterprise outlook*.
- Panzar, J.C., Willig, R.D., 1981. Economies of scope, *American Economic Review* 71(2), 268-272.
- Peters, L., Rice, M. and Sundararajan, M., 2004. The role of incubators in the entrepreneurial process, *The Journal of Technology Transfer* 29(1), 83-91.
- Phan, P.H., Siegel, D.S., Wright, M., 2005. Science parks and incubators: observations, synthesis and future research, *Journal of Business Venturing* 20(2), 165-182.
- Porter, M.E., 1998. Clusters and the new economics of competition, *Harvard Business Review* 76(6), 77-90.
- Ray, G., Barney, J.B., Muhanna, W.A., 2004. Capabilities, business processes, and competitive advantage: Choosing the dependent variable in empirical tests of the resource-based view, *Strategic Management Journal* 25 (1), 23-37.
- Rothaermel, F.T., Thursby, M., 2005. University-incubator firm knowledge flows: assessing their impact on incubator firm performance, *Research Policy* 34(3), 305-320.
- Sauner-Leroy, J.B., 2004. Managers and productive investment decisions: The impact of uncertainty and risk aversion, *Journal of Small Business Management* 42(1), 1-18.
- Schumpeter, J.A., 1942. *Capitalism, socialism and democracy*, Harper & Brothers, New York.
- Sherman, H., Chappell, D.S., 1998. Methodological challenges in evaluating business incubator outcomes, *Economic Development Quarterly* 12(4), 313-321.

Tse, E., 2002. Grabber-holder dynamics and network effects in technology innovation, *Journal of Economic Dynamics and Control* 26(9/10), 1721-1738.

Williamson, O.E., 1975. *Markets and hierarchies: analysis and antitrust implications*, The Free Press, New York.