भारतीय प्रबंध संस्थान बेंगलूर
INDIAN INSTITUTE OF MANAGEMENT
BANGALORE

WORKING PAPER NO: 358

Technology Business Incubators (TBIs): A Perspective for the Emerging Economies

Mathew J Manimala
Professor,
Organisational Behaviour &
Human Resources Management,
Indian Institute of Management Bangalore
Bannerghatta Road, Bangalore – 5600 76
Ph: 080-26993107
manimala@iimb.ernet.in

Devi Vijay
Doctoral Scholar
Indian Institute of Management Bangalore
Bannerghatta Road, Bangalore – 5600 76
deviv067@iimb.ernet.in

Year of Publication 2012

Abstract

Technology and entrepreneurship are often reckoned to be the twin-horses pulling national economies towards their developmental destinations. Technology based enterprises (TBEs) are specially attractive to policy-makers because of their higher potential for job creation and wealth-generation through business growth as well as their lower disappearance rates compared to non-technology based firms. As new technologies are often developed in R&D institutions, it was such institutions in the Western nations that first took the initiative of providing incubation facilities to transfer these new technologies to the market. The model was later used by public and private agencies for facilitating technology development for new ventures. Such initiatives are now known by the common name of Technology Business Incubators (TBIs), some of which are focused on technology transfer and others on technology development for new ventures. Though TBIs are generally considered to be a major facilitator of TBEs, the experience of their effectiveness has been mixed, especially in the emerging economies' context. It is against the background of such diversity of experiences that we have undertaken a comprehensive review of the literature on TBI performance. Our findings suggest that, while in the developed countries technology development drives the incubator movement, the process is reversed in developing countries, where the incubator movement is trying to push technology development forward. For this reason the success of TBIs in developing countries would depend largely on the public support available for them.

Keywords: Technology business incubators (TBI), Technology-based enterprises (TBE), Technology policy, Technology and entrepreneurship, Emerging economies.

Introduction

Technology and entrepreneurship are often reckoned to be the twin-horses pulling national economies towards their developmental destinations. Such a hypothesis is justified by the experiences of the developed countries, where technological developments supported by entrepreneurial initiatives have led to industrialization and economic development. It has therefore become a developmental model for the less-developed countries to emulate, especially for the ones transitioning from protectionist to capitalist economies.

Technology based enterprises (TBEs) are specially attractive to policy-makers because of their higher potential for job creation and wealth-generation through business growth as well as their lower disappearance rates compared to non-technology based firms (Doutriax & Simyar, 1987; Phillips, 2002). High-tech entrepreneurial firms tend to influence their environments, be more proactive, aggressive, innovative, focused and future-oriented than their low-tech counterparts; and, in comparison with larger firms, they are more innovative and flexible and therefore are capable of leading the economy towards new levels of development (Doutriax & Simyar, 1987). No wonder that governments around the world have begun to acknowledge the significant role played by such firms in raising incomes and living standards. Consequently, there is a greater emphasis now-a-days on governmental patronage of research and technology transfer with a view to promoting the creation of TBEs (OECD, 1997; Carayannis & von Zedtwitz, 2005).

In order to facilitate the transfer of technology from lab to market, many research institutions in Western countries have started offering incubation services to potential entrepreneurs. Successes of such institution-based initiatives have led to similar initiatives by other public and private agencies for developing technology-based entrepreneurial ideas into new ventures. Such initiatives are known by the common name of Technology Business Incubators (TBIs), some of which are focused on technology transfer and others on technology development for new ventures. Though TBIs are generally considered to be a major facilitator of TBEs, the experience of their effectiveness has been mixed. It is in this context that we propose to review the TBI experience based on the relevant literature, with a view to assessing the conditions under which they could be effective in emerging economies. The paper is

organized in four sections: the first one gives an overview of the phenomenon of incubation with special reference to TBIs; the second provides a comparative perspective of the practice of incubation in the developed as well as the emerging economies. This analysis naturally leads to the identification of a few best practices, which are explained in the third section. Finally, the last section presents the implications of the findings of this review for policy-makers, practitioners and researchers.

1.1 Subsection

For the sub-sections title, use left alignment and contents should be in the justify alignment.

Business Incubation and TBIs: Emergence and Impact

The Incubation Movement

The term 'Incubation', with its etymological roots in the Latin word incubatio, which referred to a practice by the ancient Romans of carrying rudimentary ideas with them for developing them into visionary dreams over a period of tome, is today used in the field of medicine to refer to the special facility where prematurely born babies are nurtured under controlled conditions. The concept of incubators for business start-up is borrowed and adapted from the field of medicine, and refers to institutions that play a developmental role in the vulnerable birth-phase of new ventures by providing them with physical facilities and communication infrastructure, social network and contacts especially for facilitating access to capital, credibility and respectability because of the association with the incubator and its sponsor institutions, and techno-managerial assistance through the incubator's professionals and/or network (Smilor & Gill, 1986; Aernoudt, 2004; Bollingtoft & Ulhoi, 2005).

Genesis and Growth

The beginning of incubators as a new form of enterprise support may be traced back to the Batavia Industrial Centre started in 1959 by Joseph Mancuso in Batavia, New York (O'Neal, 2005). However, the interest in incubators as a tool for stimulating a depressed economy through entrepreneurial energy began only around the late 1970s (Aernoudt, 2004). Researchers in the US have found that, in terms of creating job opportunities, business incubators have been more effective than community projects like construction of roads and bridges, industrial parks, commercial buildings, and sewer and water projects. The National Business Incubation Association (NBIA) - a US based organization that promotes business

incubation in over 60 countries - has estimated that business incubators create up to 20 times more jobs than community infrastructure projects, at a far lower per-job cost, which is in the range of $144 to $216 per job for business incubators as against $2,920 to $6,872 for community infrastructure projects. In 2001 alone, North American incubators helped more than 35,000 start-up companies that employed nearly 82,000 workers and generated annual earnings of more than $7 billion (NBIA, 2009).

An earlier study conducted by NBIA (1997) in collaboration with the University of Michigan and the Southern Technology Council under a grant from the US Department of Commerce Economic Development Administration revealed that approximately 87% of the nation's incubator graduates had been in business at least five years - many considerably longer and were still in business. It was also observed that a business incubator increases the incubatee company's probability of success from 20% to 80%. Thus, business incubators are more than a provider of physical space; rather they represent 'environments' that do not just stimulate the growth of new enterprises but also ensure that the start-ups that leave the premises are also financially viable and sustainable (Eshun, 2006).

Business incubators have become a rapidly growing industry with about 7000 incubators across the world, of which more than 1,400 are in North America (NBIA, 2009). NBIA estimates that in 2005 alone, North American incubators assisted more than 27,000 start-up companies that provided full-time employment to more than 100,000 workers and generated annual revenues of more than $17 billion. In the developing world, the most impressive growth of incubators was witnessed in China, which has got the second largest number of incubators in the world, after the United States. By the end of 2003, China had over 500 incubators, which graduated 5924 successful entrepreneurs and generated employment for 336,000 people (Chandra, He & Fealey et al, 2007). Of these, about 130 are high-tech business incubators (Harwitt, 2002), mostly promoted by the Torch High Technology Industry Center, under the Ministry of Science and Technology (MOST).

Nature, Functions and Processes

A business incubator is often defined in terms of the services it provides to potential entrepreneurs. A typical definition of this kind (Brooks, 1986:24) is reproduced below as an illustration. According to this definition, a business incubator is:

"a multi-tenant facility which provides entrepreneurs with: (1) flexible leases on small amounts of inexpensive space; (2) a pool of shared support services to reduce overhead costs; (3) some form of professional and managerial assistance; and (4) access to or assistance in acquiring seed capital."

While this definition gives a fairly comprehensive listing of the services provided by business incubators, it should be noted that a particular incubator need not provide all these services. In fact, incubators widely vary among themselves in terms of the services provided and the processes adopted for providing such services.

Defining incubators in terms of their functions has also helped researchers in appreciating the difference between incubators and technology or science parks. While some researchers treat these terms as synonymous (eg: Lindelof & Lofsten, 2004), the general consensus is that they are different, where the former differs from the latter in terms of its emphasis on start-ups. Incubators provide support to enterprises in their start-up or pre-start-up phases whereas science and technology parks offer a variety of services to different kinds of organizations in different stages of growth and development. They are typically large-scale projects that house new ventures, and sometimes even incubation systems, in addition to corporates, government agencies or university labs. However, they do not normally offer any business assistance services, which is an important feature of incubators.

The support services provided by incubators are directed towards helping SMEs deal with the very challenges that threaten their survival. Hence most incubators provide their clients with a package of services at an affordable price (ESCAP, 2004). In this process, incubators tend to play five significant roles for the development of the economy and the society at large through their support to new ventures, which are identified by Eshun (2004:8) as the following:

- *Community development/revitalization*: By facilitating the access of new ventures to talent, technology and capital, incubators serve the community by creating local jobs, enhancing a community's business climate, retaining businesses in a region, accelerating growth in a particular industry, and diversifying local economies.

- *Advocacy*: While the primary goal of incubators is to produce successful graduates who create financially viable and independent ventures when they leave the program, many incubators today are ardent advocates of entrepreneurship and new firm formation at the micro level in the economy; they extend their services to spread awareness about entrepreneurship through educational seminars and training programs, mobilize resources and support for new ventures, create networks of various support agencies, lobby with regulators and policy-makers, and liaison with potential capital and service providers (NBIA, 2009).

- *Brokering*: As noted above, one of the major components of advocacy initiatives is the mobilization of resources. Many incubators provide micro-level services in this regard and undertake intermediation between incubatees and resource-providers, and thereby offer brokering services for such resources.

- *Centrality/Mediation*: The word 'centrality' is used here to designate the mediating function of incubators, as many of them take a position at the 'meso-level' in bridging the gap between macro-level policy formulation and strategic implementation at the micro level. Often they play a symbolic role of a mediator between the public system and private actors, by introducing entrepreneurship training and development into the local community. The regional economic development and reduction of unemployment that occur as a consequence ultimately strengthens the relations of the governments with the community (OECD, 1997).

- *One-stop shop:* As incubators facilitate the availability and accessibility of multi-dimensional resources under one roof, they can be described as a one-stop shop for all the services needed by a start-up venture. The opportunity of receiving administrative assistance and the otherwise inaccessible technical support at below-market costs proves to be strong attractions for entrepreneurs (Spitzer & Ford, 1989). Incubators have evolved considerably from their traditional role (of being just the providers of office space to aspiring entrepreneurs) to offering a rich mix of services to help start-ups succeed, including comprehensive business training programs, assistance with manufacturing processes and product design and development, and help with financial management and human resources development (NBIA, 2009).

The processes involved in the operation of an incubator are identified as three-fold, namely: *selection* of clients (potential entrepreneurs), provision of *business support*, and *mediation* for resources. On each of these, there can be differences among incubators. An incubator may select its clients based on an idea-centric or entrepreneur-centric approach. In other words, the incubator may make the selection of clients based on the merits of the project idea or the entrepreneurial qualities of the person(s) behind the project. On another dimension of the selection process, the incubator managers may either seek out enterprises that they believe will succeed, or admit clients from a pool of applicants and let the market forces decide their fate. On the process of providing business support, the incubator could adopt a policy-orientation from a continuum ranging from a laissez-faire approach to an interventionist approach. Accordingly, the mentoring provided could be reactive, proactive or continual. Finally, the mediation provided by the incubator may involve either a form of networking for knowledge and expertise or a form of institutional mediation for the purpose of structural support and credibility-building (Bergek & Norman, 2008).

Types of Incubators

As the word 'incubator' has over a period of time become more like an 'umbrella term' to designate many forms of business support, there have been various attempts to arrive at typologies of incubators. A popular classification specifies that about 54 % of incubators are of the '*mixed- use*' type, even though the current trend is to have specialized incubators that cater to *technology* (39%), *services* (4%), *manufacturing* (3%) and *speciality* (3%) (NBIA, 2009). Obviously the concern for developing technology-based ventures is evident, which is suggestive of the special needs and risks associated with technology-based ventures, and thereby highlight the rationale for having incubator service for such industries rather than for others.

Irrespective of their specialization, incubators have also been classified as '*for-profit*' and '*not-for-profit*'. The not-for-profit incubators seek to commercialize research or foster economic growth and thereby employment opportunities though the creation of new ventures. The for-profits generally function as business accelerators, seeking to speed up product development and enterprise growth and thereby enhance the equity and profits of shareholders including their own (Mourdoukoutas & Papadimitrious, 2002). About 94% of North American business incubators are not-for-profit organizations focused on economic development, while the remaining 6% (for-profit incubators) aim for

enhancing the returns on shareholders' investments through faster growth and development of the enterprises concerned.

Considering the large diversities in the aims and operations of incubators, Aernoudt (2004) attempts a categorization of US incubators based on their major objectives and arrives at the following typology: (1) mixed incubators, (2) economic development incubators, (3) technology incubators, (4) social incubators and (5) basic research incubators (see Table-1 and Table-2 for a comparison of their features and performance respectively). While mixed incubators cater to more than one major objective, the other types focus almost exclusively on one. Economic development incubators address the disparities in development among nations, regions or localities by nurturing new businesses. Technology incubators focus on the development of new technology-based businesses so as to enhance the technical competencies of the society at large. Social incubators attempt to reduce the economic disparities among the different sections of the society by stimulating entrepreneurship among the depressed sections. Finally, the 'basic research' incubators are designed for developing new knowledge and its applications in selected fields by creating new ventures for that purpose. Performance data are available only for the first three types (see Table-2), among which TBIs show above-average performance on most dimensions.

Table-1: Typology of business incubators

	Main philosophy: dealing with	Main Objective	Secondary	Sectors involved
Mixed incubators	Business gap	Create start-ups	Employment creation	All sectors
Economic development incubators	Regional or local disparity gap	Regional development	Business creation	All sectors
Technology incubators	Entrepreneurial gap	Create entrepreneurship	stimulate innovation, technology Start-ups and graduates	Focus on technology, recently targeted, e.g. IT, speech-, biotechnology
Social incubators	Social gap	Integration of social categories	Employment creation	Non profit sector
Basic research incubators	Discovery gap	Bleu-Sky research	Spin-offs	High tech

Source: *Aernoudt, 2004*

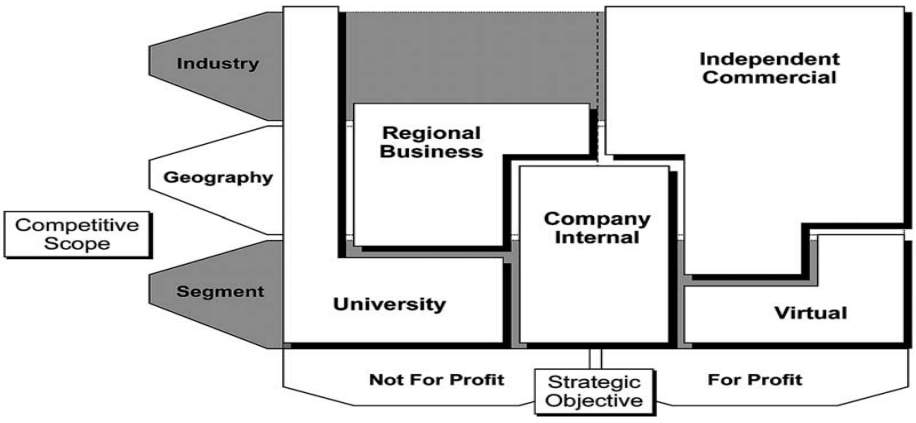
Table-2: *Performance by different types of incubators: US data*

	Mixed incubator	Economic development incubator	Technology incubator	Average
Square feet	36314	30833	31041	32729
Survival rate of graduates	87%	86%	90%	87%
Tenants by incubator	15.3	20.3	13.7	16
Employment by tenants	64	84	248	132
Employment created by graduates	196	95	430	240
Graduates remaining in community	97%	95%	97%	96%

Source: *Aernoudt, 2004*

Based on an analysis of the competitive scope (that is, the industry, geographical region or segment of population served by the incubator) and the strategic objective (defined in terms of profit-motive) of incubation systems, Carayannis and von Zedtwitz (2005) arrive at five basic archetypes of incubators (see Figure-1), namely: (1) University incubators, (2) Virtual incubators, (3) Regional-business incubators, (4) Company-internal incubators, and (5) Independent commercial incubators.

Figure-1: *Types of incubators based on competitive scope and strategic objective*



Source: *Carayannis & von Zedtwitz, 2005*.

Technology Business Incubators

The emergence of Technology Business Incubators (TBIs) around the 1980s and 1990s may be attributed to the scientific advancements in biomedical technologies and the emergence of the Internet and the World-Wide-Web around the same time (Phan, Siegel & Wright, 2005). Compared to non-technology-based firms (N-TBFs), technology-based firms (TBFs) operate in more dynamic, uncertain and complex environments. Shorter product life cycles, limited entry barriers for potential competitors,

need for collaboration among several parties, greater degrees of uncertainty associated with technology development and success, need for constant monitoring, high degree of dependence on specialized human resources and high probability of global competition constitute the turbulent environments in which TBFs attempt to survive (Manimala, 1994; Qian & Li, 2003). Further, there are also differences along other parameters such as the number of start-up activities engaged in, length of the gestation period, and sequencing patterns of start-up activities. Moreover, as TBFs experience greater degrees of uncertainty and complexity in their environments, they tend to direct more start-up activities towards planning, establishing legitimacy and acquiring resources, but not in marketing. Obviously they tend to have longer gestation periods (Liao and Welsch, 2003).

In addition, like all new firms, TBFs also face the 'liabilities of newness' (Stinchcombe, 1965) and have lesser success probabilities as compared to larger, mature firms (Singh, Tucker & House, 1986). They face external obstacles arising out of product differentiation, technological barriers, licensing and regulatory barriers, problems of vertical integration, illegitimate acts of competitors, lack of experience, and so on (Schoonhoven & Eisenhardt, 1990), whose impact is aggravated by internal obstacles such as lack of clarity in structures and roles consistent with external constraints. In other words, they also experience 'liabilities of smallness' (Aldrich & Auster, 1986) that give rise to problems of raising capital, difficulties in dealing with tax laws pertaining to normal income versus capital gains, proportionately higher overhead costs (as compared to larger and more established firms) in complying with government regulations, disadvantages in competing for labour with larger firms and limited ability to obtain benefits from specialization and economies of scale (Van de Ven, Angle & Poole, 2000).

While most of the challenges faced by TBFs are similar to those faced by new ventures in general (arising from their 'liabilities of newness and smallness), TBFs have to bear the additional risks associated with the new technology they operate with. The need felt for offering specialized services to new ventures in the technology area is the main reason for the emergence of TBIs. The definition of TBIs given in a report by OECD (1997) is illustrative of TBIs' focus on providing specialized services required by technology ventures; the report defines TBI as a specific type of business incubator that provides a range of services to entrepreneurs and start-ups, including physical infrastructure (office space, laboratories), management support (business planning, training, marketing), technical support (researchers, data bases), access to financing (venture capital funds, business angel networks), legal

assistance (licensing, intellectual property issues) and networking (with research institutions, industry services, government services and other incubators).

Until the 1980s, business incubators were a non-specialized service-provider whose primary objective was to develop competitiveness within regional economies. With advancements in technology, incubators began to establish closer contacts with higher educational and public research institutions (Aernoudt, 2004). Such incubators thus became an instrument for the commercialization of technology developed by R&D institutions (Phillips, 2002). Researchers have since observed that TBIs do not just facilitate the 'commercialization of technology', but also assist in regional economic development (Phillips, 2002). For example, TBIs can be an important tool for bridging digital divides, by providing entrepreneurs with access to global networks even from remote locations. The sustained policy-level interest in the role and significance of technology as a driver of economic prosperity and growth (Chandra et al, 2007; Carayannis & von Zedtwitz, 2005), together with the perception of TBIs as a critical source of job creation (Phan, Siegel & Wright, 2005) has resulted in a considerable increase in public and private spending on incubation as an entrepreneurship development instrument (Phillips, 2002; Phan, Siegel & Wright, 2005). It may be noted that most of the technology incubators in the U.S that came up during the 1980s and 1990s were created with public funds (Aernoudt, 2004). The involvement of the government has been necessitated by the inherent market and systemic failures that small technology-based firms have to face (OECD, 1997).

TBIs: Theoretical Perspectives

While the emergence of (Technology) Business Incubators is the result of a felt need on the part of practitioners and policy-makers, researchers have attempted to justify the existence of incubators using various theoretical perspectives such as the structural support theory, cluster theory, networks support theory and the resource based view. The structural support theory proposes that new ventures can be helped to overcome the liabilities of newness and smallness if their infrastructure and overhead costs can be reduced. Structural support could be in the form of either the basic support such as office space, communication infrastructure, and managerial assistance or technology support by way of access to laboratory, equipment, research facilities, expert staff, and so on. Obviously, the central pooling of resources can significantly reduce overhead costs and thereby increase operating efficiencies. The cluster theory builds on structural support theory to suggest that high-tech firms with similar

characteristics operating within the same value chain would cluster together to achieve faster knowledge dissemination leading to syenergistic growth using the capabilities of one another (Chan & Lau, 2005). Successful incubators have been found to provide 'organized networking' opportunities over and above the more basic services provided by the less successful ones. A successful incubator acts as a hub, to which a network of other emerging 'incubating' firms, on-site business assistance organizations and any other firms associated with the incubator management are linked. The social capital thus accrued to the incubating firm exposes it to a range of collaborative opportunities to acquire and exploit knowledge (Yli-Renko, Autio & Sapienza, 2001).

One of the most critical challenges faced by new ventures is the strategy by which they can effectively expand their knowledge base (Yli-Renko, Autio and Sapienza, 2001). The resource based view of the firm points out that the accumulation of knowledge is an integral factor in the development and growth of young firms (Spender, 1996; Grant, 1996). It has been argued that it is the innovative combination of knowledge that creates 'productive opportunities' for firms (Penrose, 1959; Spender, 1996; Grant, 1996). Knowledge therefore becomes extremely critical for technology-based firms, as it becomes the source of constant explorative as well as exploitative learning opportunities. The rationale for supporting business incubation is that the network thus created would enable knowledge-sharing across firms, so that they could leverage such knowledge for better performance (Hughes, Hughes & Morgan, 2007). It has been observed that continuous exposure to learning opportunities would stimulate rapid growth for new ventures (Kambil, Eselius and Monteiro, 2000). Young firms, faced with the liability of newness, often seek to combine their own firm-specific knowledge with that of their external partners (McDougall, Shane & Oviatt, 1994).

TBIs: Types, Special Requirements and Performance

The most commonly adopted basis for classifying TBIs is the technology sector they cater to. In a nation-wide study of 79 technology incubators in the US conducted by the National Business Incubator Association in 2003, it was observed that almost 50% of all incubators specialized in information technology and electronics, 24% in bio-sciences and bio-medical applications, while the remaining catered to miscellaneous technologies such as nano technology, military applications, and so on (OECD, 2007). While this study has found no clear correlation between incubator assistance and sales or revenue growth of tenant companies, it has clearly brought out the importance of the strength and

pervasiveness of community ties, the role of R&D institutions and technology generators and the individual skills of incubator managers.

A second basis for classifying TBIs is the sponsor – the need for a sponsor is obviously high for TBIs because of their special needs for technology and finance. Based on their sponsorship, TBIs have been classified as University-based, Private, and Hybrid types. Of these, the most common type is the University-based incubator (Phillips, 2002). Universities and incubators play mutually supportive roles - the former having the research and the human capital required for technology development, and the latter facilitating the technology transfer and commercialization (Mian, 1997). Thus the University-based Technology Business Incubators (UTBIs) have emerged as the most economically viable option for technology incubation. However, there is very little agreement among researchers about the nature and extent of interaction between the university and the TBI clients. It has been observed that the technology transfer, where it happens, could be *linear* from the university to the incubator or *reciprocal/cyclical* involving formal and informal exchange relationships (Rothschild & Darr, 2005).

While the intention of creating TBIs as part of universities is to transfer the latter's technologies to the TBI clients, the experience is different; research studies have shown that in a majority of cases, the technology used by start-ups was independently obtained rather than university based (Phillips, 2002). Several are the reasons for the ineffective interactions between academia and incubator clients. A study of incubators based out of Israel indicates that ties between academia and incubators could be strong and meaningful only if informal relationships among the concerned individuals are well developed (Rothschild & Darr, 2005). Another study has revealed that the intended interaction between universities and incubators are prevented because of legal/contractual impediments, university norms and/or the inability of incubatees to pay the royalty for technology transfer (Phillips, 2002). Illustrating the problems created by university norms, it was pointed out that in one particular case where faculty members were involved with the start-up, the technology transfer did not succeed, as the faculty were unable to devote more than one day a week (as sanctioned by the university) to the incubator. In addition, the pressure on academia to extract academic value from their work might result in their not taking enough interest in the ventures survival and growth because of their focus on writing papers and developing case-studies. Lack of interest on the part of entrepreneurs could also be a reason for the low level of interaction between the venture and the university, as it was observed in a review of the science

park experiment that many entrepreneurs came to the science parks for the respectability of the address rather than for continued interaction with the university (Manimala, 1994). There is therefore an increasingly felt need for conducting studies to understand the strategies employed by successful university based incubators, so as to strengthen the contribution made by the not-so-successful ones (eg. Mian, 1997; Markman, Phan, Balkin & Gianiodis, 2005).

Even though the informal links between technology sources and TBI enterprises are observed to be weak, TBIs are by design characterised by 'institutionalised links' to research institutions and R&D centres such as universities, technology-transfer agencies, research centres, national laboratories, and are located in specific industrial clusters near such institutions (OECD, 1997). While there are cases where TBIs are interspersed in multi-tenant buildings along with other types of establishments, the key disadvantages of such a location are higher costs and reduced contact with similar companies (OECD, 2007). The proximity to R&D institutions is a design feature of TBIs because their key objective is to achieve technology commercialisation while fostering economic development through property ventures and real estate development along with the promotion of entrepreneurship particularly among researchers and academia (OECD, 1997). While these are the general objectives, TBIs can also be established to deal with specific challenges. For instance, in Japan, incubators have been set up to increase the concentration of knowledge and industry around the major metropolitan areas; and in Israel, TBIs were initiated primarily to integrate highly qualified immigrant technologists from the former Soviet Union into the mainstream industrial community. Sometimes, technology incubators are created to provide existing technology-based small firms (or subsidiaries of large established firms) with access to technology and facilities that could be either time-intensive or expensive to develop by themselves (OECD, 1997).

As the objectives of TBIs are different from those of the general incubators, so are their requirements. Accordingly, the services provided by TBIs to their clients are far more comprehensive than those provided by the general incubators. The range of services provided by TBIs include: basic physical infrastructure facilities such as office space, office equipment and furniture, seminar and meeting rooms, clerical and receptionist services: R&D related services such as access to research labs, research and technical publications, lab equipment, sophisticated computers and other electronic equipment; financial services such as research and investment grants and subsidies, access to financiers, lending institutions

and venture capitalists; and administrative services such as legal and patent services, book-keeping/accounting and tax assistance, international trade assistance, government contract procurement assistance, employment/training assistance (Tamsy, 2007; Phillips, 2002). In addition to the above, there are sector-specific services provided by some TBIs that operate in specific technology sectors. Examples of such services include: specialized instrumentation, removal/disposal of hazardous materials, machine shops, dry and wet lab spaces, fume hoods, larger HVAC and fume capacity, and resources like chemicals, gases, water, and in some cases, animals for experimentation, etc. Besides, for some sectors, there is greater need for mentoring, greater amounts of 'patient' seed/venture capital that is willing to wait for longer gestation periods, and easier access to specialized human capital (OECD, 2007).

The additional facilities and services that TBIs offer to their clients would naturally lead to higher operating costs for TBIs. Researchers have therefore attempted to find out if such extra costs are justified by the performance of TBIs, and their findings are generally positive. It was observed that TBIs had a better survival rate, higher employment by incubating tenant companies, and larger employment generated by graduates after leaving the incubator (Aernoudt, 2004: see Table-3 below). In another study, Phillips (2002) found that TBIs had a higher rate of tenant employment and tenant revenues, as well as a larger number of patent applications per tenant firm.

Table-3: ***Performance indicators: TBIs versus general incubators***

	Technology incubators	General incubators
Floor space (square feet)	31041	32729
Survival rate of the graduates	90%	80%
Tenants per incubator	13.7	16
Employment per tenant	248	132
Employment created by graduates	430	240
Graduates remaining in the community	97%	96%

Source: *Adapted from Aernoudt (2004).*

TBI Experiences from Different National Contexts

Even though TBIs had their origin and initial growth in the developed Western countries, its apparent success in promoting economic growth through the creation of high-tech businesses has led to its

adoption by several other countries including many developing nations. As the TBI experiment has met with varying degrees of success in different countries, a comparison of the more successful ones with the less successful ones may yield some insights on the factors responsible for TBI success. In view of the substantial differences in economic, social and political conditions between developed and developing countries, the differences in TBI performance may be attributed to such differences. However, if there are drastic differences among developing countries in terms of TBI performance, such difference could largely be attributed to the design and operation of TBIs rather than the economic and social conditions. Hence the primary focus of the comparisons presented below will be the differences among developing countries (say, between the more successful Chinese TBIs with the less successful ones in India), even though one cannot completely ignore the experiences of developed countries.

TBI Experiences from Developed countries

A key element of TBIs in most developed nations is the strong affiliation with the universities and research institutions. In addition to this, there is a healthy legislative ecosystem that encourages technology commercialisation. The Bah-Doyle Act (1980) is an example of such legislation in the US that permitted the transfer of exclusive control of government-funded inventions to universities and businesses that had been involved in the creation of such intellectual property. Legislations of this kind have been found to support an entrepreneurial culture within a nation *[http://www.oecd.org/dataoecd/52/16/40208619.pdf, accessed on 25th April 2009].*

While some of the incubation systems in the US (such as the Research Triangle Park, North Carolina, and Cummings Research Park, Huntsville, Alabama) were planned investments for technology commercialization, regions such as the Silicon Valley emerged out of a fortuitous concurrence of research, entrepreneurship, and funds flow. As some regions saw rapid development through technology-based entrepreneurship, other regions and communities have sought to replicate similar conditions with a view to promoting high-tech entrepreneurship, which has led to the proliferation of TBIs in the US. *[http://www.oecd.org/dataoecd/52/16/40208619.pdf, accessed on 25th April 2009].* As of October 2006, out of the estimated 7000 incubators around the world, there were 1,115 in the United States (NBIA, 2009). *[http://www.nbia.org/resource_library/faq/index.php#3, accessed on 25th April 2009]*

In order to illustrate the nature and functioning of TBIs in a developed economy context, it is useful to look at a few such examples. An example of how incubators could serve as a development tool for a region is the Advanced Technology Development Center (ATDC) in Atlanta, which is one of the oldest TBIs in the US. It was established with public funds in 1980 by a consortium of state officials, Georgia Tech alumni and other influential groups in the region. The concept was developed in response to a perceived off-shoring threat as well as the absence of high-technology industries in the area (Culp & Shapira, 1997). This incubator is currently managed by Georgia Tech University and serves the entire state with satellite incubators in two other cities. It is a general tech incubator with wet labs, and has 16,000 square metres of office and lab space (OECD, 2007). It has three main programmes, namely: the Entrepreneurial Services Program, the Faculty Research Commercialisation Program, and the Corporate R&D Support Program (Culp & Shapira, 1997). Assistance is provided to Georgia entrepreneurs in the form of technology-driven solutions, and Georgia Tech faculty members are encouraged to evaluate the commercial potential of their technology innovations and form start-up companies. Access to Georgia Tech core lab facilities, scientific equipment and Georgia Tech library is provided free to the incubatees (OECD, 2007). The system has housed 150 companies and produced 122 graduates *[http://www.atdc.org/companies/graduates.aspx, accessed on 25th April 2009]*

The ATDC incubation system has fared well and is almost the model of incubation success stories. The occupancy rates have remained high throughout, and a study of longitudinal data suggests that firms that had graduated from ATDC have been successful (Culp & Shapira, 1997). Some of the graduates of ATDC that have completed more than twenty successful years of being in business are: MindSpring Enterprise, a major Internet service provider founded in 1997 which merged with EarthLink in February 2000; Micro Technology Consultants, Inc. (MTC), a technology integration firm founded in 1990; and Laser Atlanta founded in 1994. At least 50% of the incubatees have either been acquired by or merged with other firms, which may be interpreted equivocally: that they were so successful and therefore attractive enough for being acquired or that they were barely surviving and so needed to be merged with a strong partner to carry on further! *[http://www.atdc.org/companies/graduates.aspx, accessed on 25th April 2009]*

While the services of TBIs are generally appreciated, there is no unanimous agreement about the nature of benefits derived by clients from TBIs. Member companies of ATDC, for example, report that more than the business assistance provided, the credibility of being associated with a major technological university and the accompanying facilities had had a positive impact for them. Similar findings were reported by Manimala (1997) in a review of the literature on science parks in the UK. However, in the case of ATDC (as in the case of several other TBIs), there is a general perception that it was this agency that was instrumental in creating an image for Atlanta as a high-technology location and in pioneering improvements in the technological infrastructure of the state (Culp & Shapira, 1997). Hence it is but natural that TBIs are perceived more as instruments of regional development rather than of client development.

Reports on incubation systems from other developed nations seem to tell similar stories. The "Créatlantic" incubator under the aegis of the Saint-Nazaire Centre for Local Initiatives in France was set up in 1988 to stimulate the local economy using new technologies, when the region was stagnating because of its dependence on large traditional metal-work corporations. In addition to the basic business development services provided by all incubators, 'Creatlantic' facilitated for its clients access to a large network of other entrepreneurs. As of 1997, out of the 75 businesses that have graduated from this incubator, 70 were still active in the region and have helped create around 500 jobs (Choloux, 1997).

In the UK, the Business Innovation Centre (BIC) - a collection of incubator units for small businesses which can draw on centralised facilities for day-to-day operations - has proliferated as an institution. Fazey (1997) reports that what makes the BIC a viable model is the emphasis on commerce and profit rather than science, technology and innovation. As compared to the US, the innovation program has lesser to do with the technological capabilities of the universities and more to do with the commercial aspects of the property market. For instance, the Cambridge Science Park, owned by Trinity College, is a success story not so much because of the involvement of Cambridge intelligentsia in the client ventures. Fazey (1997) observes that it is the reputation and credibility of the university rather than the R&D inputs provided by its faculty that draws high-technology entrepreneurs to the region. (See also the above-cited findings of Manimala, 1997).

TBI Experiences of Developing Countries: China

For a long period, China's economic growth was driven by capital accumulation. However, over the last two decades, the country's policy focus has shifted towards economic growth driven by the development of technology capabilities. Integral to this approach is the Torch Program, implemented in 1988, which has identified TBIs as one of the means to commercialize technology and enhance competitiveness of SMEs (ESCAP, 2004). With substantial improvements in the policy environment, the Chinese business incubation industry has grown substantially since 1988 with about 130 business incubators to its credit. The business incubation industry in China is, without doubt, the largest among the developing countries and the third largest in the world after the United States and Germany (Lalkaka et al., 2000; Harwitt, 2002). As of 2000, about 37 percent of China's 21,000 high-tech companies in development areas were located in incubators (Harwitt, 2000).

Based on a study of 77 incubators tracked by the Torch Program, the performance of incubators in China is found to be quite impressive (see Table-4). It was estimated by Lalkaka (2000) that the $150 million investment made by the government of China up to the year 1998 would have been recovered in the subsequent five years and led to several social benefits.

Table-4: ***Performance of China's Torch Program Incubators***

Gross floor space	883,620 sq r
Tenants	4,13
Tenant employees	68,97
Tenant sales	RMB 6,066,798,00
Tenant profits	RMB 396,535,00
Tenant taxes	RMB 264,106,00
Cumulative No. of Graduates	1,31
Graduates' employees	47,13
Total Seed Capital Funds	RMB 259,819,00

Source: *Lalkaka, 2000*

The Incubation program in China is remarkable in terms of the amount of resources involved, size and scale, the number of enterprises, sales turnover, jobs created, technological innovations and the taxes generated. The incubation system is also believed to have kindled a cultural change in the society by fostering entrepreneurial energy and incentivizing the re-entry of Chinese scholars from abroad. Overall, the program appears to have been efficient in its use of funds and effective in the results obtained (Lalkaka, 2000).

However, it has also been pointed out that the Chinese incubation program has had a narrow organisational base in the Torch Program, wherein women and minorities have been poorly represented. Local empire building, control of management by bureaucrats, and inadequate supportive legislation are some of the challenges that face the Chinese incubation program (Lalkaka, 2003). An OECD (2007) report identifies a passive education system, underdeveloped market institutions, lack of managerial competence, policies unfriendly towards private sector, the lack of a robust financing system and intellectual property rights protection as some of the weaknesses of China's national innovation system. While there has been an impressive mobilization and investment of resources, the factors mentioned above may continue to restrict the development of the full potential of Chinese entrepreneurship.

An empirical analysis conducted in China by Chandra et al (2007) showed that China had more of governmental incubators than non-governmental. The former being completely dependent on the government for resources displayed very little market-orientation and therefore had low financial self-sustainability. For the reason that there is public policy interest in TBIs, most incubators in China tend to be larger in size, housed in huge, state-owned buildings and focus on the high-tech sector (Chandra et al, 2007). Comparisons between the incubator experience in the United States and China have also been revealing. While venture capital funds from both private (such as Lilly Endowment and the Kaufmann Foundation) as well as government sectors are readily available for start-ups in the United States, Chinese ventures gain more support from predominantly government owned or sponsored organizations. Most Chinese incubators follow a not-for-profit model, whereas in the American model about 25% of incubators are for-profit. The table below (Table-5) compares certain features of Chinese and American models of TBIs.

Table-5: ***Comparison between the US and the Chinese Incubator Programs***

	United States	China
Birth of business incubation	Early days- 1950s Boom in 1980's-1990s	Established in 1988.
Model	Both 'for-profit' and 'not for profit'	Primarily 'not-for-profit' models
Location	TBIs are often affiliated to universities	Located on the floors of publicly owned buildings

Source: *Chandra et al, 2007*

TBI Experiences of Developing Countries: Korea

In the Republic of Korea, the involvement of multiple ministries in the incubation system led to duplication of investments. Notably, it was found in the ESCAP (2004) study that while the government was trying to fuel high-technology based innovation, the human capital was not as equipped to handle the complexity. Moreover, even though incubators have received strong governmental support, extensive networking facilities and enhanced capacity for sustainable growth, they were still constrained by the challenges arising out of the absence of a well-developed financial services sector, unbalanced development, over-emphasis on hardware facilities, and inadequate managerial talent. The study further identified the need for professional managers for managing the incubators, the need for greater interaction between the academia and TBI clients, and the need for providing additional support services to incubating companies.

TBI Experiences of Developing Countries: India

A glance at India's innovation program will also reveal a keen policy-level interest in incubation systems. Technology Business Incubators and Science and Technology Enterprise Parks (STEP) have successfully promoted several high growth ventures. ESCAP (2004:7) reports that when viewed from the perspective of a pure investment opportunity for the government, TBIs/STEPs have provided "more returns to the government in terms of direct and indirect taxes and employment opportunities", and are hence more "commercially lucrative from a long-term societal point of view". The university business incubator model too has caught on and academia is an "excess intellectual capacity" available to the nation, which is currently underutilized. The National Science and Technology Entrepreneurship Development Board (NSTEDB), which functions under the Department of Science and Technology (DST), was established by the Government of India in 1982 with the objective of facilitating technology-based enterprises and gainful self-employment. There are about 43 Technology Business Incubators registered under the Department of Science and Technology. However, like many other emerging economies, India has not had a history of market-based economic activities, a strong research culture and national intellectual property policies encouraging and providing incentives for innovation.

Facilitating TBIs: Common Features and Patterns in Emerging Economies

The 'emerging economies' have attracted the attention of economists and policy-makers primarily because they have in recent times become the fastest growing markets in the world and therefore capable of making major contributions to world prosperity (Arnold & Quelch, 1998). They are characterized by a rapid pace of economic development aided by government policies favouring economic liberalization and the adoption of a free-market system (Hoskisson, Eden, Lau & Wright, 2000; Arnold & Quelch, 1998). As identified by Hoskisson et al (2000), there are 64 such emerging economies; 51 of them are developing countries in Asia, Latin America, Africa and the Middle East, and 13 are transition countries in the former Soviet Union.

Several studies have found that different types of contextual factors in emerging economies act as constraints against the promotion of technology incubation (eg: Pridor, 1997; Lee, 1997; Samsonova, 1997; Adegbite, 2001; Harbi, Amamou & Anderson, 2009). Fostering TBIs within emerging markets requires a deep understanding of the prevalent political, legal, economic and cultural institutions that are vastly different from those present in developed nations (Peng and Heath, 1996; Ahlstrom & Bruton, 2006). While there are certain contextual factors such as the presence of business families, and ethnic communities, the reversal of socialistic policies, promotion of ICT and pro-entrepreneurial policies, that seem to favour entrepreneurship development, there are a large number of other factors that could potentially stifle technology-based entrepreneurship. Some of the socio-cultural, economic and political factors that inhibit entrepreneurship and innovation, especially in the high-tech areas, are discussed briefly in the following subsections.

Socio-cultural Factors

Ideological perspectives and practices leading to specific patterns of social and cultural norms within a society have been found to influence entrepreneurial behaviour (Morrison, 2000). Entrepreneurship may not prosper if most members of the society view it with suspicion. A favourable attitude of the society toward entrepreneurship and a widespread public support for entrepreneurial activities are both needed to motivate people to start new businesses (Gnyawali & Fogel, 1994). The distinct socialist legacy prevalent in the former centrally planned economies has been found to discourage the development of

private enterprises. The ideology associates private proprietorship with parasitism, exploitation, and profiteering, leaving a lasting stigma on individuals pursuing entrepreneurial opportunities (Manolova, Eunni & Gyoshev, 2008). Luthans, Stajkovic & Ibrayeva (2000), referring to Armstrong's (1983) work, report about how entrepreneurship did not enjoy a high standing in the social values of the Russian empire and how persons involved in commerce were held in low esteem in that society. Other studies report that the Singaporeans and Slovenians have been found to have low tolerance for failure and thus have lower risk appetite because of the fear of durable stigma. In contrast, in societies such as North America, entrepreneurial behaviour is applauded, and failure has very few negative connotations associated with it (Morrison, 2000).

In the Asian context, one may examine the dominant values prevalent in China and India. Confucian ideology has widespread influence on the business practices in China. It is observed that Confucian philosophy encourages a rather negative view of failure, as a result of which Chinese entrepreneurs may be less willing to take risks than entrepreneurs in more mature markets. Following the same ideology, investors in China are less forgiving of failure (Ahlstrom et al., 2004; Bruton, Ahlstrom and Wan, 2001). In India, the middle class families place high value on education and approve of the pursuit of professional qualifications. These families are also risk-averse, preferring steady incomes over the uncertain or irregular incomes from business. Therefore, individuals with required domain knowledge and entrepreneurial initiatives often face discouragement from their families when they want to become entrepreneurs and find it difficult to satisfy the concerns raised by members of their extended families and social network. This apathy towards entrepreneurship has a compounded impact, since in India, more than in many other societies, family and friends have a profound influence on employment and career decisions (Ojha, 2009).

Research on societal values have indicated that societies holding strong community and collectivist values (such as Kenya, Slovenia and South Africa) do not support individualistic wealth creation through entrepreneurship, whereas societies with strong individualistic values (such as North America and Australia) generally do (Morrison, 2000). In the 'transitional' countries that were part of the erstwhile Soviet Union, the societal elites of the erstwhile era comprising former party bosses, directors of former state enterprises, and high-ranking members of the government and its ministries still have considerable power. These groups have distinctive advantages in appropriating and maintaining

entrepreneurial and leadership positions. Such insider networks became a substitute for an adequate legal system and helped in catapulting the old ruling class into powerful positions in entrepreneurial avocations (Luthans et al, 2000).

Economic Factors

Economic policies of a nation are observed to have an impact on its entrepreneurial activities. For want of supportive institutions, entrepreneurial activity is often suppressed or gets channelized into inefficient approaches. Protectionist policies that attempt to foster entrepreneurship through subsidies, quotas or similar other schemes have been found to be counterproductive in creating an enabling environment for entrepreneurship (Manimala, 1999; Kabiraj & Yang, 2001; Ojha, 2009). The absence of well-designed policies, effective distribution systems, intellectual property protection to support the private sector have often forced entrepreneurs to adopt strategies such as 'wait and see' (Arnold & Quelch, 1998) or even quit their businesses too early. (Luthans et al, 2000). On account of constraining factors such as underdevelopment of financial markets, time-consuming bureaucratic procedures of banks and other lending institutions, concentration of capital in the hands of the ruling elite, inability of venture capitalists to appreciate the investment potential of small businesses or value intellectual property, public sources of capital are not easily available to people who really need them; in fact, they are often made available to those having several other options to raise capital (Gnyawali & Fogel, 1994; Luthans et al, 2000; Ojha, 2009). Lenders in developing countries are also at a disadvantage, as they do not often have the means of enforcing repayment, on account of improper legal infrastructure and weak or corrupt enforcement machinery as well as practices (Luthans et al, 2000).

Certain types of legal and governance infrastructure such as those prevalent in the erstwhile centrally planned economies might actually inhibit entrepreneurship or even make it an illegal activity. Lack of legitimacy for the first-generation entrepreneurs with lending institutions compel them to seek private (often informal or criminal) sources of credit, which are limited and are only available at substantially higher interest rates. In order to gain legitimacy, entrepreneurs may have to resort to bribes and other illegal and expensive forms of compliance. Corruption and organized crime as alternative systems of protection to contractual agreements become more explicit during transition periods, as it was seen in the case of several developing countries transiting to market economies in recent times (Luthans et al,

2000). Marketing in emerging economies can be an intimidating task because of the paucity of market data, non-existent or poorly developed distribution systems, relatively few communication channels, high levels of product diversion within or between countries in order to capitalize on price differences and scarcity situations, resistance to locally new and innovative products because of the conservative nature of people, widespread product counterfeiting, and opaque power and loyalty structures within complex networks of local business and political players (Arnold & Quelch, 1998; Luthans et al, 2000). Entrepreneurship activities can also be hindered by the lack of regulatory discipline and a propensity, especially in transition times, to change business regulations frequently and unpredictably.

Political Factors

In emerging economies, the political systems often take time to catch up with the changes made in the economic systems. Besides, the culture created by the erstwhile governance system (a culture of dependency arising from excessive controls by the State on people) also has a dampening effect on entrepreneurial activity. Luthans et al, (2000) observe that in the CIS countries, on account of their having been a part of the former Soviet Union, a specific work culture has developed, which linked expected employment security with a low level of effort along with modest material expectations. As a consequence of the comprehensive social safety net provided free of charge or at subsidized rates by the erstwhile Soviet government to its citizens, the population has come to accept many features of this system as their 'granted' rights. Thus people in such nations have been found to be highly dependent on the system and therefore lacking in the entrepreneurial personal attributes such as leadership, creativity, self-reliance, and self-confidence generally associated with initiative and enterprise. However, in the more individual-centric and democratic societies such as those in North America, these qualities are fostered, thus stimulating entrepreneurial behaviour (Morrison, 2000). A common feature of the emerging economies is the transitory nature of governments and bureaucracies, which have been responsible for creating inconsistent policies leading to the absence of a competitive environment and a coherent economic strategy essential for supporting entrepreneurial performance; in fact, they have created a stifling environment for entrepreneurs through contradictory laws and regulations, numerous licensing requirements, excessive discretion in the hands of administrators, and so on. Such uncertainty and arbitrariness have aggravated the risk of failure that naturally accompanies entrepreneurial activity (Arnold & Quelch, 1998; Luthans et al, 2000). Compliance with unreasonable governmental

regulations, high levels of corruption, intricacies of customs rules and the irrational behaviour of customs officials are also big challenges for entrepreneurs in emerging economies (Luthans et al, 2000; Ojha, 2009).

Evaluating TBI Performance: Some Issues

Evaluation of TBI performance has not produced any conclusive findings even in developed countries. A study of 79 technology business incubators in the US found no statistically significant relationship between incubator assistance practices and the sales or revenue growth of tenant companies (OECD, 2007). On the other hand, there are a few cases of TBI success stories (see a few of them in Appendix-1) that are often flaunted for illustrating their need and performance efficiencies. In the face of such mixed reports, the only inevitable inference is that constant evaluation of incubation systems is of utmost importance!

While the incubators are seen as not producing any demonstrable impact, a more damaging 'allegation' is that the system is helping the incubated firms to exploit existing networks of relationships to acquire exploitative knowledge based on known resources (Hite and Hesterly, 2001) rather than stimulating explorative learning, which is perhaps the most critical capability of entrepreneurs. Additionally, it is also 'alleged' that most of these exploitation of existing resources is done with public money, as governments lavishly support TBIs because of their (often wrongly) perceived role in developing new technologies. The dependence on the government thus created can also lead to decreased financial self sustainability and market-orientation (Chandra et al, 2007) and thereby reduce the entrepreneurial spirit in the concerned individuals!

Extensive networking is being touted as one of the biggest advantages of incubation systems. However, it is observed that in the actual implementation of incubator projects, the networking aspect is often overshadowed by the real-estate value of the site. This is partly because it is easier for the promoters to offer the physical space than to arrange for creating network contacts based on the specific needs of the tenant companies. In fact, some studies have shown that the tenants are attracted to university science parks primarily because of the prestige of the address rather than the proposed opportunities to interact

with the researchers in the university, whereas companies outside the parks had more contact with the universities compared to those located within the science parks (Manimala, 1997).

On the positive side, one of the consistent findings of the evaluations of TBIs is that they do help in increasing the firm survival rates. However, there is hardly any consensus on many other parameters, not to mention the long-term economic impact. Operating costs appeared to be higher for technology incubators; similarly, the average operating deficit was higher for technology incubators than for other incubators (Phillips, 2002). Aernoudt (2004) reports that TBIs even in the US (where private 'for-profit' incubators are also common) continue to receive subsidies of the order of 83% of their annual operating expenses without which they would cease to exist. One of the unanticipated consequences of this situation is that in the process of ensuring financial stability for themselves through grants and subsidies, these TBIs have been spending more time on themselves rather than helping their tenants with managerial advice and networking assistance. Thus the real efficiency and effectiveness of business incubators remains debatable especially because there is practically no agreement about the manner in which TBI success is defined for the purpose of measuring their quality, efficiency and effectiveness (Bøllingtoft & Ulhøi, 2005). In fact, the criteria for evaluating TBIs are many and varied (see Appendix-2 for a listing of a few such criteria), which obviously makes it difficult to compare the outcome of different evaluations.

Conclusion

Given the multitude of challenges being faced by entrepreneurs in emerging economies, there is a strong case for fostering incubation systems. The mentoring and business assistance provided by incubators are especially useful to individuals who are not part of business communities and/or do not enjoy support from families. Established businesses and promotional organizations associated with incubators would provide the latter's clients with the much needed know-how available in such networks. In environments where capitalist institutions are in a nascent or transitional phase, there is likely to be a dearth of funding alternatives, which makes them depend on banks for their short-term as well as long-term financial requirements; obviously this is a non-viable option for financing new ventures, as the banks are rarely a source of equity capital. Business incubation systems therefore can become a very useful tool for new venture facilitation, especially in the high-tech area. Furthermore, the creation of

TBIs in large numbers can also reduce the emerging market's dependence on interventions from foreign organizations for kindling economic growth through technology-based ventures (Chandra et al, 2007). It should, however, be specially noted that the Western models of incubation cannot be blindly adopted in emerging economies because of the differences in the social, cultural, political and economic factors affecting business creation and performance in these economies.

Best Practices of TBIs: Facilitating the 'Task' versus the 'General' Environment

Considering the strong faith reposed in and the heavy investments made on incubators, it is important for the administrators to choose the right incubator models best suited for emerging economies. In other words, TBIs in emerging economies are likely to benefit from benchmarking themselves against the international best practices. This is also supported by the NBIA studies, which has shown that incubation systems that adopted such best practices generally outperformed those that did not. In this last section of this paper, we discuss these practices under two major categories, namely, the 'general' (Thompson, 1967) and the 'task' (Khandwalla, 1977) environments. The relevance of these categories for the present analysis is based on their differential impact on new venture creation, as explained in a model by Manimala (2008) – the former helping the development of the enterprising individuals and the latter facilitating their entry into the business field. In view of such differential roles, they were subsequently renamed as the 'formative' and the 'facilitative' environments (Manimala, Mitra & Singh, 2009).

The 'task environment' consists of factors that facilitate the specific inputs needed for enterprise creation, such as technological inputs, finance and investments, legal and commercial services, industry-specific infrastructural facilities, and so forth (Gnyawali & Fogel, 1994; Manimala, 2008). The 'general environment' refers to the overall economic, socio-cultural, political as well as the general and communication infrastructural factors that have an overarching influence on people's willingness and ability to undertake entrepreneurial activities and would therefore naturally have an influence on enterprise creation (Gnyawali & Fogel, 1994; Manimala, 2008). It is obvious that in order for any facilitation of the task environment to be effective, the people should have the capability and inclination to take advantage of such facilitation, which would imply that the priority attention of the policy-makers should be on the general environment. However, changes in the general environment are slower and

more difficult to bring about than those in the task environment. An effective way of influencing the general environment is to intervene in the formal and informal learning systems of the country (Manimala et al, 2009). Taking a historical perspective, it may be noted that the Industrial Revolution in Europe was preceded by the Renaissance, which liberated the learning system from the bondage of scripture and theology and gave it a much broader base and thereby stimulated inventions, innovations and entrepreneurship.

Facilitating the Task Environment for TBI Effectiveness

Bergek and Norman (2008) argue that incubator performance should not be narrowly assessed on the basis of their outcomes such as occupancy, jobs created and firms graduated (Allen and McCluskey, 1990) or tenant revenues, number of patent applications per firm and number of discontinued business incubators (Phillips, 2002). Instead, they advocate an analysis of the extent to which incubator outcomes correspond to the incubator goals because only such an approach can reveal the best practices in the industry.

Based on a review of the broader literature as mentioned above, a few recommendations are listed below:

- Incubation systems should leverage on the general credibility and reputation of the supporting institutions. The incubatee and market responses in the case of ATDC as well as the Cambridge Science Park testify to the importance of this point.
- TBIs would greatly benefit by strengthening their ties with academia, especially for making use of their research output. Current practices show that very often incubatees possess the technology and turn to University TBIs (UTBIs) for either the credibility of the address or the access to resources through the network. The research that emerges within university labs is rarely taken to the commercialization stage by the incubatees. This clearly indicates a mismatch between the objective and the outcomes of a UTBI program. While this model of UTBIs, no doubt, may stimulate entrepreneurship in the local area, it would be more productive if the research output from the universities are also used in new venture creation. There should be greater incentives

for universities to increase technology transfer. In other words, the disincentives for academics to work with the commercialization of technology research outputs must be removed.

- Research on the Chinese incubation industry has highlighted the need for incubators to avoid exclusive reliance on subsidies for investment support and to diversify the sources of financing.
- While leveraging on existing services and tailoring them to client needs is important, incubators should not over-emphasize these functions to the detriment of building new linkages and networks with industry and especially the potential investors (OECD, 1997).
- Sharing experiences among incubators and improving systems of evaluation are also useful practices.
- While TBIs can be lucrative as property-based ventures, they should not ignore the importance of balancing short-term goals (e.g. high occupancy rates) and longer-term goals (e.g. technology commercialisation).

In addition, the NBIA advocates the following:

Prior to establishing an incubation program, a feasibility study must be carried out to evaluate the market as well as the financial, legal and economic institutions in the environment *[http://www.nbia.org/resource_library/faq/index.php#6, accessed on 25th April 2009].* The design of the incubator has to be further strengthened by the following actions.

- Build an effective board of directors committed to the incubator's mission and to maximizing management's role in developing successful companies.
- Develop stakeholder support, including a resource network, which helps the incubation program's client companies and supports the incubator's mission and operations.
- Maintain a management information system and collect statistics and other information necessary for ongoing program evaluation, thus improving a program’s effectiveness and allowing it to evolve with the needs of the clients.

Facilitating the General Environment for TBI Effectiveness

Influences of the general environment on incubation systems have been considerably under-researched. For instance, Autio & Klofsten (1998) have observed that the management practices of incubators in Sweden and Finland differ in terms of parameters such as period of establishment, policy-level interest, types of firms extant in the region, and so on. As discussed in the previous section, the contextual differences in emerging economies are starker and more varied than it is generally presented in the literature, which is observed to be fragmented, highly descriptive and atheoretical (Mian, 1997). Unfortunately research on TBIs has until recently been almost exclusively focused on North American and European initiatives. In several of the emerging economies, governments have tried (with little success) to stimulate new venture creation through the facilitation of the entrepreneurial environment. A major reason for the lacklustre performance of such initiatives is that they are focused almost exclusively on the task environment (Manimala et al, 2009). For example, policy makers in India for over 50 years since Independence have created financial institutions, training facilities, research centres, industrial estates, science & technology parks, incubators, quotas and reservations systems, etc. with a view to facilitating entrepreneurship development (Manimala et al, 2009). The impact of such 'task-facilitation' processes is comparable to certain ICT initiatives in the 'least developed' regions of the world (sponsored by aid agencies), most of which failed when the sponsors withdrew from the scene (Manimala, 2009).

It is apparently futile to facilitate the task (business) environments without developing entrepreneurial orientation and capabilities among the people in the first place, for which it is important to create the right kind of 'general environment' and address the issues relating to the early-stage education and socialization, socio-cultural norms about life and career, legal-political and economic systems based on individual freedom, responsibility and empowerment, as well as the general facilitation of transport, communication and interaction among communities and cultures (Gnyawali & Fogel, 1994, Manimala et al, 2009). The need for an all-round development of the economy before it can support entrepreneurship has also been highlighted in other studies in emerging economies. For example, one may refer to the study by Manolova et al (2008), which compares the institutional environment in Hungary, Latvia and Bulgaria, where it was found that even though Bulgaria offers higher degree of social approval for a business career and people in that country believe they have the required

capabilities and know-how, business start-ups are still lagging behind because of the slow pace of reforms in the legal-political and governance systems.

A natural conclusion from the discussion above is that policy initiatives should focus primarily on the general environment, so that they help in the development of large numbers of entrepreneurial individuals in the society; subsequent initiatives of task (business) facilitation would then channelize such entrepreneurial capabilities and orientations in the society to the business field. Some specific initiatives that are observed to be effective in facilitating the general environment are as follows:

- Interventions in the learning system that are aimed at the development of the individual's capabilities for independent thinking and action as well as at creating positive socio-cultural norms about innovation and entrepreneurship (Manimala et al, 2009).
- Adoption of an economic system that recognizes and rewards individual initiatives while imposing fewer restrictions on economic activities in terms of taxes, tariffs, size, sectors, location, nationality, etc.
- Reformation of the legal-political system so as to ensure efficiency, transparency and accountability.
- Building and maintaining high quality physical, transport, communication and energy sources infrastructure and reducing the restrictions on the movement of people across nations and regions so as to facilitate intercultural interaction and information-sharing.
- Promoting technical knowledge and education among the younger generation through the creation of education and training institutions as well as R&D centres and protecting and rewarding new ideas and technologies through effective IPR laws. (TBIs and other venture-specific technology support should be seen as a consequence of the availability of technology ideas from R&D institutions rather than as a source o such ideas. As there are very few new technology ideas produced in the R&D centres of the emerging economies, they think of TBIs as a source for generating such ideas, which is often not a functional model).

Taking an overall perspective of the incubator movement in general and the TBI initiative in particular, it may be observed that TBIs have not made any spectacular contribution towards stimulating new-technology based firms. While there are isolated cases of TBI/client successes, the overall finding even

in the developed countries is that TBIs' contribution is primarily in helping the venture survive rather than in stimulating high performance and growth. As the early stage survival of firms is difficult because of the 'liability of newness' and the 'liability of smallness', assisting new firms to survive is in itself a very useful. However, in many cases, such support may deteriorate into 'ventilator support', whereby the TBI-system wastes valuable resources on non-viable enterprises. As Manimala (1999: 253) has pointed out, "if an enterprise is viable only because of a concession or support, it is not viable at all, and hence not worth supporting". Similar are the views of other researchers – see for example the observation made by Fazey (1997: 45): "By definition, entrepreneurs succeed or fail mainly through their own efforts; the skills of entrepreneurship can be taught or imparted so that people do not have to reinvent the wheel, but people who need to have their hand held on a day-to-day basis are unlikely to succeed." What is suggested here is that TBIs should follow a policy of providing early-stage support to potentially viable units rather than offer such services just because it is fashionable to do so or because there is external support for such initiatives.

The TBI movement was born in the United States as a consequence of the all-round technological developments happening in the country especially in the universities and the research institutions, where it was felt that neither the institutions nor the new entrepreneurs are able to do the commercial development of research ideas and therefore some high-potential ideas needed help with commercialization. TBI initiatives in the emerging economies, on the other hand, represent the reversal of this process, where it is hoped that TBIs would bring about the much-needed technology development, which is woefully being missed in the universities and research institutions. Instead of technology development stimulating TBI performance, the TBIs are expected to bring about technology development. In terms of the general-and task-environments model proposed above, TBIs are unlikely to be effective without first developing the research culture and initiatives in the universities and R&D institutions. Even the few new-technology ideas brought by entrepreneurial individuals to the TBIs are likely to fail for want of support from the research institutions.

References

Adegbite, A. (2001). Business incubators and small enterprise development: The Nigerian experience. *Small Business Economics,* 17: 157–166.

Aernoudt, R. 2004. Incubators: Tool for Entrepreneurship? *Small Business Economics,* 23: 127–135.

Ahlstrom, D., Young, M. N., Chan, E. S. & Bruton, G. D. 2004. Facing constraints to growth? Overseas Chinese entrepreneurs and traditional business practices in East Asia. *Asia Pacific Journal of Management*, 21(3): 263–285.

Ahlstrom, D. & Bruton, G. 2004. Guest Editors' Introduction to Special Issue: Turnaround in Asia: Laying the Foundation for Understanding this Unique Domain; *Asia Pacific Journal of Management*, 21: 5–24

Ahlstrom, D. & Bruton, G. (2006). Venture capital in emerging economies: Networks and institutional change. *Entrepreneurship Theory and Practice*, 30(2): 299-320.

Ahlstrom, D., Bruton, G. & Obloj, K. 2008. Entrepreneurship in Emerging Economies: Where Are We Today and Where Should the Research Go in the Future; *Entrepreneurship Theory & Practice* 32(1):1-13

Aldrich, H. & Auster, E. R. 1986. Even dwarfs started small: Liabilities of age and size and their strategic implication. In B. M. Staw & L. L. Cummings. *Research in oganizational behavior*. Vol. 8: 165-198.

Allen, D.N., & McCluskey, R. 1990. Structure, policy, services and performance in the business incubator industry. *Entrepreneurship Theory & Practice*. 14 : 61–77.

Arnold, D. J. & Quelch, J. A. (1998). New Strategies in emerging markets. *Sloan Management Review.* 40(1): 7-20.

Autio. E & Klofsten.M 1998. A Comparative Study of Two European Business Incubators *Journal Of Small Business Management*. 36: 30- 43

Bergek, A., & Norman, C. 2008. Incubator best practice: A framework. *Technovation,* 28: 20–28.

Bøllingtoft, A., & Ulhøi, J. P. 2005. The networked business incubator: Leveraging entrepreneurial agency? *Journal of Business Venturing*, 20(2): 265-290.

Brooks, O. J. 1986. Economic development through entrepreneurship: Incubators and the incubation process. *Economic Development Review,* 4(2), Summer: 24-29.

Bruton, G. D., Ahlstrom, D. & Wan, J. C. C. 2001. Turnaround success of large and mid-size Chinese owned firms: Evidence from Hong Kong and Thailand. *Journal of World Business.* 3(2): 146–165.

Carayannis, E. G., & von Zedtwitz, M. 2005. Architecting gloCal (Global-Local), real-virtual incubator networks (G-RVINs) as catalysts and accelerators of entrepreneurship in transitioning and developing economies: Lessons learned and best practices from current development and business incubation practices. *Technovation*, 25: 95–110.

Chandra, A., He, W., & Fealey. T. 2007. Business Incubators in China: A Financial Services Perspective. *Asia Pacific Business Review*, 13(1), January: 79–94.

Chan, K. F. & Lau, T. 2005. Assessing technology incubator programs in the science park: the good, the bad and the ugly. *Technovation*, 25: 1215–1228.

Choloux, F. (1997). The Saint-Nazaire Centre for Local Initiatives. Nantes-Saint-Nazaire Chamber of Commerce and Industry, France. http://www.oecd.org/dataoecd/35/11/2101121.pdf (first accessed on 24 April 2009).

Culp, R. & Shapira, P. (1997). Georgia's Advanced Technology Development Center: an assessment. http://www.oecd.org/dataoecd/35/11/2101121.pdf (first accessed on 24 April 2009).

Doutriax, J., & Simyar, F. 1987. Duration of the comparative advantage accruing from some start-up factors in high-tech entrepreneurial firms. In N. Churchill, J. Hornaday, B. Kirchhoff, O. Krasner, & K. Vesper (Eds), *Frontiers of entrepreneurship research*: 436-451. Wellesley, MA: Babson College.

ESCAP. 2004. *Promoting business and technology incubation for improved competitiveness of small and medium-sized industries through application of modern and efficient technologies*. United Nations Economic and Social Commission for Asia and the Pacific (UN-ESCAP), Trade and Industry Division (TID), Report No: ST/ESCAP/2323, May 25.

Eshun, J. P. 2004. Where do business incubators come from? The origins, evolution, and institutionalization of business incubators 1959-2004. Cornell University Working Paper, http://epe.cornell.edu/institutionsandeship/papers/Eshun.pdf (accessed on 20th April, 2009).

Eshun, J. P. 2006. Where Do Institutions Come From? The Origins, Evolution & Proliferation of Business Incubators, 1959-2004. Paper presented at the annual meeting of the American Sociological Association, Montreal Convention Center, Montreal, Quebec, 10 August 2006, Canada Online <PDF>. 2009-05-25 from http://www.allacademic.com/meta/p103719_index.html

Fazey, I.H. 1997. The UK experience with science parks and technology incubators. http://www.oecd.org/dataoecd/35/11/2101121.pdf (first accessed on 24 April 2009).

Gnyawali, D. R., & Fogel, D. S. 1994. Environments for entrepreneurship development: Key dimensions and research implications. *Entrepreneurship Theory and Practice*, 18: 43-62.

Grant, R.M. 1996. Toward a Knowledge-Based Theory of the Firm Toward a Knowledge-Based Theory of the Firm. *Strategic Management Journal*, Special Issue: Knowledge and the Firm (Winter), 17:109-122

Harbi, S., Amamou, M. & Anderson, A. R. (2009). Establishing high-tech industry: The Tunisian ICT experience. *Technovation,* 29: 465–480.

Harwitt, E. 2002. High-technology incubators: Fuel for China's new entrepreneurship? *The China Business Review,* 29(4), July-August: 26-29.

Hite, J. M. & Hesterly, W.S. 2001. The evolution of firm networks. *Strategic Management Journal* 22(3):275-286

Hoskisson, R. E., Eden, L., Lau, C. M. & Wright, M. (2000). Strategy in emerging economies. *Academy of Management Journal,* 43: 249-267.

http://nbia.org/success_stories/success/index.php and http://www.tap.umd.edu/

Hughes, M., Hughs, P. & Morganz, R.E. 2007. Exploitative Learning and Entrepreneurial Orientation Alignment in Emerging Young Firms: Implications for Market and Response Performance. *British Journal of Management,* 18(4):359-375

Kabiraj, T. & Yang, C. L. 2001. Licensing versus innovation incentives under uncertain government policies. *International Review of Economics and Finance*, 10(3): 247–61.

Kambil A., Eselius, E.D., Monteiro, E.D, (2000). Fast venturing: the quick way to start web businesses. *Sloan Management Review.* 41(4) :55-67.

Kirchoff, B.A., & Phillips, B.D., (1987) Examining entrepreneurship's role in Economic Growth. *Frontiers of Entrepreneurship Research*. Pg. 57- 71

Kirchoff, B.A and Phillips, B.D., (1988). The effect of firm formation and growth on job creation and economic development in the United States.

Khandwalla, P.N., 1977. *The design of organizations*. Harcourt.

Lalkaka, R., Ma Feng-Ling & Lalkaka, D. (2000). Rapid Growth of Business Incubation in China, 2000. International Conference on Business Incubation, Shanghai.

Lalkaka, R. (2003). Business incubators in developing countries: characteristics and performance. *International Journal of Entrepreneurship and Innovation Management*. 3(1-2): 31-55.

Lee. D. H. (1997). Korea's policy towards technology incubators. From OECD 1997.http://www.oecd.org/dataoecd/35/11/2101121.pdf (first accessed on 24 April 2009).

Lindelöf, P. & Löfsten, H. (2004). Proximity as a resource-base for competitive advantage: University–industry links for technology transfer. *The Journal of Technology Transfer,* 29 (3-4), August: 311-326.

Liao, J., & Welsch. H., 2003: Exploring the venture creation process: evidences from tech and non-tech nascent entrepreneurs http://www.babson.edu/entrep/fer/BABSON2003/XXV/XXV-P5/xxv-p5.htm (accessed on 6 August 2009)

Liao, J. & Welsch, H. 2008. Patterns of venture gestation process: Exploring the differences between tech and non-tech nascent entrepreneurs. *Journal of High Technology Management Research*, 19(2):103-113.

Luthans, F., Stajkovic, A. D. & Ibrayeva, E. 2000. Environmental and psychological challenges facing entrepreneurial development in transitional economies. *Journal of World Business*. 35: 95-110.

Manimala, M. J. (2009). Sustainable development through ICT: The need for entrepreneurial action, Chapter 7 (pp. 121-138) of Manimala, M. J., Mitra. J. & Singh, V. (eds), *Enterprise Support Systems: An international perspective*. New Delhi: Sage Publications.

Manimala, M. J. (2008). Entrepreneurship education in India: An assessment of SME training needs against current practices, *International Journal of Entrepreneurship and Innovation Management*, 8 (6): 624-647.

Manimala, M. J. 1999. *Entrepreneurial policies and strategies: The innovator's choice*. New Delhi, Sage Publications.

Manimala, M. J. (1997). Higher education-Enterprise cooperation and the entrepreneurial graduates: the need for a new paradigm, Chapter 6 (pp. 95-118) of Mitra, J. and Formica, P. (eds), *Innovation and economic development: University-enterprise partnerships in action*, Dublin and London: Oak Tree Press.

Manimala, M. J. 1994. Policies and founder characteristics of new technology based firms (NTBFs): A comparison between British and Indian firms. In R. Oakay, (ed), *New technology-based firms in the 1990s*. London, Paul Chapman Publishing: 192- 203.

Manimala. M. J. (1992). Entrepreneurial heuristics: A comparison between high PI (pioneering-innovative) and low PI ventures. *Journal of Business Venturing*, 7(6), 477-504.

Manimala, M. J., Mitra. J. & Singh, V. 2009. Enterprise support systems: Nature and relevance, Chapter 1 (pp: 1-35) of Manimala, M. J., Mitra. J. & Singh, V. (eds), *Enterprise Support Systems: An international perspective*. New Delhi: Sage Publications.

Manolova, T. S., Eunni, R.V. & Gyoshev, B. S. 2008. Institutional environments for entrepreneurship. *Entrepreneurship Theory & Practice.* 32(1): 203-218.

Markman. G.D., Phan, H. P., Balkin. D.B, & Gianiodis. PT. 2005. Entrepreneurship and university-based technology transfer. *Journal of business venturing*, 20: 241- 263

McDougall, P.P., Shane, S., & Oviatt, B.M., 1994 Explaining the formation of international new ventures: The limits of theories from international business research. *Journal of Business Venturing*, 9:469–487.

Mian, S.A, 1997; Assessing and Managing the University tech business incubator; *Journal of business venturing*, 12: 251- 28

Morrison, A. 2000. Entrepreneurship: What triggers it? *International Journal of Entrepreneurial Behaviour & Research*. 6(2): 59-71.

Mourdoukoutas, P. & Papadimitriou, S. 2002. *Nurturing entrepreneurship: Institutions and policies*. Westport, CT: Quorum Books.

NBIA, 2009. Website of National Business Incubation Association, http://www.nbia.org/for_entrepreneurs/ (accessed on 18 June 2009)

OECD, 1997. Technology incubators: Nurturing small firms. http://www.oecd.org/dataoecd/35/11/2101121.pdf (accessed on 18 June 2009).

OECD, 2007: OECD Entrepreneurship Evaluation Zagreb, Croatia May 21 - 25, 2007 Ronald Kysiak, IDEA Partnerships from http://www.oecd.org/dataoecd/32/49/38921201.pdf (accessed on 24 April 2009).

OECD, 2007 b: OECD Reviews of Innovation Policy CHINA Synthesis Report" http://www.oecd.org/dataoecd/54/20/39177453.pdf (accessed on 24 April 2009).

Ojha, A. K. 2009. Innovation and Entrepreneurship in the Indian IT Industry: Contextual impediments. In M. J. Manimala, J. Mitra & V. Singh (eds), *Enterprise support systems*: *An international perspective*, New Delhi: Sage Publications.

O'Neal, T. 2005. Evolving a successful university-based incubator: Lessons learned from the UCF technology incubator. Engineering Management Journal, 17(3), September: 11-25.

Panitchpakdi. S & Clifford, M. 2002 . *China and the WTO: changing China, changing world trade* Wiley

Peng, M. W. 2003. Institutional transitions and strategic choices. *Academy of Management Review*, 28(2): 275–296.

Peng, M. W. & Heath, P. (1996). The growth of the firm in planned economies in transition: Institutions, organizations, and strategic choices. *Academy of Management Review*, 21(2): 492–528.

Peng, M.W. (2001). How entrepreneurs create wealth in transition economies. *Academy of Management Executive*, 15(1): 95–108.

Penrose, E. 1959. *The Theory of the Growth of the Firm*. Basil Blackwell, London

Phan, P. H., Siegel, D. S. & Wright, M. (2005). Science parks and incubators: Observations, synthesis and future research. *Journal of Business Venturing*, 20: 165–182.

Phillips, R. G. (2002). Technology business incubators: How effective as technology transfer mechanisms? ***Technology in Society***, 24: 299–316.

Pridor, R. (1997). Technology incubators in Israel. From OECD 1997 report. http://www.oecd.org/dataoecd/35/11/2101121.pdf (first accessed on 24 April 2009)

Qian, G. & Li, L. (2003). Profitability of small- and medium-sized enterprises in high-tech industries: The case of the biotechnology industry. *Strategic Management Journal*, 24 (9): 881-887.

Rothschild, L., & Darr, A. 2005. Technological incubators and the social construction of innovation networks: an Israeli case study. *Technoinnovation*, 25: 59–67

Samsonova, K. (1997). Technology incubators in Russia and Central and Eastern Europe. From http://www.oecd.org/dataoecd/35/11/2101121.pdf (first accessed on 24 April 2009).

Schoonhoven.C.B. & Eisenhardt.K.M. (1990) .Organizational Growth: Linking Founding Team, Strategy, Environment, and Growth among U.S. Semiconductor ventures, 1978-1988 *Administrative Science Quarterly*, Vol. 35, No. 3 pp. 504-529

Singh, J. V., House, R. J., & Tucker, D. J. 1986. Organizational change and organizational mortality. *Administrative Science Quarterly*, Vol. 31, No. 4 (December 1986): pp. 587-611.

Smilor, R. W., & Gill, M. D. 1986. *The New Business Incubator: Linking Talent, Technology, Capital and Know-How*. Lexington, MA: Lexington Books.

Spender, J.C. 1996 Competitive advantage from tacit knowledge? Unpacking the concept and its strategic implications," in Bertrand Moingeon & Amy Edmondson (eds.), 1996. *Organisational learning and competitive advantage.* London: Sage Publications.

Spitzer Jr., D.M. and Ford, R.H., 1989. Business Incubators: Do We Really Understand Them? In R.H.Brockhaus., N. C. Churchill, J.A. Katz, B.A.Kirchoff, K. H.. Vesper, W.E. Wetzel, Jr (Eds), *Frontiers of Entrepreneurship Research.* Wellesley, MA: Babson College. pp. 436–446

Stinchcombe, A.L. 1965. 'Organizations and Social Structure', in J.G. March (ed.), *Handbook of Organizations*, pp. 142–93. Chicago: Rand-McNally

Tamasy, C. 2007. Rethinking Technology-Oriented Business Incubators: Developing a Robust Policy Instrument for Entrepreneurship, Innovation, and Regional Development?*Growth and Change* 38(3):460–473

Thompson, J.D. 1967. *Organizations in Action.* New York: McGraw Hill.

Van de Ven, A. H., Angle, H. L., & Poole, M. S. (Eds) 2000. *Research on the management of innovation: The Minnesota studies*. USA: Oxford University Press.

Yli-Renko, H., Autio, E., and Sapienza, H. J. 2001. Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms. *Strategic Management Journal*, Special Issue on 'Strategic Entrepreneurship: Entrepreneurial Strategies for Wealth Creation', 22 (6/7): 587-613.