

Technology Business Incubators-The promise for Modern Economic Growth

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Abstract: The proliferation of new technologies and new forms of communication along with relentless globalization has dramatically changed the business concepts and consequent economic growth. Innovation, entrepreneurship and competitive markets are the buzz words in the business economy today. Knowledge based business creation is looking ahead to become the prime drivers of economic growth. Offspring of the intelligent combination of these concepts is the technology business incubators (TBI) harbored within technology parks and often affiliated to technical universities. Backed by the knowledge base, these nascent ventures are platforms for convergence of support in synergistic system. Focused counseling and facilitation services together with smart work space and shared office facilities mark the special features of TBI. The paper first outlines such technology innovation business ventures and then, provides an overview of TBI emphasizing the special roles to be played by the state, business, venture capital and community in stimulating the venture creation process. It also discusses the related issues which make TBI a successful platform to provide catalytic input as part of building innovation based economy. They include (i) technological innovation and entrepreneurship (ii) technological acquisition strategies (iii) sustainability (iv) state-business-university linkages (v) internet incubators (vi) performance enhancement and (vii) constraints and limitations. Examples of TBIs in two developing countries namely, China and India are cited to illustrate world wide acceptance of the venture creation process in shaping innovation based economy. Discussions led to the conclusion that it is now the time to enhance this modality by identifying and applying good practices through systems of benchmarking and continuous learning. A need exists as much as the e-capability exists to establish a virtual world incubation network.

Keywords: Innovation economy, Knowledge based technology, technology parks, business incubators, Technology incubators, entrepreneurship

Introduction

New technologies like, biotech, nano-technology, smart materials, VLSI technology etc. have triggered the wave of knowledge and innovation based economy in the business world today. Knowledge based business creation is looking ahead to become the prime drivers of modern economic growth. As a consequence, innovations, entrepreneurship and competitive market are dramatically changing the current business concepts. One of such concepts favored by many is the knowledge driven business. It is carefully nurtured and stimulated in its initial phases to be grown into a full blown economic enterprise. In that process, state, community, venture capital and knowledge base - all play very important roles. Most often, a good convergence of supports synergizes such business ventures and they are characterized by well planned moves into the market from their very inceptions.

Innovation and knowledge based economy first flourishes as startups within the technology park, innovation business incubators and technology business incubators and then, it moves into the competitive market. These business concepts are highly interrelated and form integral part of the innovation economy viewed as the lead economic venture for 21st century.

The world wide trend of business shows that small businesses account for almost half of the total economy of the countries (both developed and developing). In this context, knowledge and innovation based economy, startups, business incubators and technology business incubators (TBIs) contribute significantly to the economy of the country. It is expected that with the proliferation of technology these ventures would outweigh conventional concepts in-terms of economic growth of the country.

In this paper, TBIs and similar such innovation business ventures are detailed first in a separate section. Then, an overview of TBI stating the roles of the state, business, venture capital and community in stimulating the venture creation process are outlined. Finally, related issues like, technological innovation and entrepreneurship, technological acquisition strategies, sustainability, state-business-university linkages, performance enhancement and constraints which make TBI a successful venture are discussed.

Innovation Economics

Innovation economics is a growing economic doctrine that reformulates conventional economics theory so that knowledge, technology, entrepreneurship, and innovation are positioned at the center of the model

rather than seen as independent forces that are largely unaffected by policy. Innovation economics is based on two fundamental tenets: that the central goal of economic policy should be to spur higher productivity through greater innovation, and that markets relying on input resources and price signals alone will not always be as effective in spurring higher productivity, and thereby economic growth.

Innovation economists believe that what primarily drives economic growth in today's knowledge-based economy is not capital accumulation, as claimed by neoclassicalism asserts, but innovative capacity spurred by appropriate knowledge and technological externalities. Economics growth in innovation economics is the end-product of knowledge (tacit vs. codified); regimes and policies allowing for entrepreneurship and innovation (i.e., R&D expenditures, permits, licenses); technological spillovers and externalities between collaborative firms; and systems of innovation that create innovative environments (i.e., clusters, agglomerations, metropolitan areas).

Empirical evidence worldwide points to a positive link between technological innovation and economic performance. The drive of biotech firms in Germany was due to the R&D subsidies to joint projects, network partners, and close cognitive distance of collaborative partners within a cluster. These factors increased patent performance in the biotech industry. Additionally, innovation capacity explains much of the GDP growth in India and China between 1981–2004 but especially in the 1990s. Their development of a National Innovation System through heavy investment of R&D expenditures and personnel, patents, and high-tech/service exports strengthened their innovation capacity. By linking the science sector with the business sector, establishing incentives for innovative activities, and balancing the import of technology and indigenous R&D effort, both countries experienced rapid economic growth in recent decades. Also, the Council of Foreign Relations asserted that since the end of the 1970s, the U.S. has gained a disproportionate share of the world's wealth through their aggressive pursuit of technological change, demonstrating that technological innovation is a central catalyst of steady economic performance. Worldwide examples of innovation economics exist in the successful march of the following few technology business.

- semiconductors and information technology in Silicon Valley in California
- high-technology and life sciences in Research Triangle Park in North Carolina

- energy companies in Energy Corridor in Houston, Texas
- financial products and services in New York City
- biotechnology in Genome Valley in Hyderabad, India and Boston, Massachusetts
- nanotechnology in Tech Valley, New York (College of Nanoscale Science and Engineering)
- precision engineering in South Yorkshire, United Kingdom

Business Incubator, Technology Park and TBI

Start-ups receive elaborated interest with policy makers and researchers alike. Young firms incorporate the potential for future innovation, industry development, job creation and tax revenue and are thus seen as the motor for economic growth and development. The downside of starting a business in an environment of high internal and external uncertainty is that young start-ups experience high failure rates.

One important tool for Start-up support and development is the Business Incubator. The concept of the business incubator is known for decades, but still lacks theoretical foundation. Since the concept of the incubator has been introduced, scholars and practitioners have used different terms and categorizations for the many types of incubating organizations that have developed. Incubator organizations and similar concepts are labeled as technology or science park, innovation center, business accelerator, campuses, venture catalysts, venture service firms etc. Such as an incubator is used to breed chicken and to support early-born babies until they are strong enough to survive without constant medical support, it is the idea of the business incubator to shelter and support young and promising firms until they are strong enough to survive in rough markets on their own.

An incubator can be defined as a local agglomeration of firms, usually within one building or in close proximity to it, in which an identifiable administrative entity (the incubator management) supports legally independent organizations during their start-up and early growth phases. The contractual affiliation of the young company to the incubator is limited to the time it takes the young company to be able to survive on its own, seizes to exist or exceeds a time limit set by the administrative entity. The incubators' mission is to support the fast development of the incubatee to an economically independent organization. Publicly sponsored incubators, financed by city or regional

development agencies, mainly focus on job creation and regional development (Carroll 1986, Kuratko and LaFollette 1987, Löftsen and Lindelöf 2002, Lumpkin and Ireland, 1988). Also, technology promotion is one goal of policy makers (Halkides 2001). University sponsored incubators aim mainly at commercialization of university research (Kuratko and LaFollette 1987, Rice 2002, Rothaermel and Thursby 2005), while investors such as venture capitalists (VC) seek to identify promising innovations and to gain profit from the growing value of equity shares, e.g. with an IPO (Allen and McCluskey 1990, Lumpkin and Ireland 1988). Similarly, corporations set up incubators to either develop intrapreneurial ideas independent from the daily business or to support external young firms which seem to provide future strategic potential for new business or business extensions (Hansen et al. 2000).

The typology of business incubation systems

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

Business Incubator (BI)

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

Technology business incubator (TBI)

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

commercialize new technologies through innovative entrepreneurial ventures.

Technology Park (TP)

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

The most important distinction is to be made between for-profit and non-profit incubators (von Zedwitz 2003). While VC-based and corporate incubators by definition are profit oriented, other incubators are either organized as for-profit or nonprofit. For-profit incubators have in recent years, especially during the “dot.com”- boom received quite some attention with researchers and the media, but in reality only a very small minority of incubators are for-profit (about 10%) (NBIA 2005, Stevens et al. 2005).

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

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

- Integration of the TBI into the TP creates also some additional positive effects
- companies associated to or servicing a graduated company remain located nearby
- local “business angels” and venture capital operators prefer an involvement in fast-track businesses staying in the area of their interest.

Overview of TBI

TBIs are promoted to achieve the following objectives:

- Creation of technology based new enterprises
- Creating value added jobs & services
- Facilitating transfer of technology
- Fostering the entrepreneurial spirit
- Speedy commercialization of R&D output
- Specialized services to existing SMEs

Criteria for selection of location

Ideally a TBI should be located near a source of technology and knowledge i.e. around R&D Institutions/Academic Institutions or it should have strong links with such institutions to ensure optimal use of the already existing expertise and facilities thus keeping the cost of the TBI on lower side. Locating TBIs in such location could also reduce time lag between technology development and its commercialization. Further, as the success of a TBI largely depends on its location and management besides quality of tenant enterprises, following aspects relating to the HI need to be kept in view while selecting location of the TBI:

1. R&D track record and subsequent commercialization of R&D output
2. Dedicated team of R&D persons
3. Industrial milieu in the region
4. Proximity to other R&D/academic institutions
5. Infrastructure, facilities and expertise available
6. Strong commitment and willingness of the HI

Principal requirements

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

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

Structure of the implementation plan

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

- Mission statement and strategic objectives, defining the goals of the TBI.
- TBI design and feasibility study, namely TBI type, location, site and premises, service system, technology resources, co-operation with research organizations, national and international networking.
- Legal structure, defining legal status and type of ownership (public / private / semi-public).

- Fund raising, governmental contributions, private investment, financing vehicles for tenants, nonfinancial contributions (such as buildings and infrastructure).
- Project organizational structure, Steering Committee and project team.
- Human resources implications, management team and support staff of the TBI, responsibilities and reporting, motivation and rewarding.
- Financial planning, particularly identification of financial resources, estimation of capital investment needed, operating expenses, income structure, pricing policy and cash flow forecast.
- Promotion of the TBI and client detection, dealing with promotion tools, definition of key client sectors and marketing strategy.
- Rules for admission and exit of tenants, defining the conditions for selection and departure of tenants.
- Implementation plan and timing, summarizing steps that should be taken to set up the TBI including time scale and responsibilities.
- Monitoring and Evaluation of the TBI activity, including the design of criteria (indicators) needed for the evaluation of TBI performance and the monitoring of TBI activities.
- Risk analysis, dealing with analysis of potential risk factors (strategy, financing, space capacity, and management), how to cope with difficulties and to minimize risks.

Facilities and services of TBI

TBIs should provide their clients (tenants) with a comprehensive range of facilities and services. They include the following:

- *Incubator space*, either in the form of offices, workshops, laboratories or halls available at low cost. The location of TBI near industrial estates or technology parks may be useful to help tenants find permanent premises as they graduate (usually after 3-5 years).
- *Common services*, which may include secretarial support, telephone, fax, Internet, LAN (local area computer network), security services, reception and mailing facilities, access to office equipment, meeting rooms, conference facilities, exhibition space and catering.
- *Enterprise counseling*, namely assistance to the elaboration of business planning, access to

accounting, legal, marketing, licensing and financial expertise.

- *Access to financial resources*, namely early-stage financing (seed funds, venture capital funds), soft loans and grants.
- *Technology counseling and RTD (Research and Technology Development) services*, namely in choosing innovative technologies, providing access to research specialists, matching with partners from universities and research organizations, improving productivity, quality control and maintenance.
- *Networking services*, encouraging business relations inside the TBI and providing information on networking possibilities with business actors outside the TBI nationally and internationally.

Performance Parameters and Expected Output

The performance of TBIs would be judged based on the following parameters:

- Number of tenant enterprises promoted and their growth pattern
- Number of businesses graduating successfully and their growth
- Number of new jobs generated
- New technologies commercialized
- Quality of services offered
- Number of consultancy jobs undertaken
- Net revenue earned
- Return on Investment
- Up-gradation/modernization facilitated in existing units

Issues related to TBI

Sharply declining cost of communications is breaking down the barriers of time and space that separate markets. As a result, several issues are closely related to TBI. Unless those issues are recognized and attended to, technology innovation processes in general cannot progress smoothly. These issues mainly deal with technology innovations being carried forward by entrepreneur, competitive market and acquisition strategies. Further, sustainability, linkages, and incubators as convergence platform require great attention.

Technology innovation and entrepreneurship

Technological innovation is the process that drives a concept towards a marketable product or service; it contributes towards raising productivity and competitiveness - the engines of economic growth. The entrepreneur is the agent of change who identifies an innovation to match a market opportunity and mobilizes the human and financial resources to deliver the product at competitive costs and quality, in order to meet (or create) the customer's needs. Competitiveness is the state achieved at enterprises by wise decisions on the use of factor endowments, within an environment of supportive policies, sound infrastructure and domestic/international rivalry.

- i) Establish supportive policies and Instruments
- ii) Build and focus the education system
- iii) Tackle the hurdles from venture concept to Commercialization
- iv) Financial support to promote innovation
- v) Business development services
- vi) Promote innovative structures such as technology business incubators (TBIs)

Technology acquisition strategies

The new 'black box' of technology can be prised open by industrializing countries in alternative ways. At the national level, an appropriate initial strategy in many situations is a cascade of first, importing equipment and know-how; then acquiring higher-level design and operating experience, to be adapted, improved and applied; and on to indigenous innovation and exports, both of technology-based goods and know-how itself.

In the short term, the nation (and a company) can make good progress (and money) by using other peoples' innovations and purchasing embodied research in capital equipment, with a balance between payments for intellectual property rights *and* investments in adaptation, improvement and reverse engineering. In most industrializing countries, the bulk of the formal R&D is done in publicly funded laboratories, much less in the universities and corporations.

For the longer term, the nation has to move from imitation to innovation, more so as the advanced proprietary technologies become difficult to buy. This requires analyses of the strategic implications of global change and competitive advantage for niches in regional and international markets, and realistic assessments of current capabilities and resources, to identify the gaps and take action on technical support

services, human resource development and special financing instruments.

Technology business incubator

Business incubators, evolving in the early 1980s from experiences with other business development services, have the purpose of assisting the new venture creation process (Rice and Mathews, 1995). They provide affordable work space as well as shared facilities, counseling, training, information and access to external networks for entrepreneurial groups. This focused help to selected firms has been shown to increase manyfold their chances of survival; the evidence also indicates that the initial subsidy provided by the state is returned as taxes to the exchequer, in addition to other social benefits such as stimulating entrepreneurship and cultural change.

Growth has been very rapid, and what the world needs now is not just more incubators, but improved ones. Counting the numbers of incubators is a hazardous task, as the definitions vary markedly from country to country. Also, the situation is dynamic while information flows are sporadic. Often the start-up entrepreneurs' task is to create jobs for themselves and conserve their limited funds; only after they graduate and leave the incubator may some grow exponentially, creating employment, incomes and taxes.

Sustainability

Being a start-up business to serve start-ups, the incubator itself must mimic the dynamism of entrepreneurial ventures, with the prospect of becoming self-reliant within say five years of operations. The majority of incubators in both developed and developing countries, however, operate on a non-profit basis and with economic development goals, deriving their incomes partly from rentals and some services, supplemented by subsidies (referred to euphemistically as 'infrastructure investment' or 'venture socialism').

That being said, each incubator is different from another, and the above characteristics may vary in degree of pertinence. Importantly, all incubators - traditional and tech-based - should concentrate on providing the software of counseling, training, information and networking services, as well as the hardware of space and facilities. Where the market failures are in access to affordable work space and support services, the convergence provided in an incubator could be the preferred system.

Incubator as a convergence platform

The Technology Park/Business Incubator provides the platform for convergence in a synergistic support system. Incubators currently serve businesses within walls *and* also affiliates that prefer to work in their own premises. The 'third-generation incubators' now de-emphasise low rentals and focus on enhanced business services, both for tenants in the facility and affiliates on an out-reach basis. Further, they pre-incubate nascent entrepreneurs and help those who have graduated. The Technology Park Malaysia and the Multimedia Super Corridor represent efforts to provide a variety of support services in an integrated manner.

State-business-university-community linkages

The role of the government is essentially to developing the technical infrastructure, policy framework and initial finance, in order to catalyze the venture creation process. The private sector assists through mentoring, in-kind support, 'patrons club' membership subscriptions and sub-contracts. Typically, business invests in an incubator when effectiveness is demonstrated, or as social responsibility (for instance, South African Breweries), for intra-preneurship, or for profits (as in venture capital affiliated), or to acquire innovations (as in the case of the new corporate and Internet incubators). The technical university and technological research institute constitute the knowledge base for the formation of technical skills and innovations. Professional networking and community involvement provide the underpinning of support. The associations provide advocacy, information and training.

There is significant *potential for synergies* between a technology-based incubators, an affiliated technical university, both sited in proximity to a technology park, provided that this is planned from the start, all players are induced to buy-in to this potential, and the administration proactively pursues it (Lalkaka and Bishop, 1995). There can be conflicts as the purpose of the incubator and park is to support enterprise-creation, while the culture of the university is to provide learning, within its longer cycles of the academic calendar, student graduation and faculty sabbaticals.

Good examples of synergies are at the Biominas biotech incubator at Belo Horizonte, Brazil, the SIRIM and Technology Park Malaysia, the Ruhuna Business incubator linked to the University and Business Association in Sri Lanka, and the Panama Technology Business Accel@rator in the City of Knowledge, Panama. In the Olympiad of venture creation, success can be expressed as the five interlinked rings:

1. *public policy* that facilitates venture creation and provides the business infrastructure
2. *knowledge base* of university and research
3. *private sector partnerships* for mentoring and marketing
4. *professional networking*, national and global
5. *community involvement* to promote Entrepreneurism

Lessons from the internet incubators

Despite the dot-com collapse, the for-profit, VC-driven, management consultancy-focused incubation modality has lessons for all incubators. These include the need rapidly to build a smart workspace, a competent management team with an appropriate skills mix, mobilize equity financing through strategic partners and angels, clear business model and path to profitability.

At the country level, the risk-taking environment has to be right for new business creation, based on innovations in traditional and new processes, on the best talent home-grown and immigrant, and recognizing that scale is important but so also is speed.

Enhancing performances

Raising the majority of incubators to a higher performance level would help move the industry towards the key performance goals of high relevance, efficiency, effectiveness, utility and sustainability. From the perspective of the local sponsors and international donors, sustainability implies the capability to perform effectively even after the external support has declined or ceased. For the clients, it is the satisfaction that the benefits received in building skills, accessing finance and growing are well in access of the costs.

An initial UN-sponsored assessment of incubation in seven industrializing countries (Brazil, China, Czech Republic, Mexico, Nigeria, Poland, Turkey) has pointed to the benefits and pitfalls of incubation, and the imperatives of providing the software of value-adding counseling, training, information and networking services, as well as the affordable facilities (Lalkaka and Bishop, 1996). Many programmes have been growing rapidly but without the commensurate efforts to enhance their effectiveness and impacts. Benchmarking could have a key role in this respect. Benchmarking is the process of identifying best practices on selected performance indicators among a group of comparable incubators and assisting the poor performers to enhance their standings (Costa-David *et al.*, 2002).

While one environment differs markedly from another, the European Union (EU) experience in the benchmarking of European incubators has lessons for other regions. The EU programme involved 15 countries, and considerable effort was deployed in arriving at a consensus among managers from each country on the framework conditions, distinguishing characteristics as well as the common indicators to be assessed. It would be easier to make a start on a benchmarking programme on incubators with comparable approaches within a single country.

The willingness of incubator managers has to be mobilized, with assurance of confidentiality in the information they provide. It is not possible to make valid comparisons on a continuing basis without a shared understanding of all concerned. It certainly would help to have a committed source for funding such an exercise, as was the case for the EU programme. The sponsors need to encourage (and make financial provision for) the collection of all pertinent data, and be realistic in terms of the time and expectations of such a benchmarking programme.

The real, longer-term benefits can only come when the processes are established for securing the data required to assess each coefficient, honestly, accurately and promptly; to disseminate the distilled data confidentially on an agreed schedule; and then, importantly, to help the incubator management raise its level of performance to higher levels, attribute by attribute.

In the pursuit of good-better-best practices, it has to be clearly recognized that such practices are location, time and culture specific. At best, the success factors in establishing, operating and evaluating incubators can be adapted to the local conditions, as they 'reconnoiter globally, re-engineer-locally'.

TBIs India and China

Among developing countries, India had an early start in the 1950s on building comprehensive state-supported programmes for small business support, scientific research and entrepreneurship development. For instance, the Entrepreneurship Development Institute - India, Ahmedabad, is world-class and the network of laboratories of the Council for Scientific and Industrial Research with 10,000 researchers is among the world's largest.

With support from the UN Fund for Science and Technology, three pilot TBIs were initiated in the late 1980s in India. While a good start was made on business plans, training and work space, the initial state financial support to continue operations was

insufficient. Today, full-fledged incubators are being established at the Indian Institutes of Technology in New Delhi, Mumbai and Chennai, and at several other locations. At Hyderabad, the Government of India's Materials Research Center has initiated the Advanced Materials Technology Business Incubator (AMTBI) on its campus. The objective is to assist entrepreneurs to commercialise materials technology research into advanced products for local and international markets.

The 17 Science & Technology Entrepreneurs Parks (STEPs) are similar in many respects to TBIs. These are located at technical universities, sponsored by the Government's Department of Science & Technology. The STEPs are being refurbished, and staff skills are being upgraded, to become more helpful to graduate students and others seeking self-employment.

A significant initiative of the GOI Department of Electronics is the Software Technology Parks (STP-I) Program, to help strengthen the India - Software Advantage. The 18 STPs are essentially smart workspaces, not really parks, for supporting software companies. Through 'single-point contact' for regulatory functions, the sponsor can get duty-free imports of equipment, custom-bonded warehouses for materials, income-tax exemptions for five years, repatriation of know-how fees and royalties, in order to develop and export software (domestic sale up to 50 per cent of software exported). STP-I also has a facility in San Jose', CA, to help small software companies. In addition, the Export Processing Zones at seven port cities are essentially for software exports.

There are about 400 incubator-variants, involving a government investment of US\$1.6bn. China pioneered the concept of International Business Incubation, starting in 1996, to facilitate foreign tech-based businesses to enter their markets. It is now establishing incubators in Moscow, Singapore and UK to help its entrepreneurs move abroad.

Strong government leadership in an era when market forces were still in the early stages of development has been the main determinant of China's large incubation system (Lalkaka *et al.*, 2000). This expansion is facilitated by major subsidies - typically up-front in land and buildings, low-cost loans by local state agencies, and some on-going operating subsidies. There is a continuing demand on low-cost space, together with benefits from the state by being resident in an incubator. Further, 'anchor tenants' (including banks, supermarkets, restaurants) help raise revenues. Chinese incubators have also been a means of creating cultural change. They have helped bridge the gap between government research and the marketplace, fostering entrepreneurial attitudes, and facilitating the

re-entry of Chinese scholars abroad. The incubator associations have been effective in promoting continuous interaction and learning opportunities among the managers.

The weaknesses of the programme, well recognized by the Chinese authorities, include the focus on the 'hardware' aspects. The managements are generally composed of civil servants who have little business experience. The services provided are typically not on a cost-recovery basis, which limits their quality and sustainability. In terms of rapid expansion, the programme has been outstanding. Qualitatively, incubators in China - as elsewhere - have much to do to rigorously assess their programmes and enhance performance.

Conclusions

Innovation and knowledge based economy leading to the business concepts like business incubator, technology park, technology business incubators (TBI) and knowledge driven business are discussed briefly as a background to project TBI as a promise for modern economic growth. The features of TBI and the role of venture capital, state, entrepreneurs and community to make TBI a successful business endeavor are outlined. The set of associated issues making TBIs a good catalyst for modern economic growth are identified and deliberated at length. Examples of TBIs in China and India are cited to indicate the acceptance of the concept in developing countries. This modality is now being perused all over the world and it is felt that through proper benchmarking, systematic learning and virtual networking of TBIs worldwide, the endeavor can become the most powerful support to the knowledge based economy of 21st century.

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