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Technology Business Incubators in China and in India: A comparative analysis

Mingfeng Tang[*], Angathevar Baskaran[**] and Jatin Pancholi[***]

Abstract

This is the first part of our three part comparative study of Technology Business Incubators (TBIs) in China and India. For this we employ the integrative framework developed by Mian (1997) and its adaptation to analyzing the performance of TBI, which uses three sets of variables for analysis: management and operational policies, services, and performance outcomes of TBI. The determinants we introduce into Mians's model highlight the financial, networking and organizational aspects of the incubation system.

We present an overview comparison of TBIs in China and India which provides an overall understanding of TBI environment in these two emerging economies. We mainly focus on: objectives, structure and governance of incubators, selection of tenants/incubatees, funding for incubators and tenants, services provided by incubators, performance and outcomes. By analyzing the contexts for their emergence in both countries, we identify similarities and differences between the two systems and explore the reasons for performance differences. This paper prepares the ground for the next stages of the research which involves national surveys of TBIs and tenants to explore the strength and weaknesses of the TBIs in these two countries and compare the success or failures of incubatees/ tenants of incubators in China and India which will help to identify policy learning for both countries in particular and also for other developing countries in general.

The contribution of our paper is twofold: first, the adaptation of the integrative framework developed by Mian (1997) and the second, the comparative study of two major emerging economies which fills an important gap in the TBI literature.

Keywords: Technology business incubators, TBI, high-tech incubators, tenants of TBI, incubatee companies, start-ups.

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1. Introduction

It is now widely accepted that the innovation process is interactive, complex, uncertain and context dependent. Managing innovation requires paying attention to issues such as developing appropriate learning abilities to drive new knowledge creation, accessing resources (human and financial), coordinating activities from invention (R&D) to market, and creating synergies among them (Bond and Houston, 2003, Rein, 2004), developing effective collaborations (Khilji et al., 2006, Knudsen, 2007), communicating and disseminating knowledge (Bij et al., 2003) within and outside the innovative organization, gathering information with respect to the external environment (customers, suppliers, technology developers) combined with information diffusion and processing activities designed to ease the decision-making process (Riel et al., 2004), etc. If these issues are crucial for existing firms, they might be even more important for start-ups. In this paper we consider Technology business incubators (TBI) as organizations supporting the creation of new innovative ventures. The aim of TBI is to provide an infrastructure to help new high-tech companies to overcome the barriers linked to the complexity of the innovation process.

Our main investigation focuses on the way TBI should be managed to enable the creation of successful start-ups. The governance structure for incubators, the funding system for incubators and new ventures, the selection procedures for start-ups and the services supplied by incubators are fundamental elements in this type of analysis. Based on these elements, we build an integrative framework to compare the management of TBI in China and India to analyze in what respects they are similar or different, and investigate what elements might explain their respective performance.

The analysis is structured as follows: first, a review of the literature based on various understanding of TBI, the critical success factor approach and comparative studies reviewed helps us to identify the originality of our contribution; Second, we describe the methodology used to build our analytical framework and gather the data; The third section of the paper is devoted to presenting our analysis and results. Finally, we draw some conclusions and make some recommendations for policy and future research.

2. Literature Review

2.1 Various Understandings of Technology Business Incubators (TBI)

Early incubator studies are primarily descriptive, generally embracing different understandings of business incubator's concepts and functions (Allen, 1985; Allen and Levine, 1986; Smilor and Gill, 1986). Findings of their research suggest that an incubator must have a physical plant with low market rents, shared service, logistical support, and business consulting services (Gatewood, Ogden and Hoy, 1986; Allen, 1985; Peterson *et al*., 1985) and also link effectively talent, technology, capital and know-how to leverage entrepreneurial talent; accelerate the development of new

technology-based firms, and speed the commercialization of technology (Smilor & Gill, 1986). Since the 1990s, researchers have begun to complete the concept by describing the role and services of business incubators. Incubators hatch new ideas by providing new ventures with physical and intangible resources (Allen and Bazan, 1990) and speed up new ventures' establishment and increase their chances of success (Hansen *et al*., 2002). They help entrepreneurs develop business and marketing plans, build management teams, obtain venture capital, and provide access to professional and administrative services (von Zedtwitz and Grimaldi, 2006). Counseling interactions with incubator management help ventures to gain business assistance whereas networking interactions with incubator management help ventures to gain technical assistance (Scillitoe and Chakrabarti, 2010). In sum, various understandings identified above of business incubators extend the initial focus on physical space with basic facilities to value-added services and systematic incubation process.

2.2 The Critical Success Factors Approach to TBI

The second main stream of business incubator studies focus on the critical success factors of technology business incubators (university incubators included). Successful new technology business firms (NTBF) are widely viewed as one of the driving forces in the growth of local, regional, and national economy and innovation capability building. The creation of NTBF constitutes one of the tools used to implement governments' S&T policies. Studies of technology business incubators (TBI) began in the 1980s (Mian, 1996b). Most focus on the critical success factors influencing the efficiency of TBI (Allen, 1985; Allen and Levine, 1986; Smilor and Gill, 1986; Campbell et al., 1988; Mian, 1991, 1994; Chan and Lau, 2005; O'Neal, 2005). Mian (1991, 1994) provides a checklist for a successful facility and develops a framework for assessment of TBI. Mian tries to assess the value-added contributions of TBI to new ventures (Mian, 1996a), and provides insights into elements that are key to making TBI successful in developing new research/technology based firms (Mian, 1996b). According to his results, in addition to certain TBI services (shared office services, business assistance, access to capital, business networks, rent breaks, etc.), some university-related inputs, such as university image, laboratories, equipment, and student employees add major value for new ventures. Similarly, O'Neal (2005) highlights the success factors that facilitate TBI to develop new ventures: integrating clients in the wider technology development system; fostering interactions among clients; providing management services; providing access to staff, outside experts, and an incubator advisory panel; and providing access to external funding sources, university resources, community/local government economic development agencies, and other entrepreneurial support organizations.

Links with universities are underlined in the literature as a decisive factor for success. Several research findings confirm the positive impacts of university linkages for technology-based ventures. TBI have been found to increase the survival rate of new ventures, to promote higher growth than in off-incubator firms, and to accelerate time-to-market and likelihood of successful innovations. Colombo and Delmastro (2002) show that ventures in science parks in Italy that are linked to universities demonstrate higher growth rates than their off-park counterparts. These on-park ventures also perform better in terms of adoption of advanced technologies and ability

to participate in international R&D programmes and the establishment of collaborative arrangements, especially with universities. Ferguson and Olofsson (2004) investigate survival and growth in new technology business firms located on and off two Swedish science parks linked to universities. They find on-park ventures have significantly higher survival rates than their off-park counterparts but insignificant differences in terms of sales and employment. Rothaermel and Thursby (2005) focus on the ties between ventures and universities and observe that strong ties to a sponsoring university, as measured by licensed technology or faculty as senior management, reduce the likelihood of firm failure but retard graduation from the incubator. Weak ties to sponsoring universities, such as informal interaction with faculty, do not appear to influence outright firm failure or timely graduation. McAdam and McAdam (2008) prove that university linkages are useful in terms of facilitating and developing networks with third parties and providing access to research and technology, particularly to biotechnology and information technology.

Although the critical success factors approach provides a way to assess the efficiency of TBI, some success factors may be critical in some cases, but may not be key in other cases. For example, entrepreneur training and virtual networking play critical roles in operating European TBI, whereas company financing and management functions are emphasized for the performance of TBI in the USA (CSES, 2002). Therefore, there is a need for an integrative and systematic approach to assessing the efficiency of TBI at a general level.

The literature cited above is mainly based on a non-systematic critical success factors approach. The first novelty of our paper is our focus on the integrative framework developed by Mian (1997) and its adaptation to analyzing the performance of TBI in China and India. Mian's model is based on three sets of variables which we use as the framework for our analysis: management and operational policies, services, and performance outcomes of TBI. The determinants we introduce into Mian's model highlight the financial, networking and organizational aspects of the incubation system.

2.3 Comparative studies of TBI

The third main stream of business incubator studies centers on the comparative studies of TBI. Comparative studies mainly show how the nature of incubators (TBI, public or private) influences the efficiency of the incubator system. Philips (2002) compares TBI to private and hybrid types of incubators in the US and finds that the first type does not significantly influence the declared objective of technology transfer. This is probably due to legal impediments to licensing university research for commercialization, conflicts of interest considerations between universities and their faculty members, and conflicts of interest between university posts and start-up self-employment for faculty members. Becker and Gasmann (2006) compare TBI with corporate incubators and show that corporate incubators can reduce in-house R&D costs and time, as well as investment risks, on the basis that external technology can be sourced from start-ups and university labs. Thus, corporations shift the work focus to business building and commercialization of external technology in these forms of outside-in innovation. TBI, on the other hand, tend to develop internal technology derived from their research labs and focus less on business management. To promote the performance of TBI, Becker and Gasman suggest that TBI should learn from corporate incubators in relation to a clear mission orientation, industry and

public representatives on advisory boards, value-added services to start ups and efficient management of resources. Von Zedtwitz and Grimaldi (2006) characterize five incubator archetypes in Italy and conclude that differences in competitive scope and strategic objectives influence the quality of incubator services and the way incubators are managed. Publicly-funded incubators are generally managed by people with no business experience or financial skills; thus, their competence profiles, service levels, and performance outcomes are different from those of privately-funded incubators, which are often run by professionals.

Even though TBI are widely appraised as efficient for the promotion of academic technology transfer, comparative studies have highlighted the weaknesses of publicly funded TBI, and have pointed to the need for policy makers and incubator managers to improve their efficiency. However, with the exception of Lee and Osteryoung (2004), both the critical success factors approach and comparative studies are based mainly on specific cases within national boundaries[1] and with a particular focus on US examples. Few studies have involved cross-country analysis of TBI in currently emerging countries. The second novelty of our paper is in comparing and assessing the respective performance of the Chinese and India TBI systems at a general level, based on descriptive data. We explain how TBI emerged in these countries; how they function and the lessons that each can learn from the other.

3. Research Methodology

The aim of this paper is to compare and assess the management of TBI in two emerging countries by:

- Building an analytical framework based on a review of the literature;
- Collecting data for empirical investigation.

Our research focus is twofold: assessing in a comprehensive way the management of TBI, and comparing two different national systems, both of which are enabled by an appropriate analytical framework. This dual focus structured our literature review (critical success factors approach and comparative studies). A large part of the literature is based on the former approach, which assesses the efficiency of TBI. Most papers adopt a partial approach that does not grasp the complexity of the TBI system (cf. literature review below).

Mian (1997) developed an integrative framework related to the performance assessment and management characteristics of university incubators. He distinguishes three sets of variables:

- *Management policies and practices:* program goals, structure and governance, financing and capitalization, target markets, entry/exit policies, tenant performance review policy, equity/royalty policy; intellectual property;
- *Services and their impacts:* shared incubator services and university-related services;

- *Performance outcomes:* program growth and sustainability; tenant firm survival and growth; contribution to sponsoring university mission, community-related impacts.

We use these three broad categories in our study, but slightly change the types of variables analyzed within each one. These changes are guided by the following conceptual point of view. The economic justification for incubators is related to resource allocation and resource creation issues. In other words, the role of incubators is to help tenant firms to overcome the barriers linked to the characteristics of the innovation process. Small and medium sized enterprises (SMEs) and start-ups are often seen as entrepreneurial and flexible organizations able to adapt to the evolution of the environment, but suffering from lack of resources, in terms of funding and skills, and from dependence in terms of key personnel, clients and assets, which might induce fragilities. These specificities are further accentuated in the company creation phase. The entrepreneur usually lacks the financial resources needed to start a firm and develop the technology, and may not be knowledgeable about funding possibilities (funding systems are often very complex). In the incubation phase, the technology is subject to high uncertainties linked to technological and commercial issues. Not only must the entrepreneur build the organization, it is also necessary for him or her to understand the environment. In order to survive and develop, the entrepreneur has to build appropriate learning abilities, to coordinate internal activities, to collaborate with complementary partners (universities, suppliers, future clients) and to create a network, to negotiate property rights, to screen and internalize information with respect to the external environment and to communicate with other organizations. The variables we include in our framework allow an understanding of how incubators help start-ups to build competences, and tackle resource allocation and creation issues. We emphasize the financial (resource allocations to the incubator and the start-up) and networking, services related to the building of networks) aspects.

For our data collection we employed multiple data collection methods, but largely from secondary sources for this part of our research. The data collected include: a) Annual quantitative and qualitative surveys of TBI mainly in the case of China (annual data are limited in the case of India) and other sources of rich information about the organization of incubators, the funding systems, performance, services and data on numbers of tenant firms, etc; b) official documents describing and assessing the incubation systems of both countries; c) archive documents and other secondary sources. For the subsequent stages of our study, we will survey the TBIs and their tenants through administering questionnaire and interviews and will utilize other documents to corroborate information provided by the surveys and to complement our understanding of the two systems.

4. Background of TBIs in China and India

Growth of TBIs in China

Since the 6th five-year plan (1981-1985) in China, successive national plans have focused on technological development. Several S&T programs have been created to diversify the sources of S&T funding and to increase R&D expenditures, and also to introduce new incentives, better quality and higher performance in the S&T system. Specific attention has been devoted to the need to commercialize technological activities and to encourage collaboration between research and production. In this context of reforms, the Chinese Ministry of S&T sponsored high-tech business incubators in 1988 through the Torch Program. The idea was to create high-tech business incubators to promote the commercialization and industrialization of S&T findings. The first TBI was established in a decentralized way, not within the frame of an existing public policy. In 1987, Wuhan created a TBI in Eastlake new technology development zone. The original aim of this TBI was to encourage academic researchers to create technology ventures. At the beginning, it provided very limited services in incubation place and administration support. After seven months, it got the approval from the local government and then went under the umbrella of Torch Program. Pushed by the bottom-up spontaneity and the objective of developing high-tech industries, in 1996 the State Council announced regulations for accelerating the commercialization of S&T findings and in 1999 underlined its determination to strengthen S&T innovation by developing its high technology industry, demonstrating government approval and support for the development of technology business incubators. Up to 2008, 670 technology business incubators were set up. These TBI occupied 231.6 million square meters and hosted 44346 ventures which generated 18.662 billion Euros and employed 928000 persons. In all, 31764 ventures in total have been graduated from these TBI by 2008.

Growth of TBIs in India

India's exposure to technology incubators began with the three pilot projects – Birla Institute of Technology & Sciences (BIT), Pilani; Shriram Institute, New Delhi; and MITCON, Pune – which were set up under the initiative and support of the United Nations Fund for Science and Technology (UNFS&T) during 1987-1990. Of these, only MITCON survived beyond pilot stage as the state support was not forthcoming after funding support from UNFS&T came to an end. It was not until 2000 that India again started its TBI programme with clear policy strategy. By then, China has established nearly 200 TBIs. What is interesting is that UNFS&T also supported similar initiative in China in 1988, which subsequently became more successful in creating TBIs than India. Ironically, five Indian experts from the Entrepreneurship Development Institute, Ahmadabad who were employed by UNFS&T played a major role in preparing the Chinese programme of Incubators and one of them, Dr. Rustam Lalkaka continued to be a leading consultant to the Chinese incubator programme (Somasekhar, 2001).

TBI programme in India was launched only in 2000 by the National Science & Technology Entrepreneurship Development Board (NSTEDB) which was established in 1982 under the Department of Science and Technology (DST) of the government to promote knowledge and technology driven enterprises. Until then, 18 Software Technology Parks (STPs) which were established by the Department of Electronics of the government, and 15 Science and Technology Entrepreneurs Parks (STEPs) which were established by the Department of Science and Technology in the early 1980s

have been playing the role of technology incubators in India. By 2004, only 15 TBIs were established in India by NSTEDB, mostly in Institutions of Excellence such as Indian Institute of Technology, Bombay; Indian Institute of Management, Ahmadabad; Birla Institute of Technology, Pilani; Vellore Institute of Technology, Vellore; and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad (Ministry of Science and Technology, 2004).

By the end of 2009, there were approximately 120 TBIs in India. Of these, 40 were established in Software Technology Parks (STPs), promoted by the Ministry of Information and Communications Technology. About 30 TBIs were promoted by other government departments, banks and financial institutions, and private companies. These include Indiaco (one of the oldest privately established TBI), Society for Innovation and Development (set up by Indian Institute of Science, Bangalore), and Foundation for Innovation and Technology transfer (FITT) (set up by IIT, Delhi). And 53 TBIs were promoted by NSTEDB of the Department of Science and Technology in collaboration with premier academic and research institutions. Of these 53 TBIS, 14 are in Science and Technology Entrepreneur's Parks (STEPs). Out of these 53 TBIs, 24 are in South India (Andhra - 4, Karnataka - 7, Kerala - 3, and Tamil Nadu - 10); 14 are in North India (Delhi – 2, Haryana – 1, Rajasthan – 1, Punjab – 2, Madhya Pradesh – 1, Uttarakhand – 1, and Uttar Pradesh – 6); 10 are in the Western India (Gujarat – 5, and Maharashtra – 5); and 5 are in the Eastern India (Jharkhand – 1, Orissa – 1, and West Bengal – 3). Tamil Nadu province in the South India has the highest number of TBIs set up by NSTEDB, i.e. 10 (NSTEDB, 2009). These 53 TBIs were established 53 TBIs in collaboration with premier academic and research institutions with an investment of Rs 10b (about US$21m; i.e. at US$1=Rs 47). The incubated enterprises have generated cumulative revenue of Rs 59.5b (about US$125m) by 2009 (NSTEDB, 2009, p.6). TBIs under NSTEDB focus on technology areas such as Information and communication technology (ICT), Biotechnology, New materials including nano materials, Instrumentation and maintenance, Manufacturing and engineering, Design and communication (Media & Infotainment), Health and Pharma, Agriculture and Allied fields, and Energy and environment. Tenant companies in a TBI may number 10 to 20 and they generally graduate out after 2-3 years of incubation.

Although there was no comprehensive study about the impact all 120 TBIs, it is estimated about 500 enterprises graduate from them every year and 60% of them would be technology based start-ups (NSTEDB, 2009, p.11) .

In recent years there has been increasing involvement of various government departments in setting up TBIs. Various State (provincial) Governments also making strong efforts by setting up infrastructure and allocating funds to develop entrepreneurship. The government agencies are stepping up their effort with the aim of setting up 1000 TBIs (Gupta, 2010).

5. Comparison of Chinese and Indian TBIs

This section compares Chinese and Indian TBIs along various dimensions by drawing on the literature review. Based on Mian's framework we organize our analysis around three sets of variables: (i) the management and operational policies of incubators (governance, funding of TBI and new ventures, selection and graduation); (ii) services; and (iii) performance outcomes. It is to be emphasized that that central government is directly involved in the implementation and the monitoring of TBIs in both China and India, that is: TBI are mainly supported by public funding (they are non-profit organizations in China), whose function is to reduce the cost of creating businesses by providing services, with the ultimate goal of creating jobs and sustaining regional economic development. Although there are also private sector TBIs in India, over two thirds of TBIs are promoted by the central government and therefore we take them for comparison in with Chinese TBIs in this paper. However, we intend to survey TBIs promoted by both the government and the private sector in the next stage of our research project to have a proper understanding of the TBI environment in India.

5.1. Management and Operational Policies of Incubators

In this part we characterize Chinese and India incubators in terms of objectives, governance structure, TBI funding system and new venture creation, selection, graduation procedures and duration.

(a) Governance structure:

In China, TBI, at the macro-level, are under the direction of central government, namely the Ministry of Science & Technology (MOST). But at the micro-level, they are governed by local government, sometimes with participation from universities, state-owned enterprises and other sponsors. These founders and funding institutions have representatives on the TBI' Board of Directors, which is responsible for making policies and monitoring TBI. Below board level is one or a few management committee(s), responsible for guiding the creation of TBI at the very early stage, auditing the financial situation of TBI, implementing human resources management as well as proposing entry and exist criteria for tenants (Ma, 2008). Besides, an administrative office is created to be in charge of daily operations, network building, interacting with clients, providing access to external funding and maintaining the physical facilities. The selection of tenant firms is organized within the incubator. Outside experts are usually co-opted to assess the business plans.

In India, TBIs are promoted to achieve the following objectives: (i) creation of technology based new enterprises; (ii) creating value added jobs and services; (iii) facilitating transfer of technology; (iv) fostering the entrepreneurial spirit; (v) speedy commercialization of R&D output; (vi) and specialized services to existing SMEs. Over two thirds of TBIs are under the wings of central government (Department of Science and Technology and Ministry of Information and Communication Technology) and the rest are under financial institutions and private companies. The government promoted TBIs are based in what is known as Host Institutions (HI)

which is expected to play a major role during and after the establishment of the TBI to ensure its efficient functioning. The HI which may be from the public or private sector has to provide the requisite land and building for the TBI which mainly draw upon the existing facilities of HI. That is, HI should provide a building area of about 5000-10,000 sq. ft. and also utilities such as electricity and water. TBI would create certain essential facilities such as modern work space, communication facilities, computing facilities and vital equipment needed, library & information centre, and training and conference facilities. The HI can decide the legal status its TBI, which may be one of following: (i) Not-for-profit registered society; (ii) Registered trust; and (iii) Section 25 company. In the case of a NSTEDB promoted TBI, an MOU would be signed by the TBI, HI and DST, which will clearly define the role of these three agencies. In some cases the State (provincial) Government and other government agencies may also be involved in setting up TBI. For example, some State Governments and other agencies have set up TBIs to promote specific industry such as food processing, and bio-technology. Financial institutions like Small Industry Development Bank of India (SIDBI) has also set up TBIs (e.g. TBI at Indian Institute of Technology, Kanpur and BITs, Ranchi).

Table 1: Typical Profile of a TBI in India

	Electronics & ICT Domain	***Biotech & Agri. Domain***	***Mechanical & Manufacturing Domain***
Total Floor Area	8500 -10000 sq ft	10000 to 20000 sq ft	15000 to 25000 sq ft
Number of Companies	15-20	8-12	10-15
Floor area for Each Company	100-300 sq ft	225-750 sq ft	350-500 sq ft
Number of Employees at Start-up	1 to 5	3 to 10	3 to 10
Incubation Period	1 to 2 years	2 to 3 years	3 to 5 years

Source: NSTEDB, Department of Science and Technology, Government of India (2009a) *First Status Report on Technology Business Incubation in India* (New Delhi: NSTEDB), Chapter 2.

TBI in India is governed by an Advisory/ Governing Board, which formulates a strategic plan which proposes quantifiable objectives and an efficient management system. The Board membership consists of representatives from promoting department/ agencies and experts. That is, they may be representatives of DST, SIDBI, HI, industry, VC companies, Entrepreneurs, student bodies and tenants of the TBI. The Advisory/ Governing Board will set up a separate expert committee for the selection of tenant firms. The day to day operations of TBI are managed by the Chief Executive Officer/Managing Director and a management team which may include one or two experts with technical/managerial qualification and relevant industry experience. These experts manage areas such as business planning, technology

transfer, training and consultancy. The management team also includes accounts/administrative officer and a secretarial assistant. TBI also hires outside experts/ consultants to provide specialist skills and expertise when needed on case by case basis (e.g. technical, legal, intellectual property, fund management). For this, the TBI should have a panel of experts/ consultants (NSTEDB, 2010). A survey of 36 TBIs by DST revealed that majority of the Governing Board consisted of 11 to 20 members. Table 1 illustrates the profile of a typical TBI in selected technology domains.

(b) TBI Funding System

Since about 90% Chinese TBI are non-for-profit organizations, local governments provide subsidies to TBI. At the very early stage, governments often offer TBI free land and initial construction funds. At the operation stage, governments finance TBI in three different ways: (i) take all operation cost of TBI but TBI should submit all income to governments; (ii) compensate the cost-income spread of TBI; (iii) subsidize TBI based on their performance (Ma et al., 2008). For private TBI, the funding mainly depends on sponsors themselves. Bank loans are often easily accessible in the early incubator construction stages.

In India, each TBI prepares a detailed project proposal including the cost involved and submits to NSTEDB. The project cost may range from Rs 40m to 70m. NSTEDB provides support for capital expenditure such as procuring specialised equipment, software and support facilities, and also provides partial support for recurring operational expenditure for five years. The building and basic infrastructure cost is borne by the HI. In case of private sector HI, nearly 50% of the project cost is borne by the HI. Each TBI is expected to become self sufficient within a period of five years and become free from depending on government funding. The TBI project is implemented by an expert Project Manager. After the disbursement of first instalment of funds by the NSTEDB, the subsequent funding requires financial reporting from the TBI which include funds utilisation certificate, statement of audited expenditure, audit report, activity progress report, action plan for next year, periodic review of performance and recommendations by National Advisory Committee (NAC) (NSTEDB, 2009).

(c) Funding of New Ventures

In China, tenant firms in TBI can obtain financial support in different ways.

(1) From MOST: With the assistance of TBI, tenant firms apply to the Innovation Funds for Technology-based SMEs (Innofund) provided by MOST, through a project competition. Innofund attracts other investments for incubated firms. In 2005, the average support from Innofund per project reached RMB 769 612[2]. Over 49% of the available funds for tenant firms are raised by the companies themselves, and

government support accounts for only 2.9%. Most of the government's financial support is allocated through various national S&T program competitions and through Innofund (51% of the program), which distributes non-refundable and refundable grants and also provides loans on favorable terms.

(2) From Local Government Agencies: The local Departments of Finance, S&T Bureau and the Bureau of Industry, Commerce and Taxation have some involvement in tenant firms in China. These government agencies are directly involved in pooling funds, identifying investments and channeling funds into new ventures. For instance, government-backed guarantee companies have been set up to guarantee bank loans to local ventures (White et al., 2005). Tenant firms benefit from tax 'holidays', rents at lower than market prices, "one shop" administrative services and other preferential conditions provided by local government. Tenant firms can continue to benefit from favorable tax policies after the period of incubation if they are recognized as high-tech firms.

(3) From Investors: In the early stages, venture entrepreneurs mainly depend on self-funding and very few ventures can get seed capital from TBI-based venture capital. During the incubation process, financial support can come from domestic and foreign venture capital, and regional and national Innofunds. But the funding mainly depends on individual applications and bank loans. Regional and national Innofunds are limited, and venture capital funds are difficult to obtain due to the strict selection criteria.

In India also tenants of TBIs can obtain funds from different sources: (i) Seed funding (Rs 2m to 5m, i.e. up US$100,000) from NSTEDB disbursed through TBIs and Seed funding by Technology Development Board/DST (Rs 100000 to Rs 2.5m, average is Rs 1m); (ii) Angels network/ Venture capital (VC); (iii) Lending from commercial banks/ Financial Institutions; (iv) Grants-in-aid such as the Technopreneur Promotion Programme, administered by the Department of Scientific and Industrial Research to support individuals with innovative ideas. In total, 78 tenant companies have received seed funding from TDB and NSTEDB. The Angels network includes Indian Angels Network (IAN) and Mumbai Angels Network which were formed in 2006. The members of angel networks invest in early stage businesses and invested in sectors such as IT, Intellectual property, Internet, Mobile, Education and Hospitality. Many members of Mumbai Angels Network have prior Silicon Valley experience. The network also provides mentoring, links to vast networks in India and abroad, and inputs on strategy. The Network looks at investing from US$100000 to $1m and exiting over 3 to 5 year period through IPO, M&A, or strategic sale. The VC firms are part of Indian Venture Capital and Private Equity Association (IVCA) which provides funds for seed ventures and early stage companies. The

According to the First Status Report on Technology Business Incubation in India (NSTEDB, 2009a), when 28 tenants were surveyed their responses to the question of 'Funding pattern of start-ups' were as following: Own investment – 35%; Friends/ Family – 27%; Loan – 17%; Seed – 10%; Angel – 7%; and Grants – 4%. This

suggest that in practice, the early businesses are predominantly funded by own finance, by friends/ family, and loans, rather than VC and Angels.

In practice, the early stage businesses have been facing serious difficulties in getting funds from organized investors such as banks. There was a big increase in early stage funding by VCs in 2000, but it came to an end after their portfolio companies went out of business during dot.com market crisis. Until 2004, the nature of venture capital in India was "more of a glorified loan rather than a true risk", as the VC were more concerned in protecting their capital than taking real risk. This was mainly due to the problems faced by the VCs as technology adoption within Indian companies was slow (Hariharan, 2004). Also, the VCs faced uncertainties about exit route, as the starts-up in were taking longer time for maturity (Varma, 2004).

However, the situation appears to have improved in recent years, as investors are more willing to accept risk and there are more organized funding programme early stage/start-up businesses. For example, iAccelerator programme started by Centre for Innovation, Incubation, and Entrepreneurship (CIIE) at IIM, Ahmadabad provides a start-up funding of $10,000 for entrepreneurs who has some good business idea in the internet and mobile areas. Indian Angels Network (IAN) and Mumbai Angels Network are also funding more early stage ventures than in the past (Gupta, 2010). The VC schemes of SIDBI have also improved it funding mechanisms to support early stage companies. VC investment increased by 3% to Rs 388.8b with 80 deals completed compared to Rs 378.9b invested in 85 deals in 2007 (NSTEDB, 2009a, p.82).

There are other financial incentives provided the government to support tenant companies. For example, the Ministry of Finance has exempted the tenant companies under NSTEDB promoted TBIs/STEP from paying service tax.

(d) Tenants Identification and Selection Procedure Leading to Graduation

In China, selection is often organized in TBI, based on the project and the tenant. The selection team comprises incubator staff and external experts. The linkages between TTOs and incubators are not systematic. At the organizational level, some TTOs are directly subordinate to the management committee; others are on a level with the incubator management agency. Therefore, when selecting a business plan, incubators may not necessarily request the intervention of the TTO. The selection criteria related to the incubated project include: belonging to a high-tech field; ownership of intellectual property rights; having a mature technology with commercial potential; and environmental-friendly products. In terms of the tenant firms, the selection criteria focus on legal status (clear ownership and independent economic entity) less than 2 years, registration and work place within incubator, registered capital less than €0.2 million, firm's incubation surface less than 1000m2 and the qualifications of venture entrepreneurs (R&D professionals). The average incubation period is three to five years depending on the industrial sector, the contract, and the incubation agreement. The MOST gives an outline of graduation criteria, such

as recognition of high-tech firms, sales income over €0.5 million, physical assets and self-funds more than €0.1 million. Each incubator can make specific graduation criteria based on the MOST criteria. For example, when the incubation period expires, some TBI require firms to submit graduation and provide administrative documentation, such as balance sheets, resources declaration sheets, management reports and so on. On the basis of these documents and an on-site inspection, the incubator decides whether the firm should graduate, semi-graduate (certain graduation criteria unfulfilled), have the incubation period extended or have the incubation discontinued without graduation. In sum, to graduate from the incubator firms are required to meet certain exit criteria with respect to sales income, R&D expenditure and highly qualified team members.

In India identification of potential entrepreneurs/tenants are done through business meet, referrals, and business plan competition. They are provided pre-incubation support such as one-to-one counseling, facilitating development of business plan and network support. The TBI usually sets up a Selection Committee which is composed of representatives from the faculty of the Host Institute, Financial institutes, and Technical domain experts. However, the selection policy may differ among TBIs depending upon their mission and overall objectives. Generally, the following criteria are applied for selection: (i) sound idea and business plan which are pertinent to the core areas of the TBI; (ii) commitment and integrity of promoters; (iii) potential for growth; (iv) willingness to accept and follow mentoring/ advice; (iv) capacity to meet targets; and (vi) willingness to pay for the facilities and services. The TBI enters into a legal framework with tenants such as commercial agreements, facilities agreement, and exit/ graduation terms. Exit criteria is incorporated in incubation agreements which includes maximum time limits (e.g. 2 to 3 years), stepped up rent (gradually increasing each year), incentives to exit, gradual reduction of subsidies, and non-performance (NSTEDB, 2009a, pp. 23-24).

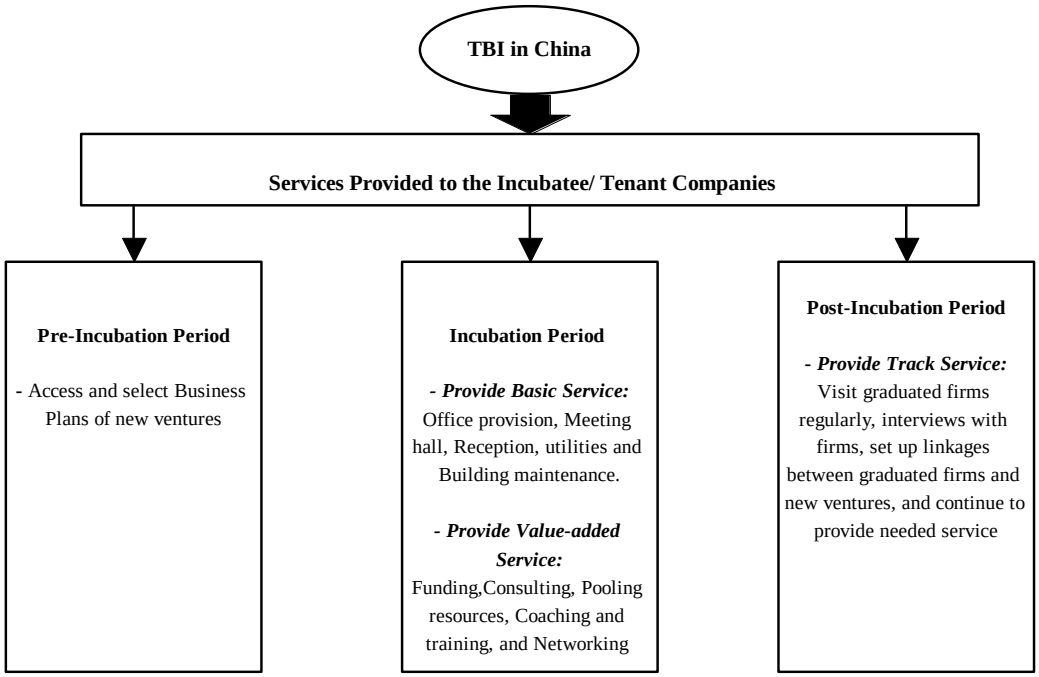
5.2. Services Provided by TBIs to Tenants

Chinese and India TBI provide different types of services (see Figure 1): assessment and selection of business plans at the pre-incubation period; access to physical resources such as office space, common meeting rooms, IT infrastructure; business support services such as secretarial and mail services, security systems, firm registration; access to capital, including seed money, venture capital, etc; business development support such as mentoring, coaching, consulting, but also legal advice and book-keeping; networking services, contacts with customers, collaborators and potential investors at the incubation period; track service after induction period. However, their service focus differs.

In many Chinese TBIs, the emphasis is on buildings and administrative management (Zhang et al., 2004; Sun et al., 2005; Ma et al., 2008). Value-added services such as business/marketing consulting and funding services for tenant firms are not satisfactory, except for top level TBI, such as Caohejing TBI and Zhangjiang TBI. Incubator staff complains that financial bottlenecks hinder the progress of professional services on one hand, on the other side, tenant firms tend to avoid using services that they would have to pay for. Besides, many Chinese incubator

management staff has little business experience, which leads to low level interactions between incubators and market actors. In many cases, Chinese tenant firms have to find and exploit niche markets without outside help.

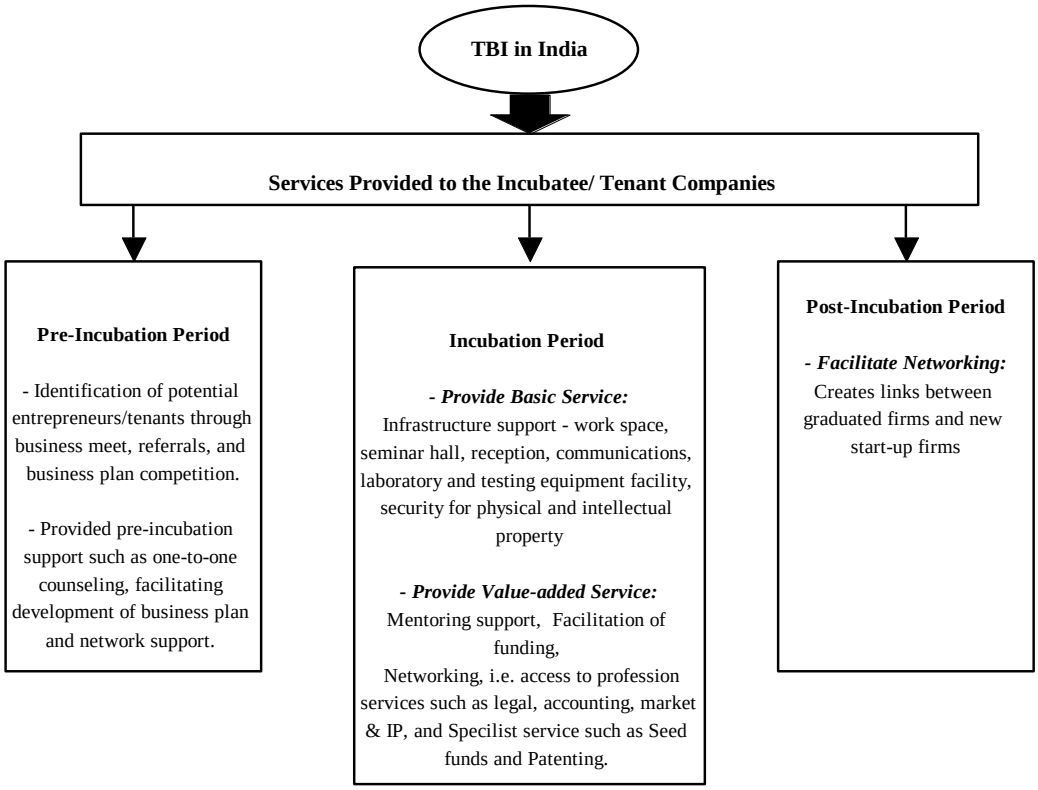
Figure 1: Services Provided by the Chinese TBI to Tenant Companies



In India, the TBIs provide a number of services to the tenant companies. 1. Mentoring or Access to Mentors: that is, providing an experienced adviser who may be from within TBI management or an outside expert (who is compensated by cash or equity for the service). Although this system works well in the TBIs located in metropolitan cities, they are working as well in TBIs located in second tier cities. 2. Networking for Business Development: that is, providing access to tenants different professional services such as legal, accounting, taxation and intellectual property, business support, skills, markets and customers, and finance. The network includes banks, business angels, VCs, business links, customer networks, local authorities, and high education/research institutions. TBIs in India also provide basic/ infrastructure facilities such as work space, meeting room, reception area, computing and communications, office equipment, networking areas, lab space, and utilities. TBI also provide safety and security to protect the physical and intellectual properties of the tenants such as expensive equipment and intellectual property assets. The mature TBIs also provide additional/specialist (value added) services and facilities such as seed fund, and patenting facility. A survey by DST has shown that typically the following support services are provided by the TBIs to their tenants: infrastructure support (seminar hall, power back up), laboratory and testing equipment facility, mentoring support, and facilitation of funding support (NSTEDB, 2009a). The TBI also provided some post-incubation period support by creating links between

the graduated firms and the new start-ups and facilitates networking for future mentoring.

Figure 2: Services Provided by the Indian TBI to Tenant Companies



TBIs in India are required to plan and undertake following general sets of activities: (i) providing specialized services to existing SMEs in the region; (ii) Facilitating technology commercialization; (iii) proving consultancy; (iv) providing training including short courses; (v) assisting with technology related IPR issues, legal and quality assurance services; (vi) marketing; (vii) assisting in obtaining official clearances; (viii) providing common facilities; (ix) assistance in preparation of business plans; (x) organizing technology exhibitions/ technology clinics/ trade fairs.

5.3. Overview of Performance and Outcomes in TBIs

In this part, we briefly examine some outcomes that characterize the performance of the two systems. We use main economic indicators of TBI: the number of TBI, incubation surface sq.m, the number of incubated companies, total income of tenant firms, accumulated number of graduated tenant firms and the number of tenant employee.

Table 2 provides a number of indicators about the growth of TBIs in China between 2005 and 2008. The number of TBIs increased from 534 to 670 and the number of tenants increased from 39,491 to 44, 346, the total income of tenants have risen from 162m Euros to 186m Euros, very significantly number of tenants graduated doubled from 15,815 to 31,746, and also the number tenant employees increased by 21000. These figures show that the TBI growth and performance in China is very significant.

Table 2: The Development and Performance of TBIs in China (2005-2008)

Item	2005	2006	2007	2008
Number of TBI	534	548	614	670
Incubation surface 1000sq.m	1969.9	2008	2270	2316
Number of tenants	39491	41434	44750	44346
Total income of tenants (€million)	162.54	192.6	262.1	186.62
Number of graduated tenants	15815	19896	23394	31764
Number of tenant employee (1000person)	71.7	79.3	93.3	92.8

Source: China Torch Statistical Yearbook 2009; *Note:* CTBI – Chinese technology business incubators; ITBI– Indian technology businss incubators

In the case of India similar data are not available and this is exemplified by the fact the First Status Report on Technology Business Incubation in India has been released only in 2009 by the NSTEDB/DST which oversees the government promoted TBIs. Even this review report is not based on a national survey and it is based on a sample of 28 and 36 respondents (NSTEDB, 2009a). No comprehensive study of TBIs in India exists. Only some summary information about the performance of TBIs are available. According to NSTEDB, in all there are about 120 TBIs in India (53 are under NSTEDB/DST, 40 are STPs promoted by Ministry of Information and Communication Technology, and 30 are under other government departments, banks, financial institutions and private companies). It is estimated about 500 enterprises graduate from them every year and 60% of them would be technology based start-ups (NSTEDB, 2009, pp. 10-11). And "over 1150 entrepreneurs have been nurtured and incubated in the NSTEDB supported incubators up to 2008" (NSTEDB, 2009, p. 39).

The performance of TBIs in India is judged based on the following parameters: (i) number of tenant enterprises promoted and their growth pattern; (ii) number of businesses graduating successfully and their growth; (iii) number of new jobs generated; (iv) new technologies commercialized; (v) number and quality of services offered; (vi) number of consultancy jobs undertaken; (vii) net revenue earned; (viii) return on investment; and (ix) upgradation/ modernisation facilitated in existing units; (x) incubator space (sq ft); (xi) Average capital investment cost per incubate over five years; (xii) Average operating cost per annum per incubatee. Monitoring of

performance is done at two levels – local and national levels. At the local level, the Governing/ Advisory Board monitors and reviews the performance on quarterly basis and takes feedback on satisfaction of the stakeholders and incubate companies. At national level, the National Expert Advisory Committee (NAC) which is composed of representatives from the government, industry, VCs, and other stakeholder organisations reviews the TBI performance twice a year against a set targets and parameters. In addition, visit to the incubators are also undertaken by the DST officials (NSTEDB, 2009). However, a survey indicated that only in about 70% of the TBIs surveys they have monitoring committees (NSTEDB, 2009a). Therefore, it is not clear how effective is the monitoring system at both local and national levels. We think more empirical data are needed to clarify this and hope that our next stage research survey data will help to answer this issue more clearly.

Table 3 shows that Chinese and India technology business incubators have similar features in terms of objectives, selection criteria for tenants, funding of new ventures, and various basic services provided to the tenants. It also shows some important differences in the following aspects: nature of structure and governance, funding of TBIs, value-added service and specialists services provided by TBIS to the tenants, duration of incubation for tenants, and also in terms of number of TBIs, number of tenants, number of employees of tenants, and revenues generated by the tenants.

Table 3: Synthesis of the Comparison of TBIs in China and India

	Chinese Incubators	**Indian Incubators**
1. Management and Operational Policies		
Objective	*Mostly TBI objectives are similar in China and India:* Creation of technology based new enterprises, facilitating technology transfer, creating jobs and regional economic development	
Nature	**China:** Non-for-profit organizations – Mostly government-sponsored **India:** Both profit and Non-profit organizations – More than two third TBIs are government promoted and about one third by others such as banks and private companies. Host institutions where the TBIs are located play an instrumental role in management and performance of the TBI	
Governance/ Structure	**China:** Central government directly involved in implementation and monitoring; Governed by local government and other investors; Board of Directors. **India:** Central government plays a promoting role and has loose control over TBIs. The main bodies that govern the TBIs are the Governing/ Advisory Board and the Executive Management Team at the local level. Unlike China, the Local or Regional governments do not have major control over TBIs, except where they are involved as one of the stakeholders.	
	China: (a) Management personnel varies between 3 and 300 (b) Management Committee: interface between	**India:** (a) Governing Board members varies from 0-5 to 16 to 20. Average seems to be 11 to 15.

	universities and community	(b) The management team includes Chief executive and, professional/ technical experts which interface with outside agencies including universities and industry.
Sources of Funding of TBI	(a) Local government (free land and initial fund) (b) Other sponsors such as universities, state-owned enterprises and other investors.	(a) Central government (b) Host institutions (c) Financial institutions (d) Private sector companies
Funding of New Ventures	*Similarities in China and India:* Very complex system with many potential funding institutions at different levels. High proportion of venture capital comes from entrepreneur themselves. Weak venture capital system especially at early stages. Public funding used (as seed) to attract other funds from other sources.	
	China: Critical role played by incubator at early stages of firm creation	**India:** (a) TBI plays a critical facilitating role to obtain funding for start-ups and provide seed capital in some cases (c) Weak support from Angels and VC, but improved in recent years.
Selection	**China:** To hold intellectual property with market potential; to have a qualified entrepreneurial team. **India:** Selection policy may differ among TBIs depending upon their mission and overall objectives.	
	Meet the requirement of MOST such as: (i) maximum registration capital; (ii) foundation year; (iii) registration place; (iv) incubation surface; (v) property of high-tech and environment friendly products; and (vi) professional entrepreneurs.	Generally, the following criteria are applied for selection: (i) sound idea and business plan; (ii) commitment and integrity of promoters; (iii) potential for growth; (iv) willingness to follow mentoring/ advice; (iv) capacity to meet targets; and (vi) willingness to pay for facilities and services.
Duration	3-5 years depending on the sector	2-3 years depending on the sector (duration can be reviewed)
Graduation	A series of formal criteria determined by MOST and TBI	A series of formal criteria determined by TBI (Bench marks suggested by NSTEDB/DST)
Link with TTO	No systematic link Some help in identification of projects	Not very clear
2. Services Provided to Tenant Companies		
	Similarities in services: Physical resources, business operation support, access to capital and investments,	

	mentoring, coaching, consulting, legal advice, book-keeping, networking services (customers, universities, investors etc.)	
	China: (a) Emphasis on building and administrative services (b) Networking not well developed (c) Focus on few services on competitive advantages	**India:** (a) Emphasis on basic – infrastructure service (b) Significant value-added services: Mentoring and Networking (c) Matured TBI provide specialist services such as Seed and Patenting
3. Performance and Outcomes		
Outcomes (2005-2008 on average)	**China:** (a) 72 tenant firms per incubator (b) 19.75 employees per tenant firms (c) 37.85 graduated firms per incubator	**India:** (a) It is estimated that about 500 tenants graduate every year from total TBIs in India (b) 60% of them are considered to be technology based start ups. (c) In terms of number of TBIs, number of tenants, employees of tenants and income, India is far behind China.

6. Some Conclusions and Recommendations

We have presented an overview of comparison of the TBIs in China and India. This forms stage one of our three stage study. We employed the integrative framework developed by Mian (1997) and its adaptation to analyzing the performance of TBI, which uses three sets of variables for analysis: management and operational policies, services, and performance outcomes of TBI. Our analysis using the above framework revealed that there are number of similarities and differences in the TBI environment in China and India. Similarities include objectives, selection criteria for tenants, funding of new ventures, and various basic services provided to the tenants. The differences include nature of structure and governance, funding of TBIs, value-added service and specialists services provided by TBIS to the tenants, and duration of incubation for tenants. In addition, there is a big difference between Chin and India in terms of number of TBIs, number of tenants, number of employees of tenants, and revenues generated by the tenants. This is due to historic factor. Although both India and China were helped to develop technology incubators under the initiative and support of the United Nations Fund for Science and Technology (UNFS&T) in 1987 and 1988 respectively, India seriously made effort to develop TBIs only after 2000, while China continued its effort since 1980s. By 2000 when India restarted its effort to develop TBIs, China has already established nearly 200

TBIs. Despite this problem of catch up, India seems to be moving fast in establishing TBIs and also the private sector seems to be involving in significant way.

Our comparative analysis of TBIs in China and India suggests that both systems could usefully benchmark the good practice of the other in order to improve their processes and management and there are useful policy learning for both countries and other developing economies. However, further theoretical and empirical work is needed to examine the effects of TBI on the growth of start-ups by comparing the progress of new ventures within and outside incubators, in China and in India. It would also be interesting to examine the differences in management styles of TBIs in both countries employing surveys. The next two stages our research project will help us to explain the complex relationships in the TBI environments in Chin and India and come up with concrete policy suggestions.

Acknowledgment

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Notes

[1] Lee and Osteryoung (2004) evaluate the performance of UI in US and Korea and find no major differences other than their goal and operational strategies.

[2] RMB100 = €9.532 (based on April 2007 values).

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