ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

PROMOTING BUSINESS AND TECHNOLOGY INCUBATION FOR IMPROVED COMPETITIVENESS OF SMALL AND MEDIUM-SIZED INDUSTRIES THROUGH APPLICATION OF MODERN AND EFFICIENT TECHNOLOGIES

UNITED NATIONS

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ESCAP works towards reducing poverty and managing globalization

On 1 July 1997, Hong Kong became Hong Kong, China. Mention of “Hong Kong” in the text refers to a date prior to 1 July 1997.

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ABBREVIATIONS

ADB	Asian Development Bank
APCTT	Asian and Pacific Centre for Transfer of Technology
ASEAN	Association of Southeast Asian Nations (comprises Brunei Darussalam, Indonesia, Malaysia, the Philippines, Singapore, Thailand, Viet Nam, the Lao People’s Democratic Republic, Myanmar and Cambodia)
BANSDOC	Bangladesh National Scientific and Technical Documentation Centre
BASIC	Bank of Small Industries and Commerce
BCC	Bangladesh Computer Council
BCSIR	Bangladesh Council for Scientific and Industrial Research
BDS	business development service
BI	business incubator
BITAC	Bangladesh Industrial and Technical Assistance Centre
BOL	Bangladesh Online Limited
BSCIC	Bangladesh Small and Cottage Industries Corporation
BTIs	business and technology incubators
BTTB	Bangladesh Telegraph and Telephone Board
BUET	Bangladesh University of Engineering and Technology
CCI	Chamber of Commerce and Industry
CD-ROM	compact disk read-only memory
DBT	Department of Biotechnology
DIC	District Industries Centre
DSIR	Department of Scientific and Industrial Research
DST	Department of Science and Technology
DST	Daeduk Science Town
EDP	Entrepreneurship Development Programme
ERP	Enterprise Restructuring Project
ESCAP	Economic and Social Commission for Asia and the Pacific
FBCCI	Federation of Bangladesh Chambers of Commerce and Industry
FDI	foreign direct investment
FDP	Faculty Development Programme
FIFTA	Foreign Investment and Foreign Trade Agency
FTP	file transfer protocol
GDP	gross domestic product
GEM	Global Entrepreneurship Monitor
GTN	Global Technology Network
GNP	gross national product
GTZ	Foreign Investment and Foreign Trade Agency
HGT	home-grown technology
HRD	human resources development
HRTI	Hampton Roads Technology Incubator
HSDC	high-speed data communication

HTVC	High Tech Venture Centre
IAS	International Accounting System
IAT	Institute of Appropriate Technology
IBI	international business incubators
IBRD	International Bank for Reconstruction and Development
ICC	Information and Communications Centre
ICICI	Industrial Credit and Investment Corporation of India
ICSID	International Centre for Settlement of Investment Disputes
ICT	information and communication technology
IDBI	Industrial Bank of India
IFC	Industrial Finance Corporation
IFCI	Industrial Finance Corporation of India
IIT	Indian Institute of Technology
IMF	International Monetary Fund
IP	intellectual property
IPO	initial public offering
IPR	intellectual property rights
IROS	incubators for returned overseas scholars
ISA	International Standard on Auditing
ISO	International Organization for Standardization
ISO 14000	international standards for environmental management systems
ISO 9000	international standards for quality management systems
IT	information technology
ITBI	international technology business incubator
ITDG	Intermediate Technology Development Group
ITV	information technology village
IVCA	Indian Venture Capital Association
JICA	Japan International Cooperation Agency
KAIST	Korea Advanced Institute of Science and Technology
KIPA	Korea IT Industry Promotion Agency
KOBIA	Korea Business Incubators Association
KOICA	Korean International Cooperation Agency
KOSDAQ	Korean Securities Dealer Automated Quotations
KTB	Korea Technology and Banking
LAN	local area network
MAS	Mongolian Academy of Sciences
MCT	Ministry of Culture and Tourism
MIC	Ministry of Information and Communication
MIDAS	Micro Industries Development Assistance and Services
MIGA	Multilateral Investment Guarantee Agency
MIME	Ministry of Industry, Mines and Energy
MOCIE	Ministry of Commerce, Industry and Energy
MOCT	Ministry of Construction and Transportation

MOF	Ministry of Finance
MOFE	Ministry of Finance and Economy
MOI	Ministry of Industry
MOST	Ministry of Science and Technology
MOSTE	Ministry of Science, Technology and Environment
MPI	Ministry of Planning and Investment
MSICT	Ministry of Science and Information and Communication Technology
MTPs	Micropropagation Technology Parks
NASDAQ	Nasdaq Stock Market, Inc.
NBC	new business creation
NBIA	National Business Incubation Association
NCST	National Council for Science and Technology
NGO	non-governmental organization
NSIC	National Small Industries Corporation
NSTEDB	National Science and Technology Entrepreneurship Development Board
NSTP	National Science and Technology Policy
OECD	Organisation for Economic Co-operation and Development
PMI	preliminary moonlighting incubator
PO	project office
PRSP	Poverty Reduction Strategy Paper
QRs	quantitative restrictions
R&D	research and development
RECAST	Research Centre for Applied Science and Technology
RGM	ready-made garment
RONAST	Royal Nepal Academy of Science and Technology
S&T	science and technology
SBMA	Subic Bay Metropolitan Authority
SEBI	Securities and Exchange Board of India
SIDBI	Small Industries Development Bank of India
SIDO	Small Industries Development Organization
SMBA	Small and Medium Business Administration
SMEs	small and medium-sized enterprises
SOEs	State-owned enterprises
SPZs	special promotion zones
STEP	Science and Technology Entrepreneurs Park
STEDS	Science and Technology Entrepreneurship Development Scheme
STIPs	science and technology industrial parks
STPs	science and technology parks
TBI	Technology Business Incubator
TBSE	Technology Bureau for Small Enterprises
TDB	Technology Development Board
TePP	Technopreneur Promotion Programme
TI	technology incubator

TIAB	temporary inter-ministerial agency on business
TIC	technology innovation centre
TNCs	transnational corporations
TOR	terms of reference
TPS	Technology Policy Statement
TRIPS	trade-related intellectual property system
UGC	University Grants Commission
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
UNTAC	United Nations Transitional Authority in Cambodia
UPS	uninterruptible power supply
VAT	value added tax
VC	venture capital
VCCI	Viet Nam Chamber of Commerce and Industry
VCF	venture capital funds
WTO	World Trade Organization
WWW	World Wide Web

EXPLANATORY NOTES

ha	=	hectare
kW	=	kilowatt
m^3	=	cubic metre
MW	=	megawatt
sq f	=	square feet
sq m	=	square metre
Tk	=	Bangladesh taka
Tug	=	Mongolia tugrik
US$	=	United States dollar
Y	=	yuan renminbi

PART ONE

REPORT OF THE NATIONAL WORKSHOPS ON PROMOTING BUSINESS AND TECHNOLOGY INCUBATION FOR IMPROVED COMPETITIVENESS OF SMALL AND MEDIUM-SIZED INDUSTRIES THROUGH APPLICATION OF MODERN AND EFFICIENT TECHNOLOGIES

I. GENERAL OBSERVATIONS

ESCAP has been undertaking various activities for the promotion of business and technology incubation system in countries of Asia and the Pacific. The major objectives of such activities have been to create awareness about the use of business/technology incubators and to provide opportunities for sharing of experience among countries which have already started the promotion of such incubators. Initially, the secretariat had prepared regional review status study and organized a regional consultative meeting in Seoul, the Republic of Korea. This activity was followed-up by the organization of a series of National Workshops on Promoting Business and Technology Incubation for Improved Competitiveness of Small and Medium-sized Industries through Application of Modern and Efficient Technologies in six countries namely: Bangladesh, Cambodia, the Lao People's Democratic Republic, Mongolia, Nepal and Viet Nam. The following sections present the situation at national levels of the participating countries, lessons of experience from China, India and the Republic of Korea and recommendations.

In these workshops, conceptual issues, practical ways of setting-up incubators as well as the experiences of China, India, and the Republic of Korea were presented. A general overview of regional perspectives on Asia-Pacific and the usefulness of business and technology incubation was also presented and discussed.

It was emphasized that the main goal of incubation system is to promote continuous regional and national industrial and economic growth through increasing of employment and general business development and to stimulate specific economic objectives such as industrial restructuring as well as wealth generation and utilization of national resources. Technology business incubation system cannot replace the usual entrepreneurial initiative and markets, but technology business incubation system can create better conditions for the emergence of new entrepreneurship especially the technology-based enterprises. Establishment of technology business incubators enhances the business image as an innovation hub, demonstrates commitment of the incubator founders to encourage and move into businesses through techno-entrepreneurship, and thus creates investors' trust and promotes value-added technology-oriented investments in the countries.

Technology business incubators bring about the following benefits:

- To government – regional economic development, new jobs, higher tax revenues, social benefits and overall improvement in national technological capabilities
- To Research and Development (R&D) community – research commercialization, interaction with industry, new sources of income generation
- To business/corporate sector – better investment choices, access to innovative entrepreneurial business models, acquisition of new technologies, fulfilling social responsibilities
- To technology-led start-ups – better access to resources based business development expertise, reduced risk and time to market

Development of technology business incubation system should be an integral component of the national technology development strategy aimed at enhancing the innovation profile of the country/region that, in turn, involves the following steps:

1. Monitoring and identifying national/regional competence and innovation potential
2. Stimulating innovation in enterprises of all sizes
3. Focusing on national/regional strengths through clustering and networking
4. Providing financial support for innovation
5. Approaching international markets

The emergence of new innovative, high-growth companies emerge from critical masses of research, education and new investments. A critical mass of commercially oriented research expertise can attract industrial technology users. Such clusters draw investors and consultants, creating favourable conditions – in particular those provided by business incubators – for the birth of fast-growing, high-tech companies, which in turn are a magnet for new talent and new money. When all components are linked, the innovation and techno-entrepreneurship process becomes self-reinforcing and developing in the country.

The incubation system combines a variety of small enterprises support elements in one integrated affordable package. It has a special niche, that is, nurturing early stage, growth-oriented small and medium-sized enterprises (SMEs), through focused assistance within a supportive environment. A "third generation system" termed as "new innovation system" based on the cooperation among universities (research institutes), industry and government is reported to be emerging to bring the full range of support services for development of knowledge-based business, with linkages to universities, research institutes, venture capital and international joint ventures.

The main concern of incubation system is to bolster the technology and business development. However, in practice, the primary goal of incubation system is to promote the development of technology-based firms, and assist them in further development of the technologies and the market.

The technology-based incubator could involve university sponsorship with the commercialization of new and emerging technologies as the prime focus for the project. Technology business incubators are located at or near universities, R&D institutes, and science and technology parks. They are characterized by institutionalized links to knowledge sources including universities, technology transfer agencies, research centres, national laboratories and skilled R&D personnel.

The aim is also to promote technology transfer and diffusion while encouraging entrepreneurship among researchers and academics. Technology incubator, in practice, is a variant of business incubator and, in fact, combines broadly the functions of technology/business incubator and innovation centre. In fact, technology/business incubators should be looked upon, in the broadest sense, as a mechanism for long-term capability-building for regional or local developments of business and innovative enterprises.

The trend is now also towards international technology/business incubators to attract foreign companies and R&D organizations to promote international linkages under the overall process of globalization and also sector specific incubators especially in high-tech areas including information technologies.

The stated good practices include strong and deep commitment of the promoters, well defined objectives and missions, recruitment of competent and dynamic management team and constitution of an advisory committee of members from promoting organizations and selected experts by focusing on cluster-based technologies, selection of tenants according to "needs".

II. LESSONS OF EXPERIENCE: CHINA, INDIA AND THE REPUBLIC OF KOREA

During the period of the National Workshops in Bangladesh, Cambodia, the Lao People's Democratic Republic, Mongolia, Nepal and Viet Nam, experts from China, India and the Republic of Korea were invited and they presented their country's experience in promoting business/technology incubators. A brief summary of their country's experience are presented below:

A. China

1. Social and economic value

(a) Create businesses

SMEs play a key role in innovation from the viewpoint of developing high technology and realizing industrialization. Chinese business incubators are well aware of the fact, and contribute a lot to nurture a good many technology-based SMEs and become a real cradle for hi-tech start-up companies.

(b) Create jobs

Unemployment has always been existing in Chinese cities and countryside. However, 15 years ago when business incubators were just founded, they were not expected to create big job opportunities. However, over the past 15 years, business incubators achieved startling success in the creation of job opportunities, which contributed much to social and economic development in China. According to the statistics in 2001, the 280 business incubators across the nation had a total of 12,583 tenants employing 263,596 people, and 3,994 graduate companies employing 195,502 people. In another word, the incubators directly created 459,097 job opportunities. If one doubles the number of indirect job opportunities generated by a direct job, by inference, the indirect job opportunities generated by incubators amounts to 918,194. Added up, the total job opportunities have been 1,377,291.

(c) Improve the success rate of scientific results transfer and accelerate industrialization of high technology

As an important mechanism to commercialize high technology, the business incubators provide a favourable environment for technical innovation and related commercialization of those technologies that have been developed. It provides the entrepreneurs with prerequisite for commercialization of their scientific results. The transfer success rate of scientific results surpasses 80 per cent, of which 30 per cent are achieved through technical transfer and cooperation, 70 per cent through self-investment. Making the transfer of scientific results from laboratories to market possible, incubators play an active role in transferring technology to productive force, which constitutes the most important part of China Torch Program.

(d) Foster and highlight culture of innovation and entrepreneurship

In the years when China practiced planned economy, the setting up of enterprises as well as the products and services were all considered and decided by government, leaving no place for private businesses, let alone personal innovation, entrepreneurial spirit or culture of innovation. China's reform policy made the birth of business incubators possible. By providing facilities and services for business creation, technology business incubators (TBIs) encourage scientists and researchers to establish technology companies in an effort to support the development of high technology. The knowledge-based businessmen appeared, simultaneously motivated a group of young intellectuals to found their own businesses. Nowadays, some university graduates start their businesses in incubator directly after their graduation from schools; some even run a business while studying in the university. The university students have become a new source of venture creation and innovation. Now, entrepreneurship has already formed within and outside incubators in China, which is unwilling to be left behind, in pursuit of excellence and new technology, daring to innovate, ready to cooperate, tolerant of failure and encourage adventure.

(e) Attract overseas Chinese scholars to start business in China

According to statistics of the 44 incubators for returned overseas scholars, by the end of the year 2001, the total floor space was 1,257,000 sq m, which have 1,449 tenant companies founded by returned overseas students. Nearly 3,000 returned overseas Chinese students are working in these incubators. Over 90 per cent of them have doctorate or master degrees.

(f) Promote international cooperation

The development of China's business incubation programme has already drawn attention internationally. The incubators keep close contacts with counterparts in the world, and have built cooperative partnership with science parks and relevant incubators in human resources exchange and training with the United States, the United Kingdom, Italy, Canada, Finland and Australia. Internationally well-known incubation experts expressed their surprise over the fast development and high quality of China's incubators in spite of the shortage of market resources and inadequate investment by government. The Government of China even had sponsored various international business incubation workshops open to developing countries. Shanghai has successfully hosted four sessions and trained 79 managers of incubators from 26 developing countries.

(g) Develop venture capital operations in China

While applying for governmental support and bank loan, incubators set up seed capital fund, credit guarantee fund and shareholding mechanism to improve the financial situation, which actually mitigate the financial difficulties of startups during the commercialization of high technology.

(h) Economic development tool

According to statistics collected by Torch Center, in the year of 2001, 280 incubators had an average floor space of 18,179 sq m, 46 tenants and 21 employees for each tenant. Each had an average of 14 graduate companies. The average tenant sales accounted to equivalent of about US$ 382,000, with profits of about US$ 21,500.

2. Advantages and constraints

Government initiatives are crucial in development of business incubators especially at the initial stage. But government support alone is not enough. Development of incubators is also affected by the social conditions and economic strength of the nation.

(1) Advantages

(i) Received strong governmental backup

(ii) Extensive networking among incubators in China and active exchanges between domestic incubators with foreign counterparts

(iii) Provided further capacity for sustainable growth

(2) Constraints

(i) Unbalanced development

(ii) Limited funding channels

(iii) Overemphasis on the hardware facilities undermines provision of value-added services

(iv) Managers of incubators are insufficient in business managing experiences

3. Experiences and lessons learned

(a) Government support is indispensable

Incubators as cradle for creation of start-ups and job opportunities and training school for entrepreneurs deserve support from government. Experience of China indicate that government backup assumes tremendous significance for development of incubators.

(b) Right choice of the location

The right choice of the location of an incubator will speed up its further progress and create enough income. Generally speaking, the incubators should be located in the science and technology industrial parks (STIPs), close to knowledge-intensive area surrounded by universities and research institutes, so that incubators can enjoy resources of technologies and knowledge workers as well as share R&D facilities of these institutes.

(c) With market orientation

For-profit or non-profit, an incubator must adopt market-oriented governance mechanism in its operation. Though government support in financing and administration is necessary in the start-up period of incubators, the ultimate purpose of incubators is to be self-sustaining and economically independent.

(d) Integration with venture investment

Experience at home and abroad shows that both venture capital and incubator are effective tools to promote development of high-tech companies and high-tech industries. By providing much needed capital as well as financial advises, venture investment can tremendously enhance the success rate of business incubation and accelerate the growth of tenant companies. On the other hand, incubators offer facilities and services to startup companies to lower the risk of commercial failures, and improve chances of success for venture investment. They are complementary and mutually beneficial.

(e) Offering comprehensive and high quality services

Quality of services is the core value of an incubator and to a large degree determines the success rate of its tenant companies.

(f) Synergy with R&D institutions, universities and other companies should be stressed

Incubator serves as a platform for convergence of resources between R&D institutions, universities and other companies.

(g) Selection of promising tenants

Incubators should be very careful in choosing tenants, such aspects as market potential, management team and business plan should be emphasized.

(h) Extensive networking

The incubators should set up such non-governmental organizations as association, chamber of commerce and club, which connects the incubator with the all walks of life. Those organizations offer opportunities to incubator in training, exchanging experience and other cooperation.

(i) Support from the United Nations

All the visits, information dissemination, investigation and conference from the United Nations play an active and important role in the incubation development.

4. Conclusion

The first phase of Chinese transition from the planning economy to market economy is accomplished successfully. The incubation programme has served as a means of facilitating this. It will show a growing and energetic trend in every respect in the following decade, like China itself. On the basis of the current development situation, as an efficient way, the incubation programme will further promote technical innovation and economic growth in China.

B. India

Technology business incubation is an institutional mechanism to develop an atmosphere for innovation and entrepreneurship. Furthermore, it leads to active interaction between academics and industries and sharing ideas, knowledge, experience and facilities and for the development of new technologies and its rapid transfer to industries through setting up of start-up companies in the emerging areas of technology.

As one enters into the 21st century, both industrialized as well as industrializing countries are arguably poised on the threshold of a major economic transition from manufacturing-based economies to knowledge-based economies. Simultaneously, nations around the world are showing renewed interest in entrepreneurship and technological innovation. It is increasingly recognized that entrepreneurial start-ups have important contributions to technological innovation, economic growth, employment generation and social equity.

Technology Business Incubator/Science and Technology Entrepreneurs Park (TBI/STEP) experience in India has demonstrated the shining examples of knowledge-based ventures promoted by entrepreneurs. Many new ventures were created through the STEP in the past one decade and these ventures are truly growing exponentially. Some of them try to upscale into large-scaled industries within this decade providing growth, employment and hope for the nation. As a pure investment opportunity alone STEP has provided more returns to the government in terms of direct and indirect taxes and employment opportunities and therefore the investment made on TBI/STEP as such are commercially more lucrative when seen from a long term societal point of view.

Academia provides another excess intellectual capacity available with the nation for grooming new knowledge-based ventures. The intellectual capacity of academicians should be deployed to produce new ventures and add more value for the society. New innovative intervention strategies need to be devised to ensure participation of academicians in the process of knowledge-based venture creation.

Entrepreneurship is an inspiring phenomenon and nations demonstrating the spirit of entrepreneurship and innovation have demonstrated that this spirit provides physical well-being of the society as whole. The practice of entrepreneurship therefore naturally paves the way to a culture of entrepreneurship. Since some of the entrepreneurs in knowledge-based ventures in TBI/STEP are shining role models they need to be brought to the attention of a larger audience to inspire them to at least appreciate and encourage the culture of entrepreneurship. At present, proper packaging and presentation of products of TBI/STEP has been paid very little attention. This has to become part of the objective of TBI/STEP development.

Awareness about TBI among important related sectors such as academicians, policy members, developmental institutions need to be strengthened. This shall create an enabling ambience and gather support for the mission.

Ventures promoted by TBI/STEP have the inherent potential to promote more new ventures by virtue of their experience and acquired skill levels in the process. This needs to be understood and the concept of 'serial entrepreneurship' should be recognized and supported.

The potential of the academia is largely undermined and unexploited at least in practice, in the process of technology business incubation in developing countries. Entrepreneurs and academicians working together is a winning combination. However, such combinations are of very rare occurrence in TBI/STEP. In the absence of a suitable mechanism to facilitate the participation of academicians in TBI process it is more likely to remain a rare occurrence in the future also. So, new institutional mechanisms are needed in this direction.

There is a need for more intensive participation of the host institutions. It is imperative that the host institutions should also redefine some of its internal structures and reward recognition system in order to appreciate and promote participation of academicians in technology business incubation process. This requires coordination at the apex levels, unveiling new mechanisms and recognition systems for facilitating academia participation in TBI.

TBI/STEP need to be self-supporting organizations after initial start-up support, in order to demonstrate high-level entrepreneurial credibility. This alone can ensure confidence and credibility in the eyes of the budding entrepreneurs. The culture of a self-supporting organization can also appreciate the efforts of growing entrepreneurs more readily. Entrepreneurs and incubators develop closer tied to each other if they become co-travelers towards the same objectives of business.

Effective planning and execution of TBI alone would not make it a success. The presence of an outstanding R&D institution alone does not cause the development of high-tech start-ups. The incubator is envisaged as a service function and a facilitator that can encourage the development of high technology enterprises, but it cannot create the trend.

The catalytic factors for technology incubation include, among others:

- National policies and legal frame works for TBIs and enterprises
- Financial support system including venture capital
- A society open to innovation and entrepreneurship
- The support services provided by the incubators to the enterprises

If TBIs are to be of significant value in promoting new technology based enterprises and generating jobs, the economic and cultural seedbeds need careful preparation to receive the entrepreneurial seed. The key factors that can affect growth of technology-based enterprises are:

- Access to skills and competencies
- Access to financing
- Access to market
- Conducive environment for innovation

The government, financial institutions and R&D centres all have significant role to play in creating an environment conducive to the growth of TBIs and high technology based enterprises. At the same time TBIs alone are not sufficient to stimulate advanced technology commercialization. Rather, TBIs are one of the services that are available today to create a growing, advanced technology industry. Various other methods for encouraging innovation, technology commercialization, and entrepreneurship are also required for fast economic growth.

In next 10 years, knowledge based industries are likely to acquire greater prominence and SMEs are likely to come up in the industry segments such as pharmaceuticals, information technology (IT) and biotechnology sectors. The role of the government will be that of a facilitator for providing support to SMEs in the era of globalization. Government would increasingly focus its energy towards providing human resource development support along with establishing suitable mechanisms to support and nurture technology oriented enterprises, the model of which may vary country to country or even region to region.

1. Recommendations for other developing countries: India's lessons

(a) Inventory of technologies

A number of appropriate technologies for the SME sector have been developed in various countries of the Asian and Pacific region. While each country has its areas of strength in the SME sector they also have many weaknesses, and it would be mutually beneficial if the already developed technologies could be made available to each other. Therefore, it is recommended that each country should prepare a comprehensive list of all state of the art technologies. These could be entered in a suitable data base and they could be on web sites on the Internet so that they could be readily accessed.

(b) National panel of consultants

Each country should prepare a list of experts and consultants, who can help SMEs within the country and the region to effectively transfer the available technologies. These consultants could assist in market surveys etc. in addition to assisting with the transfer, development and application of the technologies at a commercial level.

(c) Techno-economic survey for assessing technological needs

From these surveys, the common needs of the countries can be identified and the available technologies could be shared, e.g., low-cost housing technologies, alternative energy technologies etc. Where there is a common need which has to be met by importing technologies from outside the region, could be tackled together, rather than separately.

(d) Programmes to increase SME awareness of new technologies

There should be an information programme in each country through exhibitions, workshops, seminars, publications etc. to increase awareness of the benefits to the industrialists from acquiring state of the art technologies.

(e) Competitiveness assessment of SME sector

There is a need to make a competitiveness assessment of the SME sector in each country, with a view to assessing the gap that exists with the rest of the world. This will vary from industrial sector to sector.

(f) SME interaction with science and technology (S&T)/R&D sectors

The problem of strengthening the interaction between SMEs with the university and R&D sectors in the region was recognized. While each country should devise appropriate measures to overcome this situation, it would be useful if there could be an exchange of views and information between countries of the region so as to help overcome this problem. There should be an interaction with the countries of East Asia to gain from their experience.

(g) Venture capital

The venture capital sector is weak in the region as a whole, being worse in some countries than in others. There should be a concerted effort with a mutual exchange of views to overcome this problem. Study of venture finance availability and performance in relation to the country's technology development needs is required. In this study it would be useful to determine the industrial investment on a sectoral basis and determine the role of venture capital in this investment.

(h) Business incubation mechanisms

Each country should adopt certain appropriate mechanisms for technology business incubation in order to nurture new enterprises and provide technical advisory services to SMEs. Some external assistance from agencies like the United Nations Development Programme (UNDP), United Nations Industrial Development Organization (UNIDO), ESCAP should also be extended to the developing countries under a broad framework.

(i) Country exchange programmes

Efforts should be made to initiate country exchange programmes in the developing countries of the region to understand and complement mutual efforts in carry out studies, assessment surveys, training and setting up of incubation mechanisms, etc.

2. Guidelines for successful launch of technology business incubators

Some of the suggested steps, which may help in successful launch of a TBI, are as follows:

- Select a location after careful evaluation with a clear mission and business plan
- Sound financial support both from central and state governments and other related agencies
- Structure the incubator to provide value to tenants and stakeholders
- Careful selection of tenant firms with highest growth potential
- Appoint a proactive management board for overall guidance and a dedicated team for day-to-day operations
- Identify and develop a panel of professionals who provide critical support services for start-ups
- Facilitate access to venture capital scheme and other innovative financing mechanisms
- Effective networking with other R&D institutions for making the TBI a focal point for technology in the region
- Be customer service focused with both tenants and stake holders
- Build an effective monitoring mechanism
- Structure the activities to attain self sufficiency operations within a set time frame

C. The Republic of Korea

1. Factors of successful ventures in the Republic of Korea

The success factors of venture in the Republic of Korea such as business item, start-up team, ledge market, outsourcing, and entrepreneurship.

(a) Business item

The successful companies must have the income and growth model of business. During the last several years, Internet, information and telecommunication, and semiconductor industries expanded their market volumes and therefore any related items get the better sales volume. Market entry of new technology provided a lot of opportunity for engineers or technopreneurs to reduce the risk. In 2000, bio-venture companies were attracted by venture investors.

(b) *Strong team of start-ups*

Start-up team must have not only business-mind and professional attitude, but also unity and common goal. Entrepreneur should be open-minded, and may have a better distribution of benefits and maintain the partnerships.

(c) *Ledge market*

Ledge market, of which large companies can not take the merit, is the main target of venture, but the stability and success opportunity of the initial stage would be increased if blessed by large companies.

(d) *Outsourcing*

All the venture companies need also supply the resources for products and employ them efficiently and cost-effectively. The small companies, however, cannot have all of necessary resources, but it is supplied by outsourcing even all the human resources and facilities.

(e) *Entrepreneurship*

The entrepreneur must have the desire, leadership and vision of business as well as the technology foresight. The leadership is very important to make the uncertain project successful.

2. Policy recommendations

In the Republic of Korea, several ministries are involved with the business incubation, and as the result, there has been duplicating investments. It will be better for one ministry provide support for the business incubation.

Republic of Korea aims for the establishment of business incubators for the high-tech companies. However, as a still developing country, Republic of Korea may be better-off to establish business incubators for simple processing technology as well as incubators for high-tech technology.

It is essential to secure and train BI managers from the start of business incubators.

Support for business incubator should be stepwise such as securing incubation space and infrastructure, operation expenses, and funding of tenant firms. Also, the business incubator should seek financial independence after 5 years.

It is more desirable to establish business incubator in cooperation with universities or research institutions with the research and development capabilities. Business incubators should specialize according to their operators.

3. Lessons of experience to other countries: the Republic of Korea

Because majority of business incubators (BIs) in Republic of Korea are in the infant stage, there are many rooms for possible improvement. Based on the identified problems faced by BIs, following policy directions are suggested.

First, for the activation of BIs, several supporting activities for tenant companies such as management and technical advisory services should be strengthened by broadening the scope of services offered and hiring eligible incubator managers.

Second, management systems for BIs should become professional. Screening process to select new tenants should be improved by inviting external experts in the committee and by emphasizing business opportunities rather than technical performance as screening criteria. Also new investment mechanisms between BIs and tenants can be devised. For example, BIs can invest to tenants and tenants can pay stock option instead of rent.

Third, specialized BIs in term of tenants' business areas can be more effective by providing business-specific supports and increasing synergy among tenants. Therefore the government or government agencies should promote establishment of specialized BIs relevant to regional characteristics.

Fourth, many cases of successful incubation – success stories of tenant companies during incubation and after graduation – should be developed and publicized to encourage new venture creation of potential entrepreneurs and to attract many capable tenants into BIs.

Fifth, incubation activities should be linked to support mechanisms for potential entrepreneurs before founding and growth companies after graduation. For potential entrepreneurs, BIs can provide several services such as business planning guide, information providing, space rental such as preliminary moonlighting incubator (PMI), and training services. For growing companies graduated from BIs, STIPs or technology parks can accommodate them so that they can contribute to regional economic development and job creation by utilizing benefits of STIPs.

Sixth, networking among BIs is very important as an arena to exchange information and management knowledge. For example, the role of Korea Business Incubators Association (KOBIA) can be activated based on the benchmarking of National Business Incubation Association (NBIA) of the United States.

Seventh, BIs should be served as the framework to strengthen university-industry cooperation and to activate spin-off from universities, industries, and research institutes. In addition, globalization of BIs through international cooperation with incubator in the world should be promoted to support the entry of tenants into foreign countries.

III. PARTICIPATING COUNTRIES' EXPERIENCE AND NATIONAL RECOMMENDATIONS: BANGLADESH, CAMBODIA, THE LAO PEOPLE'S DEMOCRATIC REPUBLIC, MONGOLIA, NEPAL AND VIET NAM

A. Bangladesh

The economy of Bangladesh is growing at a modest rate with reasonable macroeconomic stability. Considerable progress has been achieved in selected micro aspects which need to be further consolidated and sustained. However, the formidable challenge facing the country is to graduate from low to a middle-to-high income currently achieving a faster and higher rate of sustained economic growth required to force an exit from endemic poverty. In the present environment of intense global market competition achievement of high and sustained economic growth requires building of a strong and competitive industrial base which is critically dependent upon development of higher technological capabilities and standards. Unfortunately, the current industrial and technological base of Bangladesh is narrow and weak and technology industry linkage is also at a low level. While increasing attention is now being paid to national science and technological capability-building through government interventions of various levels, lot remains to be done to broaden and strengthen overall technological base of the country.

Given the narrow resource base, inadequate availability of technically qualified manpower, underdeveloped S&T infrastructure, weak R&D and innovative capabilities of the present S&T institutes the government may concentrate on developing a dynamic and internationally competitive modern technology-oriented SME sector which appears to have significant potentials for augmenting poverty-focused growth and thereby achieving the millennium development goal of alleviating poverty by half by 2015.

SME development is crucial for Bangladesh to achieve falser rate of growth and sustainable development. Stakeholders including the businesses, chambers, financial institutions as well as the government need to join hands to develop the SMEs by formulating and adopting SME friendly policies and practices. Recognizing the importance of the SMEs sector, there is an emerging consensus that new approaches are needed to improve the effectiveness of the programmes supporting SMEs.

Most SMEs in Bangladesh face a number of interrelated difficulties including severe shortage of short and long term finance, modern technology, marketing problems and lack of promotional support services such as various supply and demand driven business development facilities. To overcome these problems the SMEs need an wide array of support assistance comprising both financial and non-financial services.

These may include a comprehensive and pro-active SME development policy, easy access to finance, technological support, accesses to R&D facilities and to domestic as well as international market. As the priority is on the evolution and development of a new technology based SME sector, the SME policy package must put greater emphasis on constant technology ungradation facilities, improvements in management efficiency, skill development and dissemination of market information.

Access to finance is the major problem for the SMEs as commercial lending institutions typically ignore the financial requirements of the SMEs primarily due to their weakness in offering fixed assets as collateral. It is suggested that introduction of the concept of moveable asset based financing systems would greatly benefit both the SMEs and the financial institutions. To this end, government may promulgate necessary statutes.

It is of immense necessity to work both in public and private sectors to promote the use of IT with a view to effectively establish linkages with the SMEs. Interlinkages between universities, research organizations and industries need to be carefully and consciously developed, if needed through introducing statutory regulations.

SMEs typically lack access to new technologies and to improved management techniques. The entrepreneurs who own and manage small business lack management skills, do not have access to technology, resulting both in low productivity and poor-product quality and further lack ready access to markets for their output.

To expand the local market for the SMEs, it is essential to arrange local trade fairs as well as assist in SME participation in numerous trade fairs in countries such as Japan, the United States, the United Kingdom, Australia, South Africa, the United Arab Emirates, Singapore, Italy, Germany, etc. Furthermore, there is a need for detailed structured initiatives for development of programmes for encouraging exports by SMEs, imparting technical training to the workers and numerous technology transfer workshops.

Individual SMEs experience difficulties in achieving economies of scale in the purchase of inputs such as machineries, equipments, raw materials, finance and consulting services. They are also often unable to take advantage of market opportunities that require large production quantities, homogenous standards and regular supply. However it is clear that many of these obstacles are results of their isolation rather than their size. Therefore, closer cooperation among them not only helps to overcome these problems but also creates backward support linkages for larger exporting SMEs.

Microenterprises do not have access to recognized associations to help them in widening their access to financial institutions on the one hand, and receive business development services on the other. These enterprises may therefore be encouraged and assisted to form their own associations to be able to access various business development services.

An appropriate and effective institutional network is vitally important to ensure efficient delivery of SME development assistance services. A separate institute for modern technology-oriented enterprise growth and technopreneurship development, and prevision for training and research activities may be developed with built-in arrangements for effective partnership between public and private sector. For example, Bangladesh Small and Cottage Industries Corporation (BSCIC) and Federation of Bangladesh Chambers of Commerce and Industry (FBCCI) may fruitfully cooperate in developing Internet facilities and web sites for the SMEs to facilitate easy access of these enterprises to knowledge, information, technology and markets.

Recommendations for development of technology incubation systems

Development of technology incubators should be explicitly included as an objective in S&T policies to promote and nurture high technology-based enterprises along with provision for specific financial outlays since promotion of technology incubators is generally absent. There is a need for well-coordinated and united efforts, with clear distinctions and responsibilities for various organization and agencies involved in the process. Similarly, various policies related to the incentives, tax structure, real estate development, skill-development and education programmes, and development of SMEs should be evolved in consultation with the technology incubator promotion agencies. Consortia approach between various relevant stakeholders may be a useful approach.

In least developed and developing countries like Bangladesh initial focus may be on the development of simple business incubators with technology as a central theme and located in industrial estates and industrial clusters as opposed to nurturing new technologies of generic nature through sector specific incubators mostly located in or near a university or an R&D institution, with the ultimate objective of developing new SMEs.

The national R&D expenditures, both public and private, should be enhanced continuously so that R&D facilities and expertise in universities and R&D institutions are strengthened and researchers/academicians are encouraged to become entrepreneurs. At the same time, young technopreneurs should be trained and supported to nurture their technology-based businesses. Mechanisms need to be evolved to cover or share the risks in high-tech businesses. Some of the R&D institutions may be corporatized as in Japan.

Government should support and encourage the setting up and networking of Technology Incubators Associations within the country and outside. Exchange of experiences, organization of trade fairs and exhibitions for technologies and products of incubatees, at national and international levels should be encouraged. Since incubator and graduated companies are generally small and have limited resources, such activities would assist them in marketing and promoting cooperation. Preferential access of the new generation SMEs to these facilities will be a critical determinant of high-tech based SME growth in the country.

Inward and outward foreign direct investments (FDIs) for SMEs with related technology transfers should be encouraged through technology incubators (TIs). TIs may even be technically involved in selection and acquisition of technology by large corporations in public and private sectors. Concerted efforts should be made on a long-term basis to develop trained and skilled manpower. Mobility of S&T personnel between industry and R&D institutions should be encouraged. There should be no disrespect to researchers who have been unsuccessful as technopreneurs.

Intellectual property systems including patent literacy, search and filing facilities should be encouraged through training etc. and financial support should be given to file patents abroad through the TIs. Incubatees and graduated enterprises should be encouraged and supported for international certification such as for ISO 9000 and ISO 14000, quality management and energy conservation, etc. In fact, TIs themselves should be encouraged to obtain such certifications.

Large corporations, private universities, training institutions, R&D institutions, industrial associations, export promotion councils and trade development agencies should also promote technology incubators independently or jointly with government agencies with focus in their respective areas of operations. Private financial support agencies and investors etc. should also actively associate themselves with the government supported or privately promoted incubators.

Foreign companies and transnational corporations (TNCs) should support TIs in specific areas to augment their R&D and technological capabilities, as is being done by Oracle in Singapore. TNCs can also set up R&D centres or centres of excellence in developing countries, as in India, which can be linked to TIs. R&D costs in developing countries are usually much lower than those in developed ones. However, generation of knowledge and skills is important to attract TNCs.

Large corporations and SMEs should seek the services of TIs during technology transfers and also source their requirement of goods and services from TIs or their graduates. Large corporations can subcontract their R&D or technology development projects to TI companies and also source their requirements of goods and services from TIs or their graduates.

International promotional agencies should assist national governments in developing trained managers and human resources or establishing and operating technology business incubators in the developing countries like Bangladesh to adopt best practices or to enable them to evolve their own practices and models.

International organization such as ESCAP, UNIDO and the Asian Development Bank (ADB) could also help in setting-up a small demonstration type of technology-business incubators in countries, where such facilities are non-existence.

A regional network of technology business incubator could also be promoted by the regional organization such as ESCAP.

B. Cambodia

National need and requirement

Cambodia's first Socio-economic Development Plan (SEDP) 1996-2000 set out a framework of nine guiding principles reflecting the Royal Government's approach to industrial policy-making. The main sectors in which investment is strongly encouraged are the following:

(i) Pioneer and/or high technology industries
(ii) Job creation
(iii) Export oriented industries
(iv) Tourism industries
(v) Agro-industries and processing industries
(vi) Infrastructure and energy
(vii) Provincial and rural development
(viii) Environment protection
(ix) Investment in the special promotion zones (SPZs)

With strong determination, national discipline and a clear view of the overall goals, the Royal Government of Cambodia has achieved significant result in just over two years since the early 1994. No doubt, there are still many challenges ahead and problems to be overcome, even those that arise as a consequence of progress made.

(1) Efficiency in production

Illiteracy, lack of appropriate standard of education, technical and professional training, the lack of managerial and organizational skills and instrument to support sustainable economic development especially Information and Communications Centre (ICC) had impeded the growth of productivity in some sector of the economy notably SME sector.

Of course in Cambodia, the clear change in production has substantially been made through the inflow of FDI. A number of old, broken state-owned enterprises have been privatized, renovated and equipped with new production line. For example, Apsara (condensed milk factory) and Angkor beer brewery, soft drink, winery, cigarette, textile/garment factories have been put into operation and increased in both quantity and quality.

These enterprises even can compete with foreign products and a number of them have even come to export their product overseas. But the lack of physical infrastructure has hampered the inflow of FDI. Cambodia is also facing the challenge to attract FDI, to increase productivity, to strengthen and upgrade industrial, technological and commercial activities that is to say there is still no access way to build business to business bridge in view to create lasting, long term opportunity for free enterprises to ensure sustainable economic development of the nation.

In addition to the above stated, the loose collaboration between ministries such as between the Ministry of Industry, Mines and Energy (MIME) and the Ministry of Agriculture, Forestry and Fishery (MAFF), the Ministry of Economy and Finance (MEF), the Ministry of Public Work (MPW), the Ministry of Rural Development (MRD) and the Ministry of Water Resources and Meteorology (MOWRAM) may also slowdown national productivity in terms of agro-based enterprise sector.

(2) Major Internet/e-mail service provider

Actually there are two major Internet/e-mail service providers in Cambodia the common service they provide customers are:

- Communicate worldwide instantaneously via electronic e-mail
  - ➢ Use the World Wide Web (WWW) to do research for work or school projects, learn about new products, read reviews, access information on other countries, their universities and businesses, make travel arrangement and so on

- ➢ File transfer protocol (FTP) to transfer files between remote computers or to download shareware items (software, font, game, etc.)
- ➢ Access a search engine to help find an Internet site with information on specific topic we are interested in

(3) *Full Internet access*

Full access includes complete Internet access via WWW, Gopher, FTP, Telnet and most importantly, e-mail is included in the full access package.

Even though there is no connection on systematic, integrated orientation towards proper sustainable economic development especially to support the promotion of SME sector because of the non-existence of “Information and Communication Centre”. Therefore almost all business enterprises are keeping information resources under one’s roof” for there is no proper and reliable communication system between the related MIME and its under-supervised manufacturing units. In fact at present we have no access way to strengthen and upgrade industrial, technological and commercial activities for SMEs at all.

Obviously, almost all manufacturing enterprises are aware of these needs. According to the business enterprises response to the questionnaires, we have noted that the majority of them are equipped with Internet/e-mail fax phone, Photocopy machine, mobile phone and computers. These will facilitate the relational network between MIME and SMEs and their clients. Naturally we understood that all manufacturing enterprises are facing with the shortage of skills and qualified personnel that will require training assistance.

They are also in need of technology acquisition/transfer, upgrading technology, skill training, standardization, quality control, specific technology in order to ensure the products quality and improve productivity. Also it will require mechanism to keep abreast technological development. In this initial stage, an access to online information services, Internet or CD-ROM database will be beneficial for such need.

To this extend, may we recommend MIME to find an alternative way to set up an Information and Communication Centre so that services could be rendered to SMEs enabling them the increase of their productivities.

The main objectives are:

- To set up the backbone for a national information infrastructure with global link via Internet
- To strengthen and upgrade industrial, technological and commercial activities in Cambodia
- To enhance professional capabilities in related spheres though training, motivation and access to modern technology
- To facilitate the sharing of knowledge and skills among various information technology professionals and end users local and international in private sector as well as government agencies and training institutions
- To provide a window of opportunity to foreign investors and entrepreneurs seeking information on Cambodia
- To provide comprehensive technology transfer to the industrials and entrepreneurs of Cambodia

(4) *Training*

In order to achieve the above enumerated objectives, MIME, through the assistance of ESCAP, should develop a broadly based human capitals to serve this sector, we would suggest the training assistance from ESCAP for MIME’s personnel in the following specialized areas:

- 1 Manager
- 2 Database programmers
- 2 Home-page programmers
- 4 Computer specialists
- 2 Information specialists
- 2 Marketing specialists
- 1 Trainer

(5) Equipment and software needed

- 1 Internet server, 1 router, 1 line server, firewall
- 1 Database and Internet local area network (LAN) administration server, hub
- 5 Workstations
- 2 Printers
- uninterruptible power supply (UPS)
- MS Windows NT 4.0, MS Windows 95, MS BackOffice. MS Office Professional, Outlets, Internet/Intranet

C. The Lao People's Democratic Republic

The issue of business/technology incubator is a new concept in the Lao People's Democratic Republic. In the past, the business activities have been based on the preference and talent of the entrepreneurs.

The Government intends to support the development of micro, small and medium enterprises. The dissemination of legal, regulatory and administrative information to SMEs should be perceived as one of the primary responsibilities of central and provincial level authorities and appropriate capabilities should be built. Central and local authorities can work with partners, such as the national and local Chamber of Commerce and Industry (CCI) in carrying out their regulatory information dissemination responsibilities.

The Government has tried to create an enabling environment for production and business activities by issuing of appropriate policies of encouragement. Laws, regulations and some policies have always promulgated every year.

The Government should invest, more than the past, in the field of education for the development of human resources, the capacity-building of the cadres and personnel to ensure the success of Government goal's implementation.

The Government should appropriately set the credit priority relating to tax and duty, as well as appropriate professional training for each target in order to generate employment, encourage production business in many economic sectors with various scale and at different levels, especially the promotion of small and medium scale enterprises which require small funding and technical level suitable for our people in various regions.

The Government should also concentrate on the potential of the industrial and services sectors of our country, especially in electricity generation and services, agriculture and forestry processing, and mining; expand transit services and tourism to prepare for future industrialization and modernization.

The Government should concentrate on linkage between the services and industry sector and agriculture sector, aiming at increasing the effectiveness and the volume of production.

The Government should revise the policies and regulations that promote investment, stimulate improvements to the structure of government organizations, regulations and procedures for approval of investment.

The line ministries concerned should carry out the research and propose to issue laws and regulations to regulate and facilitate the establishment and development of small and medium-sized industries.

The Government should encourage the establishment of agencies and institutions to provide services to investors through provision of training, advisory services, information, assistance in conducting product research and development and transfer of technology.

The Ministry of Education with its affiliates should emphasize the acceleration of human resources development through training of workers and managers of SMEs.

The Ministry of Commerce should revise the Business Law and existing regulations to facilitate business establishments and operations, and implement effectively the consistent regulations.

In the long term, SMEs funding with preferential rates is recommended for productivity and quality improvement, research and development, technology improvement and environment protection.

The Lao People's Democratic Republic National Chamber of Commerce and Industry is the representative of the business investors. It should encourage and organize the training, counseling, advisory and consulting services to assist the SME owner-managers for their business achievement. At the same time, they should be responsible to develop the business environment for small and medium-sized enterprises.

The banks/large private companies with the consultation of CCI can take part in establishment and the provision of development funds for private enterprises. In the medium term, they will have potential to set up the business/technology incubator for supporting their business in the international market.

The Government's decentralization policy is to building up the province as the strategic unit with responsibilities including international cooperation, the districts as the planning and budgeting, and the villages as the implementing unit with requirement in setting up evaluation systems to monitor the development plans that they have formulated. The local authorities should be master in the enhanced management over the economic business units located in their areas.

All personnel in the local/regional agencies should facilitate and create the good investment climate to the entrepreneurs who can create jobs for many people at the grassroots level.

In matters related to policies, it is essential to formulate a specific law to promote specific SMEs and business incubator, provide incentive measures including tax policies, provide R&D budget to nurture emerging technologies, and prepare policies and measures to encourage talented entrepreneur to create venture businesses.

In the field of financing it is essential to formulate innovative financing system to create venture capital companies, support angel fund, and provide initial investment for incubation building.

In institutional strengthening it is essential to organize inter-ministerial committee to promote specific SMEs and business incubator, establish special promotion agencies to promote specific SMEs and business incubators, and support to set up business incubator promotion association.

Furthermore, the Lao Chamber of Commerce has to be strengthened and should promote trade and industries association and the Government should create incentive plans to attract local and foreign investors.

D. Mongolia

(a) Government has a major role to play during the creation of a market economy, such as:

- Sustaining growth and aggregate investment, creating the institutions necessary for a market economy to function efficiently, investing directly in physical infrastructure and human capital
- Creating a monetary and financial system that facilitates private investment, and intervening directly to help the poor when all else fails

(b) To implement the opportunities for technology transfer, the following preparatory actions should be undertaken at a national level:

- Identify technology needs for main sectors
- Evaluate in-depth the priority mitigation technologies

- Identify the opportunities to promote the technology diffusion
- Identify the priority of barriers and practical steps to remove them from the development and transfer of technologies
- Establish a capacity-building and institutional arrangements
- Identify the ways to participate in the bilateral and multilateral mechanisms for technology transfer
- Promote the participation of the private sector in technology transfer

(c) The establishment and growth of small and medium-sized enterprises is the major contribution to the generation of new jobs in Mongolia. Technology/business incubators seem to have a significant impact on the survival rate for start-up SMEs.

(d) SMEs are crucial for industrial restructuring and are an important element of the reform process. The Government's role is also crucial in the development of support services for SMEs.

(e) As shown in foreign country's practice, such support institutions, business incubators, innovation centres, industrial parks and techno-parks have to be effective instruments for assisting entrepreneurs in starting a new business, nurturing young enterprises, and helping them to survive during the start-up period when they are most vulnerable.

(f) From political and social points of view, assistance to SMEs has been considered both by national governments and international donors as a step towards economic growth, and assurance against unemployment and poverty alleviation through self-employment.

(g) It is seen as a means to strengthen the private sector and a way to foster the reduction of regional disparities through decentralized and local/regional development.

(h) Last but not least, R&D has to survive the transformation of their institutions to a market economy and are aiming to catch up with their competitors in advanced market economies. Decreasing government support for R&D makes it vulnerable to use their innovative and creative thinking with which they develop their ideas for marketable products and/or services.

(i) Inclusion of representatives from leading private sector, industrial units and non-governmental organization (NGOs) in policy formulation and implementation is a backbone of successful transfer of technology.

(j) Technology transfer is not merely a movement of hardware and equipment. Hardware or physical capital only embodies one element of an entire economic process covering the subject of technology in its entirety. If successful technology transfer is to take place, then a local capacity establishes and adopts, and if necessary adapts and uses appropriate technologies to reduce environmental burden on the earth. Local capacity can be built essentially by two sets of activities. The first relates to training and human resource development, and the second focuses on the software aspects of technology, which are often ignored.

(k) Technology transfer incorporation with some of the key elements of the country's sustainable development strategies will lead to an economic development, opening up of new markets for products and services and technology sharing between countries.

(l) Significant system of academic, research organizations, and higher education establishments with great intellectual potential has been formed. There is a lack of linkages between research and industry. In this respect, there is a great need for creating a system of venture financing of innovation and R&D projects, development of a "spin-off" system as well as of network of technology business incubators.

(m) It is encouraging to note that the concept of incubators in Mongolia is just being introduced to the country. It is hopeful that, in the near future, Mongolia can build some well-established and successful incubators with assistance of international agencies.

E. Nepal

(a) The Government of Nepal should identify potential products/sectors of SMEs that could be promoted in the global market through business incubators.

(b) The Government of Nepal should develop business incubators, sponsored by government budget and policies of promoting SMEs and new ventures.

(c) The Government should facilitate, rather than take a leading role, to establish the first incubator in the country. The first incubator should be established in joint collaboration of the Government, academic institutions (universities) and the private sector. However, experienced and competent private sector should be involved especially in managing the incubator.

(d) The pace of developing the infrastructure for IT Park is significantly slow thus, needs to be accelerated so as to provide support as soon as possible.

(e) The IT policy needs to be reviewed and updated in accordance with the change in environment.

(f) Government should take initiation to develop business and technology incubation centre in the different parts of the country. For it, some incentive system needs to be initiated to encourage people to start and run incubation centre as enterprise.

(g) The research and R&D activities done in Nepal particularly in the science and technology are not sufficient however, whatever innovations done within the country and information updated from other countries are not even been accessed by business communities and other users. So, a certain mechanism needs to be initiated for it to have a coordinated effort among the concerned institutions and business communities.

(h) SMEs in Nepal, in most cases, are using outdated and inefficient technology mostly bought from neighbouring states of India to Nepal with limited information on technology. This is happening because of lack of institutions within the country to provide technology or related information. So, it demands quick and serious effort to be put for developing technology related policy as well as programmes.

(i) It is quite important to explore potential of some organizations so as to promote them as institutional infrastructure for the promotion and development of business and technology incubation centres in true sense so that access to these services can be enhanced in a wider spectrum and also efforts could be made more focused and coordinated.

(j) Networking among various agencies is crucial so as to make BDS and technology transfer and development more demand driven and tailor-made. Tailor-made and demand driven services have better prospect of being paid by the users particularly SMEs.

(k) Efforts have to be made to develop linkage and network between the university/college, laboratory and business & industrial communities so as to exchange experience and updated information.

(l) There might be several successful and effective incubation model outside Nepal which can immediately replicated in Nepal with minor adaptation.

(m) Review of policies related to BDS and technology transfer and development need to be done periodically so that change if required can be done immediately so as to address the need in true sense.

(n) Feasibility study for setting up technology/business incubators (or science parks) in Nepal may be necessary. The fund could be obtained from international organizations (e.g. UNDP) or other countries. Local organizations (especially private companies, like Lotus Holding) can play key roles in doing the study and running incubators, with adequate facilitations from the Government. In this context, the Government should facilitate the setting of business incubators and encourage the private sector to get involved more in venture capital funding for promoting business incubation system.

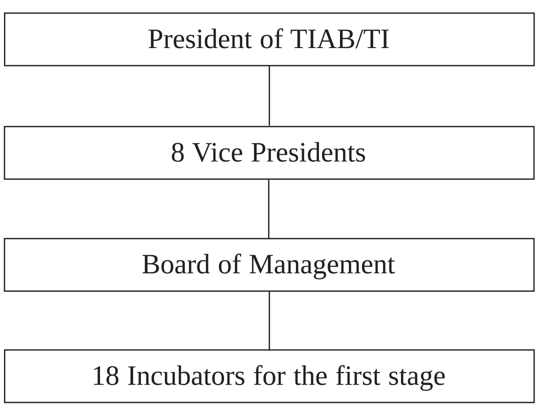
F. Viet Nam

While business and technology incubators (BTIs) are getting quite popular in several developing countries as an innovative way of developing and promoting small and medium industries, however, it is not yet practiced and promoted in Viet Nam. Pressure of competition in the process of international economic integration requires Viet Nam to apply business technology incubators as soon as possible. Especially through the government subsidy and support, it is very essential to promote business technology incubators.

As a pioneer effort and with assistance of ESCAP, the Ministry of Industry (MOI), Government of Viet Nam initiated some activities for spreading the basic conception of business technology incubators in Viet Nam in order to initiate activities to establish and develop business technology incubator system in Viet Nam. At present few Vietnamese research and development institutes are running their business as well as research and development work which have similar form to business technology incubators.

Even many government agencies support such initial results, the common definition and conception, the legal criteria and legal framework for setting up business technology incubators are not yet accepted by any government agencies yet. The urgent issue to do now in Viet Nam is to prepare a legal documentation on conception, common definition on business technology incubators and criteria for setting up business technology incubators and submit them to the Government. After that the campaign and advertisements on benefit of business technology incubators, explanation on the way of establishing and running a business technology incubators should be done widely. Training courses should be organized in the north, south and central provinces of Viet Nam.

The financing and other incentive policies should be created for the purpose of supporting business technology incubators especially at the starting stage. A time schedule for establishing business technology incubators should be set up. For managing and rushing such activities, a temporary inter-ministerial agency on business technology incubators (TIAB/TI) approved by the Government should be set up. Organization chart of TIAB/TI could be as follows.



- *President*: Director General of Department, MOI
- *Vice-presidents*: MOI (Deputy Director General), MOSTE (Deputy Director General), MOF (Deputy Director General), MOT (Deputy Director General), VCCI (Deputy Director General), 3 representatives of Hanoi, Ho Chi Minh and Danang Local Industrial Authorities, Representative of ESCAP in Viet Nam.
- *Managing Board*: Executive Director from MOI members, Directors or Vice Directors of 11 institutes of MOI, Director or Vice-director of 7 institutes of MPI, MOSTE, MOF, MOT, Hanoi, Ho Chi Minh and Danang, Local Authorities representing 18 incubators for the first stage.
- *Business Technology Incubators.*

The terms of reference (TOR) of TIAB/TI should be worked out and focusing on objectives of establishing business technology incubators under certain legal framework, priorities given to SMEs and R&D institutes, operation of business technology incubators, human resource development and financial support and resources.

Financial support should be provided for the first 2 years through the government budget and other donor agencies. After that, financing would be provided by the Government of Viet Nam and contributed by business technology incubators.

Reorganizing TIAB/TI would be done after reviewing the activities and operation within 2 years from its establishment. During that time, a national conference on business technology incubators and exhibition of products and services made and created by business technology incubators could be organized in cooperation with international business technology incubators and other multilateral agencies/bodies such as ESCAP and UNIDO.

ESCAP and UNIDO should support Vietnamese business technology incubators and TIAB/TI, first of all, in creating legal framework to submit to the Government of Viet Nam, transferring experiences on business technology incubators and financial assistance for running TIAB/TI in the first 2 years from its establishment.

MOI is appreciative of the guidance and support provided by ESCAP for the time being for the purpose of developing the business technology incubator system in Viet Nam. MOI also welcomes all experiences transferred by international experts in this field. Training courses on business technology incubators organized by ESCAP or other cities in Viet Nam or abroad would be highly appreciated as well. If MOI could successfully establish and develop business technology incubators in Viet Nam, MOI would share its experiences with other developing countries and MOI considers that it is a good way to promote the entrepreneurial skills and SMEs.

IV. OVERALL RECOMMENDATIONS OF THE WORKSHOPS

Being dynamic instruments of regional economic development, technology business incubation systems need to be promoted in an emerging economy like that of Viet Nam in order to improve community's economic vitality and maximize the success of emerging companies.

As every incubator is a unique entity and is a dynamic model of a sustainable, efficient business creation and growth, its vision and objective should be formulated to suit the need of Viet Nam.

Promoting technology business incubation should be explicitly included as an objective in the industrial and the S&T policies of the Government of Viet Nam to promote and nurture high-technology based enterprises and with specific financial outlays.

National commercially oriented research expertise and expenditure, both public and private, should be enhanced continuously so that R&D facilities and expertise in universities and R&D institutions could be strengthened and researchers/academicians are encouraged to become entrepreneurs, especially technology-oriented entrepreneurs.

Government and donor agencies as well as private sector should support and encourage the setting up and networking of technology/business incubators within the country and outside. Exchange of experiences, organization of trade fairs and exhibition for technologies and products of incubatees, at national and international levels, should be encouraged. Since incubatees and graduated companies have generally small and with limited resources, such activities would assist them in marketing and promoting cooperation.

International collaborative arrangements and agreements at government level should identify opportunities for possible linkages with institutions and incubators in different countries and seek expertise or technical assistance.

Government should develop entrepreneurship promotion programme and allocate resources for its implementation. In this context, a combination of physical technology incubators with larger investments and virtual incubators with minimum investments may be developed for a developing country like Viet Nam.

While new knowledge economy and information technology create brilliant opportunities for reinventing the traditional business incubation model, in particular through development of business e-coaching services, new generation types of hybrid physical-virtual business incubators – business e-incubators – capable to service much wider audience of both start-up companies and would-be entrepreneurs should be promoted in Viet Nam. In such course, the private sector should play a leading role.

Exchanges of R&D manpower between incubators and manufacturing companies and also training arrangements should be encouraged in Viet Nam by both R&D institutes and academia, and industrial organizations.

Private corporations as well as SMEs should increase their R&D expenditures. At the same time, private corporations should be encouraged to enhance their R&D efforts in basic sciences or generic technologies, besides setting up universities and specialized research centres, specially in thrust areas identified by the Government.

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PART TWO

RESOURCE PERSON PRESENTATIONS

I. REGIONAL PERSPECTIVES ON PROMOTING BUSINESS/TECHNOLOGY INCUBATION SYSTEMS

PRESENTED BY MR. JÜRGEN BISCHOFF, DIRECTOR,
AND MR. VADIM KOTELNIKOV, SENIOR TECHNICAL ADVISER OF THE
ASIAN AND PACIFIC CENTRE FOR TRANSFER OF TECHNOLOGY,
NEW DELHI, INDIA

Abstract

Today, "knowledge economy" and "innovation" have come to occupy central place in the competitive advantage of nations seeking technological leadership in international markets. In this process, the role of Technology Business Incubators (TBIs) as part of the system of innovation has become all the more important for transformation of technological ideas into commercial benefits. While developed countries have already taken a lead in this direction, developing countries have yet to fully exploit this system particularly to invigorate SMEs which are a crucial part of their economy in terms of employment as well as growth. After a brief introduction to technology business incubation, a description of the efforts of selected developed and developing countries using TBIs for innovations and commercialization of technologies is given thereby focusing on objectives, concepts, types and results of the different programmes. Derived from the experiences of these countries, recommendations for successful technology business incubation in the new century are proposed.

A. Introduction

The process of globalization, the establishment of the World Trade Organization (WTO), rapid scientific and technological advancements, newer developments and applications of information technology, the emergence of knowledge-based and capital intensive industries, stricter quality standards and systems including ISO 9000 and ISO 14000 systems, environment and pollution control and energy considerations, direct and indirect trade barriers by advanced countries, etc. are eroding the traditional competitive advantages of industries in developing countries particularly small and medium enterprises (SMEs) which significantly contribute to overall industrial and economic development at the national level. Industrial restructuring including privatization is creating the need for retraining and redeployment of the workforce in order to increase employment, besides enhancing in efficiency and productivity in traditional manufacturing sectors through development and use of high technologies and methods including techniques of biotechnology, application of computers and information systems for competitive advantages.

The globalization process is moving up the research and development (R&D) value chain. In this direction, the present objective is to encourage higher value addition activities and preservation of natural resources through the development and application of high technologies such as biotechnology, new materials, computers, telecommunications and information techniques and systems, microelectronics, etc. Creation of completely new industries requires the application of knowledge intensive innovative technologies.

Innovation Management:
Changing Global Scenario

New realities the companies should take into account to be competitive:

- **Shortening life cycle of products**
- **Globalization of world economies**
- **Globalization of technologies**
- **Shift of emphasis from manufacturing to knowledge-based economies**

To apply innovative technologies, the results of original basic research need to be properly nurtured in an environment that is conducive. To facilitate basic research covering a wide range of fields, it is desirable that laboratories specialized in various technical areas gather in a research park where they can share their expertise and conduct joint research. Basic research that focuses solely on the discovery of unknown areas does not result in new industries automatically. As a next step, the "incubation" stage should follow where the potential of new industries is studied. Preferably, a research park should have an incubation town in it to facilitate research at the "incubation stage". Then should follow an "innovation stage", to help new industries to grow on a larger commercial scale. In this "innovation" process, focus is given to specific new high-tech industries. In developing new products in the established industries, manufacturers will have to manage the process starting from technology research projects and ending with the creation of new enterprises in a manner totally different from a conventional one. In this direction, technology innovation centre (TBI) has come to play a crucial role.

B. Basic considerations

Besides development of high-tech enterprises in areas such as information technology, computer software, Internet and e-commerce, biotechnology, microelectronics, etc. it is necessary to apply new and high technologies to revitalize existing enterprises including SMEs in the traditional economical sectors and to promote new enterprises based on natural resources or comparative advantages. The industrial clusters and industrial estates etc. that have come up over the years in various countries need to be vitalized or reoriented through appropriate models of technology incubators located therein, with their connectivity to the larger incubators or S&T parks. These play a crucial role to bolster the technology development stage and aim to transform technological ideas or concepts into technologies for commercial exploitation. In practice, the primary goal of the technology business incubator is to promote the development of technology-based firms, and assist in completion of the technologies under development.

What is technology business incubation?

Business incubation is a dynamic process of business enterprise development. Incubators nurture young firms, helping them to survive and grow during the startup period when they are most vulnerable.

Incubators provide:

- **Hands-on management assistance**
- **Access to financing**
- **Business and technical support services**
- **Shared office space, access to equipment**

Technology incubators nurture hi-tech start-ups and present a technology-oriented variant of business incubators

These are often located in or near universities, R&D institutions, and science and technology parks (STPs). They are characterized by institutionalized linkages with knowledge generating sources including universities, technology transfer agencies, research centres, national laboratories and skilled R&D personnel. The aim is to promote technology transfer and diffusion while encouraging entrepreneurship among researchers and academics.

Types of incubators

▷ For profit

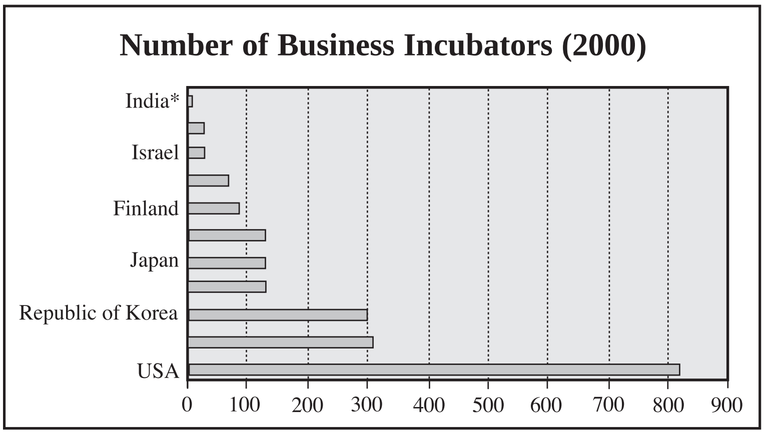
- **Strong financial support**
- **Rigorous screening**
- **Large equity share**

▷ Not for profit

- **Moderate financial support**
- **Open entry or simple screening**
- **No or small equity share**

TBIs are usually a part of the research park or S&T park or linked organically and are capital intensive. Research parks and S&T parks are integrated large facilities, mostly real estate development driven and located in or near the major universities or R&D institutions. They are mostly promoted and supported by national governments along with regional or local development agencies, easier availability of financial grants and investments. A loan on soft terms or venture capital is a major attraction to the tenant enterprises or organizations which may be a TNC or other foreign company.

As at present there are about 3,000 incubators, both for profit and not for profit, of various types in the world, more than 50 per cent of which are located in the United States of America and Europe – about 800 in the United States and 1,000 in Europe including 300 in Germany. Among developing countries, China leads with about 130 incubators. Among industrializing countries, the Republic of Korea is reported to have about 300 incubators. Japan and Singapore are also making serious efforts to promote techno-entrepreneurship in high-tech business through technology incubators.

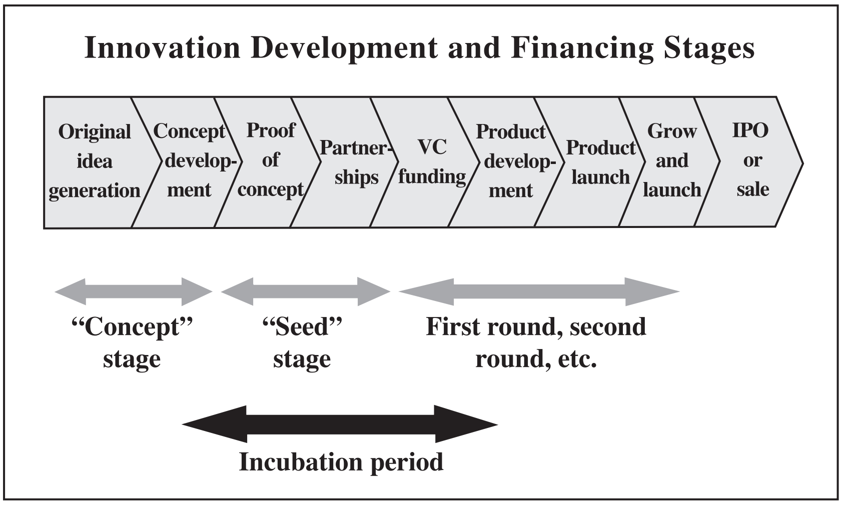


Resources, technological and industrial capacities and infrastructure are widely different in developed, industrializing, developing, least developed, and transition economies, although the basic policies tend to be similar. Thus the models of incubators in different groups of economies have to be necessarily different. As such the objectives, models, practices and impact of TBIs appear to vary widely. Some countries such as the United States, Germany and the Republic of Korea have reported much better success rates for graduating and graduated enterprises during the last two decades. For example in the United States the success rate of small graduated enterprises is about 80 per cent compared to about 30-40 per cent outside the incubators. But in many developing countries, any meaningful conclusions are yet to be drawn.

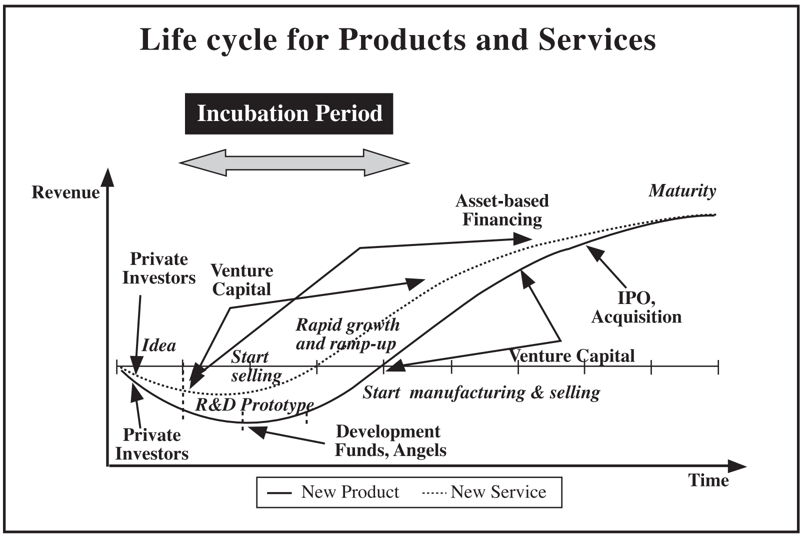
1. Characteristics and catalytic factors

TBI essentially assume:

- Strong R&D and technological capabilities in academic institutions and R&D organizations, thereby associating R&D results with commercial potential and encouraging potential entrepreneurship in research scientists.
- Potential technopreneurs including researchers, who are willing to translate their ideas/high technology into products and services, are available.
- Strong linkages with academic and financial institutions.



The various catalytic factors for supporting and expediting technology incubation for high technology-based enterprises include: well-coordinated implementable national policies including S&T, industrial, trade and commerce, and finance policies; strong R&D including liberalized tax structure and grants; technical entrepreneurship development programmes and incentives, innovative financing support system including venture capital, angel investors, specialized and liberalized stock exchange systems for high-tech enterprises; intellectual property assistance and professional services including legal and technical consultancy services; establishment of strategic business alliances and networking; and support for standardization, quality management and marketing etc. The nature of these factors will, however, vary with the stage of development and national objectives and priorities.



2. The need and scope

The new rules of international trade, investment and the protection of intellectual property rights have rendered many instruments used in the past by the then newly industrializing economies difficult to apply. As regards industrial policy, for instance, it is becoming harder to impose local content rules, give infant industry protection, or subsidize targeted activities. Nevertheless, with regard to technology policy, there is some scope for developing countries to provide technology support services and finance for innovation. Also, a number of policy options remain to strengthen the "supply side". One possible mechanism for effective transfer of technology infrastructure is to attract high technology investors. Governments can also enter the pre-production stage by fostering high technology entrepreneurs in technology incubators located in universities or technological institutes in an industrial park (*World Investment Report* 1999). The suggestions for encouraging local R&D include contract R&D with local research institutions and universities, developing human resources for R&D in specialized disciplines, developing local enterprises including clusters and network of high technology firms and enterprises active in niche markets to attract knowledge intensive FDI. According to Lalkaka, the incubator combines a variety of small enterprises support elements in one integrated affordable package. It has business incubators (BIs) which aim to assist small entrepreneurs with enterprise start-ups and development, a special niche, i.e. nurturing early stage, growth oriented ventures, through focused assistance within a supportive environment. In the Republic of Korea, TBIs host start-ups and provide various benefits and services for promoting and supporting SMEs. They promote the survival rate of newly started small and medium enterprises, reinforce the application of technological innovations, create new business and employment, re-vitalize economies and the research functions of universities and research institutes and finally, foster technical manpower. Thus the business and technology incubation concepts are at the convergence of two global movements i.e. the emergence of SMEs as instruments of economic growth and accelerated pace of technological change and innovation.

According to the Organisation for Economic Co-operation and Development (OECD), TBIs take a range of institutional forms, operating as integrated, or sometimes separate, organizations within science parks, universities, and innovation centres. TBIs present a technology-oriented variant of the BI theme. TBIs, as a system, more frequently provide technology-related services and support on issues of intellectual property, and support from law schools and local legal firms. These help tackle many problems such as: capital requirements including venture capital, linkages to sources of knowledge, strengthening research capacities with appropriate interface mechanisms, supplementing business management and marketing skills of technopreneurs, technology acquisition skills, market intelligence and strategic planning, etc.

Main Factors influencing Growth of Technology-led Enterprises

- **Access to skills and competencies**

- **Access to financing**

- **Access to the market**

- **Environment for innovation**

How technology incubators can help?

3. Technology business incubation systems

As stated above, the objectives, model and practices for TBIs have to be flexible and varying to meet specific needs, ranging from simple business incubators in least developed countries, economies in transition or in developing countries to most sophisticated stand alone TBIs or as an integral part of a technology park in industrially advanced countries. The selection of technology projects for incubation shall vary accordingly, ascending to the degree of sophistication, specialization and the needs of the industry. They may be of general type as in least developed or some of the developing countries and highly focused sector wise in developed countries and in industrializing countries or a mix of above models. It is unlikely that there would be many researchers or researchers/academia needing sophisticated technology incubators in least developed or some of the developing countries. Industrializing countries are attempting to create such capabilities in their R&D and university systems. Industrially advanced countries and industrializing countries are focusing on establishing their technological leadership in select sectors and consequently promoting high-tech corporations through technology incubation systems on a global basis.

On the other hand, the immediate problem in many of the developing countries is to revitalize and restructure the local industries including SMEs and create employment through development and applications of new and high technologies in traditional sectors, besides taking advantage of the opportunities for developing high-tech enterprises in computer software, biotechnology, and information technologies, etc. There is need to evolve and promote widely dispersed TBIs involving technological projects with lesser capital and low cost of operations, meeting technological and professional services needs of tiny units, artisans and craftsmen, etc.

There are some specific clusters of niche areas in developing countries, which are not covered by TNCs but have economic and social relevance, and need modern, high technological inputs. For example, handicrafts, the lock industry, the glass industry, carpets, garments, etc. in India. Virtual incubators may also help to promote and support such enterprises. Even simple business incubators may be initially useful in such cases, which may be upgraded to TBIs, especially in, least developed and island developing countries.

The incubation systems ranging from simple business incubators to highly complex establishments in the form of science parks/research parks or industrial parks seem to have met with mixed results, subjective to successes and failures, and are considered to be still in an evolutionary stage. The definitions, models, objectives, operations and best practices, physical structures, modes of financing and assessment and evaluation methods for incubators etc. vary from country to country and even within the same country, and seem to lack clarity in many cases.

A variety of incubation systems are in practice in developed and developing economics and also in transition economics, with the primary objective of promoting regional and interregional economic developments, providing employment, development and commercialization of high technologies as well as better utilization of R&D capabilities and facilities in public research/academic institutions, through nurturing technology-based enterprises, especially SMEs, in start up or development stages. The levels of investments, sophistications and practices may vary from country to country or place to place. In view of the faster technological developments and new rules for international trade and other issues including developments in information technology, it is necessary that appropriate incubating systems are evolved for promoting high-tech enterprises. These may vary from country to country depending on their resources, stage of development, and national policies, etc.

C. Technology project selection, monitoring and evaluation

Looking at the diversified requirements of the countries, each government should develop its own models of TBIs as per objectives and available resources, after a careful assessment of needs and planning. Technology projects need to be selected and monitored for successful communication and take off in the TBIs. Perhaps a combination of physical technology incubators with large investments and virtual incubators with minimum investments may be appropriate for most of the developing countries.

1. The need

Incubator programmes are implemented to satisfy a wide range of development objectives: South Africa, for example, has special programmes where incubation is used for empowerment of the previously disadvantaged groups in the country while incubation programmes in Israel were primarily to integrate immigrants (scientists and engineers mainly from the Russian Federation) into the mainstream and to absorb the new technologies or ideas that they brought. Moreover, they also created a climate to prevent brain drain from Israel. The endeavour bolstered the technological ability of the Israeli industry, created new jobs, and improved standards of living. These TBIs were geared to absorb any project that suited their structure and aims. It enabled technical entrepreneurs to conduct their R&D programmes in a professional, friendly, supportive atmosphere, while receiving the guidance they need in the starting phase.

Most SMEs in developing countries lack the technological requirements for sustainable competitiveness. Usually their technological needs relate only to straightforward gradual improvements in product quality and productivity or machinery upgrading. This inhibits strategic breakthrough innovations and turns companies blind to new business opportunities presented by market and technological discontinuities. The related capability required to diagnose the technological competitive position of the company, to define technological strategies and to effectively implement related technological innovation projects does not exist in the great majority of enterprises. This often leads to a situation where SMEs do not succeed in obtaining the required finance for new technology projects. This is further aggravated for start-up companies.

New Technology Financing – Success Rates

- **6 in 1,000 business plans get funded on average**
- **The No. 1 reason a start-up's valuation is cut due to incomplete executive teams**
- **10% of start up in a given venture capital portfolio will succeed**
- **6 out of 1,000,000 of technology ideas will result in IPO**

Andrew Olmsted, Co-founder, The Cambridge Incubator

In order to harness the power of strategic innovation a company must act on foresight and on insight into the current and future needs of customers. The leveraging of foresight and insight allow it to conceptualize a desired future and to create new products and businesses.

Therefore, breakthrough strategic innovations require prospective analysis of technologies prioritized by their impact on existing and future competitive factors, the detection of opportunities and threats to existing and new businesses created by market and technology discontinuities it involves, the precise identification and leveraging of an enterprise's core competencies, diagnosis of the technologically competitive position of the company, definition of respective risks of technological strategies, balanced project portfolios and innovation partner's roles. In the scenario of globalized markets and increased international competition, these enterprises require more and more technology management skills for technology projects selection and evaluation for successful incubation.

2. The process

It is very difficult to predict whether a technology will be successful in industry. Market forces play a major role in determining the success, and apart from these forces being unknown until the technology has been released into the market, they also tend to change regularly. The functions of technology evaluation and selection are, therefore, not a single event, but rather a process during which several evaluations are made before a technology may finally be selected to enter into the incubator facility.

Selection of Applicants for Technology Incubator: Idea Screening

MARKET

- **IS IT REAL?**

MARKET

- **CAN WE WIN?**

MARKET

- **IS WINNING WORTH IT?**

Incubation is an extremely powerful process in the sense that it manages the risks of new technology-based enterprises by creating a virtual business environment for development but it is not a guarantee of market success. The final filter before entering into incubation is, therefore, a more formal filter than any of the preceding ones, and is applied strictly. The following criteria are often used:

- ***Market potential***

  A business plan is prerequisite for any incubation. This plan must consider the risks and uncertainties, including the present and future market size, the distinguishing factors of the products, potential competition from rivals and substitute technologies, and the learning curve pertaining to the manufacturing and development costs for new product generations. Two critical factors which are often misjudged and viewed over-optimistically are the future development costs and growth in sales. There should be an immediate export potential.

- ***Competitive-edge and sustainability of the technology***

  Technologies must be in the growth or mature phase of the development cycle to be selected for incubation. If a technology is ageing or easily replicable, it is obvious that the company will not be sustainable for long.

The ideal technology for an existing SME is one that is found in the core competence of the SME. This will allow a range of products to be developed and will be more difficult for competitors to imitate.

- ***The personality of the entrepreneur***

It is difficult to separate the selection of the technology and the person who will develop and exploit it in the SME. Emanating entrepreneurs are usually excited about the prospect of owning their own businesses. The first and rigorous test comes when financial commitment is required. Secondly, the entrepreneur must prove his/her ability and dedication to perform on time.

It is often found that the technology is described in terms of its capability to generate various high-technology products and to solve complex problems. It is, therefore, captured in people's minds and not so much on paper or in data packs. The scrutiny of the potential of the leader of the new SME is, therefore, important.

Three attributes appear to be important in the selection of the leader or entrepreneur. Firstly, he or she must be trustworthy. This can usually be verified by looking at the career history of the person. Secondly, the person must be willing to learn, endure and accept accountability. This is not easy to ascertain although personal references may help in this regard. The third attribute is ability. This is normally established through previous work. In most cases, ability can be enhanced as long as the willingness is present, while very little can be done to build trustworthiness and willingness.

Technology when effectively utilized is a powerful instrument for starting a new venture or to enhance enterprise competitiveness. Therefore, technology project selection for incubation requires the application of those managerial techniques ensuring that the technological factor is properly utilized to achieve the enterprise goals. A critical part of this approach lies in the correct monitoring and implementation of appropriate practices related to technology and innovation management. Within this process an indispensable pre-requisite to improve enterprises' competitiveness is the identification and choice of critical technologies and project options. It is a prerequisite for successful incubation of technology management strategy which must take in due consideration:

- how technology supports the business strategy or vice versa
- if and in what ways technology can be utilized as a source of competitive advantage
- actions in technology development and acquisition to be undertaken in order to achieve the identified objectives of the enterprise

This provides a structural framework for assessing and analysing information to define a technology choice strategy for incubation.

Criteria for Selection of Applicants for Technology Incubator

Advanced technology within the focus area

Business viability

University relationships

Economic impact

Ability to benefit from the incubator

For many established enterprises, technology selection means mainly to decide which kind of improvements should be made in the manufacturing process and/or which kind of equipment should be developed/incubated to satisfy their needs. In these cases, a technology project boils down to the purchase of a new machine along the related engineering project. Sometimes, engineering projects must be executed to insure the implementation of the new machine. When the enterprise is technologically more advanced, development projects may then be envisaged. In these cases, the technological choice decisions are more complex and involve evaluation of different approaches to technology acquisition and to the management of the portfolio of technical projects.

The process of technology selection thus involves the following steps:

- Technology survey (technical)
- Developing a business strategy (commercial, financial, human resources)
- Technology strategy

Selection of Tenants: Auditing

Types of Auditing

- **Technical**
- **Commercial**
- **Financial**
- **Human resources**

Examples for selection of tenants by selected incumbents, both for profit and not for profit are shown in figures below

Example: Criteria for selection of tenants by non-profit cyber incubator (China)

- **A small young HK registered technology company with limited liabilities**
- **At least 2 full-time persons, one of whom is a shareholder**
- **US$ 40,000 paid-up working capital**
- **Majority of R&D must be conducted at the tech-centre (host)**
- **A competent, balanced management team**
- **A viable business plan**

Example: Evaluation of candidates by a for-profit incubator net strategy (USA)

Evaluation: Three steps

Screening

- **Management**
- **Market**
- **Competition**

Analysis

- **Business mode**
- **Revenue potential**
- **Potential value**

Presentation

- **Meet with management**
- **Capital requirements**
- **Scalability**
- **Exit strategy**

Example: Selection of tenants
by red-ramot hi-tech incubator (Israel)

Provides an initial home, necessary services and seed capital for entrepreneurs with the ideas, vision and determination to create a viable business in the field of biomedical technology.

Project screening elements:

- **Business potential**
- **Scientific and technological merits**
- **Personal qualities of the entrepreneur (especially marketing and business skills)**

Procedures for evaluation of start-up companies include several risk assessments:

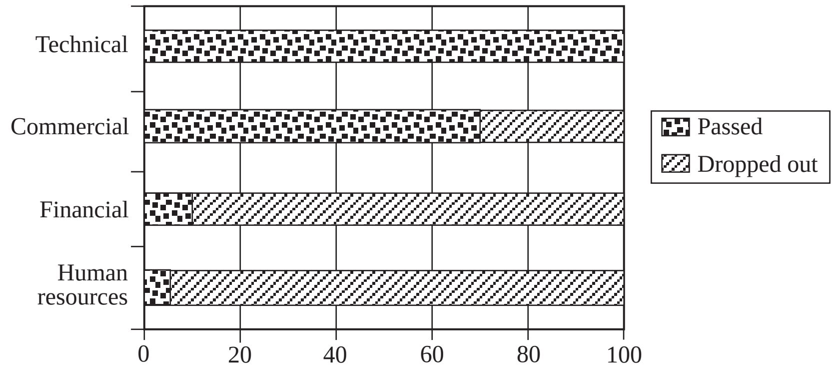
- Team risk
- Business strategy risk
- Product/technology risk
- Market risk
- Operations risk
- Financial risk
- Marketability/Project office risk.

In general, as soon as the technical idea of the potential incubator tenant passed the evaluation procedure, further start-up business valuations can use a combination of three general approaches:

- Cost approach
- Market approach
- Income approach

The cost approach uses the valuation information to restate the asset at fair market value. The market approach gather data due to value developing assets. And finally, the income approach connects data to value of developing assets.

Example: Auditing of candidates by ICT, Australia for seed capital investment



(a) Development of technology business strategy

A correct technology business strategy is a basic requirement for the choice of technological needs.

Selection of tenants:
approved business plan is often mandatory

Essentials to the business plan:

- **The business concept**
- **Market research & analysis**
- **Operational plan**
- **Financial plan**

Business plan review:
main parameters

A. Reality check
B. Market opportunity
C. Management
D. Technology issues
E. Resources
F. Commercialization programme

The essence of this strategy is to define the business actions so as to respond effectively to a customer's need in a way that is superior to the offering of the competitor.

Here the main actions to be considered are:

(i) Corporate strategies

These corporate strategies involve broad, long-term decisions regarding:

- *New markets:* This option involves the search for new customers in the same areas or in new geographical locations for the same products. Alliances with companies can be an effective way of using existing contacts with clients and distribution channels.
- *New products:* This strategic action is based on the capability of the company to innovate. The goal is to sell products that are new to the company, to the country, or in some cases, new to the world. An alliance can be a fast and cheap way of acquiring the technology to implement this strategy.
- *Withdrawing from products or markets:* In some situations, the firm will profit by dropping some products or markets. This will allow more resources for the products and markets in which the firm has competitive advantages.
- *Increase of production capacity:* This option demands an expansion of the manufacturing capacity and it will generate economies of scale and its benefits.

"Reality Check" for a new business idea

When you are thinking up a business, you do not decide what the business will be and how it will do.

Your marketplace decides that for you!

A Reality Check is called when:

- **You come up with a great new invention, but you think you should put off doing any marketing research until you have built a detailed prototype.**

For a young company, the technology business strategy varies at different phases of the company's growth:

Development Phase	Technology Development Tasks
Start-up	• Figure out technology, product and concept
Initial growth	• Introduce new technologies and launch differentiated produce • Capture market share • Grow revenues
Rapid growth	• Become market leader • Ward of competitors, develop continuous innovation mechanisms • Build management team • Hire and integrate lots of people
Continuous growth	• Dominate the industry • Reinvent growth strategy • Introduce new technologies and add products and services • Expand to new markets • Brand company and profile

(ii) Competitive strategies

This involves decisions related to beat the competitors in the markets selected by the corporate strategy. Examples of such decisions are as below:

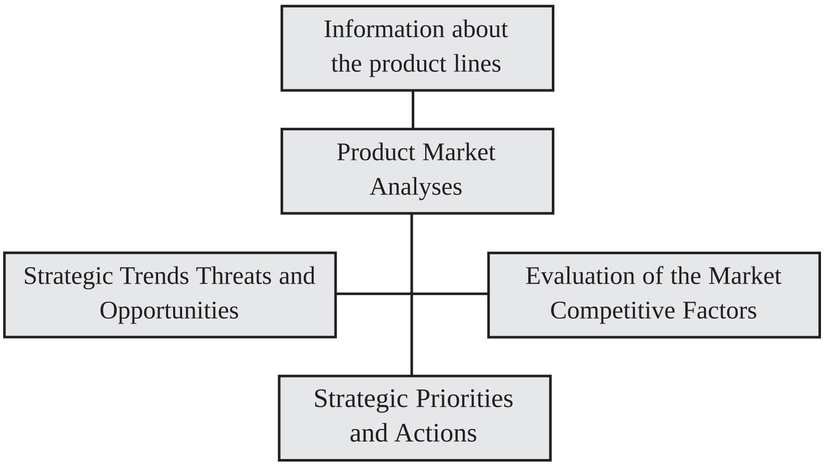
- *Lower prices:* This strategy involves measures to increase the efficiency of a firm and will help to conquer new clients by selling products at lower prices. An alliance with a company with critical process technologies can be an interesting option.
- *Product characteristics:* Client needs, technology trends, and what the competitor is doing are the basis for this strategy. The goal is to increase the product performance, gaining new customers as a consequence of the product differentiation. Examples of aspects related to this strategy are product performance, durability, guarantee, product integration compatibility and quickness of repair.
- *Other measures to add value to the customer:* Services, distribution, delivery time reduction, flexibility to respond to customer needs in terms of changes in product orders are examples of such measures.

The company may have to choose one or more of the above strategies to select which is more adequate for each product line, and sometimes for each product.

The strengths and weaknesses of the company and the opportunities and threats of the environment are important factors to be considered in this decision. Another critical aspect is the return on the investment in each option. The process of strategic planning should be flexible to allow quick changes and adaptations to new threats and opportunities.

A simplified procedure for strategy formulation has 5 basic steps: (i) information about the present product lines; (ii) product-market analysis; (iii) strategic trends, threats and opportunities; (iv) evaluation of the market competitive factors; and (v) strategic priorities and actions. Figure below shows the sequence of strategy formulation.

Strategy Formulation



One should be aware that the strategy design does not follow the sequence above, because there are many loops which will change the previous steps.

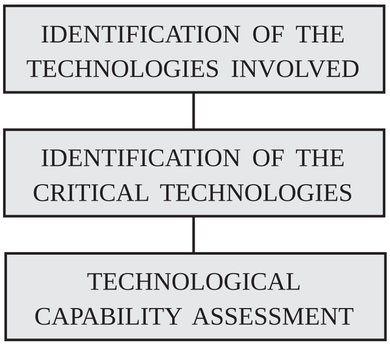
(b) Technology strategy

This addresses the issue of how to identify the critical technological needs and identifies the basic dimensions of technology choice and project options. It consists of two steps: (i) technology evaluation; and (ii) technological project portfolio.

(i) Technology evaluation

The process of technology evaluation is aimed to collect information on the current and future state of technology development, to evaluate the importance of each technology in the competitive arena and the strength of the firm in each technology. The key tasks encompassed in the technology evaluation are presented in figure below.

Technology Evaluation Tasks



(ii) Identification of the technologies involved

The identification of technologies involves a set of technological knowledge and skills, which has an impact on the overall competitive position of the firm in the marketplace currently and in the future. Criteria to be followed in order to identify the technologies are as follows:

- Start from a detailed analysis of a firm's technological structure, including product technologies, which means identification of technologies embodied into the product, including the tools used to develop a new product.
- Production process technologies, which means analysis of the production process and identification of the technologies used.
- Support technologies, i.e. those technologies used to perform a certain activity of the firm and not embodied into the firm's product or production process (typical support technologies are information technology tools, software packages, networks).
- Be broad enough to include also those technologies which may have a potential impact on future needs such as emerging technologies, i.e. technologies not yet in use but whose potential is significant.

These steps lead to identification of the technologies for successful incubation and innovation.

(iii) Identification of the critical technologies

This task aims to evaluate the competitive importance of each technology involved. This means to evaluate:

- The extent to which the technologies are relevant to sustain the firm's competitive factors.
- The importance for future competition, i.e. to what extent that competence will be critical in future competition.

This can be done using a matrix, which shows the market competitive factors associated to the product line and the technology involved. In the cells of the matrix, a score is reported which mirrors the impact of that technology on that competitive factor. It can be used as a scale from 1 to 4 where 1 means that the T has no impact on the competitive factor and 4 means the critical aspect to meet that factor.

Impact of the involved technologies on the critical competitive factors/technology involved

Competitive factors	TI-1	TI-2	TI-3	TI-4	TI-5

Note: high impact = 4; low impact = 1

In this phase, a critical aspect is the involvement of people from different functions (sales, technical assistance people, technicians, engineers, production people, etc.) and, if possible, suppliers and customers.

The technologies which have the strongest impact (grades 3 and 4) on the competitive factors are identified as the critical technologies. This provides an overall evaluation of the competitive importance of each technology involved and supports the choice of the critical technologies for each critical competitive factor.

D. Intellectual property

Intellectual property is a key legal issue for technology-based enterprises, particularly for new and high technologies in areas such as drugs and pharmaceuticals, biotechnology, microelectronics and computer software and agriculture. Often the key to business success is the ability of a company to protect legally its core technology, besides the national policies and efforts to provide appropriate support systems and patent related services. An incubator facilitates access to legal assistance in this area.

With the establishment of the WTO and its Trade Related Intellectual Property System (TRIPS) Agreement, member nations are trying to harmonize their intellectual property laws including patent laws. Several countries have undertaken modernization and upgradation of their patent related organizations and launched patent literacy among researchers and entrepreneurs. As a result, it has been noted that the number of patents filed and granted to researcher/companies in various countries in the region have dramatically increased particularly in developing countries after 1995. The number of patents granted and used is an indication of the technological capabilities in a country as well of the patenting companies. However, the data/information related to the patents obtained by the incubate companies in various countries, as yet, are not readily available or reported, though many of the incubators are providing patent facilitating services to their tenant companies. This needs a review of the R&D projects on the technology development activities being taken up in incubators, and necessary measures taken to encourage patentable developments for creation of awareness among the technopreneurs as well as the management of the incubators.

E. Examples of TBI programmes

1. Germany

Business incubation in Germany started as early as 1983 with the opening of the Berlin Innovation and Business Incubation Centre. Today Germany has one of the largest networks of incubators in the world with more than 350 centres and parks all over Germany. More than 10,300 companies started operations or attained their start-up development in these centres. The companies that started their development in these centres have created 140,000 jobs.

Germany: Role of innovation centres

Innovation centres are an instrument of regional economic development

Economic necessity was responsible for the setting up of incubators in Germany. The first incubators were established to create new enterprises and jobs in regions with serious economic problems. The basic task of German innovation centres is to support new enterprises with new products for the market. Innovation centre, is a term that is all inclusive covering business incubators, technology centres or parks and science parks. These innovation centres provide a variety of support activities for entrepreneurs and these are not limited to innovative or technology oriented start-up companies. The most important consideration is the development of new businesses. The focus of any given innovation centre, however, is determined by the regional conditions, the regional potential in industry, science and R&D, and the regional businesses and trade.

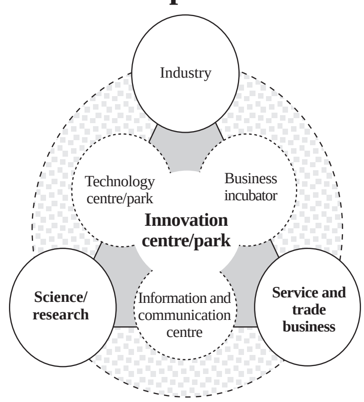
To encourage technology development certain innovation centres provide support activities for special technologies. At these centres, special instruments and infrastructure are available for selected technologies. Each centre specializes in certain specific fields of technology and especially in R&D. The focus is on high-level technologies of major importance for the future.

Germany: Innovation centres

Technology centres Business Incubators
Business incubation centres
Business innovation centres
Science parks Technology parks

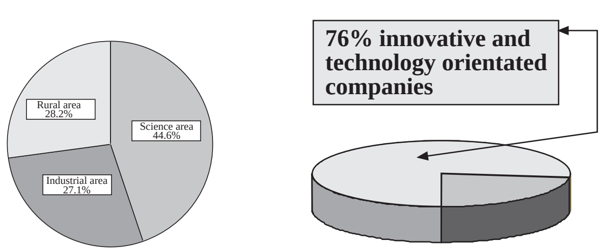
To support new enterprises with new products and services

Germany: The concept of innovation centres

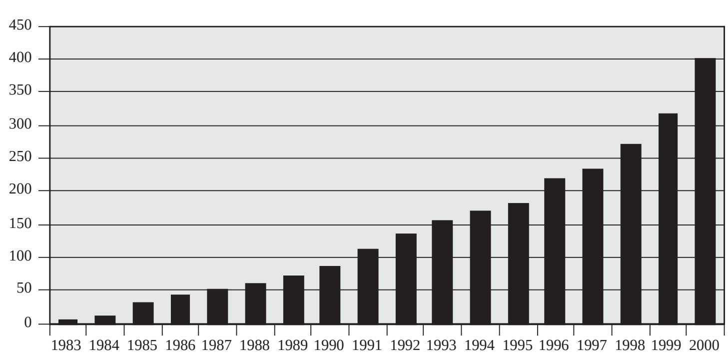


A transfer component focuses on two-way technology and knowledge transfer between science institutions and enterprises or between enterprises themselves. This is important to create strategic alliances and to achieve practicable networking.

Germany: Types of innovation centres



Germany: Development of innovation centres



2. Israel

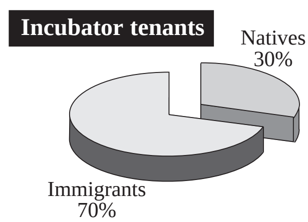
The Technology Incubator Programme in Israel was initiated in 1991 primarily to integrate immigrant scientists and engineers from the Russian Federation and to absorb new technologies or ideas that they brought. Moreover, it also created a climate to prevent brain drain from Israel. This endeavour bolstered the technological ability of the Israeli industry, created new jobs and improved standards of living. These TIs are geared to absorb any project that suits their structure and aims. It enables technical entrepreneurs to conduct their R&D programmes in a professional, friendly, supportive atmosphere, while receiving the guidance they need in the starting phase. The programme was implemented under the guidance and with support of the Ministry of Industry and Trade. The policy framework is decided by a steering committee appointed by the Ministry. The government provides most of the budget for setting up TIs, their annual operating costs and also for projects set up within TIs. The TI management is the government's trustee in running incubator projects. Support funds, for both the management of the incubator and for project are transferred to the incubator.

Israel: Technology Incubator Programme

OBJECTIVES

Nationwide Technology Incubator Programme was launched in 1991 to utilize the S&T potential of immigrants from the Soviet Union. There are 26 technology incubators in Israel today.

Technology incubators support fledgling entrepreneurs and provide opportunities to develop their innovative technological ideas and set up new businesses in order to commercialized them.



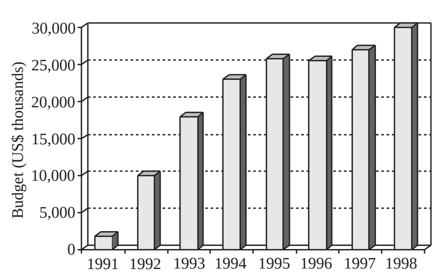
The TI is an autonomous non-profit corporation. The cost of setting up a TI is estimated at about US$ 1 million depending on its location, size, etc. It is run and managed by a professional salaried director supported by finance professional and two to three assistants including a secretary. A project committee comprising experts drawn from industry, business, science disciplines, research institutes and public assists the TI management in selecting and monitoring projects. An incubator is structured to permit about 15 R&D high-tech projects run simultaneously. The chief executive officer of the TI remains in constant contact with each of the ongoing projects to be aware of progress, problems and to facilitate solutions. The annual operating expenses of a TI are restricted to US$ 175,000 and are approved and fully met by the government.

Israel: Technology Incubator Programme

CONCEPT

Incubator is an autonomous nonprofit corporation

State provides most of the budget during a project's incubator phase



- **Maximum state support per incubator project – US$ 300,000**
- **Maximum state annual support to incubator – US$ 180,000**

The services provided by a TI include: (a) assistance in determining the technological and marketing applicability (potential) of the idea and drawing up the R&D plan; (b) assistance in obtaining the financial resources needed to carry out the project; (c) assistance in forming and organizing the R&D team (support manpower); (d) professional and administrative counseling, guidance and supervision; (e) secretarial and administrative services, maintenance, procurements, accounting and legal advice; and (f) assistance in raising capital and preparing for marketing.

Israel: Technology Incubator Programme

RESULTS

- **More than 200 technological projects are being carried out in the incubator today.**
- **More than 500 companies graduated.**
- **51% of the graduates are still in business and have 1,400 employees.**
- **Total private investment obtained by the tenant companies is more than US$ 200 million.**
- **Technology incubators have become massive repositories of potential ideas for new high-tech ventures in the future.**

Immediately on entering the incubator, the project is registered as a limited-liability company and is required to operate as a commercial venture. The idea or scientific knowledge is transferred by the entrepreneur or inventor to this company so that it becomes the company's property. An agreement is signed between the project developers (entrepreneur or inventor) and the incubator management to stipulate the developer's rights and to ensure management's ability to attain its goals and meet its commitments as trustee of the government.

There are no predetermined fields of specialization at the incubators. Some incubators, especially those located near research institutes, prefer projects that can benefit from the technological infrastructures available to them. A few incubators are now aiming to specialize; for example, there is a software incubator in Jerusalem while others are encouraging projects in biotechnology, medical, etc. after several projects in a shared discipline have matured there. Generally speaking, however, project activity is open to all fields of R&D.

F. New approaches to technology incubators

1. Extended incubation

The high-tech area around Oxford, the United Kingdom of Great Britain and North Ireland, is one of Europe's most dynamic enterprise zones, with hundreds of new companies attracting investment from all over the globe. It is noted primarily for research-based development, with a strong emphasis placed on local talents and values.

An example of a local business park that has specialized in providing tailor-made services to high-tech companies is the Milton Park estate in Abingdon, 20 km south of Oxford. It is a major mixed-use business park owned by MEPC Plc, a firm which has substantial cultural and financial connections throughout the United Kingdom and the world. As a result of substantial investment over a number of years, the site has evolved into mixed-use development with business types ranging from warehousing to pharmaceuticals. The 147 tenant businesses currently employ over 4,500 people.

A clear philosophy intended to meet the demands identified in the region has enabled MEPC to attract a number of tenants who traditionally would locate in a "science park". One of the facilities offered is a "business incubator" for small high technology businesses called the "innovation centre" – itself a part of a "business development centre" for small businesses that opened in 1992. The landlord has sought both to understand and to accommodate the needs of tenant businesses and to operate across the spectrum of business types.

Extended incubation beyond S&T park prototype development through to production

Privately financed business parks can extend the traditional science park model by offering a ladder to technology-led start-ups as they move out of prototyping and into production. This innovative approach increases survival rates and benefits both investors and start-ups.

Example: Milton Park (UK) – 85% survival rate for start-ups

Oxford Trust (university-based)	**Milton Park** (private business park)
• Strong regional expertise in innovation and technology transfer • Business mentoring support • Network access to regional R&D, business and investment communities	• Nurtures start-ups within its Innovation Centre incubator • Moves them on to the business park as they mature into successful companies

The general attitude of the management company is positive to help companies grow through introductions, high profile and aggressive advertisement of the site and superior facilities. Space is usually rented to technology-based businesses on more flexible terms than is normally available in the open market. Technology transfer advice, mentoring and management support are provided by Oxford Innovation Ltd., specialists in the field. Businesses are encouraged to grow and to move on, with rents increasing every successive year. A proactive centre management assesses a “graduating” company’s property needs, and structures a package that will suit the tenant company.

Tenants of the park like what they have. Over two-thirds of all companies which have moved on from the centre have taken space elsewhere in the park. Currently, they provide an annual rent in excess of the initial outlay. Former tenants of the innovation centre now account for 9 per cent of the clientele of Milton Park, occupying 65,000 sq ft, and employ approximately 350 people. The continued growth of companies on the site, both in terms of property requirement and jobs created, demonstrates the success of the landlord’s philosophy to manage property as a service to growing companies.

The success of the innovation centre and Milton Park demonstrates that such centres in conjunction with a larger science park can operate effectively to promote economic growth away from the research environment, provided that care is taken to develop and manage good methods of communication with the centres of research.

2. Virtual incubators

Virtual technology, business and project incubators

For entrepreneurs:

- **Business basics**
- **Access to online resources**
- **Partnership opportunities**
- **Links to risk investors**
- **Business support e-tools**
- **Networking opportunities**
- **Increased visibility**

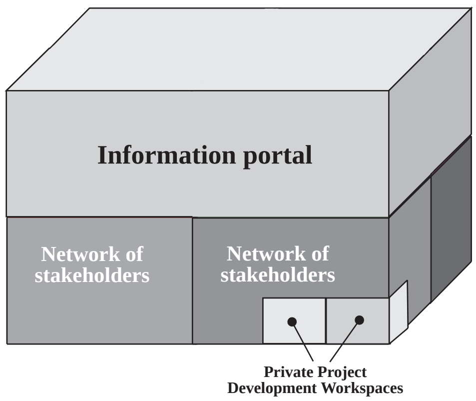
For incubators:

- **Networking of stakeholders**
- **Exchange of information**
- **Exchange of experiences**
- **Resource pooling**
- **Incubator development e-tools**
- **Linking to opportunities**
- **Increased visibility**

The Internet, which allows intangible information and ideas to be traded and exchanged instantly, across any distance, is the most recognizable symbol of today's global, knowledge-driven economy. But the economic and social impacts – not just of the internet, but of technological advances in many areas, and the rapidly increasing knowledge content of all industries, and all jobs – go much wider than a few dot.com start-ups. They present challenging opportunities, and equally challenging threats, to firms of all sizes, in traditional as well as high-tech sectors who must respond to these challenges of globalization and a knowledge-driven economy. The internet also provides an opportunity for the setting up of virtual technology incubators. These virtual incubators allow an entrepreneur to assess the necessary information and support services

Web-based technology incubator:

STRUCTURE



Internet services available to technology incubation stakeholders

Stakeholder networking:

- Network building tools
- Access to relevant online news, databanks and support services
- Sharing of knowledge and ideas
- Posting of business proposals
- Matching of prospective partners
- Expert forums
- Chat rooms
- Personal/corporate sites
- User-customized work space

Project workspace:

- Project preparation and management
- Business development tools
- Building of the project team
- File sharing
- Pooling of resources
- Access to external services
- Discussion room
- Chat room
- Administration & reporting tools

Web-based technology incubator:

PROJECT WORKSPACE

This workspace gives teams the ability to create a private online workspace where they can share project files, assign tasks, discuss ideas, schedule meetings, and chart project timelines and milestones.

MANAGE PROJECTS

TIMELINES AND MILESTONES

PROJECT TASK LIST

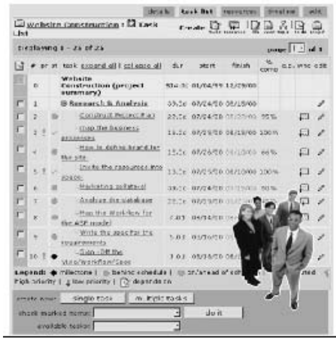
PERSONAL TO DO'S

FILE SHARING

CONTACT LISTS

DISCUSSIONS

Users can create an online project workspace where team members can securely collaborate on projects and manage the development process.



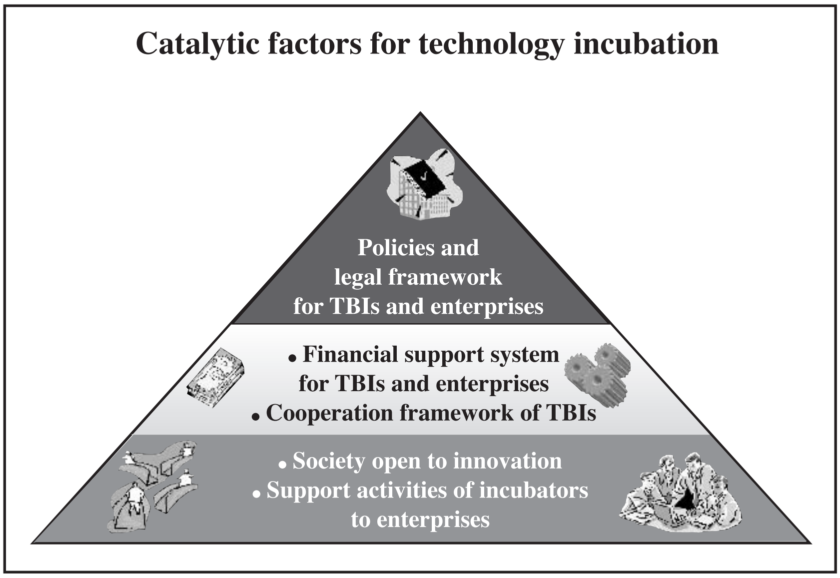
G. Conclusions and recommendations

In developing counties, the open wall type or "virtual incubators" with access to R&D facilities and support services including professional services, requiring minimum investments are desirable and need to be promoted to speed up innovations. According to Nowak and Grantham (2000), the competitive advantage for an enterprise is blind to geographic and resource constraints and focuses solely on pooling resources to optimize the strategic team's chances of success. Pooling technical and business talent across all frontiers, providing a clear focus on wealth creation and a strategy to meet the business opportunities at hand is the main goal of "virtual incubators".

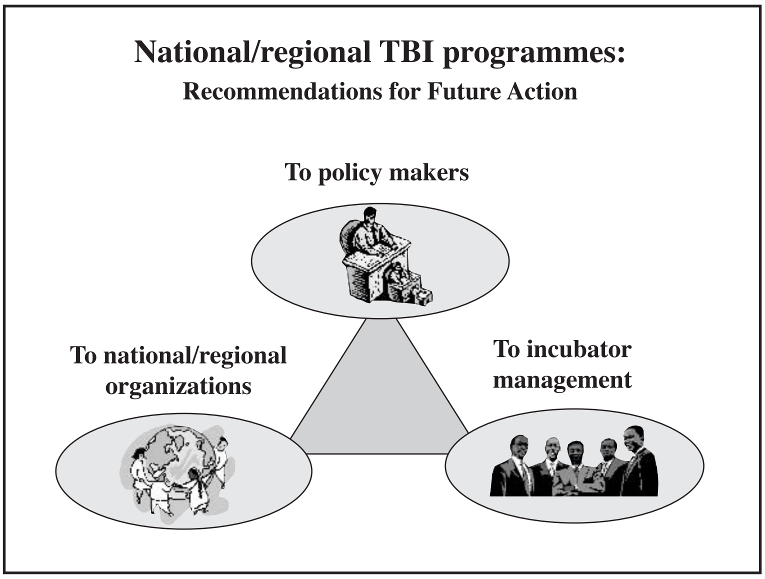
Two principles of effective business incubation:

- **The incubator aspires to have a positive impact on its community's economic health by maximizing the success of emerging companies.**
- **The incubator itself is a dynamic model of a sustainable, efficient business operation.**

What is also now emerging is the "third generation" system, more appropriately called an: "International Enterprises Centre", which will bring under a single aegis the full range of support services for development of knowledge-based business, with linkages to universities, research institutes, venture capital and international joint ventures. This trend is already evident at the convergence of support mechanisms at business incubators/techno parks in South-East Asia. The trend is now towards international technology business incubators (ITBIs) to attract foreign companies and R&D organizations to promote international linkages or R&D globalization and also sector specific incubators especially in high-tech areas including information technologies and biotechnologies.



Technology incubators should, therefore, develop strategic business alliances with the relevant organizations/agencies including large corporations and R&D institutions. They should also network with the technology incubators in other countries, besides developing networking and creating associations of incubators in their home country. Exchange of experiences and visits of specialists from the incubators in developing and developed countries would be useful for all concerned. Also, organization of exhibitions, trade fairs and workshops etc. for the technologies and products from the incubators in various countries would enhance business prospects and cooperation in the region. International organizations such as UNDP, UNIDO, ESCAP and ADB should support such activities.



Developed countries such as Japan are reorienting the strategies of TBIs to ensure their technology leadership. The Republic of Korea is building its technological and industrial strengths in select sectors through TBIs including revitalization of industrial clusters and industrial estates. The other countries such as Malaysia do not seem to be addressing existing and traditional industries but concentrating on electronics, information technology, multimedia technology development and biotechnology.

Many developing countries, economies in transition and least developed countries are yet to evolve any meaningful TBI strategies and take action to set up the same.

Conclusions

- **Technology business incubators are dynamic instruments of regional economic development**
- **Every technology incubator centre is an unique entity**

Technology Incubation System

Cannot:	***Can:***
replace entrepreneurial initiative and markets	**create better conditions for entrepreneurship**

Technology business incubators are a part of the system of innovation dealing with the specific needs of industry in the country. These needs have to be promoted and nurtured through definite policy measures particularly involving SMEs. Development of technology business incubators should be explicitly included as an objective in S&T policies, to promote and nurture high technology-based enterprises and specific financial outlays may be indicated. Presently, the promotion of technology business incubators is generally implicit. However, technology project selection and evaluation is of crucial importance in view of the specific requirements and success for incubation.

Concerning this, the quality and deep commitment of the management team and the chief executive is crucial. It is better to have an independent or private management, with an advisory committee of the members representing different interests in the TBI.

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II. BEST PRACTICES IN PROVIDING INTELLECTUAL PROPERTY SERVICES TO BENEFICIARIES OF BUSINESS AND TECHNOLOGY INCUBATORS

Presented by Mr. Guriqbal Singh Jaiya, Director,
Mr. Jaekap Yoon, Senior Counsellor,
and Ms. Lien Verbauwhede, Consultant,
Small and Medium-Sized Enterprises Division,
World Intellectual Property Organization (WIPO),
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A. Introduction

One must have clarity as to what is the key objective for setting up an incubator. It is not uncommon for policy makers to wrongly assume that the focus of incubation is employment generation, when it should be enterprise development. Employment generation will follow successful and sustainable commercial outcomes, based on dynamic competitive advantage resulting from innovation and creativity. In an increasingly demanding and globalizing business environment, harnessing innovation and creativity in the form of new or original knowledge-based products and services is becoming the key to business success. Intellectual assets are increasingly being recognized as a source of corporate value today, and are increasingly playing a critical role in influencing innovation and key value drivers across every industry. Protecting and managing knowledge is becoming therefore a core aspect of business strategy whether of a new or an established enterprise. It is from this perspective that policy makers in ministries, departments and other agencies of government, who are responsible for policies and programmes for private sector enterprise development, should look at the issue of setting up incubators. Before investing in incubation, policy makers need to ask how well markets are working in the provision of those services that incubators would supply – in business support services as well as in industrial real estate. Only if there are critical gaps should incubators be set up. The assessment of the performance of incubators should be measured with reference to these gaps. Also, measures of incubator performance should record different dimensions of enterprise development (such as reducing the time which enterprises take to establish market niches; reducing the time to develop new products if the incubator has a technological orientation; and improving management practices and/or the technology of enterprises).

The ability of an incubator to achieve its objectives is critically dependent on the type, range and quality of business support services it provides to its beneficiaries. The National Business Incubation Association (NBIA) in the United States of America defines business incubation as "*hands-on management assistance, access to financing, and orchestrated exposure to critical business or technical support services*." There are different ways of classifying these services, such as the following:

The commonly provided business support services in an incubator may be classified as follows: (i) business plan development; (ii) accounting, legal, and financial planning; (iii) aid in attracting investors; (iv) marketing; and (v) common shared services, such as secretarial support and facility maintenance.

Another way is to look at the four key areas of business support services, namely: (i) Entrepreneur training (often part of 'pre-incubation'); (ii) business advice; (iii) financial support (in some cases from incubator seed/venture capital funds but usually through links with external providers); and (iv) technology support.

Yet another approach is to focus on the six different dimensions of an incubator that have a direct impact on its success. These dimensions are: (i) facilities and location; (ii) shared services; (iii) tenant entry and exit criteria; (iv) mentoring and networking; (v) funding and support; and (vi) incubator governance.

The cost of these services may be at or below market rate and the quality varies from incubator to incubator. The client firm may pay for the services directly on a billed fee-for-service basis or as part of rent to the incubator facility. Firms may need to take out a loan for services or exchange equity in the firm for services.

Business support services, including intellectual property services, may be supplied to client firms through a variety of mechanisms and through various cost structures. These services may be provided by:

- Incubator manager and staff
- Advisory board or host institution (such as a university's faculty member or a member of the university's Technology Licensing Office)
- A local Small Business Development Centre
- arrangements with area professional service firms or network of external consultants

B. Best practices for incubation success

In one study, the best practices for incubation success were listed as follows:

- The incubator has a minimum of 30,000 sq ft of rental space with room to expand in order to be able to generate enough income to become self-sustainable. The space is flexible with movable walls to manage tenants' variable needs.
- There are at least 10 in-residence members for generating enough networking activity and sustaining the variety of shared services and support operations.
- The incubator is located either near a university or near a research laboratory so that tenants have easy access to technical facilities. Incubators located near a university get added advantage of access to students, faculty members, research labs and libraries. Similarly, proximity to a federal lab provides access to scientists, engineers and state-of-the-art equipment/testing facilities. In both cases "image" is an added bonus.
- The incubator is situated in a high-tech, top quality building, preferably with a telecommunications infrastructure to electronically connect companies with each other and the outside world.
- The incubator has a practice of enrolling non-resident clients who would get all services provided to resident clients except a lab or office space.
- A *selection committee* is set up to prescreen the clients. The selection criteria include: (i) the homology between the incubator services offered and the clients' needs; (ii) a business plan that covers the key focus, market information on competitors and customers, costs, pricing and cash flow forecasts; (iii) technology sophistication; (iv) potential for growth and job creation; (v) research & development intensity; (vi) occupational mix of the management team; (vii) practical experience; and (viii) personal commitment.
- An *advisory committee*, consisting of 5 or 6 experts from different business areas has been established for each tenant company to assist in developing a business plan, in obtaining funding, and for marketing and legal issues.
- The incubator has created an opportunity for its tenants to *network* among themselves, with the industry, and with contacts of the advisory/mentor group members.
- The funding and support from private, public or government organizations, specifically to pay off the heavy costs associated with the real estate component, is already in place.
- The manager is a highly motivated visionary individual whose goal is to see his/her tenant firms succeed.
- Boards of directors are generally responsible for policy development and not day-to-day operations which are left to the incubator manager. Bureaucracy, in case of government-sponsored incubators, is kept at a minimum.
- The incubator focuses more on support programmes than on space or physical infrastructure.

The spectrum of services offered by incubators is extremely varied, ranging from strategic business planning, to administrative services, to guidance on issues of intellectual property (particularly in the case of technology incubators). In the United States the Hampton Roads Technology Incubator (HRTI) is the first of its kind in Hampton Roads, but it is modeled on the best practices of similar organizations throughout the country and the world. The table below shows the results of the same at a 1997 NBIA survey, which asked each technology incubator to identify the specific services it offers to its clients. As may be seen, the HRTI's suite of services matches up well with other technology incubators in the United States.

Business Support Services	Percentage	Provided by
Marketing assistance	90	Ã
Networking activities	89	Ã
Links to higher education institutions	81	Ã
Investor/strategic partner linkages	79	Ã
Technology commercialization	76	Ã
Accounting/financial management assistance	73	Ã
Help with access to commercial loans and other funds	64	Ã
Intellectual property management	64	Ã
Affiliate programmes	63	Ã
Management team development	55	Ã
Shadow boards/mentoring programmes	55	Ã
International trade assistance	54	£
General legal services	53	°
New product assessment	50	Ã
Federal contract procurement assistance	50	£
Manufacturing practices assistance	46	£
Comprehensive business training programme	43	£
Help with regulatory compliance	36	°
Product design assistance	31	°
Management information systems	26	°

Notes: Ã = Provided directly or by referral to one of HRTI's stakeholders.
£ = Provided by referral.
° = Not currently provided by HRTI.

In a survey of business assistance services of incubators in the United States, it was found that there is an increasing trend in the provision of intellectual property management services. This is shown in the following table.

Percentage of incubators offering various services

Business Assistance Services	No. of incubators offering	Percentage of responding incubators that offer
Help with business basics	249	90
Marketing assistance	232	89
Accounting/Financial management	200	77
General legal services	122	47
Intellectual property management	97	37
Help with access to commercial loans/loan funds/loan guarantee programmes	201	77
Management team development	114	44
Shadow boards/mentoring programmes	109	42
Investor/strategic partner linkages	151	58
Affiliate programmes	163	63
New product assessment	106	41
Management information systems	66	25
Manufacturing practices assistance	97	37
Product design assistance	59	23
Networking activities	224	86
Technology commercialization	105	40
Links to higher education institute	197	76
Help with regulatory compliance	80	31
International trade assistance	110	42
Federal contract procurement assistance	113	43
Comprehensive business training programme	127	49

Business Assistance Services	No. of incubators offering	Percentage of responding incubators that offer
General office services:		
Conference room	238	92
Custom equipment/custom leasing	116	45
Shared administrative services	229	88
Video conferencing	50	19
Telephone system/phone answering	170	65
Internet access	162	
Computer labs	103	40

Finance is always an important question for starting a new business. For high-tech entrepreneurs, an increasingly important source of finance (equity) is from venture capitalists and business angels. In the United States, every organized angel group appears to conduct independent due diligence on their investment opportunities. The depth and extent of that due diligence varies both by group and by specific opportunity. Several common threads appear in the due diligence processes of many angel groups: (a) conducting civil, criminal, credit, and state motor vehicle checks of key managers; (b) verifying intellectual property ownership; (c) intensely evaluating the management team; and (d) understanding the potential market.

C. Basics of intellectual property management

An understanding of the major types or categories of intellectual property rights is a prerequisite for their successful management. A broad overview of basics of intellectual property is presented below from a business perspective.

1. Patents

Innovative and creative ideas are at the heart of most successful businesses. Ideas by themselves, however, have little value. They need to be developed, turned into innovative products or services and commercialized successfully to reap the benefits of innovation and creativity. Intellectual property, and patents in particular, can be crucial for turning innovative ideas and inventions into competitive products that significantly increase profit margins. A patent is an exclusive right granted for a product or a process that provides a new way of doing something or offers a new technical solution to a problem. (For a more detailed explanation, see <http://www.wipo.int/about-ip/en/patents.html>.)

A patent, once granted, gives the patent owner the right to stop all others from exploiting the patented (claimed) invention. A patent is granted to the patent owner by the government, generally for a period of 20 years, in return for a complete description of the invention in the patent application. This is considered to be a fair reward to the inventor or patent owner for an adequate disclosure of a claimed invention which is new, non-obvious and capable of industrial or business application. In this way, the patent system seeks to balance the need for exclusivity of the patent owner with the need to encourage the wider dissemination of new knowledge or information so that others may learn from it and improve upon the so-called ‘prior art’ (which may otherwise be kept as a trade secret indefinitely). The patent owner can then benefit from a limited monopoly as defined in the claims of the granted patent – in that she/he can commercially exploit her/his invention, or can license the intellectual property rights to others to exploit the invention, perhaps in return for a sum of money (royalty).

While the acquisition of patent protection is not a guarantee for commercial success, such acquisition is always important in ensuring that the patent owner has the opportunity to look for ways in which he/she can commercialize his/her invention.

An incubated enterprise is often at the centre of innovative activities, therefore, owners/managers of such enterprises must be made aware of the basic principles and practices in designing and using the patent system.

The key reasons why a one should consider patenting an invention, provided it meets the criteria of patentability, are the following:

- **Exclusive rights** – Patents provide the exclusive rights, which usually allow the patent owner to use and exploit the invention for twenty years from the date of filing of the patent application in the national or regional patent office.
- **Strong market position** – Through these exclusive rights, the patent owner is able to prevent others from commercially benefiting from the patented invention, thereby reducing competition in the marketplace and enhancing the chances of business success of the patent owner.
- **Higher returns on investments** – Having invested a considerable amount of money and time in developing innovative products, the patent owner, under the legal cover of the exclusive rights provided by a patent, may commercialize the invention to obtain higher return on investment.
- **Opportunity to license or sell the invention** – If the patent owner chooses not to exploit the patent itself, then he/she may sell it or license the rights to commercialize it to another entrepreneur or enterprise and get a one-time or recurring income.
- **Increase in negotiating power** – The patents owned by an enterprise may be of considerable interest to another enterprise or institution. Through a cross-licensing arrangement it becomes possible to exchange the patent rights between the two parties to mutual advantage. The negotiating strength of either party is linked to the strength of their respective patent portfolios.
- **Positive image of the SME** – Business partners, investors and shareholders may perceive patent portfolios as a demonstration of the high level of expertise, specialization and technological capacity of an enterprise. This may prove useful for raising funds, finding business partners and raising the market value of the enterprise.
- **Take action against free riders** – As patent owner an entrepreneur is in a stronger position to combat unlawful imitation or copying by competitors.

2. Patent information

Effective use of patent information can be very useful in ascertaining a firm's competitive position in the marketplace. "Patent information" refers to the technical, commercial and legal information contained in patent documents that are published periodically by national and regional offices and by WIPO under the Patent Cooperation Treaty (PCT). A patent document includes the full description of how a patented invention works and one or more "claims" which determine the scope of protection as well as details such as who patented the invention, when it was patented and reference to relevant literature.

About two-thirds of the technical information revealed in patents is never published elsewhere. The entire set of patent documents worldwide is well over 40 million documents. More than 90 per cent of the information contained in patent documents is in the public domain, which means its use is in no way constrained by having to seek the prior approval of any one. This makes patent documents as the single most comprehensive collection of classified technological information of immense commercial and technological value. Most SMEs are not aware of this basic fact and, therefore, do not use patent information.

Access to patent information may also pose a challenge. The Internet and digitization of patent information is helping in reducing the problems faced by SMEs to access patent information. Affordability is still a concern for SMEs in many countries, apart from the inherent difficulty in interpreting the techno-legal language in which "claims" are written. Even so, learning to use patent information in many ways is the first step towards sustainable technological progress of an SME. The availability of such wealth of technical knowledge provides enterprises with the following competitive opportunities:

- **Information on new or alternative source of inputs, components or machines:** By using patent information an SME may be able to identify new or alternate sources of inputs, components or machines for its products or services. This may provide it with valuable options regarding price, quality and terms of delivery which may ultimately have an impact on the final price of its products or service, and hence on its competitiveness.

- **Information about potential new markets:** Patent information may also be a useful source of information on potential new markets. An SME can identify other enterprises that can use its products or services as inputs, components or machines.
- **Avoiding unnecessary costs:** Investing in a new product is an expensive and risky exercise. The information contained in patent documents may save on time and scarce financial resources from being wasted on a nonviable product, as someone else has already patented a key invention. The information can also enable an SME to avoid unintentional infringement of others patents, thus saving the SME from unnecessary litigation procedures and expenses. It goes without saying that avoidance of unnecessary costs contributes to a firm's efficiency and competitiveness.
- **Information on the market (market intelligence):** For competitive enterprises information on the trends in the market and what the competitors are doing is very important. A proper analysis of patent information often provides the needed information. For example, by analyzing the patents owned or acquired by competitors it is possible to ascertain the trend of the market, and to plan the direction of the SMEs future strategy which may sometimes involve taking timely steps to not invest further in plant and machinery for making products that would bet unprofitable in the near future and/or to take timely action to exit business lines and products that would soon be obsolete with the emergence of alternate products in the marketplace. It may also provide valuable information on who are the emerging key players in the field i.e., on potential competitors. Such information would be very useful in reviewing the competition strategy of an enterprise. Apart from the manufacturer, even as a distributor or retailer of products, patent information may be of great assistance in choosing new products early and wisely.

3. Trade secrets

Today's business environment has increased the importance of trade secret protection for business by developing and implementing information protection practices that address the risks associated with a global marketplace, rapid advancements in technology and telecommunications, a mobile, highly skilled workforce, and networked strategic business relationships, including extensive outsourcing. Technology is changing so rapidly that trade secret protection is, in some cases, the most attractive, effective and easily available intellectual property right. As with all intellectual property, trade secrets can be valuable to a company's growth, competitive advantage and, sometimes, survival.

A trade secret is information of any type that is actually or potentially valuable to its owner, not generally known or readily ascertainable by the public, and for which the owner has made reasonable efforts to keep it secret. A trade secret generally has some cost associated with its development, and is not common knowledge in the industry. Even negative information, such as research options that have been explored and found worthless, can be trade secrets. Practically any type of technical and business information may be protected as a trade secret provided it meets these requirements; the following categories are illustrative:

- Data compilations, for example, lists of suppliers or customer (the more information a list contains, the more likely it would qualify for trade secret protection)
- Designs, drawings, architectural plans, blueprints, and maps
- Algorithms and processes that are implemented in computer programmes and the programmes themselves
- Instructional methods
- Manufacturing or repair processes, techniques and know-how
- Document tracking processes
- Formulas for producing products
- Business strategies, business plans, methods of doing business, marketing plans
- Financial information
- Personnel records
- Production or maintenance schedules
- Operating, maintenance or training manuals
- Ingredients of products
- Information about research and development activities of an enterprise

A trade secret may comprise of a combination of characteristics and components, each of which, by itself, is in the public domain, but where the unified process, design and operation of such characteristics or components, in combination, provides a competitive advantage. Inventions and processes that cannot be patented may be protected as trade secrets. SMEs should rely on trade secret route to safeguard the details of research and development, including draft patent applications, and patent applications before their official publication or grant. Even after grant of a patent, the associated knowledge is protected as a trade secret. A newly developed but not yet published or used industrial design or even trademark may be a valuable confidential information.

Trade secrets can create an advantage over competitors in many ways. The right to use trade secret information can also be licensed or sold. Although trade secrets provide no protection against those who independently develop the trade secret information, trade secrets never expire as do patents, industrial designs and copyright.

4. Copyright and related rights

In most countries worldwide 80 to 90 per cent of the creative industries are SMEs. Many high-tech incubators are solely focused on such enterprises. The creative industries sector includes publishing, software, music, television and radio, architecture, advertising, designer fashion, visual arts, crafts, etc. They account for 3 to 6 per cent of the GDP of most countries. In fact, the creative industries are the backbone of a knowledge economy and their rapid growth in many countries demonstrates the potential for making a significant contribution to national economy.

Protecting copyright and related rights is important because it enables creators and users of such works to support themselves from their artistic work and for creative entrepreneurs to generate profits to reinvest in tomorrow's creators. In addition, protection of such works promotes cultural integrity, diversity and variety as most of such works are created or used by SMEs.

Copyright literally means the right to make a copy of an original literary or artistic work. As a legal term, copyright refers to the rights given to creators for their literary and artistic works. The kinds of works covered by copyright include literary works such as novels, poems, plays, reference works, newspapers and computer programmes; databases; films, musical compositions, and choreography; and artistic works such as paintings, drawings, photographs and sculpture; architecture; and advertisements, maps and technical drawings.

Related rights are the rights that belong to the performers, the producers of phonograms and broadcasting organizations in relation to their performances, phonograms and broadcasts respectively. Related rights differ from copyright in that they belong to owners regarded as intermediaries in the production, recording or diffusion of works. The link with copyright is due to the fact that the three categories of related rights owners are auxiliaries in the intellectual creation process since they lend their assistance to authors in the communication of the latter's works to the public. A musician performs a musical work written by a composer; an actor performs a role in a play written by a playwright; producers of phonograms – or more commonly "the record industry" – record and produce songs and music written by authors and composers, played by musicians or sung by performers; broadcasting organizations, broadcast works and phonograms on their stations.

The related rights grew up around copyrighted works, and provide similar, although often more limited and of shorter duration, rights to:

- performing artists (such as actors and musicians) in their performances;
- producers of sound recordings (for example, cassette recordings and compact discs) in their recordings;
- broadcasting organizations in their radio and television programmes.

The owner of a copyright is the only person/entity who/which has the right to make a copy of it in any form, or to permit someone else to do so. The owner of a copyright has the sole right to control any copying/reproduction, public performance, recording or broadcasting of a work, and its translation or adaptation. This control may be exercised for a fee termed 'royalty'. Royalty payments may be arranged through performing rights societies, collective management organizations or societies, publishing houses or by the owners of copyright directly.

Collective management organizations or societies act on behalf of copyright or related rights owners and administer some or all of their rights on behalf of the membership and members of foreign affiliated rights societies. There are often separate national societies for different types of rights such as: performing and broadcasting rights for music, reprography rights, mechanical reproduction rights and retransmission rights. The primary function of these societies is to act as "licensing bodies" on behalf of the members. Membership of collective management organizations is open to all owners of copyright and related rights, whether authors, composers, publishers, writers, photographers, musicians, or performers. Broadcasting organizations are not included in the list, as they are considered users, even though they have certain rights in their broadcasts. Collective management organizations grant permission and give terms for use of works in their respective repertoires. After deducting the administration charges, the royalty collected is distributed periodically to the owners of copyright and/or related rights.

Examples of public performance are the playing of recordings in shopping malls, bars, nightclubs, discotheques, hotels, airlines, and restaurants. An example of the broadcasting of performances and sound recordings is radio airplay. In fact, radio stations are the largest single broadcast users of recorded music. Each time a radio station plays an eligible sound recording a royalty is paid to the composer, the maker of the sound recording and any performer whose performance is fixed in that recording. This makes it clear that various types of SMEs are users of works protected by copyright and related rights, not to mention the widespread use of software by an even wider range of SMEs.

The digital revolution and an era of converging technologies have created exciting business opportunities for SMEs in the entertainment, mass media, computer, and telecommunications industries, as well as for multimedia, consumer products and financial services companies that can take advantage of the new interactive technologies. There is a greater need than ever to safeguard copyrightable material on the Internet in the entertainment industry, including film, theatre, music and print publishing transactions. While the first line of action concerns dealing with IP issues in relation to e-mails, the next one is about IP issues in relation to the web site of the enterprise. All enterprises, including SMEs, have to take special measures to deal with the problem of protecting widely distributed factual confidential or copyrighted information on or in relation to web sites – even claiming trademark rights against unwelcome hypertext links to their web sites.

Multimedia is a new form of expression made possible by digital technology. With multimedia technology, graphics, video, animation, text, still images, sound and data can simultaneously appear on a computer screen and the user can interact with the content. Copyright or related rights of course protect most of these works (music, photos, paintings, texts, film extracts, etc.). To exploit them in an interactive multimedia product, it is first necessary to clear the rights. Clearing the rights simply means obtaining authorization from the owner of the rights to exploit the work or parts thereof in a multimedia product, and negotiating how much that will cost. This authorization is generally in the form of a user license in writing granted by the owner of the rights. Examples of multimedia content include distance learning, virtual visits to historic sites, and interactive games for children. Frequently offered on CD-ROM or on the Internet, multimedia presentations have become an innovative and efficient means for communicating information and for storytelling or entertainment. Most multimedia companies are SMEs and many are being nurtured in high-tech incubators in different countries. As users of copyright these companies need to understand the importance of proper use of the IP system in all facets of their business. This is not limited to use of copyright and related rights but often includes protection of trade secrets, creation, protection and use of trademarks, and protection of novel software by patents in some countries.

5. Trademarks

A well-crafted trademark often becomes a decisive factor in the success of an enterprise in the market place. A trademark enables users or consumers to distinguish products or services of an SME from those of its competitors and to associate the products or services of an enterprise with desired qualities. In other words, a trade or service mark is a distinctive sign which identifies certain products or services as those produced or provided by a specific person, enterprise or a group of persons/enterprises allowing the consumer to distinguish them from goods or services of others. (For a more detailed explanation, see <http://www.wipo.int/about-ip/en/>). A trademark may be a word, letter, symbol (logo), number, colour, shape or, where the legislation of the country so allows, sound or smell, or a combination of two or more of these elements.

No wonder, to develop trust, confidence and loyalty in its products or services, every Forward-looking SME has to develop and maintain a distinct identity, image or reputation. Only then it would be able to distinguish itself and its products or services from those of its competitors. It must also, at the same time, provide a mechanism for linking the provider of a product or service to the valuable business assets of trust and goodwill. This is mostly achieved through a distinctive trade name and one or more trademarks. These play a pivotal role in the marketing strategy of differentiating products or services from those of rivals and in developing longer-term positive relationships with customers by communicating an assiduously nurtured image or reputation.

Every business must woo customers to move them quickly from brand awareness, via brand recognition, to brand preference and finally to brand insistence, a point at which the consumer refuses to accept alternatives and is willing to pay an even higher premium for the desired branded product or service. A major step in eliminating wasteful expense and reducing risk is to register the trademark early so that it is legally secure and others cannot free-ride on it. This is often done well before test marketing the new product or service to avoid incurring expense on advertising and other promotional activities, only to discover the brand name is not available.

Some countries do provide a degree of protection to unregistered trademarks, but in most countries, protection is contingent upon successful registration. Many countries allow registration without prior use, but the trademark registration may be cancelled if it is not used in the marketplace in relation to the relevant product or service for a certain period of time. It is easier to deal with wilful free riding, known as counterfeiting of a trademark and with grey market products (so-called parallel imports) if the trademark is validly registered. Informed businesses take active steps to educate employees, dealers, distributors, newspaper editors, publishers of encyclopedias and the public that their trademark identifies their specific products alone and therefore should be used in a proper manner.

6. Industrial designs

Industrial designs are compositions of lines or colours or any three-dimensional forms, which give a special appearance to a product or handicraft. They protect the ornamental or aesthetic aspect of a useful article, which usually appeals to the sense of sight or touch and can be reproduced in significant quantities (for a more detailed explanation see <http://www.wipo.int/about-ip/en/> and <http://www.wipo.int/hague/en/index.html>).

The terms design, industrial design or design patent, when used in intellectual property law and practice, have a specific connotation. In most cases they refer to the *eye appeal* of – that is, the features of *shape*, *configuration*, *pattern* or *ornament*, or any combination of these features – of a finished article made by hand, tool or machine, as opposed to functional features which may be protected by other types of intellectual property rights, such as patents, utility models or trade secrets. In many countries, the requirement of *eye appeal* of an article of manufacture or handicraft has been modified to that of *perceptible features* of appearance, and the rule of novelty has been replaced or supplemented by an individual character requirement.

A good design strategy must compare the various alternatives for protecting industrial designs, as there are different legal ways to prevent unscrupulous competitors from unauthorized copying. Legal options may include one or more of the following: protection under industrial design law, copyright law, trademark law – as a two or three-dimensional mark – and unfair competition law. In some countries the protection of these different laws may be mutually exclusive, in others it is cumulative to varying degree.

Industrial design issues affect various types of business decisions of an enterprise. For example, the type of protection and its cost or effectiveness may affect which details should be disclosed to the designer, especially when the designer is employed by a contractor, whether to undertake design development entirely in-house, or to contract or commission an outside agency or do it jointly; timing of the initial use of a new design in advertising, marketing or public display in an exhibition; if and when to seek or continue to maintain design registration; if and when to initiate action against unauthorized/infringing acts of competitors, counterfeiters or importers; if and when to license or partially assign a design; and if and when to register the design in other markets for export or for exploring the potential of entering into strategic business alliances, joint ventures, setting up wholly owned subsidiaries, etc.

It is therefore hardly surprising that smart enterprises take great pains to timely protect the new or original aesthetic aspect of its products so as to prevent such designs from being copied by competitors; otherwise the competitive edge may be easily lost even though functionally the product of an enterprise may be superior to those of its competitors.

D. Practical intellectual property issues in developing a business plan

(a) What can a business plan do for businesses?

A business plan is a mechanism to ensure that the resources or assets of a business are applied profitably across all its activities for developing and retaining a competitive edge in the market place. For a new business it provides a blueprint for success, while for an ongoing business it provides an overview of where a business is at present, how the business is positioning itself, and how it seeks to achieve its objectives to become and/or remain successful.

Putting together a good business plan takes a lot of work. Then what justifies the time and energy you will spend creating a plan? A business plan can be used for a variety of purposes:

- To **examine the feasibility of your business idea:** A written business plan forces a company to think through all the key issues – such as the potential demand for its products or services, the nature of the competition, entry barriers, the unique selling proposition of the new or improved products or services, resources required, critical employees, relevant technologies and strategic partners, raising funds, projected start-up costs, marketing strategies, and the like.
- To **access start-up services and financing:** Business incubators and potential investors and lenders require well-formulated and realistic business plans. This is often not the case; no wonder some 80 per cent of business plans received by investors and business incubators are rejected.
- To **provide strategic guidance:** A business plan is a reference point providing you and your management team with an objective basis for determining if the business is on track to meet the goals and objectives in the time frame set and with the available resources.
- To furnish a **standard/bench mark** against which to judge future business decisions and results. This standard/bench mark may evolve along with the business, and as such the business plan is a dynamic document that should be revised based on new and evolving circumstances.

(b) Why should intellectual property (IP) be integrated in the business plan?

New or original knowledge and the creative expression of ideas is the driving force of successful businesses in the 21st century. Therefore, safeguarding such knowledge and creative expression from inadvertent disclosure or its unauthorized use by competitors is becoming increasingly critical for developing and retaining competitive advantage. Building a business also requires various types of other resources, including a network of relationships and sources of funds. The IP protection system provides a key tool for (i) keeping at bay unscrupulous competitors, (ii) developing relationships with employees, consultants, suppliers, subcontractors, business partners and customers, and (iii) obtaining funds.

To be accepted by a business incubator or to attract investors, it is necessary to have a quality business plan that takes an objective look at the prospects of the proposed business. In order to convince investors a business will have to show that (i) there is a demand for its product in the market place, (ii) its product is superior to competing products, if any, and (iii) it has taken adequate steps to prevent free riding on its success by dishonest competitors.

Most entrepreneurs would argue that the product they are offering is innovative, unique, or superior to the offerings of competitors. But is this really so? If they believe it is, they will have to prove it, and a patent (or the results of a reliable patent search) may be the best proof of novelty they can get.

Trade name, trademarks and domain names may be the prime elements that differentiate a business' product from those of competitors. Therefore, a business should carefully choose its trade name, trademark, and domain name and the steps taken to register these should be referred to in its business plan.

In addition, start-up service providers and investors will want to make sure that the product an enterprise proposes to sell is not relying, without authorization, on other companies' trade secrets, copyrighted materials, patents or other IP rights as this may bring the downfall of the business through expensive litigation. In some high-tech sectors the risk of infringing on third party IP rights is high and start-up service providers and investors may be reluctant to take the risk unless the enterprise can prove (e.g., through a patent or trademark search) that no such risks exist.

For many businesses, confidential business information (such as details of production, secret inventions, and technical, financial and marketing know-how) alone may be the source of their competitive advantage. In such circumstances, it is important to communicate to start-up service providers and investors that the enterprise has proprietary and significant business information – known as trade secrets – and that it has taken adequate steps to protect it from employees and competitors. In fact, even your business plan is a secret document that should not be disclosed except on a "need-to-know basis" and that too, generally, only after the employee, investor, or whoever else concerned, has first signed a non-disclosure or confidentiality agreement.

In short, if IP is an important asset for a business (i.e., if it owns patents or patentable technologies, industrial designs, trade secrets, reputable trademarks or hold the economic rights to copyright works), then it should be a key part of the business plan. An adequate reference to the assets of a company and of its market opportunities should not only list the tangible assets (e.g., factories, equipment, capital, etc.) but also the intangible assets as the latter are increasingly the key to a company's success in a hyper competitive environment. **As such, any indication that confirms due diligence on in the management of IP assets is likely to play an important role in convincing start-up service providers and investors of your company's potential.**

(c) How can IP be integrated into the business planning process?

Writing a plan requires good preparation. Before drafting a business plan, one needs to think over a number of issues. One should understand what is the nature of the business; what resources would be required to meet the business' objectives; what are the target markets; what is the viability and growth potential of the business, etc. Also, one should identify the commercial relevance of IP assets and the resources needed for obtaining and maintaining these assets. The outline presented below lists some key points relating to IP that an enterprise needs to consider while preparing its business plan. The importance of different points will depend on the particular situation and business. Further, the list is not exhaustive, and many additional issues may have to be considered depending on the circumstances. However, the answers to these questions may help to integrate IP assets into a business planning process.

1. **What IP assets do you own?**

   - Identify and classify your IP portfolio. This invariably includes confidential information/ trade secrets, trade name(s), and trademark(s), often also domain names, industrial designs and copyright and related rights, and sometimes utility models and patents for inventions.
   - What other intangible assets do you have? In this context, also consider franchise, license and distribution agreements, publishing rights, covenants not to compete, information databases, computer systems software, marketing profile, management expertise, distribution network, technical skills, etc.

2. **What is the status of your IP portfolio?**

   - Do you have a system for identification of your IP assets? Do you have an IP portfolio? When was it created? Who created it?
   - Which of your IP assets are registrable? If so, are they or should they be registered? Are they also registered in foreign countries/export markets? Is the registration to be renewed? If yes, when?
   - Do you conduct or plan to conduct IP audits? If so, at what periodicity and by whom?

3. **How do you plan to protect your IP assets?**

- If you commercialize your IP assets (regardless whether in-house or with a partner), do you have arrangements securing the ownership or co-ownership of your IP assets?
- If you outsource a part of your business activities, do you have contracts in place that ensure your IP rights over the outsourced work and prohibit others from taking advantage or commercializing your product without your prior agreement?
- How easy or difficult is it for others to properly acquire or duplicate your secret business information? What measures are taken to guard the secrecy of your confidential business information? Do you have an integrated security policy and plan for your physical and electronic assets? If you commercialize your IP assets (regardless whether in-house or with a partner), do you have arrangements maintaining the confidentiality of your secret business information? Have you included confidentiality or non-disclosure clauses and non-compete clauses in the employment agreements with your key employees and business partners?
- Have you ensured that confidential business information/trade secrets are not available or lost by display on or through your web site? Are all your URL headers free of confidential information? Do your web pages provide links to pages that have confidential information?

4. **How important are IP assets to the success of your business?**

- To what extent are your IP assets currently being used, potentially useful, or no longer of use to your business?
- Does your enterprise depend for its commercial success on IP assets, whether owned or licensed? On what types of IP assets does it depend?
- Do you have new products or processes which will provide a unique competitive advantage? If so, will they revolutionize an industry? Can the associated IP rights be secured, providing additional differentiation and bar competitors from entering the market?
- What competitive advantage do your IP assets (whether owned or licensed) provide to your enterprise? Assess and explain how IP provides or adds value to your customers and contributes to developing a sustainable competitive edge.
- Do your trade secrets, patents, trademarks, copyrighted works and industrial designs go far enough to protect those aspects of your business that determine your business' success?

5. **Do you own all IP assets that you need, or do you have to rely on IP assets owned by others?**

- Do you own the IP assets that you are using? Can you prove it? Do you have the records, registrations, contracts and other proof that an investor, business partner or a court of law may require? Have you identified any potential third-party claims on your IP (for example, industrial sponsors or contract research clients)?
- Are you sure you are not infringing IP rights of someone else? Can you prove it (e.g., have you conducted a patent, trademark and/or industrial design search)? Have you verified if any of your key employees, who has worked for a competitor in the past, is bound by post-employment non-compete or non-disclosure confidentiality agreements by the previous employer(s)? Do you need access to third party IP in order to exploit your business idea? Have you been granted the license(s) you need for the use of IP, which is not owned by you?
- Have you signed non-disclosure and/or non-compete agreements with key personnel, contractors, consultants or other external suppliers which assign to your business any IP they develop when working for you?
- When you use external contractors to write and design your marketing and promotional material or your web site/web pages, do their contracts specify who owns the IP that would be created? If employees do so, then is the work within the scope of their individual employment? If not, then have you taken a written assignment of copyright and other appropriate IP rights? Have you proper permissions to use written material, graphics, photographs, music or anything else created by a third party for use on your web site or in any other manner?

- Does your web site have any meta tags, hypertext links, frames or deep links to other web sites? Are these duly authorized by the third parties concerned?

6. Do you know enough about your competitor's IP strategies and IP portfolios?

- Do you have a plan for gathering competitive intelligence? Do you gather or plan to use IP information/databases for obtaining competitive intelligence on your competitors? By searching patent, trademark and industrial design registers, you can gain detailed legal, technical and business information about a competitor's operations and products. You can use this information to assess whether there is likely to be a market for your products. In addition, an IP search allows you to verify whether you can protect your IP, whether you are infringing another party's IP and whether others are already infringing or likely to infringe your IP rights.

- Are there any IP related barriers to enter your competitor's market, e.g., patents, trademarks or industrial designs which underscore customer loyalty to competitor's corporate image, brands, etc.?

7. Do you have an IP policy and IP strategy for your enterprise?

- How do you currently identify, protect, leverage and manage your IP assets?
- What plans do you have in place to derive the maximum value from commercializing your IP assets?
- Do you have a special marketing strategy? Do you plan to export? If so, have you used or plan to use a regional or international filing or registration system (such as the Patent Cooperation Treaty, the Madrid system or the Hague Agreement) for patent applications and trademark or design registrations?
- Have you assessed the potential to commercialize some or all of your IP assets partly or wholly through licensing, franchising and/or selling them?
- Have you conducted an independent IP audit periodically? And has valuation been done of your IP assets? Was this done independently?
- How far have you considered taxation and incentives issues associated with the commercialization of your IP? There may be taxation-related requisites (such as registering) to the commercialization of IP. The taxation treatment of revenues and expenses resulting from the commercialization of your IP can differ widely from the accounting treatment. There may be government financial assistance measures associated with IP assets and their commercialization.
- Do you plan to use your IP assets as security or collateral for a loan, or to create a tradable security in the securities market? What is the possibility of securitization of future revenue streams linked to a bundle/portfolio of your IP assets?
- Do you have a staff education programme that covers the management and protection of your IP assets?

E. Intellectual property self-audit

Assuming an enterprise has addressed intellectual property issues in its business plan and has been in the incubator for one year, then there are a number of questions that it may try to answer. An illustrative list of questions is hereunder:

- Are procedures regularly promulgated and responsibility assigned to ensure
  - ➢ timely filing and maintenance of patent, trademark and copyright applications, both domestic and foreign?
  - ➢ marking of products with proper notices of patents, trademarks, and mask work registrations?
  - ➢ printing of copyright notices on published materials?

- control of access to your company's confidential information?
- printing of proprietary legends on confidential software, drawings, and other documents?
- continuous education of employees regarding intellectual property responsibilities?
- that personnel involved in R&D maintain logs/diaries respecting inventions and discoveries?

- Are written agreements with employees in existence
  - requiring the disclosure to the company of invention and discoveries and cooperation in obtaining intellectual property rights?
  - requiring employees to assign all rights to inventions, trademarks and copyrights related to the company's business to the company?
  - defining the obligations of the employee with his or her duties of confidentiality respecting the business of the company?

- Are procedures in existence that require
  - timely investigation of possible infringement of others' rights by the company's new products and trademarks?
  - indemnification by vendors against infringement of others' rights?
  - handling of unsolicited disclosures of ideas by non-employees?

- Are periodic reviews made by competent personnel or counsel of agreements involving intellectual property such as employment agreements, licenses, development contracts, disclosure forms, and indemnification provisions of procurement contracts?

F. Range of intellectual property services

There is a wide array of intellectual property services that are needed by entrepreneurs and enterprises. These are classified in different ways depending on the service provider. A few examples are given below.

Example 1

- **Trademarks:**
  - Applications and registrations
  - Disclaimers
  - Recordation of changes
  - Renewals
  - Foreign registrations
  - Oppositions
  - Counterstatements
  - Appeals
  - Translations

- **Patents:**
  - Registrations
  - Renewals
  - Oppositions
  - Counterstatements
  - Appeals
  - Foreign registrations

- **Copyright:**
  - Filing
  - Recordation

- ➢ Licensing
- ➢ Foreign registration

- **Contracts:**
  - ➢ Franchising
  - ➢ Licensing
  - ➢ Distributorship agreements
  - ➢ Technology transfer

- **Enforcement:**
  - ➢ Civil and criminal actions against infringement
  - ➢ Counterfeiting and piracy

Example 2

- **Searches:**
  - ➢ Patents
  - ➢ Industrial designs
  - ➢ Trademarks
  - ➢ Copyrights

- **Application for intellectual property rights:**
  - ➢ Preparation and prosecution of applications for:
    - ❍ Patents
    - ❍ Industrial designs
    - ❍ Trademarks
    - ❍ Appellations of origin
    - ❍ Copyrights
    - ❍ Maintenance
    - ❍ Appeal
    - ❍ Advisory

- **Transfer of intellectual property rights:**
  - ➢ Consulting services in:
    - ❍ Licensing
    - ❍ Pricing
    - ❍ Negotiation and presentation
    - ❍ Drafting and applying for approval and registration of licensing agreement

- **Intellectual property litigation:**
  - ➢ Cease and desist letter
  - ➢ Temporary injunctions to settle cases of infringement
  - ➢ Initiating civil court proceedings

Example 3

- **Patents:**
  - ➢ Patent searches
  - ➢ Patentability and infringement opinions
  - ➢ Preparation and prosecution of national and foreign patent applications
  - ➢ Patent litigation

- **Trademarks:**
  - ➢ Trademark searches (including screening corporate names prior to their adoption)
  - ➢ Trademark registrability and infringement opinions
  - ➢ Preparation and prosecution of national and foreign trademark applications
  - ➢ Trade dress (product appearance) matters
  - ➢ Trademark litigation
- **Copyright:**
  - ➢ Copyright searches
  - ➢ Copyright infringement opinions
  - ➢ Preparation and prosecution of copyright applications
  - ➢ Copyright litigation
- **Intellectual property licensing and agreements:**
  - ➢ Negotiation and preparation of licenses, assignments, and similar agreements involving sales and other transfers of intellectual property
  - ➢ Advice and preparation of agreements concerning confidentiality and trade secret matters, including employment agreements and invention disclosure agreements.
  - ➢ Negotiation and preparation of publishing agreements
  - ➢ Preparation and, where required, filing of franchise agreements and of related federal and state disclosure documents
- **Assistance in investment and securities matters:**
  - ➢ Searches and opinions as to the existence, scope, validity, infringement, and/or ownership of patents, trademarks and copyrights, to assist clients and their general counsel or accountants in making investment decisions as well as in assessing tax consequences, and for secured transactions, buy-outs, mergers, and other investment transactions
  - ➢ Preparation of documents required to transfer intellectual property assets from one domestic or foreign entity to another
- **Assistance in product liability and personal injury matters:**
  - ➢ State-of-the-art searches to demonstrate what could have been or was being done in particular technologies, designs, or methods of manufacture as of a given date searches of patent records to locate manufacturer admissions as to product flaws

Example 4

- **General services:**
  - ➢ Show you inexpensive ways to find and use trademarks
  - ➢ Advise you on when and where to file patents, and when to use trade secrets
  - ➢ Develop stronger, more valuable patent claims and inventions
  - ➢ Leverage cash and manpower resources
  - ➢ Find out whether your concept will stand up to competition
  - ➢ Use experimental design to develop better formulas or methods at a lower cost
  - ➢ Eliminate minor disadvantages in new product ideas
  - ➢ Provide laboratory, pilot plant and design facilities
  - ➢ Build and/or optimize prototypes
- **Buying intellectual property:**
  - ➢ Use no-cash down options
  - ➢ Recover cost through sublicenses

- ➢ Leverage “in-kind” contributions
- ➢ Create residual value for yourself if you give up the intellectual property
- ➢ Maximize the value of cash deposits and royalty payments
- ➢ Protect your business trade secrets when dealing with inventors
- ➢ Save you money on lawyers, patent and trademark agents
- ➢ Calculate appropriate royalty payments
- ➢ Determine when and where patents are appropriate
- ➢ Create and protect trademarks at very low cost
- ➢ Save cash via joint ventures, outside funding sources or experimental design

- **Selling intellectual property:**
  - ➢ Make it easier for potential investors to buy your concept
  - ➢ Protect ideas without a patent profit, reduce cost and manage risk with joint ventures
  - ➢ assess the value of your idea
  - ➢ find customers at low cost via trade shows, trade associations and the Internet
  - ➢ create, evaluate and improve prototypes
  - ➢ create a skilled-team to improve your selling proposition
  - ➢ budget for success

Another way of classifying the services would be under the following headings:

- **Establishing intellectual property awareness**
- **Identification and tracking of intellectual property (IP Inventory)**
- **Ownership of intellectual property assets**
- **Evaluation and valuation of intellectual property**
- **Protection of intellectual property**
- **Using intellectual property assets**
- **Sharing intellectual property assets**
- **Marketing intellectual property assets**
- **Commercial arrangements and disputes (Licensing of intellectual property)**
- **Taxation of intellectual property**
- **Insurance of intellectual property**
- **Intellectual property audit**
- **Accounting and intellectual property**

Yet another way of classifying intellectual property services is as follows:

- **Intellectual property inventory and management**

  Helping clients strategically evaluate and actively manage their intellectual property against specific objectives.

- **Intellectual property assessment**

  Determining the market attractiveness of client intellectual property and identifying its most compelling applications.

- **Intellectual property valuation**

  Establishing an objective, market-driven measure of intellectual property value.

- **Intellectual property licensing**

  Providing complete licensing solutions – from identifying potential licensees to negotiating final terms.

G. Intellectual property management guidelines

Patents, trademarks, copyrights and trade secrets are more than intellectual property. They are important assets that can impact a company's viability, market share and competitive edge for years to come. Simply obtaining patents, trademarks and copyrights without an IP strategy represents increased risk and missed opportunity.

IP management is full of potential pitfalls. These guidelines flag just the most critical issues.

Save time, money and anguish by not trying to reinvent the wheel

- Do a patent and literature search before you start. Someone else may own the rights to your idea already, or to key aspects of it. Are other teams working on the same concept, and if so, how likely are they to beat your team to the finishing line?
- It is crucial to know your potential market. What is the proven need that your idea or product will satisfy? Are there perfectly adequate solutions to this need already available? How will your idea add value, or is it just a solution in search of a problem?

Do not preannounce or use new knowledge that may be worth formally protecting

- Timing is critical. Premature announcement or use may invalidate a patent application. Find out the rules on this and make sure that nobody on your team breaches them.
- Keep reliable research records. These can be used to show prior creation or to sue.

What kind of IP protection do you need for your idea?

- Learn the pros and cons of the various forms of IP protection. Is the product easily reverse-engineered and is copying common in your industry? Are you likely to want to sell or license your IP, e.g., for use in some overseas markets? Might your idea have a range of potential applications in different fields? If any of these apply, you may need more formal protection, e.g., a patent, than is available through trade secrecy.
- Using a trademark, copyright protection (which is automatic) and/or trade secrets may often be enough. A patent requires time, effort, money and full public disclosure. Is technical change so fast in your area that a patent may become rapidly outdated?
- Can you afford to lodge, maintain and protect a patent in your key potential markets? These costs mount up fast. Most patents never make enough money to cover them.
- Was the discovery (even if accidental) made at work? If so, your employer may own it.

Getting a patent or other IP protection is not the ultimate objective

- A patent is just the means to an end. The goal is to create a commercially successful product or service. The financial and marketing risks of a new venture often exceed the technical ones. Don't let your emotions take control over this or other aspects of IP.
- Inventors rarely become rich from IP licensing or royalty payments alone. Most value is added during the product development and commercialization phases. Very few inventors have all the skills needed to become a successful entrepreneur. Get help.

Take professional advice on all partnerships and joint ventures

- The key success factor to a partnership or joint venture is maintaining trust. IP is the commonest source of disputes. Complete an IP agreement before committing. Cover issues such as the declaration, valuation and use of all relevant pre-existing IP; the ownership of new IP; selling or licensing rights to it and for what purposes; who lodges, maintains and protects it; the apportionment of costs and revenues; restrictions on publishing results; and exit arrangements. Take independent advice from a patent attorney.
- Be realistic. As many joint ventures fail to fly due to excess greed as crash later due to disputes.

An effective intellectual property service requires a dedicated team of professionals who can merge their knowledge, legal and technical expertise, and business acumen with the right combination of negotiation and advocacy skills to produce legal solutions that match clients' business goals and competitive philosophies. It is not possible to have such a team in an incubator. Most of the services listed below have to be obtained from outside sources.

- Patent prosecution and counseling
- Trademark and copyright prosecution and counseling
- Intellectual property litigation
- Intellectual property issues on Internet and in e-commerce
- Intellectual property issues in licensing, technology transfer, and joint venture agreements
- Intellectual property issues in computer software, system acquisition, and data processing agreements
- Intellectual property issues in advertising, promotions and sweepstakes law
- Intellectual property audits
- Intellectual property issues in merges & acquisitions due diligence
- Intellectual property issues in rights of publicity and privacy
- Trade secrets

In big intellectual property law firms the in-house attorneys and engineers have extensive backgrounds and advanced degrees in electronics, computer science, electrical engineering, avionics, physics, e-commerce and information technology, chemistry, mechanical and chemical engineering, food science, biotechnology, biology, medical and dental devices, and structural and civil engineering. These individuals are skilled in the art of preparing and prosecuting domestic and foreign patent applications in all disciplines; analysing patentability, invalidity and infringement issues; counseling clients in the design and development of new technology and products; and negotiating patent licensing and technology transfer agreements. These attorneys also use sound business and marketing judgment to counsel clients in the selection, protection, enforcement and licensing of trademarks to address the global brand management issues which necessarily confront any company in today's international economy.

H. Best practices of IP services to incubators

(1) Orientation/training of incubating manager and other key staffs on IP issues

(2) Organization of workshop and seminars for tenants of incubators on IP issues

(3) Panel of IP specialists and other IP service providers

(4) University faculty provides on IP issues

The following is a list of "best practices" employed by incubators worldwide with a view to identifying successful mechanisms for making intellectual property rights more accessible and relevant to their client firms.

- Include intellectual property questions in pre-screening
- Assist start-up firms to cover the cost of protecting their intellectual property. The cost of protecting intellectual property is critical to both the long term and immediate viability of many start-up technology companies, absorbing much of their working capital. Assistance could take the form of helping to seek out suitable partners or offering a 'soft' loan and would be given after assessment of the start-up firm's intellectual property and business strategy.
- Assistance on intellectual property in business plans
- Assistance on intellectual property issues in technology development such as provision of patent information services, drafting of patent applications, guidance in licensing, etc.
- Assistance in addressing intellectual property issues in marketing and franchising
- Assistance in dispute settlement and enforcement
- Assistance in developing and implementing trade secret policy

- Assistance in due diligence on IP in negotiations with potential partners and in developing strategic alliances
- Assistance in securitization of IP assets
- Assistance in integrating IP strategy into the business strategy of the incubated enterprise
- Continued assistance on IP matters after the firm has left the incubator, including assistance on IP matters in developing or penetrating export markets.

I. Activities of the SMEs Division of WIPO

1. The SMEs web site

One of WIPO's major initial activities was the creation of an SME web site, as a distinct part of WIPO's main web site. The section on IP for Business on the SME's web site explains basic IP issues in relation to some practical business concerns in a simple, business-friendly language. The web site already has over a hundred pages of substantive information and advice, in addition to full text of some very useful documents and links together parts of WIPO's web site or outside links to various issues of interest to SME entrepreneurs, managers, investors and business consultants. Through the content on the web site, the SMEs Division of WIPO seeks to reach out to the largest number of SMEs and SME support institutions in a low-cost and reader-friendly manner. It allows readers to rapidly select the information they are interested in and have the option to follow links for more detailed discussions of certain issues. Finally, publication on the Internet gives the possibility to update information regularly and maintain readers informed of the latest events. The disadvantage related to such an endeavor is the limited access and spread of the Internet in many countries and therefore the inability to reach out to a large number of potential users in SMEs. WIPO is therefore committed to providing paper copies of the material available therein, including documents, presentations and IP guides to enterprises and institutions requesting the information in paper format. A CD-ROM, with a search function, containing the full content of the SMEs web site, in three languages (English, French and Spanish), has also been produced. This CD-ROM, entitled "Intellectual Property for Small and Medium-sized Enterprises", contains the entire SME web site of WIPO in English, French and Spanish, along with other relevant information from other parts of the web site of WIPO. A reasonable number of additional copies of the CD-ROM will be made available to IP offices and SME support institutions, on request.

The Division's monthly e-mail newsletter provides updates and other relevant information on IP for SMEs to some 2,000 subscribers of the e-mail newsletter service. The newsletter contains useful news on IP and SMEs, best practices, useful IP tools, useful links, etc. New subscribers may join the service by inputting their e-mail address through the home page of the SMEs Division's at http://www.wipo.sme.int/sme/.

The overall aims of the SME web site are as follows:

1. To provide an overview of the main reasons why SMEs should consider IP issues when preparing their business plans and strategies;
2. To offer practical information on how to protect, manage, license, and enforce a company's IP assets and how to deal with IP issues in e-commerce;
3. To disseminate information on "best practices" aimed at assisting SMEs to use the IP system and "case studies" on companies that have benefited from a sound IP strategy; and
4. To provide information on the SME-related activities of WIPO in general, and of the SMEs Division in particular.

Given the international nature of the information provided, there is significant scope for national customization or adaptation of the relevant content on the SMEs web site based on the national legal and institutional system. WIPO encourages national IP offices and other SME support and financing institutions to use the material and adapt it according to the needs of national entrepreneurs, and is willing to provide advice, guidance and/or other support in this respect.

The SMEs web site is currently available in English, Spanish and French at www.wipo.int/sme/ and parts of it in Chinese, Arabic and Russian.

2. Collection of "best practices"

The SMEs Division of WIPO also seeks to collect information on policies, programmes, and activities of a range of national institutions to assist SMEs to use the IP system effectively. In May to June 2001, the International Bureau of WIPO sent a questionnaire to IP offices, focal points on SMEs within governments, chambers of commerce and a number of other institutions (primarily SME associations and incubators) requesting information on the activities conducted by each institution related to the initiatives to be undertaken under the Milan Plan of Action. The information was gathered with a view to compiling "best practices" and allow for wider information sharing and exchange of experiences among and within countries. Additional information on other such best practices from around the world would be put on the web site of the SMEs Division of WIPO as and when it is made available; all concerned are, therefore, requested to help the SMEs Division of WIPO in this process.

Replies to questionnaires reflect a wide range of initiatives in this area aimed either directly at the SMEs community or having an impact on bringing the IP system closer to SMEs. Initiatives have been grouped into six broad categories. The following is a non-exhaustive list of the types of activities that were mentioned:

(i) Awareness-raising and training on IP

- Awareness-raising seminars, conferences and campaigns for entrepreneurs, researchers, inventors and students in areas of technical expertise;
- IP guides and other information material on various aspects of IP for SMEs;
- Web sites with practical information on IP issues for entrepreneurs;
- Collection and dissemination of case studies illustrating the success stories of SMEs using intellectual property;
- Building IP content into customized training manuals for enterprises operating in specific sectors (e.g., biotechnology, software, agriculture, multimedia, etc.);
- General advice to applicants on administrative issues relating to the application process (e.g., helpdesks within IP offices);
- Multimedia products (e.g., CD-ROMs) with information and advice on management of IP assets;
- Participation in business fairs of SMEs, contribution of articles on IP issues to business magazines targeting SMEs, and in other promotional activities for the benefit of SMEs;
- Monthly radio and/or television programmes on issues relating to intellectual property and innovation;
- Integrating IP issues in the national/institutional teaching and training curricula and course material for entrepreneurs; and
- Proactive visits to SMEs.

(ii) Technological information services

- Regular workshops for entrepreneurs on how to use patent information services;
- Free access to IP databases;
- Provision of a range of technological information services for SMEs at a reduced price;
- Establishment of patent libraries with specialized staff within universities, technology parks, business incubators, research centres and chambers of commerce;
- Regular provision of information on recent patents in a given technical field;
- Development of multilingual IP databases; and
- Establishment of centres for technological information or decentralized branches of the IP office for the provision of technological information.

(iii) Financial assistance

- Financial assistance to SMEs, either in the form of grants or favourable loans, patenting their inventions;
- Fee reductions for SMEs applying for IP rights;
- Partnerships between IP offices and associations of patent attorneys for providing legal advice to SMEs, either free or at an affordable (lower) price; and
- Tax incentives for expenditure in R&D, patenting, technology transfer, etc.

(iv) Customized advisory services on IP

- Legal and managerial assistance to enterprises on how to manage their IP assets and how to develop an IP strategy as a part of their business strategy;
- Promotion of and legal assistance on the use of collective marks, certification marks and geographical indications by small-scale businesses;
- Pilot projects on IP management with a selected group of enterprises; and
- Assistance in the creation of trademarks or distinctive signs.

(v) Assistance for technology transfer

- Creation of databases on licensable technologies (e.g., virtual marketplaces for IP);
- Tools for the valuation of IP assets;
- Business fairs of licensable technologies where potential licensees and licensors may meet;
- Advice for licensing negotiations;
- Programmes to facilitate and create incentives for technology transfer; and
- Establishment of technology licensing offices (TLOs) within universities and public sector research centres assisting researchers to patent their inventions, conduct prior art searches, license their inventions or set up their own start-up companies.

(vi) Partnerships between institutions

- partnerships between IP offices and other institutions providing services to SMEs such as chambers of commerce, incubators, research centres and science parks for the inclusion of IP services within a wider range of services to SMEs.

Case study: Sweden

There are several aspects of the incubator's operations that demonstrate good practice:

- The **Centre for Innovation and Entrepreneurship (CIE)** within Linköping University offers courses in entrepreneurship and new business development at both undergraduate and postgraduate level in English and Swedish.

- **Entrepreneurship Development Programme (ENP):** This course is conducted by CIE in collaboration with SMIL (Business Development in Linköping) and other local actors. These courses, which began in 1994, consist of eight modules and leads to the creation of new companies and the award of a formal 'certificate' level qualification. To enter the course, the individual has to have a good business idea. Many entrants come from the University's Business School, the others coming from small businesses in the Linköping area. Each course usually has 10-20 participants. There is a close link between the ENP and the University's research activities, on the one hand, and the CIE's wider role in providing business support services to local firms, on the other. The ENP is regarded as a model in Sweden and has been replicated elsewhere.

  Business Development Programme: This programme was created in 1986 to develop the businessperson's skills in the companies, which have been on the market for about two years. Every programme consists of up to 9 companies represented by 2-3 persons bringing their own questions to every meeting. About

100 firms have participated thus far. This programme serves the incubator programme indirectly in two important ways. First it is available as a later stage development opportunity for companies that have been incubated here and second it provides an opportunity for CIE to introduce mentors from these emerging companies to the new starts.

- **'Growlink' Scheme:** This scheme is managed by University Holding, the technology transfer arm of Linköping University. It consists of a structured framework of business support designed to speed up the development of tenant companies. The scheme begins at the pre-incubation stage, i.e., Entrepreneurship Development Programme, and at this stage includes an 'Ideas Advisory Board'. At subsequent stages in the scheme, key elements include access to a wide network of contacts (University, business support organizations, companies, etc.) in the Linköping area and access to financial assistance from the Technology Bridge Foundation which is the off-shoot of a national scheme providing grants for high tech start-ups. The Growlink scheme is noteworthy because it ensures linkages into a wider network of business support organizations and provides a structured framework for developing start-up firms. An interesting aspect of the scheme is that there are three 'Process Leaders' who ensure that the various 'Growlink' inputs are coordinated in a proactive manner.

- **Idea Lab:** Within the incubator is a space dedicated to idea formulation and innovation. Here, students, faculty, business advisers, and companies may come together to brainstorm. Within the lab is a new specially designed space-in-the-round that offers 8 comfortable chairs, plenty of wall surface on which to write, as well as light and sound controls to provide users with customizable atmospheres in which to innovate.

- **Incubator/Expert Breakfast:** This initiative brings together area experts in law, patent and licensing procedures, bookkeeping, accounting, marketing, public relations, among others to meet every last Friday morning of each month with incubator tenants for an hour and a half casual breakfast. All of the experts attend as do the tenants thereby all learning from one another. They hear a brief presentation for ten minutes and then discuss issues surrounding the presentation or other pressing issues on their minds. The experts also deliver pro bono service to tenants on a pre-arranged basis through the incubator management at Mjärdevi Science Park.

- **Incubator Fund:** Teknikbrostiftelsen (The Technology Bridge Foundation) manages a dedicated incubator fund to assist qualified new incubator companies with necessary capital for development.

- **Internationalization:** Recognizing that many new start companies in the world must often find large markets for their innovations, products, and services, the Mjärdevi Science Park Incubator offers companies information on other markets, access to overseas capital, patent search, access to tax and regulatory experts, and partnering opportunities. Mjärdevi takes advantage of the global science park and incubator network as well as its contacts in various countries' investment agencies, universities, and corporations to help serve the tenants in the best way possible. The incubator also serves as a starting point for appropriate technology-related companies from abroad seeking to establish themselves in Sweden.

- **Trade Shows:** Wherever possible, Mjärdevi Science Park leverages the resources of its tenant companies in order to allow cost-effective participation in conferences and trade shows such as CeBit, Comdex, BIO-Scandinavia, and others.

- **Media Relations:** Through affiliations with local media relations experts and through special arrangements with PR Newswire Europe, Mjärdevi Science Park is able to promote its companies often and to help companies learn to work with the media as well.

- **HomeCom Initiative:** This is a joint marketing initiative managed by the incubator/science park to describe the region's competencies in the converging IT, telecom, wireless, and electronics technologies affecting the home: security, entertainment, electrical and water systems, heating, telemedicine, and more. This is home communications. The initiative has so far led to the publication of a book on home communications designed to explain and publicize the concept, a university-backed department dedicated to home communication research, and an idea think tank. Ericsson, Nokia, and a network of other technology companies, researchers, designers, and building developers are developing a homeCom showroom, smart homes and apartments. Backed by both Ericsson and Nokia this is a good example of a pre-competitive collaboration between major firms that potentially benefits smaller companies researching new technologies in this industry and spawns new start-ups as well. Home communications in Linköping is recognized at the national level as an official competence centre.

Key Issues

In the view of the incubator manager, the following points are critical in the successful setting up and management of business incubators:

- *Quality of business support* – the Mjärdevi Science Park has established a comprehensive network of business support organizations that work closely with tenant companies. This is seen as one of the keys to its success.

- *Structured programme of business incubation.* At the Mjärdevi Science Park incubator, start-ups follow a structured programme starting with entrepreneurship training, progressing through starter units to the growth units. This system, served by the Growlink network and careful on site attention, is seen as a distinctive feature of the incubation approach at the science park.

- *Linkages between university and science park/incubator* – a number of schemes ensure that there are exceptionally close links. These include Growlink, the Entrepreneurship Development Programme, and the role played by the Technology Bridge Foundation (a national scheme that provides financial support for technology transfer) and University Holdings. Taken together these and other elements provide a structured framework for technology transfer and entrepreneurship. The higher education system, under which teaching staff own the ideas they develop, is also a driver of technology transfer and commercialization.

- *Technology focus* – Mjärdevi Science Park incubator acknowledges that business incubators/science parks may often have a particular technology focus, but that the focus must be truly reflective of the region's and university's strengths and that the incubator should be flexible enough to respond to changes in markets and evolving technologies.

III. PROMOTING BUSINESS AND TECHNOLOGY INCUBATION FOR IMPROVED COMPETITIVENESS OF SMALL AND MEDIUM-SIZED INDUSTRIES THROUGH APPLICATION OF MODERN AND EFFICIENT TECHNOLOGIES IN CHINA

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A. Review of the new China's development in economy and technology

1. Economic development of the new China

China founded after the World War II was a poor and backward agricultural country. From 1949 to 1977, under the system of centralized planning entirely by the Central Government, the national economy experienced a period of recovery, a period of the high tide of large-scale construction, a period of adjustment and a period of slow development in the ten years of the Great Cultural Revolution. Because of the poor foundation and the restriction of the planned economy system, China's economy was always at a state of backwardness. Especially for the influence of the Great Cultural Revolution, China's economy was at the brink of collapse.

China's pursuance of reform and opening up policy from the end of the 1970s and her gradual transition from the socialist planned economy to the socialist market economy with Chinese characteristics have put the national economy on a track of continuous rapid and healthy development. The annual average growth rate of China's GDP was 9.3 per cent, which was three times of the average growth rate of the whole world economy, two times of the average growth rate of the developing countries and four times of the developed countries in the same period. According to the report of the World Bank, China's GDP leaped to the 7th place in the world in 1997, thereby becoming an important force in the world economy. In 2001, China's GDP was up to Y 9,593.3 billion (US$ 1,200 billion). China's economy has been greatly strengthened; the Chinese people are becoming better off; and the supply of commodities has been in abundance. In 2001, the amount of foreign investment absorbed by China was US$ 46.8 billion, up by 14.9 per cent; the international payments were balanced; the year-end national foreign exchange reserve was US$ 212.2 billion, up by US$ 46.6 billion from the end of the preceding year; and the consumption level of individual residents raised by 0.7 per cent[1]. China's economy has been integrated in the world economic development. China today is surprising the world with the great scale and high speed of her change and the vigour and vitality of her growth.

2. Review of New China's science and technology development

Under the planned system, S&T and industry were separated from each other, many R&D achievements were only samples, gifts, and items on display. Since the pursuance of reform and opening up to the outside world, the Government of China has resolutely insisted on the strategy of "relying on science and education to rejuvenate the nation", which has made China's science and technology enter a period of rapid development. In 1978, China held a national science conference; in 1988, Deng Xiaoping advanced the idea "science and technology are the primary productive force"; in 1985, China implemented system reform in science and technology and formulated and followed the policy that "science and technology must be relied on for economic development and science and technology must be oriented to economic development". The most essential purpose of the policy is to rapidly and extensively apply science and technology achievements to industrial production, give full play to the role of scientific and technological personnel, and greatly liberate the productive force of science and technology so as to facilitate the growth of economy and progress in society. The Government of China has unceasingly propelled R&D institutes, educational institutions and production units to cooperate to form a mechanism of synergy that integrate scientific research, design, production and service for transformation of science and technology towards direct productive force. The said policy has strengthened independent development capacity towards the economic construction, market and society of scientific research institutions, especially technological development institutions, and strengthened the linkage between technology and economy. A large group of new-type high-tech enterprises have spun off from scientific and technological institutions and become an important force and a new source of economic growth in China's development of the high-tech industry. The situation of unreasonable distribution of talents and waste of human resources has been changed to a great extent. A lot of scientific and technological personnel have left their ivory tower and begun operating enterprises through way of contracting or leasing. Participating in fierce market competition, they have become technological entrepreneurs who not only have scientific and technological knowledge but also are proficient in management.

From rice gene database, human genome programme and functional genome research in basic research to important industrial achievements with proprietary intellectual property rights (e.g., integrated computer technology,

[1] China, Government Work Report for the National People's Congress, 2002.

communication technology, network technology, microelectronics technology and cryptographic technology), many great achievements have been made in the development of science and technology. The development of science and technology has given momentum to China's economic development and become an inexhaustible driving force for the progress of the nation.

B. The launch and development of technology business incubators[2]

The Government of China has implemented the Torch Program and identified science and technology industrial parks (hereinafter referred to as STIPs) and technology business incubators as means to industrialize technology and to enhance the competitiveness of small and medium-sized enterprises.

1. Implementation of the Torch Program

Approved by the State Council in August 1988 and implemented by the Ministry of Science and Technology (MOST), the Torch Program is a guiding programme for the development of China's high and new technology industry. The core mission of the Torch Program is to give scope to the advantages and potentials of China's scientific and technological forces and accelerate commercialization of high and new technology achievements, industrialization of high and new technology products and internationalization of the high and new technology industry with market as the orientation. The focus of the Torch Program is to create an environment favourable for the development of high and new technology industry, which include such initiatives as formulation of related policies, laws and regulations, establishment of a suitable management and operation system for high-tech industry, exploration of new financing channels including venture capital investment mechanism, developing domestic and foreign information sources, building information networks and formulate long and mid-term development plans as well as implementation plans consistent with objective reality.

2. The launch and development of science and technology industrial parks[3]

In 1984, MOST, then called the State Science and Technology Commission, submitted to the State Council a report on how to respond to the challenges of the worldwide new technology revolution. This document proposed to tentatively establish STIPs in cities with appropriate conditions and requested relevant departments of the State Council to formulate preferential policies towards STIPs and business incubators. That was the first time when the concept "business incubator" was mentioned by a government department. Thereafter, MOST supported a research project to study business incubator and make relevant investigations. China's decision on system reform in science and technology was announced in March 1985. The announcement of this decision provided broad space for scientific and technological personnel to start new businesses. China's first STIP was established in Beijing in May 1988. By the end of the 1980s, the stress of STIPs began to shift to the development of high and new technology enterprises and modern industries, the absorption of foreign capital and the expansion of foreign trade and export.

STIPs have become the most vigorous source of growth in China's economic development. After more than ten years of building-up, various STIPs of China have realized continuous rapid economic growth through unceasingly improving their environments for innovation and new business creation and trying to promote the commercialization and industrialization of scientific achievements. In recent years, nearly 6,000 scientific achievements of provincial/ministerial level or above have realized industrialization in high and new technology zones. The proportion of the output value of China's high and new technology industry in the total industrial output value has increased from about 1 per cent ten years ago to more than 10 per cent at present and 50 per cent of the output value of the high and new technology industry is contributed by STIPs. By the end of 2000, the output value of products in the six technological fields of electronic information, biology, new materials, new energy, environmental protection and optical-mechanical-electrical integration accounted for 73 per cent of the

[2] Business incubators in China are sometimes called incubation centres, innovation centres or pioneer parks. Different designations may appear in the following chapters due to translation differences.

[3] In China, science and technology industrial parks are also called high and new technology zones, referring to a certain area designed by the government for concentration of hi-tech companies, special policies and good infrastructure are provided to the certified hi-tech companies located inside it.

total industrial output value of STIPs; the total technological, industrial and trade income of the 53 national level STIPs was up to Y 920.9 billion; their total industrial output value was Y 794.2 billion; the total amount of their profits and taxes was Y 105.7 billion; and the amount of foreign exchange they earned through exporting products was US$ 18.58 billion.

3. The origin of China's technology business incubators

At the end of the 1980s, with the deepening of China's reforming in science and technology and economic restructuring as well as her policy of opening up to the outside world, the situation especially the transformation of scientific achievements necessitated the birth of technology business incubators. In 1987, Mr. Rustam Lalkaka, then Director, United Nations Fund for Science and Technology Development (UNFSTD) made a suggestion to the Science and Technology Minister of China at that time to set up technology business incubators in China. In the same year, funded by UNDP and the Government of China, the National Research Centre for Science and Technology for Development conducted a study on the feasibility of establishing business incubators – high and new technology incubators in China. Wuhan, Tianjin, Guangzhou, Shenzhen, Xi'an Jiaotong University and Shanghai also carried out similar studies. In June 1987, China's first business incubator – Wuhan Donghu Pioneers Centre was formally established. Since then, business incubators have sprung up in China.

Nearly 30 business incubators were successively established in China during 1989-1990. In 1991, a group of business incubators with their own floor space were successively established and put into operation in Tianjin, Chengdu and some other places. At that time, there were nearly 40 business incubators in the whole country; more than 300 start-up companies and more than 1,000 high and new technology achievements were nurtured in the business incubators; the value of the business incubators' fixed assets and funds exceeded Y 100 million; and the first group of tenant companies began graduating.

4. Periods of development of China's technology business incubators

China's high-tech business incubators have generally experienced the following two important periods of development.

(a) The period of classic development

This was the first period of development of business incubators. The main characteristic of this period was that the government offered special policies for supporting the establishment and development of incubators and made heavy investment in building the most basic facilities needed by the incubators. The incubators laid their stress on transforming the existing scientific achievements and nurturing the existing small enterprises, by providing physical facilities and various junior consulting. They paid more attentions to social benefits rather than direct economic benefits. Institutionally, as self-reliance organizations independently responsible for their own incomes and expenses, the incubators gradually evolve into corporate management. This period lasted for about 10 years. The most pre-eminent achievements of the incubators in this period were as follows:

(i) The transformation rate of scientific achievements into production increased from a national average level of 25 to 30 per cent to more than 70 per cent.

(ii) The survival rate of small high-tech companies was greatly increased. According to many countries' estimation, in the condition of market competition, the survival rate of start-up enterprises is generally less than 30 per cent. However, after nurturing by business incubators, the survival rate of newly-started companies is generally more than 80 per cent.

In this period, the incubators mainly adopted primary financial measures (e.g., guarantee of credit, offering loans or equity investment) to support tenant companies and used individual efforts and primary methods (e.g., information release, exhibition, etc.) to assist the tenant companies to develop markets for their products. In addition, the incubators also provided some administrative supports to tenants. The incubators laid stress on transformation and cultivation of existing scientific achievements or existing small companies. The development of incubators in this period was characterized by the high transformation rate of scientific achievements, the high survival rate of small new technology companies, the low success rate of enterprises and limited range and primary method of service for enterprises. The period of classic development was extremely important for the development of incubators and the foundation for their continuous growth.

(b) The period of diversified development

This period already started from the end of the last century and is expected to last for 20 to 30 years. In this period, the focus of incubation is laid on serving high-tech enterprises and entrepreneurs in a wider range and at a higher level, bringing out their potentials and satisfying the needs in the transformation of scientific achievements and the development of technology industrialization. The development of technology business incubators in this period mainly has the following characteristics:

(i) Gradual transition from providing the tenant companies with thorough and all-round service to directly serving the entrepreneurs. In this period, the stress in nurturing is not only a technology or a product but also a process of invention that includes certain concept or a certain idea. The activities of incubator service will cover the whole process from an idea to research, development, production, and sales and until a company become listed in the stock market (or being acquired) as well as all necessary services in the aspects of capital, administration, property, market, law, etc. In the process, a technology or idea stands more chances of being successfully nurtured and transformed into viable products. Various incubation models will appear in this period.

(ii) Development towards industry-specific incubators. The thorough and all-round service will directly leads to the appearance of successful enterprise clusters, the formation of targeted (industry-specific) incubators and STIPs, the realization of closer cooperation between incubators, tenant companies and universities or scientific research institutes and the gradual establishment of state-of-art STIPs with high technology intensity. Since 1996, Beijing has established specialized technology incubators in such fields as medicine and new materials. By now, Torch Center has identified 22 software science and technology parks have been established in China.

(iii) Venture capital investment. The shortage of venture capital was one of the main reasons for the low success rate of the tenant companies in the incubators in the classic period. Chinese business incubators have recognized this issue and some incubators already began to tackle the problem by setting up venture capital funds themselves.

(iv) Networking at regional and provincial levels. Because of the broad territory of China, the huge number of scientific research institutes and the diversified development of high-tech business incubators, networking is inevitable for incubators. Therefore, urban networks, regional networks, national networks and international networks were formed in the period of diversified development.

(v) Profit-oriented development. The profit-oriented development of incubators seemingly goes against their objective. However, the profit-oriented development here does not mean the profit-oriented business behaviour in general sense. It means that incubators make profit while properly taking their responsibility as institution for the public good for the purpose of enhancing their own strength and capability and consequently realizing further development of public good undertaking in a greater scale and at a higher level, which means to enter a “sound development cycle”.

(vi) Internationalized development. Overseas students pioneering parks, international business incubators, the overseas base of high-tech business incubators and international incubation networks are the symbols of internationalized development.

The two periods of development of high-tech business incubators are only a relative concept in terms of time on the basis of an ideal subject. In fact, because of the broad territory of China and the great differences among different regions, generally speaking, the said two periods are mutually overlapping. It means that no matter what period the principal part of China’s business incubators has reached, the incubators of the other periods will coexist at the same time.

C. The current situation and characteristics of business incubators in China

1. The present situation of business incubators in China

Since the first technology business incubator established in 1987 in China, Chinese business incubators has developed rapidly after fifteen years’ efforts. The policy environment for business incubator has been improved and more capital has been put in the establishment of business incubator; the number and scale of incubators has been increased and service functions has been strengthened; a large quantity of technology enterprises and entrepreneurs have been brought up. According to statistics by Torch Hi-tech Industry Development Center of Ministry of Science and Technology (hereinafter referred to as Torch Center) at the end of 2001, there are 280 incubators of different kinds all over the country and 12,821 tenant enterprises. More than 3,900 enterprises have graduated from incubators. The total incubation space is 5,090,000 sq m.

Table 2-III-1. Main economic performances of business incubators in China
(million of Y)

Index	Year 2000	Year 2001
Number of incubators	131	280
Floor space (sq m)	2 721 000	5 090 000
Tenants	7 693	12 821
Tenant sales	17 880	40 540
Cumulative number of graduates	2 770	3 994
Graduates' sales	35 690	30 880
Total amount of seed capital	740	1 090
Tenants' employees	128 776	263 596
This year's new tenants	2 389	5 048

Source: Statistics of Chinese Torch Program in 2001, Torch Program, High Technology Industry Development Center, Ministry of Science and Technology.

Note: * US$ 1 = approximately Y 8.3.

The successful operation of business incubators accelerates the transformation of scientific achievements, creates a good environment, develops the entrepreneurial spirits of "tolerating failure, encouraging venture and advocating innovation", attracts a group of overseas personnel of high quality to start business in China and promotes international cooperation. The central and local government gives great support to incubators and the whole society pays much attention to them. Business incubators explore a new way to speed up the transformation of scientific achievements in market economy, which contributes a lot to technological innovation and sustainable development.

2. Characteristics of business incubators in China

Chinese business incubation programme has drawn on many foreign experiences especially best practices of the United States since its beginning of establishment. As the same period during the 15 years from 1987 to 2002, China was experiencing a rapid development in both economy and society. Combined with these factors and Chinese cultural traditions, the Chinese incubation programme has formed so-called characteristics as follows:

(a) Strong support from government

The Chinese business incubation programme is under the guidance and coordination of a special institution – Torch Program Office of MOST, which is unique in the world. To promote and standardize the development of incubators, the Torch Program office enacted *The Principled Comments on Technology Business Incubators* in November 1994, describing the nature, mission and establishing criteria of Chinese incubators, making preferential policies for incubators, and suggesting management in detail as well. Similar to the management of STIPs, the Torch Program office identified a group of incubators as national ones, which set an example for others. The guidance and coordination of the Torch Program office is vital in every stage of incubator development.

Most of the Chinese business incubators were established by technology administrations or STIPs. The programme is incorporated into the Torch Program and local high-tech industry development programmes. The initial fund mainly came from government. All the incubators got total or partial financial support from governments at provincial and city levels and STIPs in their early stage.

(b) Nurturing technology enterprises as main objective

As one important mechanism in implementation of the Torch Program, business incubators in China are playing an important role in transforming scientific results to real productive force. The main objective is to nurture technology enterprises and technology entrepreneurs by providing efficient services. Incubators accelerate commercialization and industrialization of scientific achievements by supporting SMEs.

TBIs in China generally stipulate clear criteria and qualification of technology enterprises to be admitted. The common principle is: the tenant must be technology-based; the legal representative must be a technological personnel with good education and quality, and understands the policies well, be honest, and well disciplined. In addition, he must have demonstrated potential business management ability.

(c) Close linkage between incubators and STIPs

(i) Many incubators are set up by STIPs. Now there are 53 national STIPs all over the country and a large number of STIPs at provincial levels. The STIPs set up incubators to satisfy the demand of scientific achievement transformation.

(ii) The STIPs give great support to incubators. Many STIPs have well-built infrastructure, therefore, incubators can get access to the infrastructure easily in its initial period. Some STIPs even don't expect incubators to be economically independent; instead, they expect incubators to provide them high-tech enterprises of good performance.

(d) Paying much attention to value-added service

Incubators in China pay much attention to provide all kinds of value-added services for tenant companies, including:

(i) Funding sources and financial consulting. Funding is always a key problem when establishing an enterprise especially for small high-tech ones. Incubators assist entrepreneurs in financing by making use of its linkage with government, banks and other related institutions. At the same time, those incubators that have enough capital would like to help entrepreneurs to overcome financial difficulties by their own funds. Incubators also provide assistance in the tenants' daily financial management in terms of accounting, consulting, acting as financial representative for newly built enterprises. And the tenants' financial development was well reviewed by studying their financial reports.

(ii) Training. The present training approach is mainly to organize various training courses, with study tours at home and abroad as supplement. The training programme covers policies and laws, business management, marketing, international trade, finance and tax, audit and insurance. The overall objectives are to improve the entrepreneurs' management skills, and help to transfer them from technology personnel to technology entrepreneurs.

(iii) Developing international cooperation. Generally speaking, in the initial period, entrepreneurs are aware of the importance of international cooperation but have difficulties in finding international cooperation channels. Incubators assist enterprises in overseas study tours, negotiation, and training, recommending international cooperation projects and finding export channels for products and assisting in related procedures.

(iv) Preferential policies. The government provides many preferential policies to certified high-tech enterprises to implement Torch Program. Local governments have adopted corresponding preferential policies. Incubators have a full understanding of these policies by long-term management experience. In this way, incubators can help enterprises to make use of these policies or assist in policy consulting.

(e) Investment and financing service of incubators

As a special service organization, business incubator introduces venture capital into enterprise start-up process as the most important supporting means. From establishment to maturity, an enterprise undergoes start-up, growing and expanding stages. And the venture capital comes in the form of seed capital, initiation capital, venture capital and development capital, which covers and supports the entire venture process for technopreneurs. Incubators provide its tenants with various kinds of investment and financing options. The primary methods are as follows: invest in the start-up companies by incubators' own-seed capital, invest jointly through cooperation of incubators and venture capital companies, facilitate cooperation between venture capital companies, banks and tenant companies, and seek all kinds of government funds to subsidize the tenants.

(f) Diversified types

(i) General technology business incubators

General technology business incubators are the mainstay of incubators in China. It absorbs transferable technology achievements and promising small technology enterprises and provides them with necessary services, such as floor space and facilities, financing, marketing development, development consulting, business management training, financial management, laws and policies, and financial support. All these create a favourable environment for the transformation of scientific achievements and the nurturing of technology enterprises. Generally speaking, the average term of incubation is 3-5 years, and the survival rate is over 85 per cent. Incubators are non-profit institutions. With the support of preferential policies and funding provided by government, incubators produce high-tech enterprises that are competitive and with great growth potential to STIPs. In this way, incubators need government support to have floor space and seed capital fund needed in their initial period to evolve into financially independent institutions.

(ii) Specialized technology business incubators

Based on the experiences in developing general-purpose technology business incubators, specialized technology business incubators target at transformation of scientific achievements and cultivation of SMEs of a special technology field with the support of universities or R&D institutes. They pay more attention to design and use of the incubation space and services with expertise orientation, and are more industry-specific than general TBIs in terms of technology field, marketing, information and training. So they have greater ability, better services to help tenants to grow. Specialized technology business incubators are in a vigorous period of growth in China today, and shows one of the development trends of Chinese business incubator. They usually focus on software, new material, bio-medical, cmos (complementary metal oxide semiconductor) chips, energy-saving and environmental protection and telecommunications, etc.

Software parks are larger than common incubators and resemble the quality of a science park with small and medium-sized software technology enterprises as tenants. Approved by MOST, 19 software parks have been founded in STIPs in China.

(iii) University-related S&T parks

University-related S&T parks are generally set up by universities to take advantage of technology resources in universities. The mission is to transfer scientific achievements of universities and foster SMEs built by universities or technology enterprises that have cooperation relationships with universities. Technology personnel can make full use of technology research facilities and combine teaching with research in universities. University-related S&T parks create better development environment for enterprises. University-related S&T parks are incubators in essence, transferring new scientific achievements, nurturing technology companies and pushing forward the development of local high-tech industries. Nowadays, 22 university-related S&T parks at national level have been set up in China.

(iv) Incubators for returned overseas scholars (IROS)

IROS is a special kind of incubator open to more than 300,000 Chinese students studying abroad and overseas Chinese scholars. Generally set up in medium and big cities that have large number of Chinese studying abroad and intensive technology resources, it provides better infrastructure and policy according to the characteristics and demands of overseas scholars. The overseas scholars are familiar with cutting-edge technology, knowing the norms of conducting foreign market and modern business management well, and have a strong desire to return and start up venture at home. Although the majority of the 25 incubators for returned overseas scholars have a history of only 1-2 years, they show a flourishing trend. IROS is also practical and preferable approach for incubators to have international operation.

(v) International business incubators (IBI)

In 1996, with the help of experts from the United Nations, MOST selected eight better performed incubators from Beijing, Xi'an, Suzhou, Shanghai, Wuhan, Tianjin, Chengdu and Chongqing as pilot IBIs. IBIs are designed to assist both international and Chinese start-up firms enter the Chinese and international markets respectively, and to promote cooperation between the two. While the traditional incubator serves only national ventures, the IBI is intended to facilitate small companies with significant technical products but with limited resources to enter a complex market such as China. The international operation of Chinese business incubators is a responsive measure to enterprises wishing to develop international operation. IBIs have set good examples and are accelerating the cooperation between business incubation in China and internationally.

(vi) Incubators set up by state-owned enterprises (SOE incubators)

Setting up incubators within SOE is an important practice in reconstructing traditional industries by utilizing high technology, and this infuses new vigour into China's incubation programme. Relying on the existing resources of SOEs, incubators can promote the transfer of technology achievements, speed up the reconstruction of traditional industries by utilizing high technology, nurture the new technology and new products, cultivate new sources of economic growth so as to reconstruct and upgrade the business operation of the SOEs.

Beijing Gas Engine Manufacturing, new and high-tech incubator, is the first incubator set up by SOEs in China. The Gas Engine Group is the largest manufacturer of combustion engines in China. In recent years, the products were over produced and outdated, efficiency was low and demand was falling. Other problems include low efficiency of management, staff redundancy and lacking of capital. With supports from Torch Program and Beijing Municipal Government, Beijing Gas Engine Group, Beijing Polytechnic University and Beijing Hi-tech Business Incubator jointly established the said Incubator in August 1999. Taking the TBI model and selecting the promising manufacturing high-tech projects and enterprises as tenants, the incubator provides the services needed for transformation of scientific achievements and technology start-ups and financing, training and marketing services as well. Over two years of practice, the incubator has got very good performance with 20 enterprises nurtured, tenant sales over Y 50,000,000, more than 400 jobs created. One business among the 20 was even created by nine workers who resigned from Beijing Gas Engine Group. The Incubator has shown a bright future.

Until now, more than ten SOE incubators have come into being, concentrated mostly in Beijing.

(vii) General purpose business incubators

While the above incubators are predominantly for commercializing innovations, the incubator to address other social and economic issues has also been explored. Now, an incubator in Tianjin focusing on enterprise creation by laid-off female factory workers, and sponsored by UNDP, Australian Agency for International Development (AusAID) and the Tianjin Women's Federation, is presently in the implementation stages and has been operating well since its official stating in October 2000. The All-China Women's Federation (ACWF) is expecting to promote the model in the whole country.

D. Models and trend for China's business incubation programme

1. Two institutional models

From the end of 1970's to the present, China has been undergoing profound social changes from the planned-economy system to a socialist market-economy system, and a series of new type social organizations continue to arise. Whether viewed from the standpoint of their form or functionality, the former planned-economy system did not have these kinds of new organizations, and as such there is no way to use the planned-economy system's means of classification to distinguish and address these new organizations. While the new market system is in the process of development, two institutional models have been chosen for China's business incubators. One model is a non-profit model, which is for public good, and the other is the commercial for-profit business model. Of these two models, the non-profit currently is in the predominant position.

(a) The non-profit model

China's business incubators adopted the non-profit organizational model when the pioneer TBIs set-up, and most of the followed as well. But because China did not yet have this kind of non-profit organizational description at that time, they enlisted the formerly used autonomous institutions in which the organization would be responsible for its own profits and losses. Generally in China, government departments set up business incubators, they provide initial funds and appoint the incubator's management team. Thereafter, the government hands the responsibility over to this management team, no longer bears the responsibility for the financial operation. Then the government takes on the role of providing services to the organization in order to reach public goals. Like most of the incubation programmes around the world, China's business incubators are mainly promoted by the government. The main reason why the Government of China has become the biggest investor in business incubation is because of the great changes have been taken place in the functions of the Government of China since the Reform, that means the government would no longer like to plan and control all the economic matters in detail, but taking the utilities of more and more social agencies.

(b) The commercial model (for-profit)

In recent years, people have discovered that business incubators are also of a great deal of commercial value and have the possibility to be used as profitable business enterprises. As such, in recent years there have been many attempts to begin profitable business incubators. When taken the commercial model, the business incubator's value is relied on its ability to foster the growth of its tenants, and discovering the latent potential of the enterprises' entrepreneurs, and the enterprises' market value fostered would increase the incubator's value. Especially while in the process of new economic fast development in China, the continual emergence of new sources of growth becomes the seeds to be incubated, and through which incubator develops into a "business that produces businesses".

Under the commercial model, the business incubator is seeking to make progress together with its incubated enterprises, and wishing the success of which could be reflected in economic benefits to both parties ultimately. This allows business incubator to be designed to a special type of for-profit corporation. And the relationship between incubator and its tenants is not only the traditional give-and-take services, but also have the give-and-take investment relationship. The investment can be both actual capital input and services investment, with each service provided being counted as a kind of investment. Then, as the enterprise develops, it begins to repay the business incubator. Moreover, the model is to be designed as incubator services plus venture capital plus strong consulting services.

The business incubator's management company (taking the authorization to run other people's incubator) is also taken as a kind of profitable company model as well.

2. Financing model

Since 1987, as China's incubation programme has grown and developed, incubator sponsorship forms have also continuously developed. The sponsorship forms have experienced two stages namely single sponsorship and diversified model.

(a) Single sponsorship

If differentiated from the perspective of the business incubators' main sponsorship, the first ten years of development (1987 to 1997) comprised the initial stage, since at that time the S&T administrative, namely the Ministry of Science and Technology, local science and technology committee and the STIPs, sponsored most of the business incubators in China. In the initial of this stage of development, provincial or city level science committees sponsored the majority of business incubators, and later, most business incubators were sponsored by the STIPs. According to the Ministry of Science and Technology 1998 statistics, of the then 77 business incubators in China, there were 24 incubators sponsored by provincial or city science committees, comprising 31.2 per cent of the total. These incubators were mainly established between 1988 and 1994. Forty-seven were sponsored by STIPs, comprising 61 per cent of the total. One incubator was co-sponsored a provincial S&T committee and STIP, two were sponsored by state-owned enterprises; another two by universities, and one by an economic technology development zone.

During this period, the government has been China's business incubators' main investor. A government sector usually invests directly on an incubator, plus loans from banks in the name of the government or business incubator. These funds are used for building the incubator's premises, facilities, purchasing equipment, training staff, etc. (see tables 2-III-2 and 2-III-3).

Table 2-III-2. Investment funds ratio of China's business incubators by 1994

Investors	Ratio (percentage)
National or local government allocated funds	42.2
Bank credit loan	39.3
Other (including reinvested funds)	15.3
Total	**100.0**

Source: High Technology Industry Development Centre, Ministry of Science and Technology and China's High-Tech Industries Development Zone Association, *Scientific and Technological Incubators* (China's Business Incubator, March 1995).

Table 2-III-3. Sponsors of China's business incubators, through 1998

Type of Sponsor	Number of Centres
Provincial or city level science committee	24
STIP	47
Science committee and STIP cooperation	1
State-owned enterprise	2
University	2
Economic technology development zone	1
Total	**77**

Source: Ma Feng-Ling. *Chinese Business Incubators Development Evaluation Report* (February 2000).

(b) Diversified financing model in economic transformation period

In recent years, the financing model for China's business incubation is diversifying. From the original foundation of solely government sponsorship model, there has now evolved enterprise-sponsored and multiple-investors-sponsored incubators, such as those funded by SOEs, privately owned enterprises, international organizations and other types of sponsors. Nowadays, the Chinese business incubators' investments mainly come from the following sources:

- Government/quasi-government sectors. The government's S&T administrations are currently the primary investors, including all levels of S&T Committee, all levels of STIPs, and all levels of economic technology development zones. The personnel department, the education department, the social security and labour department and other related departments are also gradually involved;
- Universities, R&D institutes;
- Various types of enterprises, including state-owned enterprises, privately owned enterprises, foreign enterprises, investment companies and listed companies;
- Non-governmental organizations;
- International organization.

3. Organization models and leadership styles

(a) Organization models

The organizations for China's business incubators are divided into two types: public institutions and corporate enterprise organizations. Specific models are as follows:

- Government-sponsored public institutions in which the funding comes solely from government appropriated funds

- Government-sponsored autonomous-management public institutions (self-reliance ones)
- Government-lead, mixed-investment corporate enterprises
- Government-background SOEs sponsored corporate enterprises
- Non-government-background SOEs sponsored corporate enterprises
- Privately-owned enterprise business incubator
- Non-governmental-background mixed-economic-form business incubator
- University or R&D institute sponsored public institution business incubator
- University or institute sponsored corporate enterprise business incubator
- NGO sponsored public institution business incubator

(b) Leadership Style

Because of the different sponsors, the business incubators' organization models and leadership styles vary. Generally, a director or a manager will be appointed to take the primary responsibility for the incubator's leadership. Another difference is whether the incubator has a board of directors.

When the investor is a government agency, the incubator is usually set up according to the public institution model, and in most cases the director-led leadership style is used, and usually without a board of directors. Enterprise sponsored incubators would like to have a board of directors and appoint a manager.

Incubators set up through the cooperation of government and enterprises are also usually set up in the corporate style, as are those incubators set up by universities, institutes, intermediary companies, or private investors. Corporate-style incubators mainly use the general-manager-led or board-of-directors-led leadership styles. NGO sponsored business incubators use the governing-board-led style of leadership.

Compared to the government sponsored business incubator, more private enterprise business incubators adopt a modern corporate system, with the prominent characteristics being that there is a standard, formal board of directors which decides upon the incubator's important matters and a general manager who is appointed by and is responsible to the board of directors. The general manager assumes responsibility for the incubator's specific daily management.

The multi-investor cooperation model refers to those business incubators that are founded by two or more investors and run according to a determined cooperation contract. In order to be carried out as close to the market economy standards as possible, some newly established multi-investor cooperation incubators have adopted a joint stock company model, and therefore established a board of directors to be responsible for the incubator's major decisions and appointed a general manager to run daily affairs.

Along with the development of a market economy, some newly established government-sponsored business incubators also follow the corporate style, creating a board of directors and implementing the general-manager-led style of leadership.

Table 2-III-4. Analysis of three types of business incubators

Category	Government Sponsored Model	Private Enterprise Model	Multi-Investor Cooperation Model
Investor	Government	Private	Multiple investors
Main purpose	Service oriented	Profit oriented	Diverse interests
Nature	Public institution	Corporate enterprise	Diversified
Characteristics	Policy tool	Flexible	Shared model
Issues	Relationship between the government and the incubator, and funding issues	Potential conflict between the incubator's function and profit goals	Diversified goals contradiction, management confusion

Source: Zhang Jingan, China's Science and Technology Business Incubator, *Case Analysis and Development Countermeasures* (Science and Technology Document Publishing House, May 2001), p. 243.

4. Service models

During its 15 years of development, China's business incubator has formed some certain service models. In terms of structure, functionality and other aspects, the business incubators has gone through continuous development, all the while maintaining a common model among all incubators and yet allowing each incubator to develop their own distinct characteristics. In summary, the incubation service models can be described as the following three:

(a) Service model 1: Shared space + shared facilities + shared service

This is the business incubator's basic service model, which is used to reduce the start-ups costs. This model includes the following services:

(i) Physical Infrastructure:

- *Floor space*: enterprises are provided with flexible, rental space in which all basic requirements can be met (water, heating, electricity)
- *Office services*: mainly includes typing, copying, printing, reception, conference rooms, recording equipment, reference materials, transportation, security, etc.
- *Communication*: mainly includes telephone, fax, post office box, etc.
- *Financial channels*: mainly includes banks, guarantor companies, investment companies, etc. Can also invite one or more banks to open branch offices either in or nearby the business incubator
- *Information services*: high-speed Internet access, construction of LAN, electronic press releases, foreign periodicals, etc.
- *Production development*: common-use computer facilities, electrical laboratory, machining equipment and other common-use facilities
- *Representative services*: mainly includes business license registration, tax registration, opening bank accounts, personnel file management, professional title evaluation, collection of utility, sanitation and environment beautification services fees, fire protection inspections, hosting of various activities and events, etc.
- *Basic services*: restaurants, sanitation services, shower facilities, shopping facilities, health and fitness facilities and cultural and entertainment facilities

(ii) Software Environment:

- Create an entrepreneurial culture and atmosphere;
- Provide management guidance: Inform enterprises of national and locally determined ordinances, statutes, and other relevant policies in a timely manner and provide necessary training and consultation services. Enable enterprises to follow the proper development path in a rapid manner;
- Help enterprises create development plans, marketing strategies, etc.
- Provide financial channels and financial consulting;
- Human resources training;
- Project finding services;
- Project application services;
- Implement preferential policies;
- International cooperation partners;
- Trademark recognition. The business incubator has a well-known reputation, so tenants associated with the incubator can receive benefits from being associated with the incubator and its trademark.

Under this model, the business incubator pays great attention to the construction of optimized local environments in which to foster new enterprises. An environment in which enterprises feel more comfortable, and from which interference of all kinds is excluded is very important for the development of a new enterprise. At the same time the business incubator regards some procedures in the founding of new enterprises as their core works, and also emphasize the creation and execution of preferential policies.

(b) Service model 2: Shared space + shared facilities + shared service + professional consulting

Based on reducing the start-ups costs, this model begins to deepening the incubator's service functions and move towards the phase that the incubators to increase the enterprises in value. One concrete way of increasing the value is to offer specialized consulting services, or the said business development service (BDS).

Management obstacles are the most prominent difficulties incurred while enterprises developing. So the character of this period requires deep research into numerous issues of the start-ups, including enterprise team building, technological development, market development, production, financing, rules of enterprise development, and the tests and trials experienced in founding successful enterprises.

Professional consulting services include:

- Consulting with regard to business planning, market development planning, human resources development planning, financial planning, product development planning, and production planning;
- Consulting in finance and law and other professional services;
- Providing practical training courses to enterprises;
- Assisting in market development for enterprises;
- Assisting enterprises in connecting with all walks of life.

Under this model, the business incubator pays special attention to the building of key abilities so as to enable enterprises to not just survive, but to have fast and healthy development. The incubators truly become a learning tool for future entrepreneurs. This is accomplished by providing business development services and creating conditions to train, support and develop successful small enterprises, encourage active practice and the fostering of entrepreneurial and creative spirits.

(c) Service model 3: Shared space + shared facilities + shared service + professional consulting + venture capital investment

In terms of problems incurred during the enterprise growth, lack of capital is another most difficult problem to solve as it seriously restricts the enterprises' healthy development. Because of the special character of China's transition economy, banks nowadays are not willing to provide loans to SMEs who do not have a mortgage or other guarantees, SMEs usually cannot get financial support from the bank, thus making the funding problem very prominent. When taken as a societal problem, it is now being gradually recognized, and the national government is already formulating and will continue to formulate a series of measures to address this problem. Additionally, solving this problem for new ventures has always been a main responsibility of the business incubator. The main means by which to solve this problem includes using the incubators' own commercial credit standing and related channels in order to provide the enterprise with a loan guarantee, a short-term cash-flow loan and start-up capital investment (seed capital).

Furthermore, the model incubator plus venture capital is also a well approach for business incubators to get enough fund as growing with the promising incubatees.

5. Trends of China's business incubator

Chinese business incubators have already entered the stage of rapid development. The characteristics of this stage are:

(a) Rapid increase in number across the nation

By year 2005, it is expected that China may have as many as 1,000 to 1,500 business incubators. The underlying reasons for this rapid increase are: (a) a large number of entrepreneurs are now starting businesses, the incubators are fulfilling this urgent market demand; (b) now after fifteen years of practice, the society have come to recognize that business incubators produce an obvious social impact; (c) the industries and investing institutions are now very willing to invest in this area.

(b) Diversified financing

All levels of government, all kinds of development zones, SOEs and privately-owned enterprises (among them many are listed companies), foreign capital, women's organizations, organizations for assisting the empowerment, charity institutions, private individuals and many others will become sponsors in business incubators.

(c) A variety of business incubator operational models

In terms of organizational models, the business incubators would include both non-profit institutions and for-profit institutions. There will also be various types of commercial models. Some models may be based on physical space requirements while others have no physical space requirements and thus fall into the category of "virtual" incubators. The business may also be varies depending on their different business scopes which may be, for example, consulting services, training services, intermediary financial services, investment services, etc.

(d) More and more specialized technology business incubators

Numerous specialized technology business incubators will appear in the near future. The reason behind this rapid development is that entrepreneurs are eagerly in need of a technological innovation platform with profession technological services.

(e) Competition intensifies

Competition among incubators in different major cities, in different districts within the same city, and in areas with abundance of knowledge and capital resources will be inevitable. The competition is not only limited to organizations within China, but overseas investors will come on the stage and make the competition more and more intense.

E. Role of the Government of China in the development of business incubation programme

1. Strong administration

Up to now, the Torch High-tech Industry Development Center of MOST is the specific administrative organization overseeing the work for China's STIPs and TBI programme at the national level. The local science and technology committees and STIPs are in charge of the management of their own regional incubation programme.

2. Macrodirection and policy guidance

(a) Identify the social status of incubators

The national and local governments formulated a series of laws and regulations to confirm the social function of business incubator, including China SMEs accelerating law, decision about strengthening technical innovation; developing high technology and realizing industrialization; rules on accelerating transfer of Research Results, Principle Comments on China's Hi-tech Incubator, Relevant Comments on Implementing central government decision of strengthening technical innovation; developing high technology and realizing industrialization by Ministry of Education, etc. The local government stipulated relevant policies. The said laws and regulations have supported the development of business incubation in China.

(b) Formulate standards of technology business incubators

MOST formulated Assessment Criteria and Methods of National Technology Incubator to define the nature of incubator, its mission and commencement requirements. It also formulated Comments on Accelerating

Incubator Development in the Tenth Five-Year and Development Outline for China's Business Incubation in the Tenth Five-Year.

(c) National conferences and training workshops

To further develop the business incubators, MOST organizes working conferences at regular and irregular intervals. In 2000, in cooperation with Ministry of Foreign Trade and Economic Cooperation, Ministry of Education, Chinese Academy of Science, Chinese Academy of Engineering, Shanghai Municipality and UNDP, MOST succeeded in hosting the International Conference on Business Incubation and Technology Innovation, which attracted more than 100 overseas high-ranking government officials, business leaders, scholars and experts and incubator managers as well, more than 200 domestic participants presented their views and exchanged opinions on issues concerning business incubation. This conference has drawn extensive acclaim and greatly boosted profile of Chinese business incubators in the world. The local governments often hold similar meetings.

Besides national conferences, the Government of China actively sponsors training workshops and seminars on business incubation as well. From 1988, MOST has organized 15 workshops attended by over 300 managers from international business incubators. World-known experts were invited to give keynotes on their experiences in developing incubators. Chinese scholars and experts also expatiated on their practical experiences in the workshops. MOST organizes seminars during Beijing Hi-Tech International Week and Shenzhen Hi-Tech Week, both of which are held every year. To draw experiences from abroad, Chinese incubator managers were sent to attend training workshops in other countries, too. There have been a total of 64 incubator managers and staff who attended training courses in the United Kingdom or Finland. All of these played an active role in developing the incubation programme.

3. Preferential policies

The policies cover encouragement to both incubator itself and its tenants, such policies as tax exemption or reduction to tenant companies, tax exemption and reduction for income generated from incubator services, policy to attract talented personnel to incubator management, encouraging policy for all walks of life to set up incubators, low rentals for start-up companies, provision of value-added services etc. Meanwhile, government also provides various supports in the incubators' business services, consulting, human resources training, international exchange and cooperation, financing, and personnel transfer, etc.

4. Financial support

Financial support is one of the most important means that government adopts to help incubators. Funds are made accessible to incubator infrastructure building as well as earmarked spending. By the end of year 2001, the Torch Program Fund, administered by MOST, directly invested in business incubators with a total of over Y 70 million. This has a very good model effect. Local governments across the country invested Y 1 billion in the development of business incubators.

MOST set up Innovation Fund for Hi-Tech SMEs, which provides US$ 25 million annually in the forms of grants or loan interest subsidies to support SMEs in their technological innovation. The local governments also set up matching funds for Innovation Fund, which added up to Y 1.19 billion (about US$ 143 million).

5. Support and facilitate the development of Associations

The government pays attention to support the development of non-governmental organizations for incubation. It greatly advanced the non-governmental activities such as the establishment of China Science Park Association Business Incubation Sub-Committee, and initiation of China Technology Business Incubation Association. The non-governmental organizations of business incubators create a strong cooperative atmosphere in training, experience exchange, consulting and international cooperation between the incubators national wide, and help to bring about a sound development for business incubation.

6. International exchanges

The government actively organizes incubators managers to participate in international exchange activities, such as attending annual international conferences held by the International Association of Science Parks (IASP), Asia Science Parks Association, the National Business Incubation Association (NBIA), organizing delegation of science parks, business incubators and SMEs to visit abroad to exchange experiences in technology and relevant policies, inviting world-known experts and specialists to give lectures in China, holding international workshops to introduce Chinese incubator management experiences to participants from developing countries, and sending experts to countries like Pakistan, Viet Nam and Egypt to do technical consulting in incubation development.

7. Importance attached by top leaders of the state and local governments

The leaders from central and local governments pay great attentions to the development of incubation programme. There was quite a lot of news coverage about the leaders' inspecting incubators in the media. Up till now, most of China's top leaders have inspected incubators, which is considered a big drive for development of incubation programme.

F. Conclusions and suggestions

1. Social and economic value

(a) *Social benefits*

(i) *Create businesses*

SMEs play a key role in innovation from the viewpoint of developing high technology and realizing industrialization. Chinese business incubators are well aware of the fact, and contribute a lot to nurture a good many technology-based SMEs and become a real cradle for hi-tech start-up companies.

(ii) *Create jobs*

Unemployment has always been existing in Chinese cities and countryside. However, 15 years ago when business incubators were just founded, they were not expected to create job opportunities. Over the past 15 years, business incubators achieved startling success in the creation of job opportunities, which contribute much to social and economic development in China. According to the statistics in 2001, the 280 business incubators across the nation had a total of 12,583 tenants employing 263,596 people, and 3,994 graduate companies employing 195,502 people. In another word, the incubators directly created 459,097 job opportunities. If we double the number of indirect job opportunities generated by a direct job, by inference, the indirect job opportunities generated by incubators amounts to 918,194. Added up, the total job opportunities have been 1,377,291.

(iii) *Improve the success rate of scientific results transfer and accelerate industrialization of high technology*

As an important mechanism to commercialize high technology, the business incubators provide a favourable environment for technical innovation and related commercialization. It provides the entrepreneurs with prerequisite for commercialization of their scientific results. The transfer success rate of scientific results surpasses 80 per cent, of which 30 per cent are achieved through technical transfer and cooperation, 70 per cent through self-investment. Making the transfer of scientific results from lab to market possible, incubators play an active role in transferring technology to productive force, which constitutes the most important part of China Torch Program.

(iv) Foster and highlight culture of innovation and entrepreneurship

In the years when China practiced planned economy, the setting up of enterprises as well as the products and services were all considered and decided by government, leaving no place for private businesses, let alone personal innovation, entrepreneurial spirit or culture of innovation. China's reform policy made the birth of business incubators possible. By providing facilities and services for business creation, TBIs encourage scientists and researchers to establish technology companies in an effort to support the development of high technology. The knowledge-based businessmen appeared, simultaneously motivated a group of young intellectuals to found their own businesses. Nowadays, some university graduates start their businesses in incubator directly after their graduation from schools, some even run a business while studying in the university. The university students have become a new source of venture creation and innovation. Now, entrepreneurship has already formed within and outside incubators in China, which is unwilling to be left behind, in pursuit of excellence and new technology, daring to innovate, ready to cooperate, tolerant of failure and encourage adventure.

(v) Attract overseas Chinese scholars to start business in China

According to statistics of the 44 incubators for returned overseas scholars, by the end of the year 2001, the total floor space was 1,257,000 sq m, which have 1,449 tenant companies founded by returned overseas students. Nearly 3,000 returned overseas Chinese students are working in these incubators. Over 90 per cent of them have doctorate or master degrees.

(vi) Promote international cooperations

The development of China's business incubation programme has already drawn attention internationally. The incubators keep close contacts with counterparts in the world, and have built cooperative partnership with science parks and relevant incubators in human resources exchange and training with the United States, the United Kingdom, Italy, Canada, Finland and Australia. Internationally well-known incubation experts expressed their surprise over the fast development and high quality of China's incubators in spite of the shortage of market resources and inadequate investment by government. The Government of China even had sponsored various international business incubation workshops open to developing countries. Shanghai has successfully hosted four sessions and trained 79 managers of incubators from 26 developing countries, which won China a good reputation worldwide.

(vii) Develop venture capital operations in China

While applying for governmental support and bank loan, incubators set up seed capital fund, credit guarantee fund and shareholding mechanism to improve the financial situation, which actually mitigate the financial difficulties of start-ups during the commercialization of high technology.

(b) Economic development tool

According to statistics collected by Torch Center in the year 2001, 280 incubators had an average floor space of 18,179 sq m, 46 tenants and 21 employees for each tenant. Each had an average of 14 graduate companies. The average tenant sales accounted to equivalent of about US$ 382,000, with profits of about US$ 21,500.

Statistics shows that by the end of 2001, the governments at all levels had invested more than Y 1 billion or US$ 121 million in 280 incubators. It is expected that all the investment will be returned by the amount of taxes charged from the tenants within three years after 2001, let alone social benefits generated directly or indirectly by incubator, such as job opportunities, increased payable tax by supplier and customer, innovative culture, technology products and service value, etc.

Table 2-III-5. Performances of Torch Program incubators, 2001

Gross floor space	**5 089 716 sq m**	
Tenants	12 821	
Tenant employees	263 595	
Tenant sales	Y 40 540 000 000	US$ 4 900 000 000
Tenant profits	Y 2 300 000 000	US$ 275 100 000
Tenant taxes	Y 1 580 000 000	US$ 190 200 000
Cumulative number of graduates	3 994	
Graduates' employees	195 502	
Total seed capital funds	Y 1 100 000 000	US$ 130 200 000

Source: Torch High-tech Industry Development Center, Ministry of Science and Technology. *The Statistics of Chinese Torch Program in 2001.*

2. Advantages and constraints

Government initiatives are crucial in development of business incubators especially at the initial stage. But government support alone is not enough. Development of incubators is also affected by the social conditions and economic strength of the nation.

(a) Advantages

(i) Strong governmental backup

The remarkable growth of Chinese business incubation programme is mainly attributed to governmental advocacy by stipulating favourable policies and provision of funds. Governmental policies not only provide incubators and entrepreneurs with financial incentives in terms of tax reduction and exemption but also demonstrate positive attitude of government towards companies set up by individuals. This was particularly important during China's transition from planned economy to market economy and greatly liberated people's traditional mindset. Financial support from government to incubators also assumes great significance. Up to now, government at all levels has invested more than Y 1.7 billion or about US$ 205 million to incubators to improve their infrastructure and quality of services rendered.

(ii) Extensive networking among incubators in China and active exchanges between domestic incubators with foreign counterparts

With Torch Center as the nodal point, business incubators in China can benchmark their performance and learn from each other through meetings, identification of national incubators and various activities. The government also promotes international exchanges by organizing delegations of incubator managers to go abroad to study and exchange view and ideas with foreign counterparts, sponsoring training workshops on business incubation open to international participants and hosting international conferences. Non-governmental organizations like Incubator Associations at national and local levels also promote interactions among incubators.

(iii) Full potentials and capacity for sustainable growth

As a later comer, Chinese incubation programme can draw lessons and experiences from other countries and achieve sustainable development.

(b) Constraints

(i) Unbalanced development

Due to difference in sponsorship, basic conditions, governance and operation mechanisms and available facilities, incubators vary greatly in scope and quality of services.

(ii) *Limited funding channels*

Start-up companies inside incubators always encounter shortage of fund due to market failure. In addition, capital market in China is yet to be further perfected to encourage development of venture capital and other investment activities, as well as the incubators.

(iii) *Overemphasis on the hardware facilities undermines provision of value-added services*

At the start, government gave excessive attention to develop physical facilities of incubators, which led to negligence of offering quality value-added services.

(iv) *Managers of incubators are insufficient in business managing experiences*

This limits the services that the incubator can provide to the incubatees.

(v) *The social environment is expected to be improved*

China is experiencing the transition from planned economy to market economy. The social mechanism cannot fully support or encourage the development of SMEs yet. Neither can the service system meet the needs of the innovation activities. The innovation service organizations are still waiting for support from all walks of life.

However, there is a common understanding that with the development of the incubation programme in China, these problems are being or will be solved. The incubation planners as well as the managers are well aware of these facts.

3. Experiences and lessons to be learned

(a) Government support is indispensable

Incubators as cradle for creation of start-ups and job opportunities and training school for entrepreneurs deserve support from government. Experiences indicate that government backup assumes tremendous significance for development of incubators.

(b) Right choice of the location

The right choice of the location of an incubator will speed up its further progress and create enough income. Generally speaking, the incubators should be located in the STIPs, close to knowledge-intensive area surrounded by universities and research institutes, so that incubators can enjoy resources of technologies and knowledge workers as well as share R&D facilities of these institutes.

(c) With market orientation

For-profit or non-profit, an incubator must adopt market-oriented governance mechanism in its operation. Though government support in financing and administration is necessary in the start-up period of incubators, the ultimate purpose of incubators is to be self-sustaining and economically independent.

(d) Integration with venture investment

Experience at home and abroad shows that both venture capital and incubator are effective tools to promote development of hi-tech companies and high-tech industries. By providing much needed capital as well as financial advices, venture investment can tremendously enhance the success rate of business incubation and accelerate the growth of tenant companies. On the other hand, incubators offer facilities and services to start-up companies to lower the risk of commercial failures, and improve chances of success for venture investment. They are complementary and mutually beneficial.

(e) Offering comprehensive and high quality services

Quality of services is the core value of an incubator and to a large degree determines the success rate of its tenant companies.

(f) Synergy with R&D institutions, universities and other companies should be stressed

Incubator serves as a platform for convergence of resources between R&D institutions, universities and other companies.

(g) Selection of promising tenants

Incubators should be very careful in choosing tenants, such aspects as market potential, management team and business plan should be emphasized.

(h) Extensive networking

The incubators should set up such non-governmental organizations as association, chamber of commerce and club, which connects the incubator with the all walks of life. Those organizations offer opportunities to incubator in training, exchanging experience and other cooperation.

(i) Support from the United Nations

All the visits, information dissemination, investigation and conference from the United Nations play an active and important role in the incubation development.

4. Conclusion

The first phase of Chinese transition from the planning economy to market economy is accomplished successfully. The incubation programme has served as a means of facilitating this. It will show a growing and energetic trend in every respect in the following decade, like China itself. On the basis of the current development situation, as an efficient way, the incubation programme will further promote technical innovation and economic growth in China.

IV. PROMOTING BUSINESS AND TECHNOLOGY INCUBATION FOR IMPROVED COMPETITIVENESS OF SMALL AND MEDIUM-SIZED INDUSTRIES THROUGH APPLICATION OF MODERN AND EFFICIENT TECHNOLOGIES IN INDIA

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POLICIES AND SUPPORT FOR PROMOTION OF BUSINESS AND TECHNOLOGY INCUBATION IN INDIA*

A. Introduction

India is now in a stage when it can take pride of having a strong network of S&T institutions, trained manpower with innovative potential and a strong industrial base backed by equally efficient financial institutions. This has resulted in the building up of confidence among our entrepreneurs, scientists, engineers and academicians to come together to achieve integrated excellence and to take advantage of the new economic order which has made the economy, technology and research globally competitive. Thus, India is now well positioned to take advantage of knowledge-based industries and is in a position to share its experience and also offer its facilities in a mutually beneficial way. S&T sector has accepted the challenges brought about by the changing global economy in taking over the command in the field of communication, computers, biotechnology or the use of new materials and products so that barriers that are created by more advanced countries to the access of the technology can effectively be tackled by suitable alternatives. The investment in S&T sector witnessed a corresponding increase signifying the greater primacy this sector assumed over the years. The Prime Minister of India, while addressing the Indian Science Congress (2002) has assured a gradual increase in investment in R&D to reach 2 per cent of the GDP by the end of 10th Plan (2007).

1. S&T policies and development

In the emerging scenario of globalization and competitive economy, science and technology have come to be regarded as one of the powerful instruments of growth and development. India is one of the top ranking country today in the field of basic research and our success in technology development have not been insignificant either. There is self-sufficiency in food and India occupies mega position in the world in several items of agricultural production. Our capability in building nuclear reactors, communication and remote sensing satellites and guided missiles, just mention a few, have been clearly demonstrated. There are more than 200 universities and 400 national laboratories with sizeable industrial base as well 1,800 in-house R&D institutions of the industry. Industry handles a wide range of technologies.

Science and technology has, therefore, had a major role to play as a result of these fresh developments and the new demands that are being placed on the S&T system. Support to basic research has been receiving high priority during the earlier Plan periods. Recent developments have brought home the need to perform like wise in the technology field as well. There are a number of technology related areas which may be characterized as core technologies, which need to be strengthened in the country with particular emphasis on ensuring partnership with other socio-economic ministries and industry wherever possible. An exhaustive Technology Vision document, which sets out technological developments and intervention priorities for the future, across sections of the society and economy, e.g., agriculture and food industry, infrastructure especially power and roads, biotechnology, advanced materials, health, etc. has already been drawn up. This will form the basis for the identification of key missions for implementation.

(a) Scientific Policy Resolution (1958)

In pursuance of the Nation's commitment to using science and technology for development, the Parliament passed the Scientific Policy Resolution (SPR) on 4 March 1958, which emphasizes Government's responsibility "to foster, promote and sustain, by all appropriate means, the cultivation of science and scientific research in all its aspects – pure, applied and educational". The policy also envisages the well planned effort for promoting and encouraging the growth of science and technology personnel on a scale adequate to fulfil the country's needs in

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areas of education, agriculture, industry and defence. The SPR also aims "to secure for the people of the country all the benefits that can accrue from the acquisition and application of scientific knowledge". Government has been pursuing this SPR through its various ministries and departments.

(b) Technology Policy Statement (1983)

Recognizing the role that technology can play in the development of society, a Technology Policy Statement (TPS) was formulated in 1983 with the basic objective of developing indigenous technology and ensuring efficient absorption and adaptation of imported technology appropriate to national priorities and availability of resources. It is aimed at attaining technical competence and self-reliance, reducing vulnerability particularly in strategic and critical areas and making maximum use of indigenous resources. The TPS also aims at using traditional skills and capabilities making them commercially competitive. Several other measures through technology-intervention are envisaged to optimize demand on energy and ensure harmony with the environment. With a view to strengthening the economy, structural reforms have been introduced through adoption of a new industrial policy which will have an important bearing on the programmes of development pertaining to science and technology.

(c) S&T in the Five-Year Plans

Government has made conscious efforts at planning and allocating appropriate resources as part of the development process. From the beginning of the First Five-Year Plan, the programmes of various national laboratories and scientific departments have been supported by allocating resources. Planning for S&T is mainly achieved by preparing plans for the following three sectors in an independent manner: (i) plans for the scientific departments, viz. Department of Science and Technology, Department of Scientific and Industrial Research, Department of Biotechnology, Department of Ocean Development, Department of Space, Department of Atomic Energy, Ministry of Information Technology, Ministry of Environment and Forests; (ii) planning for science and technology component of over 30 socio-economic ministries/departments including organizations like Indian Council of Medical Research, Indian Council of Agricultural Research, Central Board for Irrigation and Power, etc. and (iii) a separate S&T sector in the Plans of the States and Union Territories.

(d) Science and Technology Policy (Draft)

Recognizing that science and technology are powerful instruments in the tasks of national reconstruction, economic resurgence and maintenance of national security the Government of India, therefore, enunciates the following elements of its science and technology policy:

- To promote the teaching and practice of all disciplines of science at school and college levels, reaching out to all creative talent in the country;
- To foster scientific research in the universities and national institutions, which have a multiplier effect and to emphasize the critical and essential role of science in the sphere of higher education;
- To encourage the participation of all sections of the population in science and technology endeavours and to ensure the creation of conditions that permit the full participation of women scientists and technologists in all areas of research and development;
- To ensure that academic and R&D institutions function with the greatest autonomy and accountability, so that an ambience of creative work of the highest order is encouraged and to build and maintain centres of excellence, which will raise the levels of work in selected areas to the highest international standards;
- To integrate the teaching and practice of science and technology with the widely prevalent and extensive knowledge acquired over the long civilizational experience of India, with a view to ensure the creative participation of large sections of our society in innovation and wealth generation;
- To harness modern scientific and technological advances so that rapid progress is made in the field of agriculture, to ensure food and water security, in a sustainable way and in the field of health, to bring modern health care to the people of the country;
- To encourage the highest level of innovation and research and development in industry and to promote close and productive interactions between private and public institutions in science and technology;

- To integrate science and technology with all spheres of national activity in order to enhance India's global competitiveness, to ensure continued development of national infrastructure and to safeguard national security;
- To exploit the full power of science and technology for the mitigation of natural hazards, particularly, earthquakes, floods, cyclones and drought;
- To use science and technology as a vehicle for international cooperation and collaboration and to promote the pooling and sharing of material and intellectual resources in order to achieve common goals.

The Government of India clearly recognizes that these objectives will be best realized by a dynamic and flexible science and technology policy, which can readily adapt to a rapidly changing world environment. It is the purpose of this policy, to ensure that science and technology, as practiced by our high calibre scientists and technologists, contributes to the economic and social uplift of our people, while maintaining our many traditional values. Through this science and technology policy, the Government reiterates India's commitment to participate as an equal and vigorous partner in the task of harnessing the advances in science and technology for the benefit of mankind.

2. Industrial policies and development

Industrial policy resolutions or statements made by the Government from time to time have facilitated the promotion and development of SMEs in the country. The measures taken by the Government, both at the central and state level, include, among others, (i) identification of the type of industries to be promoted for the public/private sector-individual and cooperative enterprises, (ii) creation of infrastructure facilities, (iii) provision of incentives for SMEs, (iv) reservation of items for exclusive manufacturing by SMEs, (v) development of industries in the backward and rural areas, (vi) review of definition of SMEs, (vii) setting up of institutional support structure, and (viii) government procurement through preferential purchases. In the wake of liberalization and the opening up of the economy, there has been a shift in the policy approach in favour of development support in place of mere protection.

India has nearly 3 million SMEs, which account for almost 50 per cent industrial output and 42 per cent of India's total export. They constitute the most important employment generating sector and an effective tool for balanced regional development. They account for 50 per cent of private sector employment and 30 to 40 per cent of value addition in manufacturing. They produce a diverse range of products (about 8,000) including consumer items, and capital and intermediate goods. As the nations integrate into a global village, these SMEs will have to respond accordingly, and thus deserves special attention. To enable SMEs to overcome their technological backwardness and to have easier access to new technologies, they need to be given a conducive environment, which, in the present context of globalization, calls for human centred approach, with tacit knowledge playing a predominant role.

The process of globalization, establishment of the World Trade Organization (WTO), rapid scientific and technological advancements, emergence of knowledge-based and capital intensive industries, stricter quality standards, environmental and pollution control and energy considerations, direct and indirect trade barriers by advanced countries, etc. are eroding the traditional advantage of industries in the developing countries, particularly small and medium enterprises, which significantly contribute to overall economic and industrial development at the national level.

The globalization process is moving up the R&D value chain and in this direction the present objective is to encourage higher value addition activities and preservation of natural resources through the development and application of high technologies such as biotechnology, new materials, computers, telecommunication and information techniques and systems, microelectronics, etc. Creation of completely new industries requires the application of knowledge intensive innovative technologies. To apply innovative technologies, the results of original basic research need to be properly nurtured in a conducive environment. In India, a major effort has been made in the past to support basic research covering a wide range of fields. As a next step, the "incubation" stage should follow where potential of new industries are studied. It should be followed by an "innovation" stage, which helps new industries to grow on a larger commercial scale.

(a) New Industrial Policy (1991)

The New Industrial Policy (NIP) announced by the Government of India in 1991 has created new vistas for technology transfer as well as industrial development. It has opened up the Indian industry not only to foreign investment but also to technology collaboration to "obtain higher technology, to increase exports and to expand the production base". The NIP states that "foreign investment would bring attendant advantages of technology transfer, marketing experience, introduction of modern managerial techniques and new possibilities for promotion of exports". This in turn is expected to inject the desired level of technological dynamism in Indian industry. Indian companies will be free to negotiate the terms of technology transfer with their foreign counterparts according to their own commercial judgment. The predictability and the independence action that this has provided to Indian industry is expected to induce them to develop indigenous competence for the efficient absorption of foreign technology. Greater competitive pressure will also induce our industry to invest much more in R&D than they have been doing in the past. However, foreign investment and the related technologies will come to India only in those areas where manufacturing in India provides a cost or export advantage to the investing company.

A process of integrating Indian economy with global economy has already been initiated. However, this process will not be completed unless the development of indigenous technology is integrated with global technology. In order to remain globally competitive, the level of innovation, creativity and entrepreneurship will have to be enhanced significantly.

(b) Comprehensive policy package for SMEs

Based on the recommendations of the Study Group on Development of Small Enterprises and the package chalked out by the Group of Ministers, comprehensive policy measures were announced by the Prime Minister on 30 August 2000. Some of the important measures announced include: (i) increase in the central excise duty full exemption limit from Rs 5 million to Rs 10 million; (ii) increase in the limit of composite loan from Rs 1 million to Rs 2.5 million; (iii) industry related service and business enterprises with a maximum investment of Rs 1 million to qualify for priority lending; (iv) increase in the eligible project cost limit for soft loan assistance under National Equity Fund Scheme from Rs 2.5 million to Rs 5 million with a soft loan component of 25 per cent of the project cost, subject to a ceiling of Rs 1 million; (v) to launch a Credit Guarantee Fund Scheme; (vi) to provide capital subsidy of Rs 12 per cent of investment in technology in select sectors; (vii) to set up an inter-ministerial committee of experts to define the scope of technology upgradation and sectoral priorities; (viii) to continue granting Rs 57,000 to each unit that obtains ISO 9000 series certification, till the end of the Tenth Plan; (ix) to strengthen the Technology Bureau for Small Enterprises (TBSE) set up by Small Industries Development Bank of India (SIDBI) so that the former functioned effectively as a Technology Bank; (x) to give a one time capital grant of 50 per cent to small Scale Industry Association who wish to develop and operate testing laboratories, provided they are of international standard; (xi) increase in the eligible family income limit from Rs 24,000 to Rs 40,000 per annum for incentives under PMRY and (xii) to go in for a fresh census that would cover, inter-alia, the incidence of sickness and its causes.

3. Globalization of R&D impact on India

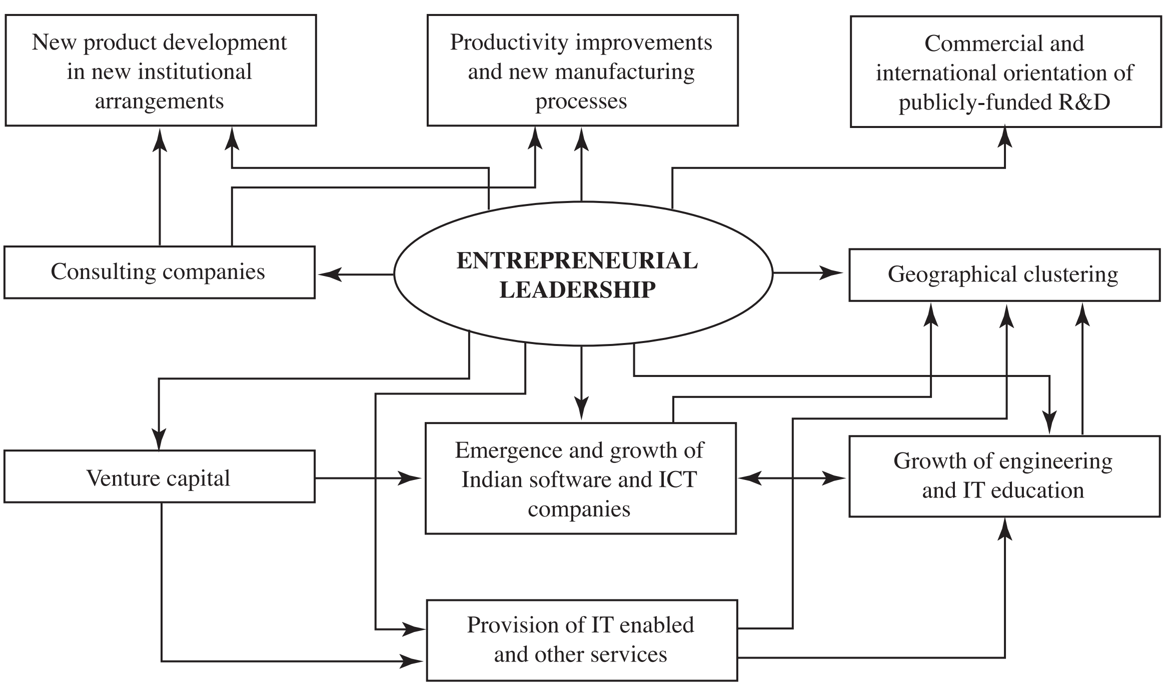
As Indian industry is moving from a protected environment to a progressively decontrolled market-driven economy, the developed countries are not only looking for opportunities for investments in India but are also willing to see it as a source of new knowledge. This is evident from an increasing trend of companies from the developed countries investing in R&D in Indian institutions. Even though market oriented activities are the major interest for the multi national companies, technology oriented activities are also undertaken to a large extent. Obtaining access to high quality scientists, engineers and designers in India and developing new product ideas are gaining importance with the foreign investors (Hirwani R.R. and Jain K. 2001). More than 300 R&D centres have been set up in the past few years by the foreign companies to tap the knowledge capabilities of the Indian scientists and technologists. Some of these units have indicated that "establishing links to the Indian scientists and technical community" is very important to them and they sometime subcontract part of the research to Indian universities and laboratories.

The transition phase of Indian economy is reflected in the changing trend of R&D in such companies. Some of them have adopted complete restructuring of their in-house R&D with a change in focus from developing products for Indian market to a global market. Global Centres of Excellence have come up in selected areas of science and technology. Even though initially the R&D centre was set up to support to Indian operations, subsequently they were restructured to meet the global need. Examples are the R&D centres of Astra, Uniliver, GE, and software development centres of Texas Instruments, Microsoft, Oracle and others. Thus, the growing presence in India of multinational companies with large R&D operations and coupled with substantial rise in foreign direct investment have led to growing number of corporate research centres and joint R&D efforts with foreign partners. This is more visible especially in the pharmaceutical and biotechnology sectors. The challenge is how to continue to trap the incredible dynamism of global R&D so that Indian institutions and companies can assume the leadership in creating high-wage jobs and building new industries. This will require a sustained commitment to investment in science and technology to strengthen research infrastructure, development of capabilities and means to rapidly integrate new knowledge and technologies into products and gain access to growing global sources of innovation, development of technology centres and government incentives and protection of intellectual property rights (IPR).

4. The National Innovation System

The National Innovation System in India has changed in the last decade, since the introduction of the new industrial policy in 1991, and some of the trends currently visible are likely to continue resulting in a considerably different innovation system in the years to come. The economic policy changes – removal of industrial licensing, freer trade, reduced emphasis on the public sector (in some cases even divestment and privatization) – are well documented. These trends and the linkages between them are shown in figure below.

Indian National Innovation System and the linkages



Source: R&D Management Conference, 2001.

These phenomena have been the result of two broad forces-economic pressures for survival and growth of Indian organizations in a relatively open economy, and the new opportunities arising from greater integration with global economy. While productivity and operational process improvements, new product development, the commercial orientation of publicly-funded R&D, and the propensity to cluster have been driven predominantly by the pressures to survive in a more competitive economy, the emergence and growth of software industry and IT enabled services, and the growth of engineering/IT education and venture capital have been driven predominantly by the new opportunities that have arisen. The single most important feature of the new innovation system is the entrepreneurial leadership exercised by key players in different sectors of economy (Krishnan R.T. 2001).

5. Entrepreneurship development initiatives

India has been encouraging entrepreneurship development through the Five-Year Plan since independence. A number of institutional mechanisms have been set up in the past to encourage entrepreneurship among the people. The Small Industries Development Organization (SIDO), through the network of Small Industries Service Institutes (SISIs) has been a pioneer in conducting Entrepreneurship Development Programmes for various sectoral groups. National Institutions such as the Entrepreneurship Development Institute of India (EDII), Ahmedabad; National Institute for Entrepreneurship and Small Business Development (NIESBUD), New Delhi; and the National Institute of Small Industry Extension and Training (NISIET), Hyderabad are engaged in entrepreneurial activities since their inception. In addition, state level institutions such as the Centres for Entrepreneurship Development (CED) and Institutes of Entrepreneurship Development (IED) look after the entrepreneurial efforts in the States. The District Industries Centres (DICs) set up at the district levels is also engaged in entrepreneurial activities.

National Science and Technology Entrepreneurship Development Board (NSTEDB)

The NSTEDB was established by the Government of India in 1982 "as an institutional mechanism to promote gainful self-employment in the country and to link idle S&T manpower with the under utilized institutional credit facilities".

The major objectives of the NSTEDB are:

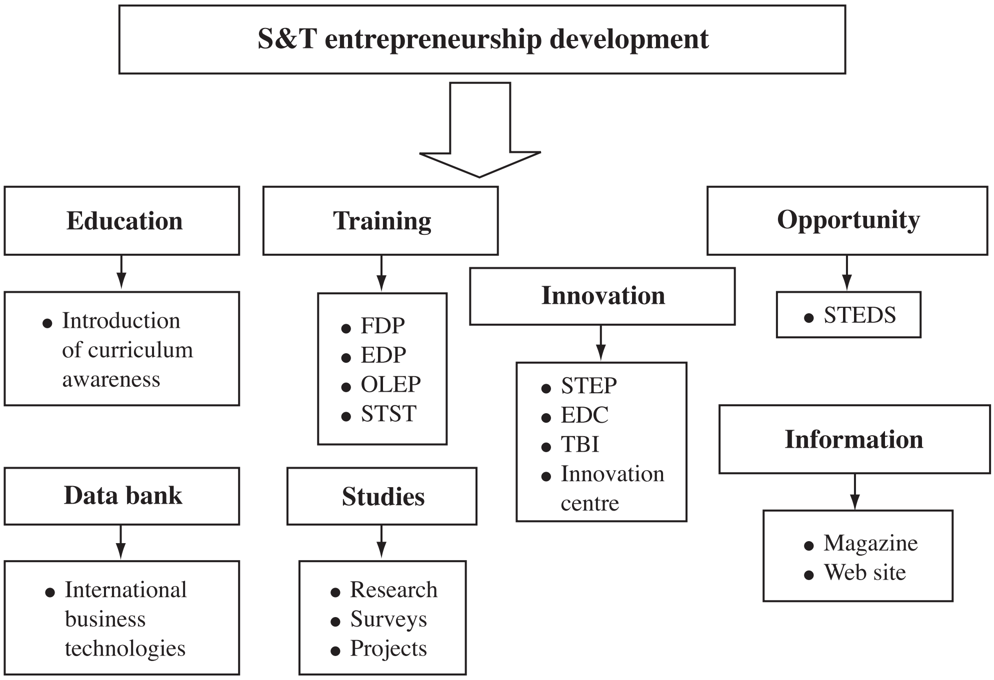
- To promote and develop entrepreneurship through the use of science and technology;
- To facilitate and conduct various informational services relating to entrepreneurship development using S&T;
- To network various central and state government agencies and NGO's in entrepreneurship and self-employment developments using S&T with special focus on backward areas as well;
- To act as a policy advisory body to the Government in regarding entrepreneurship based on S&T and conduct studies supporting policy evolution;
- Any other matter incidental to the above.

The major activities that have evolved during the past and is being implemented by the Board is shown in figure below.

As result of the multifaceted activities spreading around the country, awareness among S&T persons to take to entrepreneurship as a career has been created. The academics and researchers have started taking a keen interest in such socially and economically relevant roles and have engaged themselves in several ventures. More than 100 organizations, most of which are academic institutions and voluntary agencies, were drafted to the task of entrepreneurship development and employment generation.

NSTEDB is the nodal agency in India for promoting STEP, TBIs and other mechanisms of high-tech enterprise development.

Entrepreneurial activities supported by NSTEDB



Notes: FDP: Faculty Development Programme
EDP: Entrepreneurship Development Programme
OLEP: Open Learning in Entrepreneurship Programme
STST: Skill Development through Science and Technology
STEP: Science and Technology Entrepreneurs Park
EDC: Entrepreneurship Development Cell
TBI: Technology Business Incubator
STEDS: Science and Technology Entrepreneurship Development Scheme

6. Entrepreneurial activity

The Global Entrepreneurship Monitor (GEM) study in 2001 indicates that courtiers varied widely in terms of their level of entrepreneurial activity. The range for the Total Entrepreneurial Activity (TEA) index was from 5 per cent (Belgium) to 18 per cent (Brazil). India with a level of 11.2 per cent was ninth from the top. A separate analysis of the major sub-types of entrepreneurship showed that India was the highest among 29 countries on necessity based entrepreneurship (with a level of 7.5 per cent) and this was highly correlated (r = 0.70) with projected national economic growth. Presumably, the country is poised for a period of fairly high growth.

While a conducive set of framework conditions can create more opportunities, their perception and exploitation would largely depend on the entrepreneurial capacity among the people. The GEM study shows that the entrepreneurial capacity is fairly high among Indians- with 30 per cent able to perceive good start-up opportunities in the next six months, 42 per cent feeling confident that they have the knowledge and skills required for start-up, 53 per cent being optimistic about their own future and 20.6 per cent interacting with other entrepreneurs. The degrees of entrepreneurship associated with the four types of activities studied (Autonomous start-up, Start-up as part of one’s job, Owning and managing a business, and Angel funding for other’s businesses) are perceived to be different. Autonomous start-up and baby businesses (less than 42 months old) need the highest degrees of entrepreneurship. Start-up as part of one’s employment requires less degree of entrepreneurship. Angel investment in other businesses is considered to be the least entrepreneurial of the four because the investor is not interested in the work of nurturing and growing the fledging venture but only in extracting his share from the fruits of other’s work.

The GEM study also shows that the most important source of funds for entrepreneurial start-ups has traditionally been the personal resources of the entrepreneur. This is true of all countries, and India is no exception, with 68.1 per cent reporting self-funding. The notable other finding on the source of funding is that the banks and financial institutions come in the second position, with 55.2 per cent using institutional funds for start-up. Interestingly the Government programmes also play an important role in providing funds for start-up (21.7 per cent). The data suggests the following inferences about the economy, the entrepreneurial individual and the framework conditions in India:

(a) The economy is positively changing as suggested by the average or above average scores on market dynamism, ease of entry, availability of financial support, and the commercial and professional infrastructure.

(b) The level of readiness of the entrepreneurial individual is also getting better as indicated by the scores on opportunity perception and entrepreneurial capacity.

B. Business and technology incubation

1. Science and Technology Entrepreneurs Park (STEP)

The STEP programme was initiated by the Government in 1984 with the following major objectives:

- To forge a close linkage between universities/academic institutions on the one hand and industry on the other;
- To promote entrepreneurship among S&T persons;
- To provide R&D support and other facilities to small-scale industries.

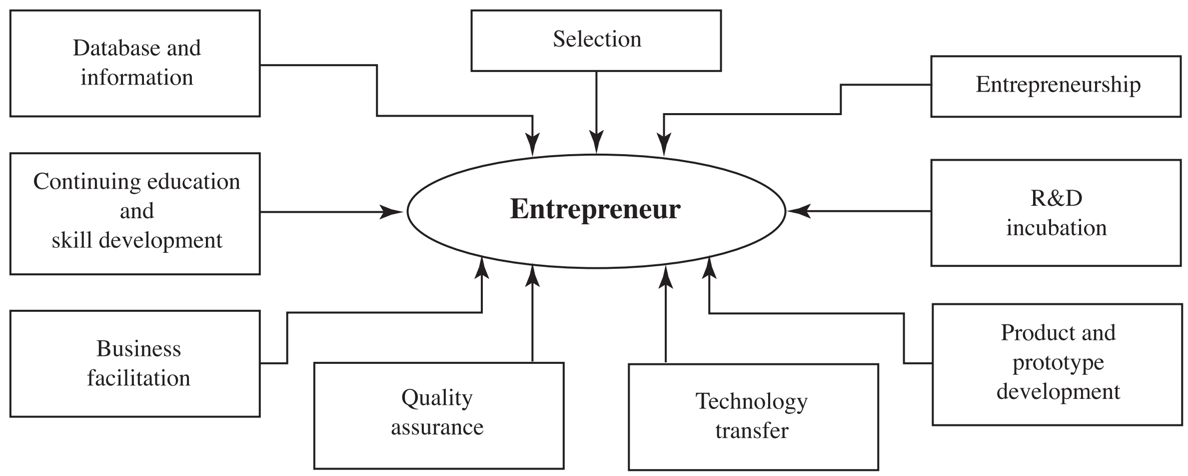
STEP provides a reorientation in approach to innovation and entrepreneurship involving education, training, research, finance, management and government. It creates the necessary climate for innovation; for sharing of ideas, experience and facilities and opens up avenues for students, teachers, researchers and industrial managers to grow in a common transdisciplinary culture, each understanding and depending on other inputs for starting a successful economic venture.

The task, therefore, is to create an “employer culture” where increasingly S&T people will seek to create their own employment. It also involves changing the existing attitude of seeking wage employment to look for a career in small business. To create an impact on this situation requires changes in the educational curriculum, in the way in which occupational choice is developed, in the way in which career advice is given and ultimately the role of small-scale sector in wealth generation.

Traditionally, several mechanisms have been employed to develop closer interactions between academic research and industry, such as, use of university faculty as consultants in industry; research projects in university funded by industry; students hired by industry; visiting professorship filled by industry scientists; advisory committee membership to university faculty; and universities providing special courses to industrial personnel. These link mechanisms, however, are not adequate and flexible to meet growing challenges of the future requirements. STEP is a total system approach to technology development, innovation and entrepreneurship.

The STEP has a primary mission of ushering in a technocrat industrial society through human resource development (HRD) inputs enhancing the managerial and technical capabilities in particular and providing infrastructure and expertise support for enhancing productivity, quality, finance, R&D personnel, management capabilities, etc. during the establishment, sustenance, and growth of the incubating enterprise in general. However, the STEP should reach a financial self-sufficiency without loosing focus on the development, which has an impact on the economic activity in the region. The STEP model, therefore, has been designed in striking a balance between development and self-sustenance. The areas of activities such as entrepreneurship training, product development, database, information, servicing, consultancy, quality assurance, business facilitation, continuing education and skill development training, etc. are grouped under three categories as follows: promotional, cost and profit activities. The deficit arriving out of the promotional and cost activities will have to be augmented through the profit activities in due course of time. Promotional and cost activities are aimed at

STEP – process and action



aspiring entrepreneurs and start-up companies covering entrepreneurship development, business facilitation, skill development, etc.

The Government of India has set up 15 STEPs in the past and out of which 14 are now undertaking business incubation activities in different sectors of science and technology, (one has been closed due to management problems) depending on the core strength and industrial milieu existing in the vicinity. Each STEP also follows its own particular model depending on the local needs and the environment. The number of start-up units, technologies developed, employment generated, total turn over by companies are shown in table below.

STEP locations showing number of start-up units, technologies developed, total turnover and employment generated

Step locations	Number of units	Technologies developed	Turnover (Rs in million)	Employment
Mysore	110	25	300.00	800
Trichy	153	26	300.00	1 700
Kharagpur	31	59	30.00	313
Ranchi	51	60	105.00	695
Pune	25	60	10.00	160
Roorkee	18	40	15.50	150
Ludhiana	95	53	110.00	680
Kanpur	16	10	30.00	200
Bhopal	63	08	15.00	1 458
Suratkal	106	04	103.30	298
Coimbatore	55	05	150.00	1 090
Hyderabad*	4	03	–	24
Bagalkot*	3	01	–	15
Patiala*	1	03	–	6
TOTAL	**731**	**357**	**1 168.80**	**7 589**

Note: * New locations.

The programme was initiated to promote entrepreneurship among the first generation S&T persons so that a new breed of technology-oriented entrepreneurs could be developed. Therefore, it is expected that a large number of the entrepreneurs come from the S&T background. An analysis of the STEP entrepreneurs' educational qualification indicates that majority of them has a degree in engineering (47 per cent), followed by graduates in science (21 per cent), diploma holders in engineering (21 per cent) and others (11 per cent). The industry-wise distribution shows that majority entered into engineering related business (42 per cent), followed by electronics and IT (18 per cent), chemicals and pharmaceuticals (18 per cent), services (10 per cent) and others (12 per cent).

2. Software Technology Park (STP)

The STP scheme was initiated by the Government of India to boost software exports from the country. To meet this objective, suitable framework was formulated covering aspects like simplification/rationalization of procedures, providing single point contact services to the industry, providing basic amenities needed for export operations with a very short gestation period and share captive infrastructure facilities like computing resources and data communication services in a cost effective manner. STPs act as a "single windows" in providing services to the software exporters. Some of the STPs provide incubation infrastructure to small and medium enterprises, enabling them to commence operation without any delay. The STPs are equipped with basic facilities like back-up power, electronic private automatic branch exchange (EPABX), security, training aids, library, photocopier, fax, etc. with a built-up space of 200,000 sq ft all over India. Due to the weak capital market for the Indian software industry, lending institutions including banks are reluctant in taking risk especially for new entrepreneurs. The STPs give an indirect short-term shelter to start-up companies to establish themselves in the market by reducing the investment required.

The Government has set up 35 STPs in the past at the following places:

Serial No.	Location	Serial No.	Location
1.	Bangalore	19.	Kanpur
2.	Manipal	20.	Dehradun
3.	Mysore	21.	Gandhinagar
4.	Mangalore	22.	Thiruvananthapuram
5.	Hubli	23.	Chennai
6.	Bhubaneswar	24.	Coimbatore
7.	Rourkela	25.	Trichy
8.	Pune	26.	Madurai
9.	Navi Mumbai	27.	Mohali
10.	Aurangabad	28.	Jaipur
11.	Nagpur	29.	Guwahati
12.	Hyderabad	30.	Kolkatta
13.	Vizag	31.	Indore
14.	Vijayawada	32.	Srinagar
15.	Warangal	33.	Shimla
16.	Thirupati	34.	Bhilai
17.	Noida	35.	Pondicherry
18.	Lucknow		

The cumulative investments in 35 STP centres are around Rs 868 million (US$ 16.36 million). The total export figure from the STPs represents approximately 60 per cent of the national software exports. Member units have exported software over US$ 4,000 million during 2000-2001.

The highlights of STP scheme are as follows:

- Approval under single window clearance mechanism;
- 100 per cent foreign equity permitted;
- Imports in the STP units are completely duty free;
- Second hand capital goods may also be imported;
- Custom bonding period shall be five years, but may be extended to ten years in case of products requiring significant capital investment and infrastructure;
- Exemption of local taxes for domestic purchases;
- The sales in the domestic market are permissible unto 50 per cent of the exports;
- Exemption from corporate income tax for a block of ten years;
- The export obligation on net foreign exchanges should be US$ 0.25 million or five times the CIF value of the goods imported, whichever is more, to be fulfilled over a period of five years.

The most important contribution of STP to the companies is that of providing high-speed data communication (HSDC) services. STP has designed and developed state-of-the-art HSDC Network called Softnet, which is available to software exporters at internationally competitive prices. The following services are provided through the network:

- International Private Leased Circuits (IPLCs) in the bandwidth of 64 Kbps to 2 Mbps
- Shared Internet services which include:
  - ➢ E-mail
  - ➢ Remote computing
  - ➢ File base access
  - ➢ Database access
  - ➢ World Wide Web
- International video conferencing service
- Web/Home page-hosting, authoring and maintenance

The STP operates through practically all-international telecom administration for worldwide connectivity and is radiating around 53 Mbps and is operating with around 57 carriers from its earth stations from various destinations.

3. Technology Business Incubator (TBI)

The Government of India has recently initiated a scheme for the promotion of TBIs located in the vicinity of R&D institutions or academic institutions so that industry clusters in the high-tech areas could be catalysed and promoted. As the success of the project largely depends on the location, management and quality of the incubatees, while selecting the venue for a TBI, the following aspects related to the host institution is kept in view:

- R&D strength and the commercialization efforts in the past
- Industrial milieu of the region
- Proximity to other R&D institutions
- Facilities and expertise available in the parent institution
- Strong commitment and willingness of the host institution

The goal of technology incubators is to promote technology-based firms, and to address regional and local developmental issues through S&T. TBIs are located at or near technical institutions and are characterized by institutional links to knowledge sources including technology transfer agencies, research centres, national laboratories and skilled R&D personnel. TBIs promote technology transfer and diffusion while encouraging entrepreneurship among researchers and academics. Therefore, the objectives of TBI in the Indian context are the following:

- Creation of technology-based start-up companies
- Creation of value-added jobs and services
- Developing new tools for technology transfer
- Fostering the entrepreneurial spirit among S&T persons
- Speedy commercialization of R&D outputs
- Business facilitation to the tenant companies as well as other SMEs by way of specialized services.

Each TBI would focus attention on one or two thrust areas depending on the core strength of the sponsoring institution and would be based on the expertise and facilities available in the institute, and the market potential for the products and processes. Additional facilities in the selected thrust areas for the scaling up of the technology and sample production will be created through governmental support. The idea is to provide necessary infrastructure and other facilities to the entrepreneur to reduce his initial investment in his project so that its viability can be demonstrated before graduating from the incubator and setting up the complete unit elsewhere. The services provided by the TBI to the incubating companies are the following:

- Assessing market potential and provision of marketing assistance
- Business planning and training
- Management, technical and legal assistance
- Assistance in obtaining statutory approvals
- Technological back-up
- Arranging finances
- IPR related assistance
- Equipment and infrastructure facilities of the host institution
- Modern workspace
- Other shared common services such as fax, conference room, library, etc.

TBIs have been set up in the following locations:

Serial No.	Location	Thrust area
1.	JSS Academy of Technical Education, NOIDA, Near New Delhi	Information technology
2.	Anna University, Chennai	Biotechnology
3.	MITCON, Pune	Agri-biotechnology
4.	International Advanced Centre for Powder Metallurgy and New Materials, Hyderabad	New materials
5.	Centre for Development of Composite Materials, Bangalore	Composite materials
6.	PSG College of Technology, Coimbatore	ICT

TBIs are being set up in the following location:

Serial No.	Location	Thrust area
1.	Thapar Institute of Technology and Engineering, Patiala	Biotechnology
2.	National Design Institute, Ahmedabad	Design
3.	International Crop Research Institute for the Semi-Arid Tropics, Hyderabad	Agro-biotechnology
4.	National Institute of Technology, Calicut	IT
5.	Vellore Institute of Technology, Vellore	Leather
6.	Kongu Engineering College, Erode	ICT

Looking into the potential and relevance of TBIs in promoting techno-entrepreneurship in the Indian scenario, where a sound technical infrastructure generating critical mass of expertise and technology already exists, it is proposed to accord special focus on this programme during the Tenth Five-Year Plan (2002-2007). It is proposed to launch 25 TBIs by the end of 2007.

4. Small Industries Development Bank of India (SIDBI) (National Programme on Innovation and Incubation for Small Industries)

Financing and promotion of knowledge-based enterprises, which are primarily in the small and medium sector, have already emerged as the focus area for financial institutions in India. SIDBI has set up two innovation and incubation centres at Indian Institute of Technology, Kanpur and Birla Institute of Technology, Ranchi.

5. Other initiatives

The Department of Biotechnology, Government of India has set up "Biotechnology Parks", which also promote start-up enterprises in the area of biotechnology. Other efforts by the state governments and private sector companies include projects like Tidel Park, Info Park, Knowledge Park, and Agro Park, etc. which are more of real estate activities with modern facilities for the start-up companies.

C. Financial and other support for new technology-based ventures

1. Technology Development Board (TDB)

The Government of India constituted the TDB in 1996 to encourage development and commercialization of indigenous technologies and adaptation of imported technologies for wider applications. The Board provides equity capital or other financial assistance to industries and other agencies for commercialization of R&D. The loan from TDB carries a simple interests of 5 per cent and does not levy administrative, processing or commitment charges. The loan has to be repaid in five annual instalments starting from the year after the successful completion of the project. The assistance is generally limited to 50 per cent of the project cost. The equity subscription will be up to 25 per cent of the project cost. During the year 2000-2001, the TDB disbursed over Rs 1,000 million.

2. Programme Aimed at Technological Self-Reliance (PATSER)

PATSER is a programme, which aims at promoting and supporting the industry's efforts in development of indigenous technologies and absorption of imported technologies. It provides partial financial support to research, design, and engineering projects undertaken jointly by industry and R&D organizations and academic institutions. These projects cover products and processes in various important industries such as metallurgy, electrical, electronics, instrumentation, mechanical engineering, earth moving and industrial machinery, chemicals and explosives. This programme has so far supported 120 projects.

3. Technopreneur Promotion Programme (TePP)

Realizing the importance of innovative and inventive minds to meet the challenges of changing industrial and technological requirements of the country, the Ministry of Science and Technology, Government of India, initiated a programme titled "Technopreneur Promotion Programme". TePP aims to assist and promote individual innovators/investors in the categories like farmers, students, scientists, engineers, doctors, and technicians, etc. to translate their innovative ideas for the development of working prototypes/processes. TePP is crucial for individual innovators to become technology-based entrepreneurs. It also acts as an interface to enable innovators to avail of the other support mechanisms to scale up their successful development further. Thus, the basic philosophy of TePP is being one of turning grassroots innovators into technology-based entrepreneurs. So far 33 projects have been supported under this programme.

Financial support under the scheme is limited to the maximum of 90 per cent of the project cost. The remaining 10 per cent is to be borne by the entrepreneur. Apart from this, TePP also provides assistance in patent support and guidance, scientific and technical consultancy, fabrication assistance, market information and networking with research laboratories, etc. in specific areas and needs.

4. Home-Grown Technology Programme (HGT)

The HGT programme is a major mechanism for supporting the commercialization of technologies developed by indigenous R&D. HGT programme assists to reach technologies from bench-scale level to pilot scale or semi-commercial level. In the process, it catalyses research and development efforts in the country and fosters closed linkages between R&D/technology institutions and the Indian industry. It also encourages multi-institutional funding for the technology projects, so that at various stages of the innovation chain, the entrepreneur may avail of assistance from more than one agency. HGT provides financial, techno-managerial and patent-related support to deserving technology development projects. The financial support is limited to 50 per cent of the project cost. It is necessary that the industrial partner or a major user must contribute 25 per cent of the total project cost. The rest may be arranged from the financial institutions.

5. Opportunity.com Consortium

Council of Scientific and Industrial Research (CSIR) together with National Research Development Corporation (NRDC), global consultant Ernst and Young (India) and NASDAQ, the leading stock exchange of the United States, have come together through Opportunia Enterprises in a major strategic alliance. The alliance seeks to promote technology-based businesses in India, in the fast growth sectors such as biotechnology, pharmaceuticals, etc. by assisting entrepreneurs to tap the potential of CSIR's excellent infrastructure, technology and technical skills. Opportunia is one-stop platform where entrepreneurs and emerging fast growth companies get end-to-end support and solutions for all points in the business life cycle-conceptualizing, seeding, growth, diversification, initial public offering (IPO), mergers and acquisitions. The strategic partners in the consortium bring with them a vast complementary of experience and knowledge giving the entrepreneur an integrated business service for technology, IPR related issues, legal, financial, management and marketing.

6. Venture capital

The first origin of modern day venture capital in India can be traced to the setting up of a Technology Development Fund (TDF) in the year 1987-1988, through the levy of a cess on all technology import payment. TDF was meant to provide financial assistance to innovative, high risk technological programmes through the Industrial Bank of India (IDBI). In 1988, Technical Development and Information Corporation of India (TDICI), now known as Industrial Credit and Investment Corporation of India (ICICI) Bank Ltd., was set up followed by Gujarat Venture Finance Ltd. The Securities and Exchange Board of India (SEBI) issued the VCF regulations in 1996. Though young, by international comparison, the Indian venture capital industry has matured fast as a result of the liberalization processes initiated by the government in early 1999's. Today, there are more than 55 VCFs; out of which majority are members of the Indian Venture Capital Association (IVCA).

IVCA is the nodal centre for all the venture activity in India. The pool of funds available for investment to its members in 1997 was Rs 25.6 billion, out of which Rs 10 billion was invested in 691 projects. As most funds are of private equity kind, size of investments has shown an increase in the past. There is infusion of funds from overseas, private individuals, 'angel' investors and a host of financial intermediaries and total pool of Indian venture capital today, stands at Rs 50 billion according to industry estimates. Though the IT companies are among the most favoured by venture capitalists, companies from other sectors were also benefited. The health-care sector with pharmaceuticals, medical appliances and biotechnology industries also get much attention from VCF companies. With the deregulation of the telecom sector, telecommunication industries have also joined the list of favourites. So far these trends have been in keeping with the global scenario of venture financing. The investment in various stages of the company is shown in table below:

Stage of the company	**Investment in percentage**
Seed	5
Start-up	41
Early/First	18
Later/Second	36
Expansion/Third	–
Turnaround/Other	1

The financing pattern by industry is shown in table below:

Industry	**Financing in 1998 (Rs in million)**	**Number**
Industrial products and machinery	2 956.67	219
Computer software, service	2 508.87	100
Consumer related	1 381.49	52
Medical	817.48	457
Computer hardware, systems	735.41	30
Food and food processing	718.56	50
Telecommunication and data communications	4 571.89	18
Biotechnology	448.77	27
Other electronics	426.06	40
Energy related	229.56	18
Others	1 865.09	127
Total	**12 559.85**	**728**

The financial institutions mainly drove the venture capital industry, when it started in India, viz. IDBI, ICICI and Industrial Finance Corporation of India (IFCI). More recently the SIDBI has launched a Venture Capital Fund and the corpus (as on 31 March 2001) stood at Rs 1.55 billion. The nature and extent of assistance is determined on the basis of requirements and package of assistance which may include any one or combination of instruments such as equity, conditional and normal term loans. SIDBI has also floated a national level venture fund, viz. *National Venture Fund for Software and IT Industry*, exclusively dedicated to the software and IT industry. The fund, promoted jointly with the Ministry of Information Technology, Government of India and IDBI has an initial corpus of Rs 1 billion.

The ICICI venture fund is available for idea stage start-ups, companies with one to three years of revenue record that require growth financing and companies close to initial public offering. ICICI venture has the following active funds: (i) Global Opportunity Fund, (ii) IT Fund, (iii) Technology Incubator Fund, and (iv) Equity Fund. ICICI Technology Incubator Fund seeks investment in conceptual/early stage start-ups in the IT area. The fund has a targeted corpus of Rs 500 million. The incubator team of the fund also guides the incubatees through the initial start-up phase by providing them with managerial inputs and various support services. ICICI Biotechnology Incubation Fund is dedicated to start-ups in the area of biotechnology and life sciences. The targeted fund size is Rs 1 billion.

D. Conclusions and recommendations

Technology/Business Incubation is an institutional mechanism to develop an atmosphere for innovation and entrepreneurship; for active interaction between academics and industries; for sharing ideas, knowledge, experience and facilities and for the development of new technologies and its rapid transfer to industries through setting up of start-up companies in the emerging areas of technology. As we enter into the 21st century, both industrialized as well as industrializing countries are arguably poised on the threshold of a major economic transition from manufacturing based economies to knowledge-based economies. Simultaneously, nations around the world are showing renewed interest in entrepreneurship and technological innovation. It is increasingly recognized that entrepreneurial start-ups have important contributions to technological innovation, economic growth, employment generation and social equity.

Effective planning and execution of TBI alone would not make it a success. The presence of an outstanding R&D institution alone does not cause the development of high-tech start-ups. The incubator is envisaged as a service function and a facilitator that can encourage the development of high technology enterprises, but it can not create the trend. The catalytic factors for technology incubation include, among others, (i) national policies and legal frameworks for TBIs and enterprises, (ii) financial support system including venture capital, (iii) a society open to innovation and entrepreneurship, and (iv) the support services provided by the incubators to the enterprises. If TBIs are to be of significant value in promoting new technology-based enterprises and generating jobs, the economic and cultural seedbeds need careful preparation to receive the entrepreneurial seed. The key factors that can affect growth of technology-based enterprises are: (i) access to skills and competencies, (ii) access to financing, (iii) access to market, and (iv) conducive environment for innovation.

The Government, financial institutions and R&D centres, all have significant role to play in creating an environment conducive to the growth of TBIs and high technology-based enterprises. At the same time, TBIs alone are not sufficient to stimulate advanced technology commercialization. Rather, TBIs are one of the services that are available today to create a growing, advanced technology industry. Various other methods for encouraging innovation, technology commercialization, and entrepreneurship are also required for fast economic growth.

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INDIAN EXPERIENCE ON PROMOTING BUSINESS AND TECHNOLOGY INCUBATION FOR IMPROVED COMPETITIVENESS OF SMALL AND MEDIUM-SIZED INDUSTRIES THROUGH TECHNOLOGICAL DEVELOPMENTS*

A. Introduction

Technology and knowledge are becoming the buzzwords of the new millennium. As the technology is leapfrogging beyond the speed of light, enormous activities are underway in research and development areas paving ways for new and newer technologies day by day and also resulting into the emergence of new areas of technology. These rapid pace of developments in the field of science and technology are also leading towards a new class of knowledge savvy entrepreneurs and knowledge/technology driven enterprises, which are being recognized as an important factor for the economic development of nations and a source of value-added employment generation. At the same time, the process of globalization, establishment of World Trade Organization, stricter quality and environmental considerations, imposition of trade barriers by developed countries, information technology revolution continues to adversely affect the conventional/traditional competitive advantage of the small and medium industries in the developing countries and threaten their survival in the marketplace.

1. Indian economic scenario

India has made considerable achievements during its fifty-five years of independence. Economic reform and liberalization measures over the last decade have led to strong economic growth, increased exports, reduced inflation and a positive impact on social indicators. Today, India is the fifth largest economy and second most populous country in the world. It has 29 states and six union territories.

India's march towards building a strong economy is reflected through some of the key economic indicators given below. Our GDP is about US$ 420 billion (2001), with 45 per cent accountable to services, 29 per cent to agriculture and 24.7 per cent to industry. The GDP per capita amounts to US$ 410 (2001). The average annual inflation in 1998 was below 3 per cent. Some of the key economic indicators are shown in table below.

Economic Indicators	Units	Value
GNP	Billion Rs	20 706
GNP per capita	Rs	20 320
GNP (PPP)	Billion US$	2 390
Per capita GNP (PPP)	US$	2 432
Real GDP growth	Per cent	5.39
Inflation (WPI)	Per cent	2.85
Inflation (CPI)	Per cent	4.16
Prime lending rate	Per cent	10.00
Export	Million US$	3 801.51
Imports	Million US$	4 167.98
FDI approvals	Million US$	3 043.25
Foreign exchange reserves	Million US$	61 500
Market cap on Bombay stock exchange	Billion Rs	5 840.42
Population	Number in million	1 037
Population (growth)	Per cent	1.77

Source: Centre for Monitoring Indian Economy (CMIE).

Notes: CPI = consumer price index. GNP = gross national product.
FDI = foreign direct investment. PPP = purchasing power parity.
GDP = gross domestic product. WPI = wholesale price index.

* This country paper was presented at the National Workshop on Promoting Business and Technology Incubation for Improved Competitiveness of Small and Medium-sized Industries through Application of Modern and Efficient Technologies at Phnom Penh, Cambodia and was prepared by ESCAP resource person, Ms. Anita Gupta, Scientist, Department of Science and Technology, India.

Our top leadership has given strong thrust on science and technology. Our new President, Dr. A.P.J. Abdul Kalam, is a nuclear and defence scientist of par excellence. Our Prime Minister, Mr. Atal Behari Vajpayee has highlighted his scientific vision in his new slogan for the nation: *Jai Jawan (Salute the Soldier), Jai Kissan (Salute the Farmer) and for the 21st Century, Jai Vigyan (Salute the Science and Technology).*

2. Indian SME sector: vision 2010

In the current dynamic world "change" is the only permanent thing. The process of change has been accelerated in recent years due to macroeconomic transformation taking place both domestically and globally. In the present era of borderless and market-oriented economy, the two big global economic forces which are competing for world attention are (a) the emergence of a 'new economy' underpinned by information and communication technologies, and (b) growing instability and uncertainty linked to globalization. With the emergence of WTO, a new trade environment is emerging. With the removal of quantitative restrictions (QRs) on import of 715 items w.e.f. 1 April 2001, a large number of items are now under Open General License (OGL). There has also been reduction in import duties in recent years. These have emerged as challenge before the SME sector since these warrant that the SME sector must be more competitive and efficient to face the international competition successfully. There have been changed in the types of products demanded and their quality as well as in fashion and tastes. There has also been changed in the mode of production and technology. To cope up with these changes, the SME sector will have to undergo many internal and external transformations. Some of the issues and aspects related to SMEs have been discussed in subsequent paragraphs.

(a) Concept of SME and market

All over the world, the unorganized manufacturing sector is known as SMEs while in India this is known as SME defined in terms of investment in plant and machinery which is up to 100 lakhs for SMEs. At present, two distinct types of markets exist for the SMEs. These are (i) domestic local market, and (ii) global/international market. Under WTO regime, there may be only one market as there may be no distinction between global and domestic market and the watchword for the same would be the quality and price to be attained by use of the state of the art technology.

(b) Role of Government as facilitator

Small enterprises which are over 3 million in number producing over 8,000 items assume special significance in India because of their role as creator of large-scale employment opportunities apart from contributing significantly to industrial production (50 per cent), exports (42 per cent) and regional development. In the present era of globalization resulting in economic and industrial reforms, *the role of the Government would be changing from one of the protector to facilitator.* Various support mechanisms are being experimented or are in the evolution stage by the Government for providing facilitation services to SME in various areas such as financing, technology development and skill upgradation, etc.

(c) Focus areas for SMEs

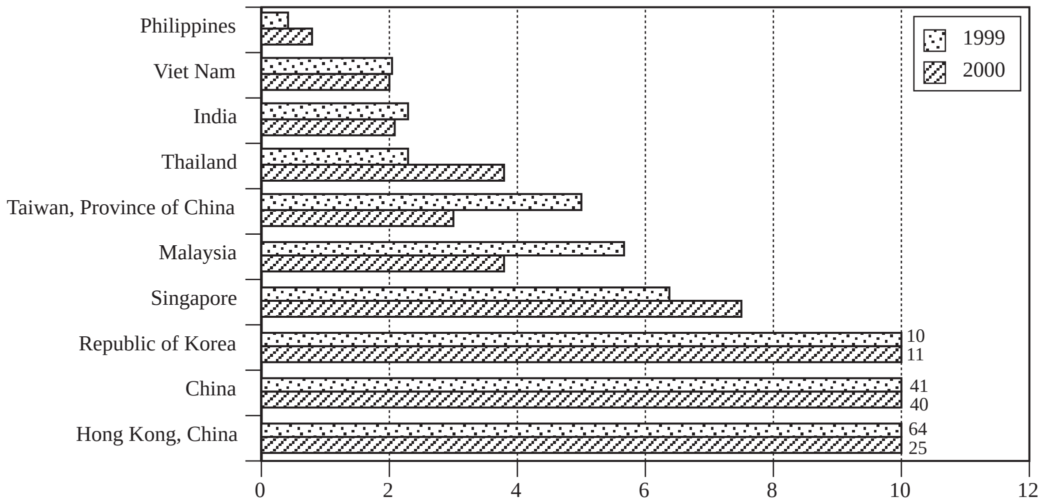
New product lines are emerging in the field of information technology, electronics and biotechnology, etc. Knowledge-based industries are taking precedence over others. Other sectors where new products are emerging are in the field of communication, entertainment, toy, auto-components, etc. Most of the entrepreneurs in these sectors need venture capital support to run their enterprises. During the past two years, venture capital funds have been created for information technology and biotechnology sectors. It would be essential to set up large number of incubation centres to support new enterprises in these areas.

(d) Change in the technological requirement

The competitiveness of any economy depends on how efficiently all the resources in the process of production are utilized and how efficiently these are marketed, hence the entire chain of production and marketing has to be efficient. Many of the items produced in the small-scale sector are becoming redundant because of the change in tastes, preferences, and also due to emergence of new technology. The entry of foreign brands in the white goods segment has not only given consumers a wide choice of hi-tech and good quality products at competitive prices but has also given them improved after sales service. This means that the process of production has to be cost efficient and meet quality needs of the consumers. This improvement can come through the use of latest technology. Hence, the need for change in technology is more relevant for SMEs than large units. As a result, all over the world, large companies have been withdrawing from direct manufacturing activities and concentrating more on marketing, technology creation, diffusion and networking with SMEs in manufacturing related activities. Thus, in the new environment, the competitiveness of large firms greatly depends on the efficiency of small firms. It should be up-to-date but at the same time it must be able to meet the needs of both traditional and new product lines.

(e) Impact of FDI inflows on SME sector

Developing Asia and the Pacific: FDI flows top 10 economies
(Billion US$)



Source: UNCTAD, *World Investment Report 2001.*

FDI inflows are the indicator of the economic health of a nation. As reflected from figure above, the fastest growing economies like China, the Republic of Korea are able to attract more FDIs. Through multinationals and large corporations, FDIs offer a medium of technology transfer for globalizing the state of the art technologies. Technology and globalization go hand in hand. It shortens the product life cycle, and changes the way business operates. On the other hand, such a situation is emerging threat for 80 per cent of local SMEs who could be left in the race if they do not upgrade their capacity to absorb new and high technologies and management techniques. They have to be innovative and respond faster to the changed scenario. This implies competitive product development, efficient production, faster delivery, real time information processing and customer driven services. In the process about 20 per cent of technology savvy SMEs may be benefited by being supplier of local goods and services to these multinational corporations, thus enabling local integration and providing a level playing field for the foreign firms and as well as host economies.

(f) Sourcing of technology

Technology, which encompasses products, processes, designs, machinery, tools, testing, equipment, technical training, consultancy, upgradation, etc. is considered one of the most important components of industrial process. In the SME sector, technology is mainly sought in the form of processes and product know-how. Other forms of acquisition are also observed in certain industries. The different sources from which technology flows into the SMEs are: (a) government institutions, (b) local suppliers of machinery and equipment, (c) foreign suppliers, (d) research and development institutions, (e) industry associations, (f) parent companies in case of ancillary and subcontracting units, (g) collaborators, and (h) re-engineering of machines and equipments.

Recent studies on sources of technology for SMEs have found that the entrepreneurs obtained technology largely from the local machinery suppliers. Technology identification, technology acquisition, technology transfer, technology adoption and technology upgradation are some of key issues in relation to technology management relevant to SMEs.

(g) Innovative financing mechanisms for technology upgradation

Keeping in view the growing importance of technology and situation prevailing in the SME sector presently characterized by lack of familiarity with new technology options, inability in accessing them and organizing necessary finance for technology advancement, collaboration can be tied up with international institutions like APCTT and SIDBI. Resulting from the collaboration, a Technology Bureau for Small Enterprises provides information on a wide range of technologies, facilitates contact between business partners from different countries of the ESCAP region for collaboration and arranges meetings of technology sellers from different parts of the world with the prospective buyers of the technology in the country and assist in tying up financial and other requirements. Finance syndication, promotion of technologies, export and extension of other relevant support are part of the package available to SMEs from the Bureau.

IFCI has incorporated a company named Risk Capital and Technology Finance Corporation Limited (RCTFC) for providing technology finance and venture capital to commercialize indigenous technology and to improve and adopt technology innovations. The company is basically catering to the needs of the medium sector.

The Government of India has recently taken some steps to financially assist the small-scale industries for technology upgradation. Technology Development and Modernization Fund and Credit Linked Capital Subsidy Scheme for technology upgradation of SME units have been formulated. Under this scheme, 12 per cent back-ended capital subsidy is admissible on the loans advanced to the SMEs by the scheduled commercial banks/designated financial corporations for technology upgradation in certain select sectors.

A ‘Compendium on Technologies’ is being drawn by the National Small Industries Corporation (NSIC), a government enterprise, along with the office of the Development Commissioner (SME), Government of India. The compendium will be relevant for having information on different technologies available for use by the small-scale industries. NSIC has also been operating a scheme of providing machinery and equipment on lease to small industries to upgrade their technology.

Online information and technologies

Some of the useful web sites on technology and business-related aspects hosted by Indian organizations for the small industries and entrepreneurs are:

- <www.technology4sme.com>
- <www.techno-preneur.net>
- <www.techsmall.com>

(h) Institutional measures for supporting SMEs

- *Small Industries Development Organization (SIDO)* – under Ministry of Industry
  - ➢ Formulates and monitors policies and programmes for small-scale sector
  - ➢ Provides business services (from quality control to consultancy) by a network of institutions
  - ➢ Establishes product-cum-production development centres (R&D institutions to carry out advanced development work and act as centres of excellence)
  - ➢ Establishes district industry centre
  - ➢ Establishes industrial estates
- *Small Industries Development Bank of India (SIDBI)* – a special financial Institution for SMEs
  - ➢ Special schemes for direct financing for bigger credit needs through its regional offices
  - ➢ Refinances state financial corporations and state industrial development corporation for long-term credit needs of SMEs

- Marketing and export promotion
- Marketing assistance to SMEs by SIDBI
- Sector specific export promotion councils

- *National Small Industries Corporation (NSIC)* – a public sector enterprise under Ministry of Industry
- *Special institutions for technology and R&D related services*
  - Technical consultancy organizations at state level – project report preparation, feasibility studies, technological information, manpower deployment, technology clinics, technology upgradation
- *National institutions for specific industries* – fashion design, packaging, glass and ceramic, new products training manpower, technology upgradation
- *Small industries information and resource centre networks (SENET)* – creates electronic network for small enterprises.
- *Technology Development Board (TDB)* – set up by Department of Science and Technology
  - Financial assistance (soft loan, equity and grants) for industrial concerns, attempting commercialization of indigenous technologies or adapting imported technologies for wider domestic application
- *Technology Information, Forecasting and Assessment Council (TIFAC)*
  - Technology assessment and forecasting studies
  - Technology watch on global trends
  - Nationally accessible technology information system
  - Home-grown technologies – further upscaling of indigenous technologies from lab to commercial, scale
  - TIFAC line – technology-related information service to industries

3. Enabling environment for technological and industrial growth

Experience worldwide convincingly demonstrate that countries with the highest technological growth are endowed with national innovation system with the following environment.

- Educational system that fosters indigenous technological development, adaptation of technologies to local conditions, imparts technical and commercial skills
- Favourable environment for R&D and innovation
- Favourable economic conditions
- Stable legal conditions
- Good and well-maintained physical infrastructure
- Conducive political conditions

(a) S&T infrastructure in India

India has made commendable progress in terms of the growth of scientific and technological culture. Today, India has a vast pool of S&T infrastructure with over 800 technical institutions including around 200 universities. The estimated annual out-turn of the engineering graduates is around 2.0 lakhs. In addition, it already has a critical mass of cutting edge research through 400 national laboratories, over 1,300 in house R&D units in the corporate and other sectors. However, the environment and support system are not congenial for the faster commercialization of R&D outputs. There exists lot of delay in commercialization of R&D outputs and in majority of cases the R&D outputs do not get commercialized for want of initial investment, the needed environment and the networking. In the recent past, the Ministry of Science and Technology, Government of India has been focusing its attention towards this and initiated a number of programmes in order to plug the gaps cited above.

(b) Vision 2020: technology policy

By training engineers and technologists well, and encouraging them to innovate by rewarding them (and the institutions where they operate) generously with both real and psychic income, India will ably compete in the world economy and thrive by trading high quality, high-tech products over international boundaries.

This vision has three components: (a) high quality training, (b) promotion of innovation, and (c) production of internationally competitive high-tech products.

Objectives

1. Indian technology will be internationally competitive, so much so, no manufacturer will have the need to seek, or have, trade protection.

2. India will be a technologically advanced country. In evidence thereof, it will import, and not export, talented people.

3. India will deploy technology to promote good ecology. It will ensure thereby (a) high quality of air, water and soil, (b) smooth flow of goods and people, and (c) free flow of information.

4. India will use technology to minimize income disparities and do so by minimizing poverty rather than by reducing wealth.

5. India will maximize employment by matching employment skills to technology innovation and by promoting employment multiplication.

6. India will be self-reliant in technology. It will have enough capability to exchange whatever foreign technology is needed with comparable indigenous ones.

(c) Major highlights – R&D statistics[1]

- The national investment on R&D activities attained a level of Rs 12,901.54 crores in 1998-1999. The same is estimated to be Rs 15,090.2 crores in 1999-2000 and Rs 17,660.21 crores in 2000-2001;
- 0.81 per cent of GNP was devoted to R&D during 1998-1999;
- Sector-wise percentage share of national expenditure during 1998-1999 was central government 62.5 per cent, state governments 8 per cent, higher education 2.9 per cent, public sector industries 5 per cent and private sector industries 21.6 per cent;
- 83 per cent of R&D expenditure incurred by central government sources came from 12 major scientific agencies: Council of Scientific and Industrial Research, Defence Research and Development Organization, Department of Science and Technology, Department of Biotechnology, Department of Atomic Energy, Department of Space, Ministry of Information and Communication Technology, Ministry of Non-Conventional Energy Resources, Ministry of Environment, Indian Council of Agriculture Research, and Indian Council of Medical Research;
- In industrial sector, the R&D expenditure was highest in biotechnology followed by drugs and pharmaceuticals, defence industries, etc. In public sector, R&D was dominated by the defence and fuels industry groups;
- Nearly 0.38 million personnel were employed in R&D establishments of which 31 per cent were performing R&D activities;
- India's per capita R&D expenditure was Rs 130.26 during 1998-1999;
- Industry spent 0.52 per cent of their sales turnover on R&D in 1998-1999.

[1] Department of Science and Technology, *R&D Statistics* (May 2002).

(d) Funding of R&D projects

There are several schemes for funding R&D projects in industry. A few particularly those provided by government are discussed below, in brief.

1. The Department of Scientific and Industrial Research (DSIR) under its PATSER financially supports research, development, design and engineering projects. The basic objectives of the PATSER scheme are:

   (i) Supporting industry for technology absorption, development and demonstration;

   (ii) Building indigenous capabilities for development and commercialization of contemporary products and processes of high impact.

2. As a new initiative, DSIR and the Department of Science and Technology (DST) launched a joint programme known as Technopreneur Promotion Programme (TePP). The programme aims at tapping the vast innovative potential of citizens of our nation. Under the scheme, individual innovators are provided financial support for converting their original ideas into working models, prototypes, etc.

3. The Government through its budget 2000, announced a New Millennium Indian Technology Leadership Initiatives (NMITLI). The scheme envisages to support innovation centred scientific and technological developments.

4. The DST is funding several industrial R&D programmes such as 'Drugs and Pharmaceuticals Research Programme', 'Instrument Development Programme' and 'Advanced Materials Development Programme'.

5. The Department of Biotechnology (DBT) has been promoting and financing various aspects of an R&D in relation to biotechnology undertaken by several agencies including industry. The main thrust areas of DBT support are HRD, biotechnology R&D and infrastructure development.

6. The Department of Electronics has launched a scheme entitled "Funding R&D in Electronics Industry (FRIEND)" for funding industrial R&D programmes.

4. Status of entrepreneurship development in India

Entrepreneurship is a global and multifaceted phenomenon with significant difference between countries. It has positive relationship between entrepreneurship and economic growth that contribute towards the wealth and social development of a nation under the given technological, industrial and political framework. Silicon Valley in the United States is a very shining example of the contribution of techno-entrepreneurship to the whole world.

As per the latest GEM Report 2001, the level of that entrepreneurial activity in India at 11.2 per cent is high relative to other GEM 2001 countries. Approximately two-thirds of this activity is driven by necessity. Less than 1 per cent of the adult population invests in start-up business. This is among the lowest of the GEM 2001 countries. Entrepreneurial activity in 2001 among men is more than twice that of women, a similar pattern to that observed in 2000 and similar to the average for all GEM 2001 countries.

The economic reform process set in motion a decade ago countries and small firms are still adjusting to changes in the business environment. Government support for the small firm sector – funding infrastructure and protection from competition has been withdrawn. Social and cultural norms in India favour stability and security. Risk taking in general is not encouraged. However, there is considerable regional variation in this respect. Access to capital, particularly for early stage development, is a major hurdle faced by entrepreneurs in India. Growth is hampered due to the scarcity and high cost of working capital, financial institutions do not appreciate the specific nature of entrepreneur's needs. The physical infrastructure in the country is good but inadequate, as is the supply of professional and commercial services.

There is a need to incorporate skill-based learning and the principles of the market economy early in the education cycle. While government agencies and educational institutions carry out quality research and development, there is little focus on the commercial aspects of business. Industry investment in research and development is low.

Mechanisms to nurture techno-entrepreneurship

In India, the Government has recognized the need to support and nurture entrepreneurship through successful mechanisms tried world over but adapted to suit local environment and conditions. Some of these have been discussed here.

National Science and Technology Entrepreneurship Development Board (NSTEDB)

NSTEDB, established by the Government of India in 1982, is the nodal government agency promoting various mechanisms to promote gainful self-employment in the country and to link idle S&T manpower with the under-utilized institutional credit facilities. The Board, which has a governmental structure, is serviced by DST.

The major objectives of NSTEDB are:

- To promote and develop entrepreneurship through the use of S&T
- To facilitate and conduct various informational services relating to the entrepreneurship development using S&T
- To network various central and state government agencies and NGO's in entrepreneurship and self-employment development using S&T with special focus on backward areas as well
- To act as a policy advisory body to the Government agencies in regarding entrepreneurship based on S&T and conduct studies supporting policy evolution
- Any other matter incidental to the above

The programmes have created awareness among S&T persons to take to entrepreneurship as a career. The academics and researchers have started taking a keen interest in such socially relevant roles and have engaged themselves in several programmes. About 100 organizations, most of which are academic institutions and voluntary agencies, were drafted in the task of entrepreneurship development and employment generation. More programmes are being evolved to suit the changing economic scenario and the available scope for entrepreneurship development.

- STEP – Science and Technology Entrepreneurs Park
- EDC – Entrepreneurship Development Cell
- Training – Skill development training
- EDP – Entrepreneurship Development Programme
- OLPE – Open Learning Programme in Entrepreneurship
- EAC – Entrepreneurship Awareness Camp
- STEDS – Science and Technology Entrepreneurship Development Scheme
- FDP – Faculty Development Programme
- TEDP – Technology-based Entrepreneurship Development Programme

Other leading agencies involved in entrepreneurship development and promoted by various central governments, state governments, financial institutions and the private agencies in the country are listed below.

- Entrepreurship Development Institute of India, Ahmedabad
- Centre for Entrepreneurship Development – various states
- Indian Institute of Entrepreneurship
- Entrepreneurship development institutes
- Small Industries Development Bank of India
- National Small Industries Corporation
- Development commissioner, small scale industries
- District Industries Commissioner
- Technical consultancy organizations
- Science and Technology Entrepreneurs Parks

- Technology business incubator
- Entrepreneurship Development Institute
- Leading technical and management institutes

B. Incubation and similar mechanisms

Various enabling factors crucial for the success of incubating mechanisms in a country are presented in the table below.

Parameters	Developed countries	Developing countries
1. R&D expenditures	3% of GNP	< 1% of GNP
2. New technologies	Large number	Very few
3. R&D – industry interactions	Strong	Weak
4. Resources	Large	Limited
5. Orientation	Technology leader	Follower
6. Production and trade	High value addition	Low value addition
7. Costs	High	Low
8. Socio-economic conditions	Conducive for technopreneurship	Yet to really appreciate role of S&T

Source: ESCAP study 2000.

First generation entrepreneurs need various support services like marketing, business facilitation, technical expertise, resources for financing and business management during their start-up phase to enhance their prospects of survival. Incubators and similar mechanisms are intended to provide a conducive atmosphere and a range of critical support services and needed facilities to nurture and support a start-up.

Various mechanisms like science parks, technology parks, innovation centres, business incubators, technopolis technology incubators are being experimented world over to catalyse growth of technology-based new enterprise. These mechanisms are somewhat similar at macro level but have some distinguished characteristics at the micro level. Some of the Indian experiments on business incubation are presented below.

1. Science and Technology Entrepreneurs Park (STEP)

The science park and similar initiatives in the developed countries are the latest in the evolutionary line to create an atmosphere for innovation and entrepreneurship; for active interaction between academics and industries; for sharing ideas, knowledge, experience and facilities for the development of new technologies and their rapid transfer to the end user. The STEP programme was initiated by NSTEDB in 1984. STEP provides a reorientation in approach to innovation and entrepreneurship involving education, training, research, finance, management and government. It has been promoted jointly by the DST, state government, financial institutions and the host institution.

Objectives of STEP:

- To forge a close linkage between universities, academic and R&D institutions on the one hand and industry on the other
- To promote entrepreneurship among science and technology persons, many of whom were otherwise seeking jobs soon after their graduation
- To provide R&D support to the small-scale industry mostly through interaction with research institutions
- To promote innovation based enterprises

Facilities and services provided by STEPs:

- Offers facilities such as nursery sheds, testing and calibration facilities, precision tool room/central workshop, prototype development, business facilitation, computing, data bank, library and documentation, communication, seminar hall/conference room, common facilities such as phone, telex, fax, photocopying;
- Offers services like testing and calibration, consultancy; training, research, prototype development/ process development, human resource development (short-term courses), technical support services, business facilitation services, database and documentation services, quality assurance services and common utility services.

The NSTEDB, jointly with all India financial institutions, has so far catalysed 15 STEPs in different parts of the country which have promoted nearly 788 units generating annual turnover of around Rs 130 crores and employment for 5,000 persons. More than 100 new products and technologies have been developed by the STEPs promoted entrepreneurs. In addition, over 11,000 persons have been trained through various skill development programmes conducted by STEPs.

2. Software Technology Parks (STPs)

The Ministry of Communication and Information Technology is establishing STPs through the Software Technology Parks of India (STPI) all over the country. The main objective of the Software Technology Parks scheme is to boost the software exports from the country using high-speed data communication links. So far, 35 STPs including 19 international gateways have been set up.

3. Biotechnology Parks

The Department of Biotechnology (DBT) is promoting Micropropagation Technology Parks (MTPs) for providing an interface between the research institutions and industry and biotechnology parks to provide opportunities for women entrepreneurs through the application of environment friendly biotechnologies. DBT has set up 2 MTPs, one at Tata Energy Research Institute (TERI), New Delhi and another at National Chemical Laboratory, Pune. A biotechnology park for women has been set up by DBT at Chennai in collaboration with the state government.

4. Technology business incubators (TBI)

A TBI helps in incubating knowledge-based start-ups into commercially viable products/services by providing specialized guidance, critical support services, innovative financing and networking support within a conducive environment (affordable, well-equipped workspace).

(a) World scenario

At present, there are around 3,000 incubators of various types operational in the world. In the United States, there are over 800 incubators including about 200 Internet incubators. Europe has about 1,000 incubators including 300 incubators in Germany. Among the developing countries, China leads with about 100 incubators. Among the industrializing countries, Republic of Korea is reported to have about 300 incubators.

Earlier (1980s) incubators were essentially offering affordable space and shared facilities to carefully selected entrepreneurial groups. Thereafter, the incubators started varying widely in key respects such as objectives, sectoral focus, and business modes, etc. In some countries the incubators were set up for empowerment, while in others for technology commercialization. In the 1990s, workspace and shared facilities were supplemented with counselling, skills enhancement and networking services to access professional support and seed capital. Starting in 1998, a new incubation model is emerging. With the technological progress, the incubators are intended to mobilize information and communication technology (ICT) and provide a convergence of support, towards creating knowledge-based ventures. An incubator combining technology with business is a technology business incubator. Virtual incubator or incubators without walls have also emerged recently, which offers need-based services by networking with the relevant agencies.

(b) Scenario of selected Asian countries

Country	Technology	Business	Others	Total
Bangladesh	3	–	–	3
Cambodia	–	–	–	–
China	110	–	–	110
India	19	10	6	35
Philippines	7	61	–	68
Republic of Korea	291	10	–	301
Uzbekistan	2	21	–	23
Viet Nam	5	5	–	10
TOTAL	**433**	**107**	**6**	**546**

Source: ESCAP study 2000.

(c) Indian scenario

World over TBIs have been found as useful tool for catalysing the development and growth of technology-based start-up enterprises. Keeping this in view and also visualizing that in India too, TBIs could become important tools in establishing crucial link to technopreneurship chain by catalysing the development and growth of knowledge-based start-ups. Recently a scheme on TBI has been launched by DST, it would be implemented in a mission mode. The DST is also being helped in its effort by APCTT through UNDP Technology Management Programme Support (TMPS) – sub-component "*Nurturing Technological entrepreneurship through STEPs and TBIs*".

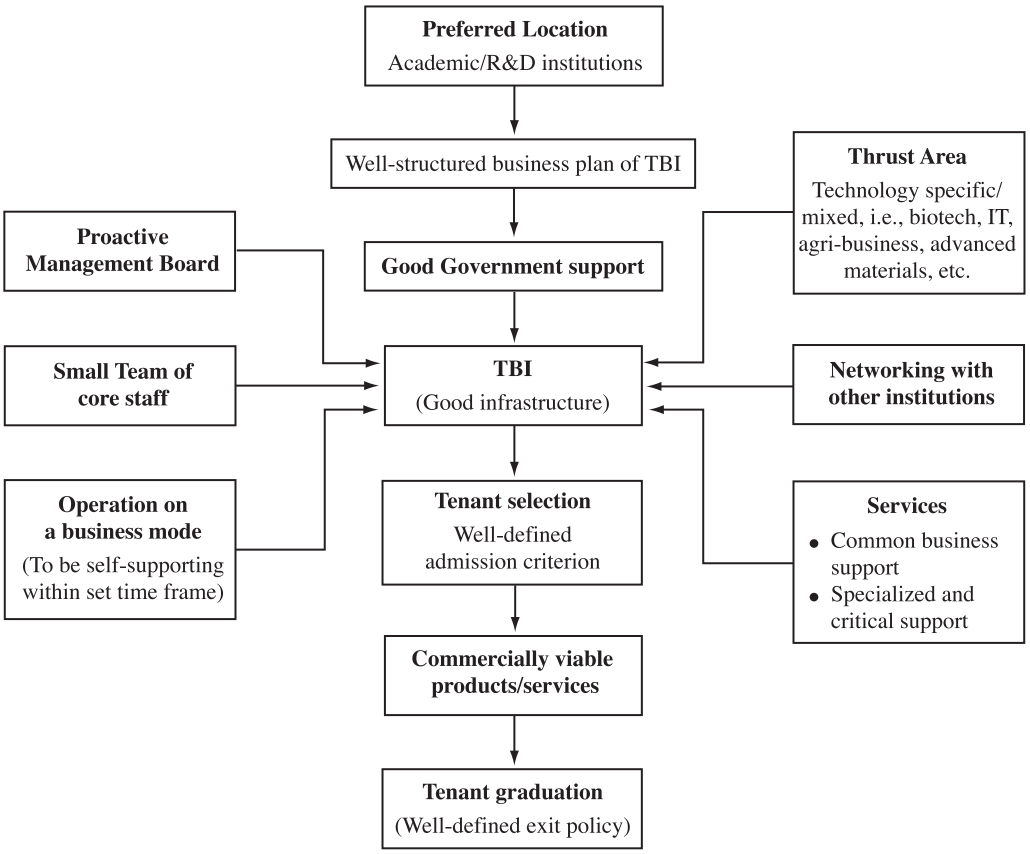
Objectives of TBIs:

The TBIs are aimed at achieving the following objectives:

- Enterprise and entrepreneurship development: An appropriate tool for economic development by promoting technology/knowledge-based businesses, culture of technopreneurship and creation of value added new jobs;
- Technology commercialization: To provide a platform for speedy commercialization of the technologies developed in the institutes to reach the end-users;
- To provide an interfacing and networking mechanism between academic, R&D institutions, industries and financial institutions;
- To provide value addition through its services provided to its tenants as well as to the existing technology dominated SMEs;
- To provide R&D for industry: It also enables small industry to take up R&D activity and the technology upgradation activities.

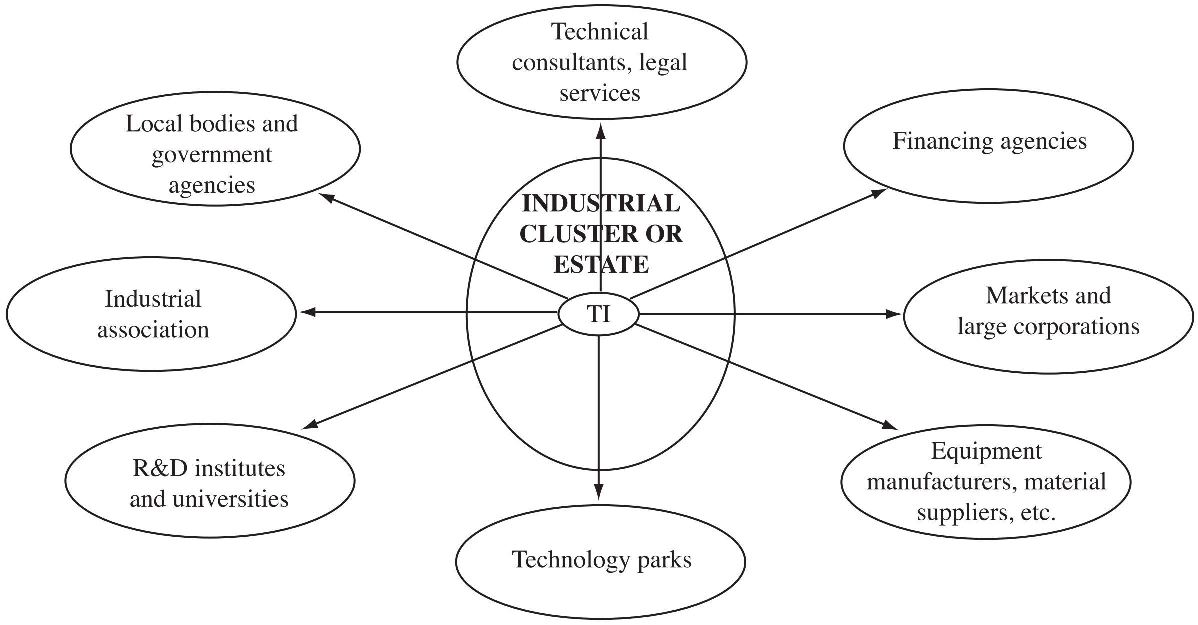
Working mechanism of TBI:

Working mechanism of TBI



The working mechanism of a typical TBI is shown in the figure above. The various aspects in the successful operation of a TBI are its location, preferably to a knowledge source with some formal links. A well-structured business plan should include the identified focus areas, a good management team, plan for arrangement of financial resources including cash inflow and outflow. It should provide a sophisticated array of services and devise well-defined tenant selection and exit mechanisms. It should be properly networked with the relevant agencies as shown in the figure below.

A typical networked technology business incubator



TBI model for India

World over experiences show that a single model may not be applicable to all locations. Suitable models have to be developed keeping the local needs, climate and the objectives in view. India being a country full of diversities, a single and a uniform model of TBI may not be appropriate. For each location, the model should be worked out after carefully examining the local needs, infrastructure available and viability of the concept within the overall framework of objectives to be achieved. For example, initially the TBIs could be targeted at the academic institutions/R&D institutions of excellence preferably with focus on areas such as biotechnology, herbal medicines, information technology, advanced materials, agri-business, hi-tech services, designs, bio-medical, drugs and pharmaceuticals, instrumentation, etc. The model should be designed so as to optimally utilize the expertise and the facilities of the host institution. It should also have effective networking with other sources of R&D.

Services to be offered by TBI

A TBI is a managed workspace with shared office facilities with emphasis on business and professional services necessary for nurturing and supporting early stage growth of technologies and technology-based enterprises. The services may include common services such as a well-equipped workspace, communication facilities, phone, fax, Internet and other shared services including secretarial assistance. Business support services may include business skill development, business planning and development, business management and networking with stakeholders. The specialized services may include engineering and design, research and development, testing, legal, IPR related, etc. A TBI is also expected to assist the start-ups in getting access to financing such as venture capital support, funding from angel investors, other innovative financing mechanisms and equity participation.

Indian TBIs

- Primarily initiative of DST
  - ➢ Noida – Information Technology
  - ➢ Bangalore – Composites
- DST being assisted by UNDP and APCTT
  - ➢ Anna University, Chennai – Biotechnology
  - ➢ MITCON, Pune – Agri-biotechnology
- SIDBI initiated a national programme on innovation and incubation: Based on Israeli model where Government provides all the funds for setting up incubation centre, operating the centre as well as providing seed money to the projects set up within the centre.
  - ➢ Indian Institute of Technology (IIT), Kanpur
  - ➢ Birla Institute of Technology and Science (BITS), Ranchi
- Few IITs/Indian Institute of Management (IIMs) – as their own initiative/alumni support

5. Other industrial infrastructure facilities for new enterprises

- Industrial area, estates
- Growth centres and industrial townships
- Export Promotion Industrial Park
- Hardware Technology Park
- Sector specific park: Info Park, Agro Park, Biotech Park, Food Processing Park
- Knowledge Park
- Techno Park
- Industrial Park
- Tidel Park

6. Venture capital organizations in India

In Asia, the venture capital funding is mainly concentrated in Hong Kong, China; and Singapore. In other countries this mechanism of financing is yet to make its presence felt. In India too, the penetration of venture in the new enterprises is low. The first origin of modern day venture capital in India can be traced to the setting up of a Technology Development Fund (TDF) in the year 1987-1988, through the levy of a cess on all technology import payments. In 1988, Technology Development and Information Company of India (TDICI) (now Industrial Credit and Investment Corporation of India (ICICI Ventures) and Gujarat Venture Finance Ltd. (GVFL) were formed. In 1996, SEBI came out with guidelines for venture capital funds, which paved the way for entry of foreign venture funds into India.

Current trends in VC funding

- Capital is pouring into private equity funds;
- First generation entrepreneurs are finding easier to raise funds;
- Most States are setting regional VC funds;
- VC firms are getting professionalized;
- Incubators and serial entrepreneurs are germinating;
- VC firms are getting specific industry focused.

With the burst in IT boom, the VCs are no longer interested in IT and dotcoms and presently are focusing mainly in biotechnology, telecommunication, food technology, entertainment, education and new materials sectors, etc. At present, there are over 100 established VCs operating in India at the national level, state level mainly from the Government (financial institutions) and private sector. The total pool of Indian venture capital today, stands over Rs 50 billion.

C. Conclusions and recommendations

In next 10 years, knowledge-based industries are likely to acquire greater prominence and SMEs are likely to come up in the industry segments such as pharmaceuticals, IT and biotechnology sectors. The role of the Government will be that of a facilitator for providing support to SMEs in the era of globalization. Government would increasingly focus its energy towards providing human resource development support along with establishing suitable mechanisms to support and nurture technology oriented enterprises, the model of which may vary country to country or even region to region.

1. Recommendations for the developing countries

(a) Inventory of technologies

A number of appropriate technologies for the SME sector have been developed in various countries of the Asian and Pacific region. While each country has its areas of strength in the SME sector they also have many weaknesses, and it would be mutually beneficial if the already developed technologies could be made available to each other. Therefore, it is recommended that each country should prepare a comprehensive list of all state of the art technologies. These could be entered in a suitable database and they could be on web sites on the Internet so that they could be readily accessed.

(b) National panel of consultants

Each country should prepare a list of experts and consultants, who can help SMEs within the country and the region to effectively transfer the available technologies. These consultants could assist in market surveys, etc. in addition to assisting with the transfer, development and application of the technologies at a commercial level.

(c) Techno-economic survey for assessing technological needs

From these surveys, the common needs of the countries can be identified and the available technologies could be shared e.g., low-cost housing technologies, alternative energy technologies, etc. Where there is a common need, which has to be met by importing technologies from outside the region, could be tackled together, rather than separately.

(d) Programmes to increase SME awareness of new technologies

There should be an information programme in each country through exhibitions, workshops, seminars, publications, etc. to increase awareness of the benefits to the industrialists from acquiring state of the art technologies.

(e) Competitiveness assessment of SME sector

There is a need to make a competitiveness assessment of the SME sector in each country, with a view to assessing the gap that exists with the rest of the world. This will vary from industrial sector to sector.

(f) SME interaction with S&T/R&D sectors

The problem of strengthening the interaction between SMEs with the university and R&D sectors in the region was recognized. While each country should devise appropriate measures to overcome this situation, it would be useful if there could be an exchange of views and information between countries of the region so as to help overcome this problem. There should be an interaction with the countries of East Asia to gain from their experience.

(g) Venture capital

The venture capital sector is weak in the region as a whole, being worse in some countries than in others. There should be a concerted effort with a mutual exchange of views to overcome this problem. Study of venture finance availability and performance in relation to the country's technology development needs is required. In this study it would be useful to determine the industrial investment on a sectoral basis and determine the role of venture capital in this investment.

(h) Business incubation mechanisms

Each country should adopt certain appropriate mechanisms for technology business incubation in order to nurture new enterprises and provide technical advisory services to SMEs. Some external assistance from agencies like UNDP, UNIDO, ESCAP should also be extended to the developing countries under a broad framework.

(i) Country exchange programmes

Efforts should be made to initiate country exchange programmes in the developing countries of the region to understand and complement mutual efforts in carrying out studies, assessment surveys, training and setting up of incubation mechanisms, etc.

2. Guidelines for successful launch of technology business incubators

Some of the suggested steps, which may help in successful launch of a TBI, are as follows:

- Select a location after careful evaluation with a clear mission and business plan;
- Sound financial support both from central and state governments and other related agencies;
- Structure the incubator to provide value to tenants and stakeholders;
- Careful selection of tenant firms with highest growth potential;
- Appoint a proactive management board for overall guidance and a dedicated team for day-to-day operations;

- Identify and develop a panel of professionals who provide critical support services for start-ups;
- Facilitate access to venture capital scheme and other innovative financing mechanisms;
- Effective networking with other R&D institutions for making the TBI a focal point for technology in the region;
- Be customer service focused with both tenants and stakeholders;
- Build an effective monitoring mechanism;
- Structure the activities to attain self-sufficiency operations within a set time frame.

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PROMOTING BUSINESS AND TECHNOLOGY INCUBATION FOR IMPROVED COMPETITIVENESS OF SMALL AND MEDIUM-SIZED INDUSTRIES THROUGH APPLICATION OF MODERN AND EFFECTIVE TECHNOLOGIES IN INDIA*

A. Executive summary

There is a great need for any country to plan, to manage change in the context of globalization and focus on S&T intervention for heightening economic activity within the country to attain economic independence.

In this context, there is a trend of paradigm shift from *capital-intensive economic* activity to *knowledge-based economic* activity. The generation, dissemination, application and exploitation of distinctive know-how are the driving force behind the economic growth in a globally inter-connected economy.

For knowledge-based economy to grow, the institutions of higher education, industrial community and the Government should form a trinity of the interaction module which in any country takes up the leading role in the technological and economic growth of that particular country. This factor is influencing the promotion of BTI for improved competitiveness of small and medium-sized industries through application of modern and efficient technologies. In this context, science parks, technology business incubators and other similar initiatives are the latest in the evolutionary line of effective institutions of higher education and industry mechanisms to act as catalyst for the growth of knowledge-based economy.

If one looks at the experience of any country, irrespective of developed or developing, it is very encouraging that the concept of promoting knowledge-based industries through the initiative of science parks/technology business incubator movement is catching up throughout the world.

India, the seventh largest and the second most populous country in the world, has also taken up the advantage of this concept and brought out the economic reforms, aiming at stimulating growth of knowledge-based economy and enhancing foreign direct investment. This has moved India firmly into the front ranks of rapidly growing country in the Asian and Pacific region, unleashing the latent strength of the huge scientific and technological manpower in the country.

This paper deals in-depth in the context of new reality – knowledge-based economy, Indian scenario with some of the key factors partly the outcome of the policy framework relevant to the S&T and SMEs, especially focusing on S&T intervention under NSTEDB with emphasis on different programmes, suiting the changing economic scenario and available scope for technocrat entrepreneurship development like:

- STEP – Science and Technology Entrepreneurs Park
- EDC – Entrepreneurship Development Cell
- Training – Skill Development Training
- EDP – Entrepreneurship Development Programme
- OLPE – Open Learning Programme in Entrepreneurship
- EAC – Entrepreneurship Awareness Camp
- STEDS – Science and Technology Entrepreneurship Development Scheme
- FDP – Faculty Development Programme
- TEDP – Technology-based Entrepreneurship Development Programme
- STST – Skill Development Training through Science and Technology

* This country paper was presented at the National Workshop on Promoting Business and Technology Incubation for Improved Competitiveness of Small and Medium-sized Industries through Application of Modern and Efficient Technologies at Vientiane, Lao People's Democratic Republic and was prepared by ESCAP resource person, Mr. M.N. Shivaram Director, SJCE-Science and Technology Entrepreneurs Park, Sri Jayachamarajendra College of Engineering, Mysore, India.

Finally, after having understood the economic scenario and also the growth of knowledge-based industries through science and technology entrepreneurs park/technology business incubator initiatives, some of the lessons learnt are brought out as recommendations, especially in the context of environmental factors leading to the concept of incubation, possible types of incubators with emphasis on different models, helping policy makers and implementers, suggestions and recommendations are also provided as to the type of incubation organization, composition of national steering committee, composition of state/regional level steering committee and their functions respectively, evolving of budget for supporting this kind of projects, terms of reference and financial implication with emphasis on monitoring and evaluation.

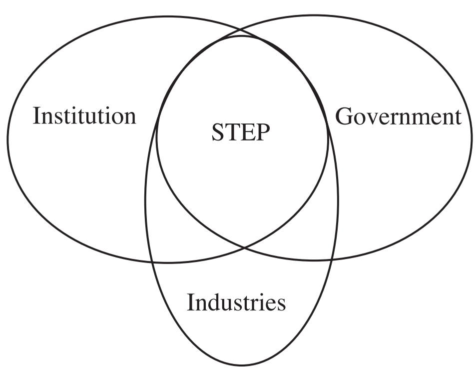
Further, it also provides suggestions for innovative financial support for the knowledge-based industries because the traditional financing support will not be able to provide the required emphasis for the growth of innovative start-up companies.

Hence, it is very critical for any country to look into the all-round requirements of these innovative development initiatives and identify the areas to support these initiatives and nurture it throughout the process of establishment, sustenance and growth.

B. New reality – Knowledge-based economy

If one looks at the total growth of economic activity of a developed country, he would be able to understand the paradigm shift that is taking place from capital-based economy to knowledge-based economy. He can clearly see the transformation from an economy based on manufacturing to one based on knowledge, which is an inevitable process. The generation, dissemination, application and exploitation of distinctive know-how are the driving force behind economic growth in a globally interconnected economy. The paradigm shift from capital-intensive economic activity to knowledge-based economic activity is also very true in the developing countries. The globalization, the shift from manufacturing to services, the increasing complexity of manufactured products and acceleration of the flow of S&T into new products and new industries make intangible assets like ideas, knowledge and skills, the fundamental sources of wealth and value.

For the knowledge-based economy to grow, the institutions of higher education, industrial community and the Government should form a trinity of the interaction module which in any country takes up the leading role in the technological and economic growth of that particular country. It is evident from the experience of several developed countries that the technical education system and the industrial community cannot grow in isolation.



It is very critical that the institution, industry and the Government work together to enhance the knowledge-based economic growth. The major impediments experienced in this type of interaction to succeed in several countries are:

- The primary orientation of industries is towards short-term profits and product improvements.
- There is a mismatch between an institution of higher education's orientation towards basic research and industry's short-term needs for new or improved products.
- Industry's in-house R&D do not take into consideration the cost advantage of institutions of higher education research.

- Industry has the view that institutions of higher education do not understand its objectives (namely that it is product-oriented and seeks to maximize profits).
- Academics are generally unable to perform effectively industry sponsored or directed research.
- There is a difference between an institution of higher education's need to protect the right to publish and industry's need to protect proprietary information.
- Institutions of higher education and facilities having equity or other ongoing financial interest in industry create a conflict of interest.
- Industry is reluctant to fund the total cost of research.

The success of institutions of higher education-industry interaction, however, is dependent heavily on the presence of highly competent scientists and engineers in the institutions of higher education who are strongly motivated to take on industrially relevant problems and to work on them in ways compatible with industry's notions of cost and time constraints.

C. Science parks

Science parks and similar initiatives are the latest in the evolutionary line of effective institutions of higher education-industry interface mechanisms.

A "***research park***" – the first attempt in this group of "Institutional Mechanisms" – according to the Association of institutions of higher education related parks of the United States of America:

- Has a contractual and/or formal operational specifically designed for providing better R&D facilities, high technology and science-based companies and support services;
- Has contractual and/or formal operational relationship with an institution of higher education;
- Has a role in promoting R&D by the institution of higher education in partnership with the industry assisting the growth of new ventures and promoting economic development;
- Has a role in aiding transfer of technology and business skills between the university and industry tenants.

A "***science park***" on the other hand as defined by the United Kingdom Science Park Association is a property based initiative which:

- Has formal and operational links with an institution of higher education;
- Is designed to encourage the formation and growth of knowledge-based business and other organizations normally resident on site;
- Has a management function that has an activity engaged in the transfer of technology and business skills to the organizations on site.

In a research park, the planning permission is more rigid permitting only prototype production. Usually, this is maintained by the institution of higher education having a key role in the management of a park with scientific advance being more important than financial returns.

In contrast, small-scale manufacturing is permitted in the science parks and the term "park" is intended to imply low-density development.

A "***technology park***" is usually a development to accommodate companies engaged in commercial applications of high technology with very little or no institutions linkages. Some science parks end up as technology parks, or when under pressure to attract tenants effectively become business parks where R&D are irrelevant and all that is provided is pleasant environment.

Moreover, in spite of their heterogeneity they have similar objectives:

- To provide a mechanism for spin-off companies from academic research
- To provide an organized institutional structure through which technology/knowledge can be transferred to industry

- To provide an avenue for improving the academic teaching and research relevant to industrial needs
- To inculcate a culture of entrepreneurship among academics and students

1. World scenario

(a) The United States experience

Much of the impetus for the development of science parks comes from the United States, where an entrepreneurial culture exists and various forms of university-industry linkage mechanisms have been tried over the years.

The first research park in the United States was established in 1948 – Venion Park in California. This Park, however, had no affiliation to any university.

The first and probably the most successful university related Science Park was the Stanford University Research Park, which was started in 1951 and credited with providing the impetus to the electronic revolution in "Silicon Valley".

The Association for University related Research Parks of the United States lists 111 such initiatives, which have a direct university connection.

The original objectives of research parks in the United States were:

- To establish university-industry linkage
- To strengthen the research programme of the university
- To develop local industry
- To generate financial return
- Others (to set up consultancies and employment for faculty and students, the creation of a broader tax base and more jobs)

(b) The United Kingdom experience

The science park movement in the United Kingdom is undoubtedly one of the most successful in Europe today. Starting with 18 science parks in the year 1985 to 53 science parks in the year 2001 and the total number of tenant companies starting from 607 in 1987 to 1,694 in 2001. The number of jobs created by the tenant companies is totally 39,037 in the year 2001. This speaks of the popularity of this concept and its effectiveness on the growth of hi-tech companies.

Although the United Kingdom science parks had different beginning, objectives, organizations and sponsors, there are several general characteristics that underlie their development and growth:

- The beginnings of the Science Park in the United Kingdom occurred on university land and were aimed at increasing industrial liaison.
- The local authorities and regional development agencies became involved and the objectives were modified to encourage economic development through increased industrial development and employment generation.
- The success of the Cambridge Science Park and Herriot Watt University Research Park has attracted involvement of financial institutions and real estate developers in this activity.
- The technology utilized by the science park companies are at the leading edge and considerable portion of their activity is involved in R&D.
- Science park management teams generally constitute a small group acting as a catalytic agent for the development.
- Science parks have a mix of companies at all stages of development, which brings about interdisciplinary teamwork.
- The university linkage is very well organized in some cases.

- Inter-tenant linkages are also common.
- There is a growing involvement of private sector investors.
- Most parks are nursery or incubator units to encourage growth of small firms.
- New developments are better planned and less ad hoc in their approach.

(c) The German experience

Many of these concepts like science and research parks were also promoted in West Germany and are generally known as innovation centres or technology centres. The first innovation centre was started in the year 1983 at the Technical University of Berlin and was known as the Berlin Centre for Innovation of New Enterprises.

Germany had no science park or innovation centres for a long time, but by the year 1985, they had established 18 such centres. Now an innovation centre is being planned in almost all the towns of the country.

All the innovation centres seek to ensure a certain degree of technology orientation. The main areas of technology pursued by the companies are as follows:

- The production of largely standardized goods and services using established technologies
- The application of established technologies to new fields
- The development of new technologies and their application to new and established fields

Even though the main goal of innovation centres is to generate new technology-based firms, relocators are also encouraged in some cases.

(d) The Japanese experience

The development of the technopolis in Japan is an expression of a trend, which parallels the development of research parks/science parks/innovation centres and other initiatives but with some differences. One difference lies in the basic motivation and the other, in the degree of involvement of the Government of Japan.

In the United States, where land is available in plenty, high technology industries moved to locations where the knowledge-capital was available. In Japan, where land is scarce, the plan is to move the universities to those locations where industrial development is envisaged.

In the case of technopolises, the initiative and sustaining efforts come from the local governments such as the municipalities and the government with a catalytic role being played by the central government.

In 1980, the Ministry of International Trade and Industry (MITI) announced the technopolis concept, an ambitious plan to build new Silicon Valleys throughout the Japanese archipelago.

MITI had studied all the science parks and high technology regions in the world and distilled its findings in the technopolis programme.

The technopolise will have new universities, science centres, research parks, joint R&D, venture capital and office complexes concentrated to form a critical mass. They will also offer ample housing, shopping centres, schools, recreational areas and a relaxed life style. The technologies are located in the scenic areas away from the cities. They aim at decentralization of the production and R&D functions of high technology industries to local areas, the revitalization of indigenous enterprises and assistance for their building up the strength necessary to create new products and technologies. At least 10 of them have begun functioning and are attracting large companies on to the premises including overseas companies like Texas Instruments, Nippon Fairchild, etc.

The technopolis programmes have set off a ground swell of new projects. MITI estimates that the Government of Japan is currently experimenting with 150 regional infrastructure projects with names such as Teletopia, Agripolis, Marinpolis and New Media City. Moreover, there are at least 10 research cities coming up in the Tokyo region and 8 more in the Kyoto region.

(e) Experience of other countries

Three European nations in addition to the United Kingdom and Germany have shown great interest in STEPs. France had established 18 science parks in 1986 and is planning to develop the Southern Coastline into a Technological Home for 21st century industries.

Belgium is consciously attracting research oriented companies to its parks whereas the Dutch are encouraging local initiatives. As a result, the science parks in Belgium have companies like Digital, Honeywell, Wang and IBM from the United States.

Other countries like Canada, Australia, Sweden and India have also started many such ventures and the Russian Federation has science cities serving the same purpose.

2. Indian Scenario

India is the seventh largest and second most populous country in the world. A new spirit of economic freedom is now stirring in the country, bringing sweeping changes in its wake. A series of ambitious economic reforms aimed at deregulating the country and stimulating foreign investment has moved India firmly into the front ranks of the rapidly growing country in the Asian and Pacific region and has unleashed the latent strengths of a complex and rapidly changing nation. India's process of economic reform is firmly rooted in a political consensus that spans her diverse political parties. India's democracy is a known and stable factor, which has taken deep roots over nearly half a century. Importantly, India has no fundamental conflict between its political and economic systems. Its political institutions have fostered an open society with strong collective and individual rights and an environment supportive of free economic enterprise.

India's time tested institutions offer foreign investors a transparent environment that guarantees the security of their long-term investments. These include a free and vibrant press, a judiciary that can and does overrule the government, a sophisticated legal and accounting system and a user-friendly intellectual infrastructure. India's dynamic and highly competitive private sector has long been the backbone of its economic activity. It accounts for over 75 per cent of its gross domestic product and offers considerable scope for joint ventures and collaborations.

Today, India is one of the most exciting emerging markets in the world. Skilled managerial and technical manpower that match the best available in the world and a middle class whose size exceeds the population of the United States or the European Union, provide India with a distinct cutting-edge in global competition.

Some of the key economic indicators are:

Indian Economy	**1997-1998**	**1998-1999**	**1999-2000**	**2000-2001**	**2001-2002**
GDP (billion Rs, at factor cost, current prices)	13 901	15 980	17 556 (P)	18 958	20 803
GDP (billion US$, current prices)	373.7	379.6	405.5	414.8	438
GDP growth (percentage, constant factor cost)	4.8	6.5	6.1 (P)	4.0 (Q)	5.4 (A)
GDP per capita (US$, current prices)	387.4	368.3	405	404	
Foreign investment inflows (Sum)	5 385	2 401	1 581	5 099	
Total exports (sum of current prices)	35 006	33 218	36 822	44 560	32 572 (Apr-Dec 01)
CPI (for industrial workers) (base: 1982 = 100)	380	414	434	445	469 (Dec 01)
CPI index (percentage, variation)	6.8	13.1	3.4	3.7	4.2 (Apr-Dec 01)
Exchange rate Rs/US$	37.2	42.1	43.3	45.7	47.5 (Apr-Jan 02)
Population (million)	964.4	982.7	1 001.1	1 027	

(a) Policy framework related to S&T and SMEs

> *"Of the many forces that will shape human history in the new millennium, science and technology will perhaps be the most potent."*

– Sri. Atal Bihari Vajpayee, Prime Minister of India

> *"Indians not only have a great learning capability but most of them also have an entrepreneurial and competitive spirit. Today, there are not enough avenues to channelize this spirit constructively and productively. That is what we should aim for."*

– Dr. A.P.J. Abdul Kalam, President of India

Knowledge-based ventures are engines for the growth of a nation today. So, it is necessary for a government to consciously develop new mechanisms for promoting an environment of business incubation and technology support intervention in this area. India has been an early beginner in this area, at least among the developing countries. The NSTEDB, Department of Science and Technology, Government of India, is a policy making and implementation body primarily promoted for this purpose way back in 1980's. Since then NSTEDB has been constantly coming up with new mechanisms for promoting knowledge-based venture of science and technology persons. It has established many new institutional mechanisms such STEPs/TBIs as a shining example of developmental institutions in science and technology intervention for promotion of a knowledge-based venture creation environment.

(b) India's SME friendly schemes

SMEs are the most vibrant sector of the industries for any nation and India is no exception to this. SMEs in India have contributed commendably to the nation's industrial development. In India 50 per cent of the industrial production is from the SME sector and with 42 per cent contribution to exports and 80 per cent in employment generation, we can by no means discount the SMEs contribution as small. India has a wide variety of schemes to promote SMEs, with both the central and state governments time and again stressing the importance of their role for a balanced development of our society. The United Nations organizations such as APCTT, UNIDO, UNDP and UNESCAP have also instituted many useful projects for the promotion and well-being of the SME sector. Government of India has promoted many institutional mechanisms such as National Small Industries Corporation, Small Industries Development Organization, Technology Information, Forecasting and Assessment Council, Small Industries Service Institute as fine mechanisms for SMEs promotion. In addition to these each state government have their own framework and institutions to promote SMEs. State government organizations such as district industries centres, small industries development corporations, state industries corporations, and state technology missions are some of the institutions catering to the SMEs needs. Each of these institutions offers a variety of schemes for promotion of SMEs. They also follow many different methodologies to address the SMEs promotional requirement. It shall be beyond the scope of this paper to go into details of the schemes offered by these institutions for promoting industrial growth. Suffice to say that India houses a plethora of development institutions directed at promotion of SMEs. Now, our main focus therefore, shall be on the initiatives taken up by the NSTEDB, Department of Science and Technology, Government of India in promoting TBIs and STEPs in India for promoting knowledge-based ventures.

(c) National Science and Technology Entrepreneurship Development Board (NSTEDB)

The NSTEDB was established by the Government of India in 1982 "as an institutional mechanism to promote gainful self-employment in the country and to link idle S&T manpower with the underutilized institutional credit facilities". The Board, which has a governmental structure, is serviced by the Department of Science and Technology. It has representation from socio-economic and scientific ministries/departments.

The major objectives of NSTEDB are:

- To promote and develop entrepreneurship through the use of S&T
- To facilitate and conduct various informational services relating to the entrepreneurship development using S&T

- To network various central and state government agencies and NGO's in entrepreneurship and self-employment development using S&T with special focus on backward areas as well
- To act as a policy advisory body to the Government agencies in regarding entrepreneurship based on S&T and conduct studies supporting policy evolution
- Any other matter incidental to the above

While a few promotional programmes were initiated during the terminal year of the Sixth Five-Year Plan (1984-1985), several new programmes were conceptualized and launched during the Seventh Five-Year Plan (1985-1990) in consultation with other ministries/departments and agencies.

The programmes have created awareness among S&T persons to take to entrepreneurship as a career. The academics and researchers have started taking a keen interest in such socially relevant roles and have engaged themselves in several programmes. About 100 organizations, most of which are academic institutions and voluntary agencies, were drawn in the task of entrepreneurship development and employment generation.

More programmes are being evolved to suit the changing economic scenario and the available scope for entrepreneurship development.

- STEP – Science and Technology Entrepreneurs Park
- EDC – Entrepreneurship Development Cell
- Training – Skill Development Training
- EDP – Entrepreneurship Development Programme
- OLPE – Open Learning Programme in Entrepreneurship
- EAC – Entrepreneurship Awareness Camp
- STEDS – Science and Technology Entrepreneurship Development Scheme
- FDP – Faculty Development Programme
- TEDP – Technology-based Entrepreneurship Development Programme

(d) Science and Technology Entrepreneurs Park (STEP)

The science park and similar initiatives in the developed countries are the latest in the evolutionary line to create an atmosphere for innovation and entrepreneurship; for active interaction between academics and industries; for sharing ideas, knowledge, experience and facilities for the development of new technologies and their rapid transfer to the end-user.

The potential growth of new technology based industrial units is vitally important issue, which has motivated initiation of such new kinds of linkage mechanisms between R&D institutions and industry.

The STEP programme was initiated by the NSTEDB in 1984. STEP provides a reorientation in approach to innovation and entrepreneurship involving education, training, research, finance, management and government.

It creates the necessary climate for innovation; for sharing ideas, experience and facilities and opens up new avenues for students, teachers, researchers and industrial managers to grow in a transdisciplinary culture, each understanding and depending on the other's inputs for starting a successful economic venture. The task, therefore, is to create an "employer culture" where increasingly S&T people will seek to create their own employment.

Objectives of STEP:

- To forge a close linkage between universities, academic and R&D institutions on the one hand and industry on the other
- To promote entrepreneurship among science and technology persons, many of whom were otherwise seeking jobs soon after their graduation
- To provide R&D support to the small-scale industry mostly through interaction with research institutions
- To promote innovation based enterprises

Promoters:

- Department of science and technology (DST)
- IDBI, IFCI and ICICI
- Concerned state government
- Host institution
- Commercial bank

Facilities provided by STEPs:

- Nursery sheds
- Testing and calibration facilities
- Precision tool room/central workshop
- Prototype development
- Business facilitation
- Computing
- Data Bank
- Library and documentation
- Communication
- Seminar hall/Conference room
- Common facilities such as telephone, telex, fax, photocopying

Services offered by STEPs:

- Testing and calibration
- Consultancy
- Training
- Research
- Prototype development/Process development
- Human resource development (short-term courses)
- Technical support services
- Business facilitation services
- Database and documentation services
- Quality assurance services
- Common utility services

The NSTEDB, jointly with the all India financial institutions, has so far catalysed 15 STEPs in different parts of the country. They are in different stages of development.

(e) Entrepreneurship Development Cell (EDC)

The concept of EDC was evolved to institutionalize entrepreneurship in S&T institutions. The EDC acts as a nucleus for carrying out entrepreneurship development activities in the institution as well as in the region. The objectives of establishing EDCs are as follows.

- To create an entrepreneurship culture in the host institution and to promote the activities of NSTEDB in the region where it is located.
- To organize Entrepreneurship Awareness Camps and Entrepreneurship Development Programmes in the premises of the host institution for the benefit of S&T persons. To extend necessary guidance and escort services to the trainees during approval and execution of their projects.

- To introduce a curriculum on Entrepreneurship Development formulated by the NSTEDB as an elective subject in various courses (engineering degree or diploma, or degree in science, as the case may be) in the host institution.
- To conduct research works and survey for identifying entrepreneurial opportunities (particularly in high technology areas).
- To arrange factory visits for prospective entrepreneurs.
- To act as a Regional Information Centre on opportunities, technologies, markets, etc.
- To provide testing, quality assurance, design, tool room, pilot plant and other facilities for entrepreneurs.
- To conduct FDP in the field of entrepreneurship for teachers from colleges, polytechnics and other institutions in the region.
- To render advice to sick enterprises to rehabilitate them.
- To organize Total Quality Management (TQM) training for the working professionals and engineering students.
- To undertake products/process development which have potential for entrepreneurship development.

Organizational structure

- The EDC is a part and parcel of the host institution for all administrative purposes. All departments of the institution should support the EDC by maintaining proper linkages. Entrepreneurship development should form a part of the objectives of the long-term plan of the host institution.
- An advisory committee with head of the host institution as chairman guides the EDC.
- The Cell will have a representative of DST on its Advisory Committee to ensure proper implementation of the scheme on a uniform basis throughout the country.
- Representatives of organizations dealing with small industries promotion and entrepreneurship development at the State level shall also be included in the Advisory Committee.
- The faculty members should have an adequate industrial and/or entrepreneurial background.
- Core staff will be provided to implement the activities of the EDC.
- Experts from the industry and other institutions could be associated as guest faculty.

(f) Skill Development Training through S&T (STST)

The NSTEDB, since its inception in 1982, has been devoting its attention for programmes of entrepreneurship development and self-employment generation using S&T methods and techniques and by using the expertise developed in technical and R&D institutions for upgradation of skills. With development of new and better technologies, it becomes essential to upgrade the skills of manpower using such enhanced versions of equipment/tools. Training has been a long felt need in some of these areas and NSTEDB has been trying to fill this gap right from its inception and the present STST addresses itself to upgrade the skills in a need-based manner for a select group of processes and technologies.

The main objectives of STST are:

- To demonstrate that skills can be developed/upgraded through the application of S&T
- To harness the resources of S&T infrastructure of the country, which have so far remained under-utilized, for skill development training
- To enhance quality of services/products and thereby enhance income generation among skilled workers

(g) Entrepreneurship Development Programme (EDP)

An EDP aims at training the S&T graduates and diploma holders in the essentials of conceiving, planning, initiating and successfully launching of an economic activity. Some of the EDPs are jointly sponsored by DST and the all-India Financial Institutions (IDBI, IFCI, ICICI), state governments, Commercial Banks, etc. These EDPs are for potential entrepreneurs and the programme duration is 6-8 weeks.

The course content includes, identification of business opportunities, specific product/services to be offered by various constituents of support systems including financial institutions, banks, DICs, State Industrial Development Corporations, etc. preparation of a viable project report, achievement motivation training (AMT) and the essence of management of an enterprise. Advice and guidance on technology are arranged from national and state level technical institutions, depending upon the nature of project selected.

Special EDPs are being conducted with more emphasis on linkages with R&D institutions to take up projects based on indigenous technologies and services, in high technology areas, such as leather, plastics, bio-medical equipment, high speed data communication and other emerging areas of technology.

(h) Faculty Development Programme (FDP)

In order to meet the growing need for trainers in S&T entrepreneurship development, the scheme FDP is being implemented to train teachers from technical institutions, R&D institutions and voluntary agencies in sufficient numbers, so that they can function as resource person in motivating students and teaching them the intricacies of entrepreneurship. This will also fulfil the need to have a large number of counselors for the Open Learning Programme in Entrepreneurship. FDPs are organized by specialized institutions in entrepreneurship development.

(i) Technology-based Entrepreneurship Development Programme (TEDP)

TEDP is a structured training programme of 6-week duration designed to motivate and develop entrepreneurs in specific products/technologies/processes developed by CSIR labs, R&D institutions, universities, etc.

In a TEDP:

1. The entrepreneurs are exposed to technical knowledge about the products and technologies and are enabled to develop their skills at the lab of the technology provider.

2. The R&D lab having commercially viable technologies, get potential entrepreneurs as its “takers”.

3. The entrepreneurship-training institute can put concerted efforts in a specific discipline of product-technology and thus can have better control over the course of the programme and its success.

The participants are selected through various tests and personal interviews to assess their potential of becoming a successful entrepreneur. During the training, the participants also gets to know the intricacies of how to start and manage an enterprise. At the end, they are assisted in preparing a bankable project report.

(j) Science and Technology Entrepreneurship Development Scheme (STEDS)

For identifying and documenting specific entrepreneurial opportunities based on local resources, skills, demand and matching those with prospective entrepreneurs, a programme called STEDS is in operation, since 1985, in some of the backward districts of the country.

A number of activities are being taken up which include, among others, preparation of resource inventories, preparation of thematic resource maps, generation of specific entrepreneurial opportunities, identification of prospective entrepreneurs, dissemination of information, organization of skill development training, creation of entrepreneurial awareness among the unemployed educated youth and organization of Entrepreneurship Development Programmes for them.

(k) Technology Development Board (TDB)

With a view to providing financial assistance to the industrial concerns for the development and commercialization of indigenous technology in a dynamic economic environment. The Government of India constituted a TDB on 1 September 1996. As a Statutory Body under the Department of Science and Technology, New Delhi, the TDB invests in equity capital and gives soft loans to the industrial concerns and other agencies as applicable to:

1. Attempting the development and commercialization of indigenous technology

OR

2. Adapting imported technology to wider domestic application

The Board has provided financial assistance to 97 projects in the emerging areas of health and medicine, engineering, chemical, agriculture, energy and waste utilization, air and road transport, information technology and telecommunication, etc.

The Board has also instituted two national awards for the successful commercialization of indigenous technology as per below:

1. Cash award of Rs 5 lakhs each to

   (a) An industrial concern, which has successfully commercialized

   (b) The developer/provider of such technology

2. Cash award of Rs 2 lakhs to an SSI unit, which has successfully commercialized a product based on indigenous technology.

Awards will be given annually on the Technology Day, i.e., 11 May every year.

D. STEPs and TBIs in operation in India

The NSTEDB, Department of Science and Technology, have so far promoted 15 STEPs in the country. These STEPs are promoted along side and with the involvement of premier educational institutions in India such as Indian Institutes of Technology and Regional Engineering Colleges and some reputed other engineering and technology institutions. The STEPs are broadly geographically distributed keeping in view the necessity of balanced regional development. Each STEP is an autonomous body attached to a premier education institution to facilitate management requirements and technological assistance required for incubation. STEPs and TBIs use different developmental mechanisms described earlier such as EDP, TEDPs to promote a new class of technology enterprises. They provide required support in the form of training, counseling, facility provision and escorting for budding entrepreneurs. Recently, NSTEDB has also promoted five TBIs as more focused initiatives for promoting knowledge-based industries. STEPs and TBIs attract young S&T persons and catalyse them to become technology-based entrepreneurs. The 15 STEPs so far have promoted 788 technology-based units with an annual turn over of Rs 1,300 millions. These technology enterprises also provide employment for nearly 5,000 persons.

E. Business incubation process in STEPs/TBIs

STEPs and TBIs being institutions for promoting knowledge-based ventures need to have mechanisms and facilities for entrepreneurship and technology development. Since, STEPs/TBIs are attached to premier educational institutions, the facilities and expertise available with parent institutions readily flow to the requirements of the budding entrepreneurs and then through them are channelized to meet the product/service requirements of the society. In addition to this, facilities are made available in STEPs/TBIs to further this process of serving the customer needs through entrepreneurs. To cite some of these facilities as examples, the following facilities are presented:

- Product and prototype development
- Database and information
- Testing and calibration
- Design and development
- Consultancy support
- Fully equipped incubation space support
- Infrastructure support like office automation, seminar hall, video-conference, restaurant and recreation facilities

The product and prototype facilities such as common machining centres, fabrication centres, rapid prototyping, design facilities and laboratories are available for the budding entrepreneurs. This reduces the risk of the entrepreneurial venture during the initial stages and aids them in developing and testing prototypes and final marketing. Based on the feed back from the marketplace, the budding entrepreneur can then put up his/her own facilities for promoting the business venture further. The catalogue library and databases help the entrepreneurs in strategic planning exercises. Nursery sheds with basic infrastructure facilities such as required power and water further facilitates easy launching of successful ventures for the entrepreneurs. Computer networking and office automation support/consultants support provides much needed business professional support for the entrepreneurial ventures. All these basic initial facilities help the budding entrepreneurs to concentrate on his/her core process of value addition to customer using technology and liberate him/her from the onerous routine tasks.

Now the process of business incubation can be seen from the process point of view. The input for the incubation process is often the fresh science and technology graduates from educational institutions. As such they lack experience, awareness, information about many facets of business promotion and industrial requirements. They cannot be expected to possess information about production, marketing, finance and personnel aspects of business. In order to bridge this gap, STEPs/TBIs utilize the EDP and the TEDP as the right entry point in the incubation process. The EDP envisions the budding entrepreneurs about business requirements, further it provides him basic management concepts and tools to develop his business promotion skills. The EDP also provides entrepreneurs with opportunity guidance to expose him to some firm possible opportunities with business potential to venture into. The EDP provides opportunity for entrepreneurs to interact with bankers, venture capitalists and understand the funding possibilities and requirements for his venture. Real-life cases of successful entrepreneurs provide them further insights into the business processes. After completing this EDP now the entrepreneur is expected to have acquired basic entrepreneurial skills and competencies. After the EDP training, STEPs/TBIs begin to address the specific technological as well as business requirements individually. While technological assistance for the proposed entrepreneurial ventures are done through match making with the concerned faculty of the parent institution, the strategic business counselling is done through STEPs/TBIs under the guidance of a professional team. The output of all these value-adding processes creates a favourable condition for the success of the entrepreneurial ventures. This is also validated by the higher success rates of EDPs conducted by STEPs/TBIs when compared to other developmental organizations. While the EDPs conducted by other organizations may provide various services for budding entrepreneurs, STEPs/TBIs provide a comprehensive package and a one-stop-stall for the budding entrepreneurs.

For budding entrepreneurs having the required experience lateral entry points are available for his/her technology business venture. The formal EDP training is not the only entry point. A budding entrepreneur can choose his/her own service requirements from STEPs/TBIs, based on his/her business requirements and entrepreneurial capabilities. Thus STEPs/TBIs provide a very flexible model for business incubation process also. After successful establishment of his/her business venture, STEPs/TBIs also provide suitable exit strategy for the entrepreneurs by helping him to shift to a permanent place. The STEPs/TBIs business incubation efforts have produced high growth industries that bring wealth, employment and hope for the region. Some of the ventures are growing fast enough to become large-scale industries within this decade. Thus STEP/TBI model is a proven developmental effort, with growing and sustainable benefits. For every Rupee that the Government is investing on STEPs/TBIs, after an initial gestation period, the Government gets back more than 1 Rupee every year in terms of direct/indirect taxes and thus STEPs/TBIs in addition to being an excellent developmental model, is also an unparalleled investment opportunity for the society as a whole.

F. Conclusions and recommendations based on lessons learned

It is very clear that the trend globally in the economic development is shifting from capital management to intellectual capital management. The human capital with which any country is being blessed, resulting in creating and innovating product inputs will be directly supporting the value-added economic activities in that particular country. This leads to higher level of impact. Any such development initiative, which is oriented towards effectively utilizing the intellectual capital towards the economic gain of any county, is extremely important in leading that particular country towards economic independence. The total approach for the development of strategy should look at the manpower available, the level of S&T development and application of this knowledge for product/process development, leading to the commercial exploitation linking with business opportunities.

The Technology Business Incubator Programme should aim at fostering technological entrepreneurship, which is innovative, focusing on S&T innovation, S&T intervention in enhancing the quality of process and the productivity either by individual or groups.

The environmental factors leading to the concept of incubation:

- Many S&T personnel looking out for self-employment;
- Small business being revolutionalized from non-technological business to those with technological potentials;
- Entrepreneurship as solution to unemployment, entrepreneurship as potential for realizing talents;
- Small business being revolutionalized from non-technological business to those with technological potentials;
- Entrepreneurship as solution to unemployment, entrepreneurship as potential for realizing talents;
- Encouraging innovation-based economic activities;
- Effectively utilizing the infrastructure which has been established at very high cost;
- Utilizing the untapped resources.

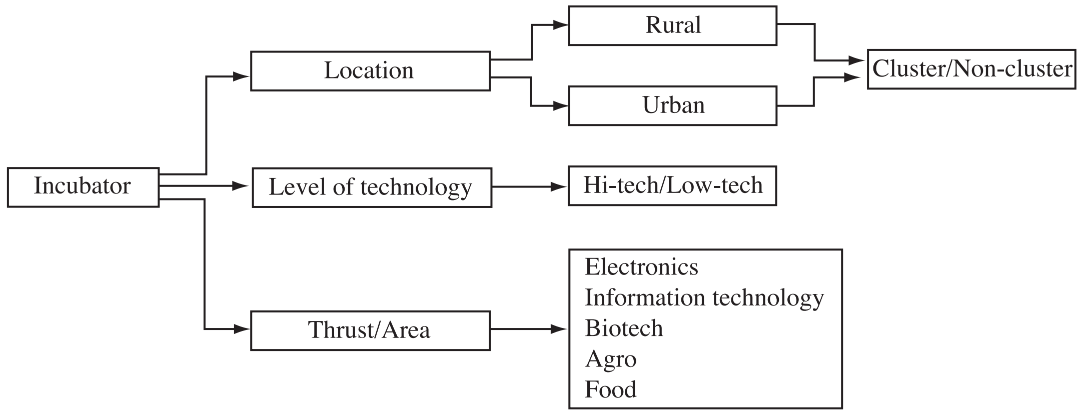
It is recommended that any country, which is looking for implementing such development initiative, should look at the possible types of incubators based on the need of that particular country. They should adapt the concept but not adopt it. In this direction, it is very relevant to bring out the outcome of the particular project in which I was the resource person, which was handled under the Workshop on "Structuring a Comprehensive Public Support System for SMEs – A central Factor of Development Policy" which was jointly organized by International Centre for the Promoting of Small and Medium-sized Enterprises (INCeP-SME), a Department of the Negev Institute for Strategies of Peace and Development (NISPED) and World Association of Small and Medium Enterprises (WASME), at Israel, from 28 November to 19 December 1999, as suggestions for any country which is looking for establishing this kind of concepts.

These suggestions are the outcome of the report evolved by my group under the caption "The incubator as support device for new small business and preparing a programme for the establishment and operation of an incubator". This is very critical in terms of utilizing S&T manpower in a country and converts them as enterprise builders, creating an impact on high-tech industrial development and also contributing parallel to the rural sector.

1. Possible types of incubators

Incubator is a concept which provide supporting and protective environment for individual and groups, for the development of innovative product and process, through innovation – S&T intervention converting them into business opportunities. This concept should be highly flexible to adapt to the needs of the rural and urban clientele. When the type of incubator is being discussed we have to classify keeping in view the policy makers and the implementers with an accent on fulfilling the needs encompassing social, technological and economical issues.

(a) Classification model I (helping the policy makers)

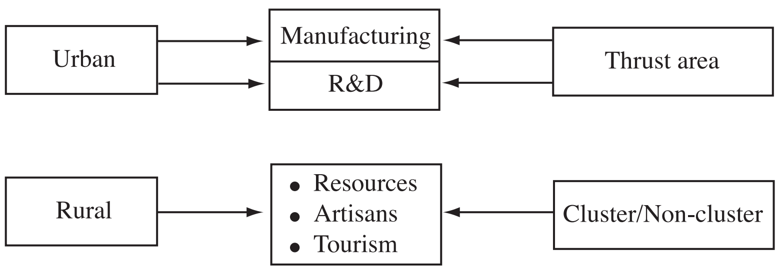


The criterion for classification – helping the policy makers in terms of formulating incentives like tax holiday, grants and others are (a) location, (b) level of technology, (c) thrust area.

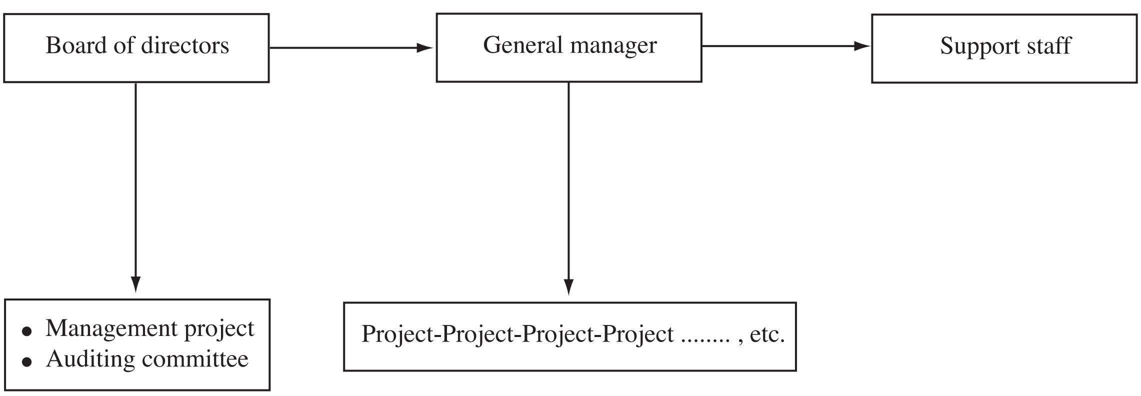
(b) Classification model II (helping the implementers)

The criterions for the classification, helping the implementers are human resource availability, proximity to the marketplace and the infrastructure and resources available. This is different in urban and rural area especially in developing countries.

Keeping in view these specific issues the Classification Model II helping implementers have been evolved. Implementation should be based on need analysis. In the urban areas, it can be further classified manufacturing and R&D incubators, with specific thrust areas helping identifying a common facility to enhance the performance of the tenants of the incubators. In the rural areas, it can be further classified as resource based or artisans based. It can be focused on the existing cluster of artisans or based on resources or creating new clusters.



2. Incubator organization



The incubator programme is suggested to be administered by Ministry of Industry and Commerce with the total power delegated to National Steering Committee of Incubators supported by the regional committee. Suggested organization chart for the effective implementation, monitoring and evaluation is as follows:

(a) National Steering Committee

Composition of National Steering Committee:

1. The Chairman – representative from Ministry of Industries and Commerce (MOIC)
2. Members representing:
   - Ministry of Science and Technology
   - The public representation from hi-tech industries
   - Ministry of Agriculture and Animal Husbandry
   - Coordinator from the Ministry of Finance
   - Member Secretary – in charge of incubator programme

Functions of National Steering Committee:

- Policy regarding criterion based funding (location, technology, thrust area)
- Identification of thrust area based on national polity and growth potential
- Networking policies between state level committee and national level committee for interstate and inter-ministerial support

(b) State/Regional Level Steering Committee

Composition of the State/Regional level Steering Committee:

- Chairman – representative from Ministry of Industries and Commerce (State)
- Ministry of Science and Technology (State)
- Representation from hi-tech industries
- Ministry of Agriculture and Animal Husbandry (State)
- Public representation of the incubators graduates
- Coordinator from the Ministry of Finance (State)
- Member Secretary – in charge of incubators

Function of State/Regional level Steering Committee:

- Screening of projects and approval based on the merits of the projects
- Development and implementation of criterion for selection of the projects/aspiring entrepreneurs
- Decision on the extension of the projects period based on status of the projects
- Approval of the recruitment of the personnel to the incubator management based on job description
- Developing exit policies of the tenants of the incubator based on performance
- Attracting investors through proper mechanism of the advertisement
- Evaluation and monitoring of the incubators performance and taking corrective actions

3. Budget support from the Government

The criteria for evolving the budget may be:

a. Location

b. Thrust area

c. Urban and rural bias in the policy – Based on this criterion for incubator, 50 per cent grants of approved budget annually are from national level and 50 per cent from state level. Support can be provided to encourage economic development. For projects, 55 per cent of the approved budget cost can be provided as grants for a period of 2 years.

For the projects in urban area, 60 per cent of approved budget to be provided as grants annually subject to maximum of amount decided by Steering Committee based on projects. The remaining 40 per cent come from investors like venture capital providers/angels/government support.

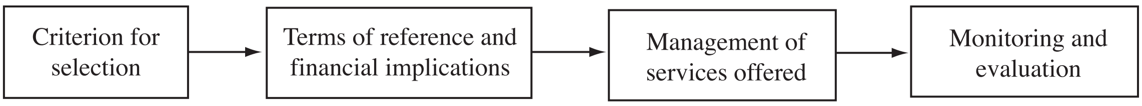
In the rural areas, 90 per cent of approved budget can be provided as grants annually subject to a maximum of approved amount decided by the Steering Committee based on projects. The remaining 10 per cent come from the investors.

The support can be extended for the period of 2 years in case of urban areas and 3 years in case of rural areas.

4. Implementation

After the budget is made available, the action plan is drawn up which consists of physical target in terms of completion of building and installation of equipment and common facilities and financial targets based on cash flow with the support of PERT and CPM which provides activities and time plan including parallel processing.

Programme of operation:



(a) Criterion for selection of the project/entrepreneurs

- Rooted in indigenous product development and process development
- S&T intervention in product/process development
- Justifiable R&D plan
- R&D project based on innovative technological idea that aims to develop a product with export marketing potential
- Technically feasible and has potential for economic viability
- S&T intervention helping group entrepreneurship aiming at cluster development especially in rural areas

(b) Terms of reference and financial implications

Initial ownership of the project would lie with the individual/group, the incubator management the complimentary financing agencies (investors).

Ownership ratios may be as follows:

Inventor/Entrepreneurs/Individual/Groups	–	minimum 50%
Investor a complementary financing	–	up to 20%
Incubator management	–	up to 20%
Development team/researchers	–	minimum 10%

The charges for the services provided to be paid by the tenants would be at the discretionary power of the incubation management. The rates to be fixed at 25 per cent lower than the market rate depending upon the type of services being provided.

After the success of the projects, projects should pay 3 per cent of the profit as royalty and the capital support provided, to be repaid over a period of 5 years (without interest).

After two years of operation, they are expected to be independent and move out of the incubators providing access for new incumbents.

(c) Management of services offered

The proposed services like consultancy, testing and calibration, financial accounting, book-keeping, outsourcing, recruitment, prototype development, marketing, institutional linkages for R&D, location of strategic partners/joint ventures to be managed by competent persons taken as consultants from time to time based on the need with a common facilities of secretarial support, financial management support, telephone, fax, internet and photocopying.

(d) Monitoring and evaluation

The monitoring and evaluation will be based on the following indicators of success:

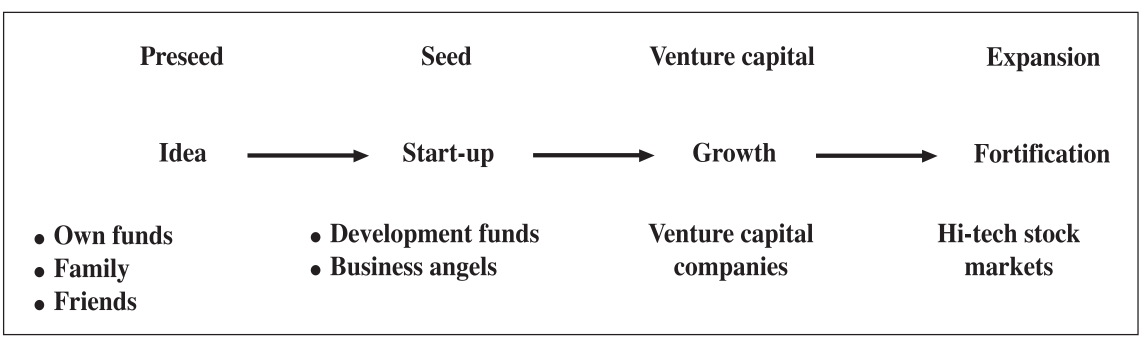
- Number of private investments attracted based on R&D plan
- Number of projects successfully established (commercial establishment of the projects)
- Return on investment in term of 20 per cent equity of the incubator management and 3 per cent royalty
- Number of indigenous projects establishment

Further, there is a great need for providing innovative financial support for this kind of knowledge-based start-up growth.

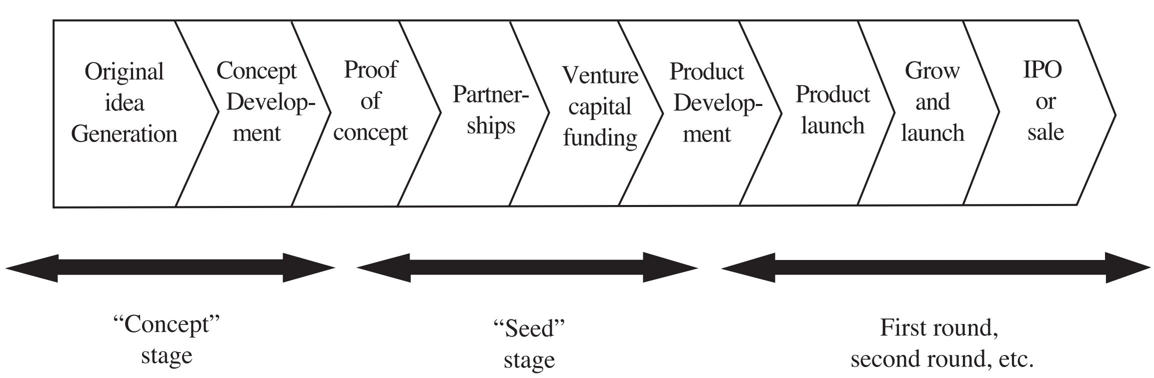
5. Innovative financial support for knowledge-based companies

When we are talking about the knowledge-based companies, the traditional financing support will not be able to provide the required emphasis for the growth of innovative start-up companies. Many of the start-up companies do not require a very high sum in the initial stage. In this context, a lot of discussion is going on in understanding the total process of the growth of knowledge-based companies from its idea generation to establishment and growth stage.

This can be termed as innovation financing chain, since venture capital cannot finance innovation on its own. Dynamic innovation demands an unbroken financial chain, from seed capital to stock market. This can be understood by the diagram below.



This can be further understood properly by understanding the process of growth of knowledge-based enterprises from original idea generation to IPO stage as explained in the following diagram:



According to a study by APCTT, the factors influencing the speed of technology/knowledge commercialization can be divided into the following four distinctive parameters:

1. Institutional and fiscal incentives to inventors, entrepreneurs and employees.
2. The availability of high quality scientific and business skills.
3. The supply of capital in the forms which match the needs of new firms at each stage of their growth.
4. Long-term predictability of the regulatory framework as a basis for confident investment decisions.

Hence looking at the Diagram, it is very clear that the funding should cater to three distinctive levels of support:

1. Concept stage
2. Seed stage
3. After the proof of concept, the actual venture funding to support the growth of the organization.

This has been very well accepted in the Silicone Valley, the United States, as mezzanine funding, which has lead to lower risk and higher return on investment, because the total funding can be divided into three stages and at each stage, venture capital funding organizations can retract itself depending upon the viability.

Further, the levels at which, the companies approach venture capital/mezzanine funding are as follows:

1. At the initial stage of idea generation and developing the project for proof of concept.
2. After the proof of concept and ready for launching the project for commercial viability.

Hence, it is very critical for any country to look into the all-round requirements of these initiatives and identify the areas to support these initiatives and nurture it throughout the process of establishment, sustenance and growth.

INDIA'S EXPERIENCE IN PROMOTING BUSINESS AND TECHNOLOGY INCUBATION*

India is the seventh largest and second most populous country in the world. A new spirit of economic freedom is now stirring in the country, bringing sweeping changes in its wake. A series of ambitious economic reforms aimed at deregulating the country and stimulating foreign investment has moved India firmly into the front ranks of the rapidly growing Asian and Pacific region and unleashed the latent strengths of a complex and rapidly changing nation. India's process of economic reform is firmly rooted in a political consensus that spans her diverse political parties. India's democracy is a known and stable factor, which has taken deep roots over nearly half a century. Importantly, India has no fundamental conflict between its political and economic systems. Its political institutions have fostered an open society with strong collective and individual rights and an environment supportive of free economic enterprise.

India's time tested institutions offer foreign investors a transparent environment that guarantees the security of their long-term investments. These include a free and vibrant press, a judiciary which can and does overrule the government, a sophisticated legal and accounting system and a user friendly intellectual infrastructure. India's dynamic and highly competitive private sector has long been the backbone of its economic activity. It accounts for over 75 per cent of its GDP and offers considerable scope for joint ventures and collaborations.

Today, India is one of the most exciting emerging markets in the world. Skilled managerial and technical manpower that match the best available in the world and a middle class whose size exceeds the population of the United States or the European Union, provide India with a distinct cutting edge in global competition. (See p. 119 for some of the key economic indicators.)

A. Policy framework related to S&T and SMEs

1. Science and Technology Policy – 2001

Science and technology have been an integral part of Indian civilization and culture. India's traditions in science and technology stretch over several millennia and have been founded on the principle of universal harmony and respect for all creation. In the half century since independence, India and its people have been committed to the task of promoting the spread of science and have recognized the key role of technology as one of the most important elements of national development. The Scientific Policy Resolution of 1958 and the Technology Policy Statement of 1983 enunciated the principles on which the growth of science and technology in India has been based over the past several decades and continue to inspire our endeavours even today. These policies have emphasized self-reliance and sustainable and equitable development. We stand today on the threshold of a new century, at a time when the advance of science is both tumultuous and spectacular. We live in a world where political, social and economic equations have been dramatically transformed in the last decade. It is therefore necessary for the Government and people of India to reaffirm their commitment to the growth of science and technology, which in turn must spark and fuel the march of national development.

Policy objectives:

Recognizing that science and technology are powerful instruments in the tasks of national reconstruction, economic resurgence and maintenance of national security, the Government of India, therefore, enunciates the following elements of its science and technology policy:

- To promote the teaching and practice of all disciplines of science at school and college levels, reaching out to all creative talent in the country, to foster scientific research in the universities and

* This country paper was presented at the National Workshop on Promoting Business and Technology Incubation for Improved Competitiveness of Small and Medium-sized Industries through Application of Modern and Efficient Technologies at Ulaanbaatar, Mongolia and was prepared by ESCAP resource person, Mr. V. Raghavendra Prasad, Executive Director of PSG College of Technology Science and Technology Entrepreneurial Park, India.

national institutions, which have a multiplier effect, and to emphasize the critical and essential role of science in the sphere of higher education.

- To encourage the participation of all sections of the population in science and technology endeavours and to ensure the creation of conditions that permits the full participation of women scientists and technologists in all areas of research and development.
- To ensure that academic and R&D institutions function with the greatest autonomy and accountability, so that an ambience for creative work of the highest order is encouraged and to build and maintain centres of excellence, which will raise the levels of work in selected areas to the highest international standards.
- To integrate the teaching and practice of science and technology with the widely prevalent and extensive knowledge acquired over the long civilizational experience of India, with a view to ensure the creative participation of large sections of our society in innovation and wealth generation.
- To harness modern scientific and technological advances so that rapid progress is made in the field of agriculture, to ensure food and water security, in a sustainable way and in the field of health, to bring modern health care to the people of the country.
- To encourage the highest level of innovation and research and development in industry and to promote close and productive interactions between private and public institutions in science and technology.
- To integrate science and technology with all spheres of national activity in order to enhance India's global competitiveness, to ensure continued development of national infrastructure and to safeguard national security.
- To exploit the full power of science and technology for the mitigation of natural hazards, particularly, earthquakes, floods, cyclones and drought.
- To use science and technology as a vehicle for international cooperation and collaboration and to promote the pooling and sharing of material and intellectual resources in order to achieve common goals.

The Government of India clearly recognizes that these objectives will be best realized by a dynamic and flexible science and technology policy, which can readily adapt to a rapidly changing world environment. It is the purpose of this policy, to ensure that science and technology, as practiced by our high calibre scientists and technologists, contributes to the economic and social uplift of our people, while maintaining our many traditional values. Through this science and technology policy, the Government reiterates India's commitment to participate as an equal and vigorous partner in the task of harnessing the advances in science and technology for the benefit of mankind.

(a) Scientific and engineering research

- Science and Engineering Research Council
- Intensification of Research in High Priority Areas (IRHPA)
- Integrated Science Olympiad Programme
- Kishore Vaigyanik Protsahan Yojana
- Programmes related to young scientist and HR development
    - ➢ Swarana Jayanti Fellowships
    - ➢ Fast Track Scheme For Young Scientists (FAST)
    - ➢ Better Opportunities for Young Scientists in Chosen Areas of Science and Technology (BOYSCAST)
- Earth System Sciences
- Seismicity Programme
- Utilization of the Scientific Expertise of Retired Scientists (USERS)
- National Science and Technology Management Information System (NSTMIS)
- Regional Sophisticated Instrumentation Centres (RSICs)

- Fund for improvement of S&T infrastructure in universities and other higher educational institutions
- Assistance to professional bodies and seminar/symposia
- Partial financial assistance for participation in conferences abroad

(b) Instrumentation Development Programme

Instrumentation is one of the major areas of S&T which makes a great impact on vital sectors of national activities such as education, scientific research, industry, agriculture, medicine and health, etc. The Department of Science and Technology (DST) has been promoting the area of instrumentation through its Instrumentation Development Programme (IDP).

(c) Technology Development Board

(See p. 147-149)

(d) Science and society

"Working for technological empowerment and sustainable livelihoods at the grass-roots levels"

Science and Society Division (SSD) has been set up under the Department of Science and Technology established with the broad objectives of providing opportunities to motivated scientists and field level workers to take up action oriented and location specific projects aiming towards socio-economic upliftment of poor and disadvantaged sections of the society through appropriate technological interventions especially in the rural areas. Under this programme efforts have been made to associate concerned National Labs or other specialist S&T institutions with each major programme so as to build-in expert input, utilize national S&T infrastructure and link it up with grassroots S&T interventions/initiatives.

(e) Highlights and achievements of science and society schemes

Following schemes are operational for action oriented, innovative and field based technology generation and adaptation programme/projects for specific targets groups:

- *S&T Application for Rural Development (STARD)*

  STARD aims at facilitating development of promising S&T based field groups and innovative technologies related to rural development. It also has a unique programme to support selected voluntary agencies with a proven track record of innovative work in development and application of technologies for rural areas.

- *S&T Application for Weaker Sections (STAWS)*

  This scheme is aimed at the development of economically weaker sections of the society in rural and urban areas. It focuses attention on specific S&T inputs for improvement of rural artisans, landless labourers, etc.

- *Women Component Plan (WCP)*

  This programme is focused on women to increase their contribution to S&T and development. It also aims at promoting research, development and adaptation of technology, improve the life, working conditions and opportunities for gainful employment of women especially in rural areas.

- *Special Component Plan (SCP)*

  SCP aims at promoting research and development under adaptation of technology to the needs of economically weaker scheduled caste/scheduled tribe communities in urban/rural areas.

- *Tribal Sub Plan (TSP)*

  TSP aims at improving living conditions of tribal population with science and technological activities.

- *Young Scientist Programme (YS)*

  The scheme is focused on young scientists who have adequate background of and training in fields of science and technology and show inclination to undertake action research projects, which are socially relevant and have application for rural development.

The Department is vested with the mandate to identify, facilitate, and promote international cooperation in the emerging and frontier areas of science and technology under bilateral, multilateral or regional framework. This has been achieved through a systematic attempt in promoting interactions between governments, academia, institutions and industries with specific focus on areas of common interests through a reciprocal arrangement that benefits both India and the partner country. India currently has S&T cooperation agreements with 57 countries.

(f) Programmes:

- Programmes with developed countries
- Programmes with developing countries
- Integrated long term programme
- Regional and multilateral cooperation
- Centres of excellence
- E-mail directory creation

2. National Science and Technology Entrepreneurship Development Board (NSTEDB)

(See p. 143-149)

3. Policy and facilitation framework for SMEs: mission for the millennium

Policy:

Create a sound policy environment to help the sector cope with the emerging challenges of globalization. Measures to include:

- Constitution of state level advisory boards
- Separate policy for tiny and micro enterprises
- Higher investment limit for ancillary units
- Special dispensation for sectors with high export potential
- Special thrust on modernization and technology upgradation of existing units
- Focus of reservation policy on enhancement of competitiveness
- Special package for promotion and development of small and village enterprises in north-eastern and hill regions

(a) Foreign direct investment:

Encourage FDI as a means to infuse additional resources, technology and modern management practices with a view to making the sector internationally competitive. Measures to include:

- Enhancement in the limit of foreign equity participation, subject to management control vesting with Indian shareholders;
- Placement of FDI in small-scale industry sector, under automatic route within the enhanced equity cap.

(b) Industrial legislation:

Simplify immediate measures to include:

- High-powered Committee for recommending single comprehensive legislation for SSI units;
- Simplification of inspection procedures based on self-declaration and post audit;
- Review Choir-Board Act and Khadi and Village Industries Commission (KVIC) Act in the context of emerging challenges.

(c) Administrative set-up:

Redefine the role of the existing machinery to make it more responsive. Measures to include:

- High-powered Committee to recommend the most appropriate organizational structure for SIDO and SSIs;
- Mechanism for participation of SSI associations and NGO's in the small and village enterprises development programmes.

(d) Credit:

Strengthen credit delivery system through:

- Credit guarantee scheme
- Earmarking flow of bank credit to micro, tiny and small enterprises
- Scheme for credit rating of small-scale units
- Exploring possibilities of securitization of guaranteed loans
- Exploring possibilities of strengthening viable state financial corporations
- Promoting venture capital funds and factoring services, exclusively for small-scale sector

(e) Delayed payments:

Facilitate timely payment through:

- Mandatory schedule in audited balance sheets for reflecting interest accrued under Delayed Payments Act;
- Special mechanism, including Industry Facilitation Councils at state level, for settlement of disputes regarding delayed payments.

(f) Rehabilitation of sick units:

Put in place an appropriate policy framework for addressing the problem of industrial sickness through:

- Strengthening of State Level Inter-Institutional Committee (SLIC) for timely identification and rehabilitation of sick units;
- Exploring the possibility of introducing statutory provision for the revival of viable sick units;
- Exploring the possibility of setting up of Debt Recovery Tribunals for facilitating recovery of SSI dues of commercial banks and financial institutions.

(g) Technology development:

Modernize small-scale enterprises through a multipronged approach including:

- National modernization plans for select sectors having high export potential
- National plan for technology exchanges
- High-powered committee to recommend linkages between R&D institutions, training institutions, technology banks and user groups

- Expand the scope and coverage of technology development and modernisation scheme
- Introduce standards for testing
- Efforts to introduce utility patent protection for small innovations

(h) *Marketing:*

Extend comprehensive marketing support through:

- Project subcontracting promotion policy
- Vendor development programme for linkages between small, medium and large industry
- Thrust on rural marketing
- Comprehensive policy for investment marketing brand promotion and overseas market access

(i) *Fiscal regime:*

Create an appropriate fiscal environment through:

- Rationalization of taxes and tariffs for small-scale industries
- Rationalization of subsidies to make them WTO compatible
- Organize WTO sensitization programmes for small-scale industries

(j) *Village industries:*

Focus through:

- Strengthening Prime Minister's Rozgar Yojna and Rural Employment Generation Programme;
- Strengthening National Rural Industries Programme;
- Strengthening rural artisan complexes;
- Modernization and capacity building in village industries;
- Special thrust on small agro-industries.

(k) *Infrastructure:*

Bridge critical infrastructure gaps through:

- Strengthening National Cluster Development Programme, including identification of critical infrastructure gaps on cluster basis;
- Functional industrial parks.

(l) *Entrepreneurship development:*

Strengthening National Entrepreneurship Development Board:

- Comprehensive plan for promotion of rural entrepreneurship
- Close linkages with premier institutions, engaged in management and entrepreneurial training
- Adoption of "turn-key concept" for entrepreneurship training

(m) *International cooperation:*

Strengthen bilateral and international cooperation through:

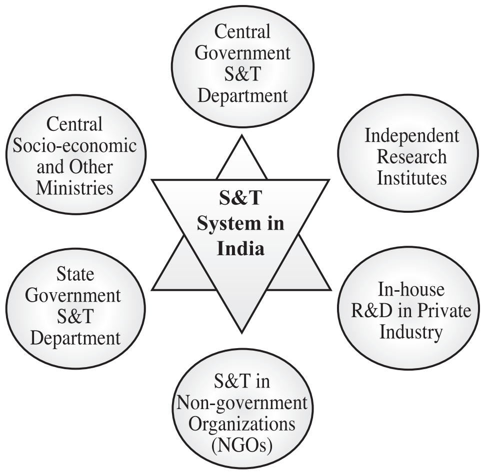
- Separate cell in the Ministry for International Cooperation and joint ventures
- Sector specific development programmes with the assistance of UNIDO and UNDP
- SME partenariat with various international and multilateral organizations

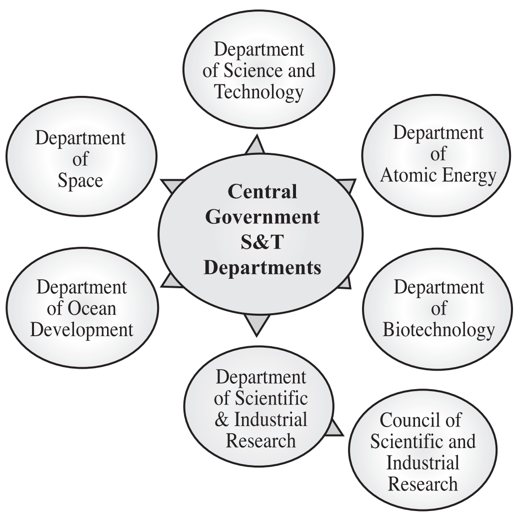
(n) *Information technology:*

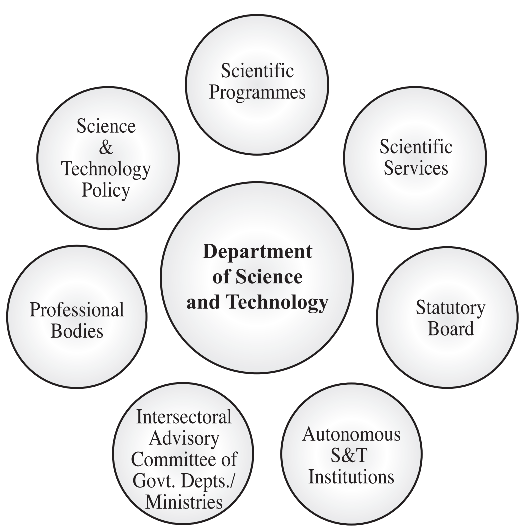
Strengthen IT support:

- Master web site on small industries comprising information on policies and procedures, technology, products, etc. with hyperlinks to states and countries;
- Comprehensive plan for preparing small-scale industries for e-commerce, with appropriate electronic infrastructure support.

S&T System in India







4. Industry promotion policies

(a) *Policies classified according to specific promotional activities or focus area:*

- EXIM policy *(Central)*
- Civil aviation policy *(Draft) (Central)*
- Entrepreneurship development *(States)*
- Awards to meritorious entrepreneurs *(States)*
- Consultancy services *(States)*
- Environment and pollution control *(States)*
- Export promotion policy *(States)*
- FDI and NRI *(Central and States)*
- Financial infrastructure and services *(States)*
- Foreign investment policy *(Central)*
- Human resource development *(States)*
- Industrial parks, complexes, estates, development *(States)*
- Infrastructure policy *(States)*
- Industrial policy *(Central and States)*
- Information technology policy *(Central and States)*
- Land allotment *(States)*
- Labour laws and policy *(States)*
- Monetary and credit policy, 2002-2003 *(Central)*
- Natural resources and conservation *(States)*
- Port policy *(States)*
- Power policy *(Central and States)*
- Procedure and clearance to set up units *(States)*
- Public sector undertakings *(States)*
- R&D improvement in productivity and quality upgradation *(States)*
- Raw materials *(States)*
- Small-scale, rural and cottage industries *(Central and States)*
- Sick industries *(Central and States)*
- Simplification and streamlining of rules and procedures and administration *(States)*
- Single window *(States)*
- Special economic zones *(States)*
- Taxes *(States)*
- Technology upgradation
- Thrust areas (I)
- Transport *(Central and States)*
- Telecommunication *(Central and States)*

(b) *Policies classified according to sector or industry:*

- National health policy *(Central)*
- National water policy *(Central)*
- Agro and food processing policy *(States)*
- Biotechnology policy *(States)*
- Education policy *(Central and States)*

- Electronic policy *(States)*
- Forest-based industries *(States)*
- Film policy *(States)*
- Gas and downstream industries *(States)*
- Handloom and handicraft and cottage industry sectors *(States)*
- Hydropower policy *(Central)*
- Housing and urban policy *(Central and States)*
- Liquid fuel policy *(Central)*
- Medical and medical college policy *(States)*
- Development of mineral and mineral-based industry *(States)*
- Mining *(States)*
- National housing and habitat policy *(Central)*
- Pharmaceutical policy – 2002 *(Central)*
- Rice export policy *(States)*
- Road policy *(States)*
- Rural non-farm sector *(States)*
- Sericulture *(States)*
- Slum policy *(Central)*
- Tea policy *(States)*
- Telecommunication *(Central and States)*
- Tourism policy *(States)*
- Textile *(Central and States)*
- Web policy *(States)*

(c) Incentive schemes:

- Airfreight subsidy *(States)*
- Backward area *(States)*
- Contribution to feasibility study, project report preparation cost *(States)*
- Drawal of power line and generating sets *(States)*
- Capital/State investment subsidy *(Central and States)*
- Electricity charges and water charges rebate *(States)*
- Employment generation *(States)*
- Exemption in central excise tariff *(Central)*
- Export promotion *(States)*
- Human resources and training *(States)*
- Marketing support *(States)*
- Margin money/seed money for SSI/tiny units *(States)*
- Modernization/expansion subsidy *(States)*
- Non-resident Indians and foreign investments *(States)*
- General incentives *(States)*
- Incentive scheme for modernization of jute industry *(Central)*/infrastructure *(States)*
- Information technology *(States)*
- Interest subsidy *(Central and States)*
- Land allotment *(States)*
- Non-conventional energy sources *(States)*
- Premier, pioneer, large industries and mega projects *(States)*

- Port *(States)*
- Price preference *(States)*
- Power *(States)*
- For quality, productivity and technology upgradation and pollution control devices *(States)*
- Research and development and patent
- Road *(States)*
- Sales tax concessions *(States)*
- Sick units *(States)*
- Small-scale, cottage and tiny industries *(States)*
- Stamp duty, octroi, and local taxes exemptions *(States)*
- Subsidy scheme for technology upgradation in SSI sector *(Central)*
- Subsidy on drawal of power line and generating sets *(States)*
- Subsidy on registration fee of promotion council, Indian standards institution, commodity board, Chamber of Commerce *(States)*
- Technical know-how subsidy *(States)*
- Transport subsidy *(Central and States)*
- Special incentives for women *(States)*
- Weaker sections and physically handicapped *(States)*

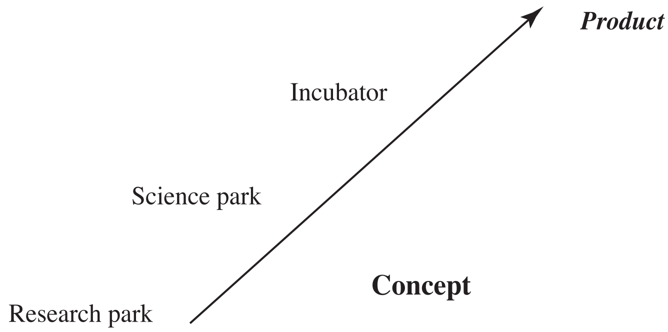
(d) Industrial infrastructure facilities:

- Industrial area, estates
- Integrated infrastructure development centre
- Growth centres and industrial townships
- Export promotion industrial park and zones
- Special economic zone
- Software technology park
- Hardware technology park
- Notified areas
- Sector specific park
- Science and technology entrepreneur park

B. Speedy commercialization of R&D outputs: role of interfacing mechanisms

The universities and a few good academic institutions in the western world have undoubtedly been the leaders of the change. It has been established through number of studies that wherever the level and quality of research work is superior, the entrepreneurship has thrived. For taking research developments to the end-users in the form of products or services, the universities were pioneers in adapting to the entrepreneurial stances to a whole range of activities associated with the promotion and commercialization of faculty research. In the pursuit of revenue streams independent of the government support, universities themselves have started to function as an entrepreneur, striking a good balance between imparting education and generating revenues by optimally utilizing its resources. A competitive environment was set wherein once some universities altered their policies on IPR; others were forced to these efforts. This resulted in establishment of initiatives such as science parks, technology parks, and research parks, which were started in the United States in the 1950's. Subsequently, these initiatives gained acceptance world over as these helped in the promotion and growth of New Technology-based Enterprises (NTBEs) and in generation of additional avenues of gainful employment. These mechanisms (briefly explained below) also found to help in strengthening links between academic institutions and R&D institutions on the one hand and industries on the other. Figure below shows the various stages of these mechanisms.

Arrangement of technology park/incubator concept



Research park: Differs from a science pin the sense that it prohibits all manufacturing except prototypes. Various companies are welcome to establish their research centres in the park adjacent to a higher education institution. The research personnel benefit most from interaction with each other and with the academicians in the higher education institution.

Science park: An industrial complex close to the place of learning (Higher Education Institution). It is designed to encourage formation of knowledge-based industries in a high quality and pleasant environment. According to the United Kingdom Science Park Association (UKSPA), a science park is a property-based initiative which includes the following features:

- Has formal and operational links with a university, other higher education institution or research centre
- Is designed to encourage the formation and growth of knowledge-based businesses and other organizations normally resident on site
- Has a management function, which is actively engaged in the transfer of technology and business skills to the organizations on site

Technology park: An industrial complex where all types of facilities are provided for the growth and development of TBEs. However, a technology park need not to have formal links with a higher education institution and therefore the level of academic and entrepreneurial interaction is generally low.

Technology and business incubator: There is a notable difference between a technology park and an incubator, as the incubator incorporates a new feature 'graduation', which implies that a start-up firm attains certain level of maturity after a specific period of probation. While the technology and business incubator can be considered akin to each other, the major distinction is that the later caters to wide range of tenants not necessarily technology intensive firms. Certain similar initiatives such as innovation centre, business parks, technopolis, etc. are also being tried world over.

1. Evolution and growth of incubators

The concept of business incubation has evolved in the last 30 years. The 'first generation' of business incubators (1980s) were essentially offering affordable space and shared facilities to carefully selected entrepreneurial groups. Thereafter, the incubators started varying widely in key respects such as objectives, sectoral focus, and business modes, etc. In some countries the incubators were set up for empowerment, while in other for technology commercialization. Incubators were mixed type, focused on technology and in some places even kitchen and arts incubators were set up.

In the 1990s the need was recognized for supplementing workspace with counselling, skills enhancement and networking services to access professional support and seed capital, for tenants within the facility and affiliates outside; this led to the 'second generation' model, although most are still stuck in the original mode.

Starting in 1998, with the moves towards globalization, a new 'third generation' incubation model is emerging. A shift has also been experienced in the business mode of the incubators from the *not-for-profit* incubators to *for-profit* incubators. The for-profit incubators are intended to mobilize ICT and provide a convergence of support towards creating knowledge-based ventures. Some of these in turn can expand rapidly and contribute towards economic growth. Virtual incubator or incubators without walls have also emerged recently.

2. Initiatives taken in India

India has made commendable progress in terms of the growth of scientific and technological culture. Today, India has a vast pool of S&T infrastructure with over 800 technical institutions including around 200 universities. The estimated annual out-turn of the engineering graduates is around 2.0 lakhs. In addition, it already has a critical mass of cutting-edge research through 400 national laboratories, over 1,300 in-house R&D units in the corporate and other sectors. However, the environment and support system are not congenial for the faster commercialization of R&D outputs. There exists lot of delay in commercialization of R&D outputs and in majority of cases the R&D outputs do not get commercialized for want of initial investment, the needed environment and the networking. In the recent past, the Ministry of Science and Technology, Government of India has been focusing its attention towards this and initiated a number of programmes in order to plug the gaps cited above. These programmes include STEP and a recently launched scheme on TBI, which are basically institutional mechanisms promoted by the Department of Science and Technology (DST) in and around the academic institutions of excellence and selected R&D institutions for offering the needed environment, networking and the linkages to promote techno-entrepreneurs. Other initiatives of the Department include Patent Facilitation Cell and Drugs and Pharmaceutical Programmes. Biotechnology parks are being promoted by the Department of Biotechnology (DBT). Various state governments and other agencies in private sector are aiming for establishment of property-based initiatives such as Info Park, Knowledge Park, Agro Park, Tidel Park and the incubators promoted by the private industrial houses.

3. Institutional mechanisms initiated by the Government for promoting techno-entrepreneurship

The STEP programme was initiated by the NSTEDB in 1984 in collaboration with the all India financial institutions (IDBI, IFCI and ICICI). STEP enables S&T person to cultivate entrepreneurship culture and fosters close linkages between universities, academic and R&D institutions on the one hand and industry on the other. STEPs are functioning in 15 locations primarily in the engineering colleges and the technical universities throughout the country. Some of the salient achievements of STEP include conversion of 750 S&T persons into job-generators by way of starting industries, capital mobilization of Rs 500 millions through promotion of new enterprises with estimated annual turn over of Rs 900 millions. STEPs have also been instrumental in development of 150 new and improved products and commercialization of 80 products. In addition, nearly 5,000 jobs have been generated through the units set up and about 11,000 additional jobs generated through imparting skill development training to the youth belonging to various sections of society.

4. Innovative financing mechanisms

While the institutional mechanisms help in the development and growth of TBEs by providing the requisite facilities and environment conducive for their development and growth, innovative financing mechanisms are equally important as these help in their development by providing timely and easy finance. Some of the innovative financing mechanisms promoted by DST for speedy commercialization of indigenous R&D efforts and for supporting innovative ideas include creation of a TDB in 1997 and initiation of schemes such as HGT under TIFAC. DSIR has initiated PATSER and TePP, a joint initiative with the TIFAC. Recently, DST has also set up a National Innovation Fund for supporting grass root level innovations. Financial institutions have also introduced funds such as SIDBI venture Fund; ICICI Venture Fund for supporting the knowledge-based start-ups. In addition, privately managed venture capitalists and the angel investors are also increasing their presence and playing active role in facilitating the financing of the start-ups having potential for faster growth.

5. Scheme on establishment of TBIs

As described in earlier paragraphs, world over TBIs have been found as useful tool for catalysing the development and growth of TBEs. Keeping this in view and also visualising that in India too, TBIs could become important tools in establishing crucial link to techno-preneurship chain by catalysing the development and growth of knowledge-based start-ups. Recently, a scheme on TBI has been launched by the DST, since it is being felt that the TBIs would be playing an important role in the economic development of the country, it is being planned to implement the programme in a mission mode. One TBI has been recently promoted in the area of information technology. Many new proposals for establishment of TBIs are under consideration of the department. The Department is also being helped in its effort by the APCTT through the UNDP supported Technology Management Programme Support (TMPS) – subcomponent "Nurturing technological entrepreneurship through STEPs and TBIs". Under the UNDP supported programme, two TBIs are to be established. (See p. 128-131 for more information of TBI.)

Benefits from TBIs

- *For tenants:* It enhances the chances of success, helps overcome market failures, and facilitates access to mentors, information and seed capital.
- *For governments:* The incubator serves as an economic development tool, promotes regional development, and generates jobs, incomes and taxes.
- *For research institutes and universities:* The TBI helps strengthen interactions between industries, promotes research commercialization, better use of lab facilities and gives opportunities for faculty/graduate students to enhance their capabilities.
- *For corporate sponsors:* The TBI can develop opportunities for acquiring innovations, supply chain management and spin-offs, and helps them meet their social responsibilities.
- *For the community:* Creates self-esteem and an entrepreneurial culture, as a majority of graduating businesses stay within the area.

Guidelines for successful launch of TBIs

Some of the suggested steps, which may help in successful launch of a TBI, are as follows:

- Select a location after careful evaluation with a clear mission and business plan.
- Sound financial support both from central and state governments and other related agencies.
- Structure the incubator to provide value to tenants and stakeholders.
- Careful selection of tenant firms with highest growth potential.
- Appoint a proactive management board for overall guidance and a dedicated team for day-to-day operations.
- Identify and develop a panel of professionals who provide critical support services for start-ups.
- Facilitate access to venture capital scheme and other innovative financing mechanisms.
- Effective networking with other R&D institutions for making the TBI a focal point for technology in the region.
- Be customer service focused with both tenants and stakeholders.
- Build an effective monitoring mechanism.

The TBIs, thus, should be managed by a professional team and run as a business itself with a clear mission of achieving self-sufficiency in a short span of time.

6. Real-estate development activities with modern facilities promoted by Ministry of Commerce and Information Technology, DBT, State Government, ICICI

- Software Technology Parks
- Info Park
- Knowledge Park
- Techno Park
- Industrial Park

- Tidel Park
- Agro Park
- Biotech Park
- Science and Technology Entrepreneurs Park

C. Conclusions and recommendations

1. Policy related issues

- Increasingly greater allocation of funds for S&T with the government redefining its role;
- Policy framework more in favour of capitalizing on the knowledge base built over the years;
- Emphasis on leveraging the traditional knowledge system;
- Industry orientation of S&T.

2. Institutional arrangements

- Huge reservoir of hardware, software and brainware resources in academic and R&D institutions to be untapped for venture creation;
- To create a multiplier effect of government support by increasing private participation;
- The Institution-Industry-Government model works the best and hence to be given greater thrust;
- Greater facilitation for IPR creation and protection.

3. Lessons that we have learned

- The Government's role will have to be that of a facilitator providing the right framework and impetus only;
- Academic (or) R&D institution-industry involvement is very critical;
- Each country will have to evolve its own model based on the level of S&T, core competitive advantage, cultural ethos, etc.
- The TBIs will have to be run with the right mix of business and technology orientation;
- Both sector specific and inter-disciplinary TBIs with requisite skill sets are required for commercializing technology;
- Newer funding mechanisms to be made available to the potential technopreneurs;
- Leveraging IPRs will be the key to wealth creation.

PROMOTING BUSINESS AND TECHNOLOGY INCUBATION FOR IMPROVED COMPETITIVENESS OF SMALL AND MEDIUM-SIZED INDUSTRIES THROUGH APPLICATION OF MODERN AND EFFECTIVE TECHNOLOGIES IN INDIA*

A. Backdrop

The oracle of human development provides infallible clues that the knowledge society has begun to take shape. This change has to reorient our long-learned habits of work, learning, communication and culture. Human efforts to exist and to improve upon, have constantly and qualitatively changed from one phase to another. From food gatherers and hunters, humankind developed itself into a harmonious and artistic topped agricultural economy. The accumulation of wealth in the agricultural economy gave way to a more dynamic and vibrant industrial economy. The industrial economy further improved the support systems of the human society, including health, education and social security systems. The knowledge generated in the matured industrial economy gave birth to the possibility of a paradigm shift towards a knowledge society. The success factors for a nation in an agricultural economy have been land, labour and natural resources. Nations of the feudal world who were bestowed with these factors generated wealth and improved their quality of national life. In an industrial economy the winning edge of the nations and therefore quality of life of their populace came from capital, management and machinery. Obviously industrial economy saw those nations with these dynamic ingredients prospering. In a knowledge society the factors of success come from its strength in science and technology, entrepreneurship and innovation. Those nations developing and sustaining these capabilities shall emerge most prosperous. The factors ensuring success in the different phases of the evolution process though not completely new have to be reoriented and reprioritized to ensure the necessary momentum.

The global trend across developed and developing countries has shown that knowledge-based industries generate wealth and employment opportunities and bring prosperity to the nation. So, conscious and concerted efforts to develop suitable mechanisms for promoting knowledge-based industries have become the focus of science and technology and industrial promotion. It is estimated that around 3,000 incubators of various types exist around the world. Among them, the United States and Germany along with other European countries contribute more than 80 per cent of the incubator population. Among developing countries and areas, China, Taiwan Province of China, Republic of Korea and Malaysia have shown good progress in promotion of incubators for promoting knowledge-based industries.

Science parks, a new class of industrial promotion organization, developed alongside the higher institutions of learning, have been experimented throughout the world, only during the last 50 years as first generation. The science park as an organization is dedicated to encourage the formation and growth of knowledge-based industrial ventures and to be actively involved in transfer of technology and business skills to industries. In India, way back in 1980s, the Nayudammah Committee, taking cognizance of this new phenomenon worldwide, clinically analysed the Indian situation and reiterated the need for a new Indian model of science park. After careful deliberations, considering the prevalent industrial and cultural situation in our society, sharper focus was brought to this and the STEP concept was born. While the broad framework of the worldwide science park is maintained, the focus had been more sharpened towards entrepreneurship development for our society which lacks the intensity of an entrepreneurial culture, that is prevalent in some of the successful western and eastern counterparts. In addition to this, the objective of ushering in a technocrat society is added to unfold the mission canvas peripheries to include a much broader mission to the Indian STEPs.

NSTEDB, under Ministry of Science and Technology, Government of India has responded to this situation by promoting STEPs as a first phase for promoting knowledge-based industries and is now, developing TBIs as a smaller but more focused initiative to promote hi-tech start-up companies. The main source of creative ideas

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for new activities should emanate from the environs of the knowledge source that is educational/research institutions, using the facilities and expertise of educational/research institutions.

This should to be taken to the marketplace by the entrepreneurs for the benefit of the society. So, in order to maintain our competitive advantage globally, science and technology parks and incubators are indispensable and have been the call of our time. Department of Science and Technology, Government of India taking an early lead has promoted 15 STEPs in India within leading educational institutions such as Indian Institutes of Technology and Regional Engineering College together with the state governments and financial institutions. Now, Department of Science and Technology is in the process of promoting 5 to 7 TBIs in different parts of the country. While STEPs shall remain as the multidimensional developmental projects, taking up many development projects such as skill development, industrial promotion and other activities along with business incubation, technology business incubators on the other hand shall focus mainly on knowledge-based initiatives. For this shared sophisticated facilities are being established by Department of Science and Technology, in specific technology areas in the educational/research institutions in India.

India is the second most populous country in the world and the seventh largest. Liberalization policies have been opening up new threats and opportunities in India at a mind boggling pace. A series of ambitious economic reforms aimed at deregulating the country and stimulating foreign investment has moved India steadily into the front ranks of the rapidly growing Asian and Pacific region and unleashed the latent potential of a complex and rapidly changing nation. Its political institutions have fostered an open society with strong collective and individual rights and an environment supportive of free economic enterprise.

India's time tested institutions offer foreign investors a transparent environment that guarantees the security of their long-term investments.

Today, India is one of the most exciting emerging markets in the world. Skilled managerial and technical manpower that match the best available in the world and a vibrant middle class whose size exceeds the population of the United States or the European Union, provide India a distinct edge in global competition.

B. Policy framework related to S&T and SMEs

(See pp. 143-148)

C. STEPs and TBIs in operation in India

(See pp. 148-149)

D. Conclusions and recommendations

1. Policy care

1. We are at a historic crossroad in industrial development, where new ventures especially knowledge-based ventures and entrepreneurs have to be groomed right from conceptualization till realization of the ventures and this process cannot be viewed as a spontaneous phenomenon. Knowledge-based ventures have proved beyond doubt, worldwide that they can generate wealth and employment for the nation. The return on investment for cultivating and harvesting the benefits of knowledge-based ventures needs to be measured and investments for knowledge venture farms/STEPs/TBIs have to be made based on these returns for the society. As of now we have no system to measure the multifaceted benefits of TBIs/STEPs and cursory glance would reveal the results produced by them far out weigh the investments made. The benefits of the TBIs/STEPs have a real snowballing effect over a period of time, this has been hardly recognized and so, not properly utilized for the benefit of our societies.

2. TBI experience in STEPs in India have provided us with shining examples of knowledge-based ventures promoted by our entrepreneurs. Many new ventures were created through the STEPs in the past one-decade and these ventures are truly growing exponentially. Some of them shall upscale into large-scale

industries within this decade providing growth, employment and hope for our nation. As a pure investment opportunity alone STEPs have provided more returns to the government in terms of direct and indirect taxes and employment opportunities and therefore the investment made on incubators/STEPs as such are commercially more lucrative when seen from a long term societal point of view.

3. Academia provides another excess intellectual capacity available with the nation for grooming new knowledge-based ventures. The intellectual capacity of academicians should be deployed to produce new ventures and add more value for our society. New innovative intervention strategies need to be devised to ensure participation of academicians in the process of knowledge-based venture creation.

4. Entrepreneurship is an inspiring phenomenon and nations demonstrating the spirit of entrepreneurship and innovation have demonstrated that this spirit provides physical well-being of the society as whole. The practice of entrepreneurship therefore naturally paves the way to a culture of entrepreneurship. Since some of the entrepreneurs in knowledge-based ventures in STEPs/TBIs are shining role models they need to be catwalked to a larger audience to inspire them to at least appreciate and encourage the culture of entrepreneurship. At present, proper packaging and presentation of products of STEPs/TBIs has been paid very little attention. This has to become part of the objective of STEP/TBI development.

5. Awareness about TBIs among important related sectors such as academicians, policy members, developmental institutions need to be strengthened. This shall create an enabling ambience and gather support for the mission.

6. Ventures promoted by STEPs/TBIs have the inherent potential to promote more new ventures by virtue of their experience and acquired skill levels in the process. This needs to be understood and the concept of ‘serial entrepreneurship’ should be recognized and supported.

2. Institutional mechanisms

1. The potential of the academia is largely undermined and unexploited at least in practice, in the process of TBI in developing countries. Entrepreneurs and academicians working together are a winning combination. However, such combinations are of very rare occurrence in STEP/TBIs. In the absence of a suitable mechanism to facilitate the participation of academicians in TBI process, it is more likely to remain a rare occurrence in the future also. So, new institutional mechanisms are needed in this direction.

2. There is a need for more intensive participation of the host institutions. It is imperative that the host institutions should also redefine some of its internal structures and reward recognition system in order to appreciate and promote participation of academicians in TBI process. This requires coordination at the apex levels, unveiling new mechanisms and recognition systems for facilitating academia participation in TBIs.

3. TBIs/STEPs needs to be self-supporting organizations after initial start-up support, in order to demonstrate high-level entrepreneurial credibility. This alone can ensure confidence and credibility in the eyes of the budding entrepreneurs. The culture of a self-supporting organization can also appreciate the efforts of growing entrepreneurs more readily. Entrepreneurs and incubators develop closer ties to each other if they become co-travelers towards the same objectives of business.

4. The relationship between STEP/TBIs with the knowledge-based ventures need to be revisited at this point. If knowledge-based ventures are getting leveraged because of Incubators, then Incubators also need to be benefited by the relation. Equity participation is one such mechanism which shall ensure a symbiotic relationship between incubators and the promoted knowledge-based ventures.

5. STEP/TBIs need to evolve into entrepreneurial organizations among developmental organizations. This is possible only by developing innovative facilitating system in place of management control systems. For this management knowledge is as important as new technology.

6. STEP/TBIs need to develop “angeling” mechanisms for promoting future entrepreneurs by the already bloomed knowledge-based ventures. This again shall be a mechanism for leveraging entrepreneurial growth.

V. PROMOTING BUSINESS AND TECHNOLOGY INCUBATION FOR IMPROVED COMPETITIVENESS OF SMALL AND MEDIUM-SIZED INDUSTRIES THROUGH APPLICATION OF MODERN AND EFFICIENT TECHNOLOGIES IN THE REPUBLIC OF KOREA

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A. Introduction

As a new engine of technological innovation and economic development, high-tech ventures are attracting greater attention from government, industry and universities in the Republic of Korea. Now fostering entrepreneurship and promoting new venture creation have become priority policy actions. Many new ventures have spun off from universities, government-supported research institutes, and private companies, especially after the restructuring of the economy. Recently, many new ventures have been spun off from universities, industries, and STIPs such as the Daeduk Science Town (DST). Now DST has developed into Daeduk Valley by accommodating high-tech start-ups spun from research institutes located at DST.

BIs are sprouting up rapidly in the Republic of Korea. During last 5 years, the number of business incubators has grown up very rapidly and now almost 350 incubators are in operation. Despite of increasing number of BIs and revealed performance of BI operation in the Republic of Korea, supporting activities and mechanism of BIs have some improvement opportunities. This paper reviews the current situation of Korean BIs and analyses performance, problems and recommendations. In addition, the case of the Korea Advanced Institute of Science and Technology (KAIST), technology innovation centre (TIC)/TBI is presented as one of successful BI in the Republic of Korea.

BI can be defined as a controlled work environment designed to foster the growth of new and emerging companies (NBIA, 1998). Major services provided by incubators are as follows (Lalkaka, 1997). It can be called as the seven Ss to start, survive, and succeed: (1) Space for working and growing – it should be affordable, flexible, and modular, (2) Shared facilities such as office equipment, receptionist, conference rooms, (3) Services for improving – counselling on marketing/finance, information, promotion, (4) Skills development for tenants in business planning and management development, (5) Support for accessing university faculty, facilities and students, professional networking, (6) Synergy to do cooperation-competition through tenant interactions, clusters, and spin-offs, and (7) Seed capital such as in-house revolving fund, access to credit, royalty, and risk capital.

Many studies were carried out to identify success and failure factors (Molnar and others, 1996; OECD, 1997; Smilor, 1987; Mian, 1997; Lalkaka and Bishop, 1996; Lalkaka and Abetti, 1999). The results show that seven factors are most important for the effective operation and management of BIs. These are:

(1) Clear goals and operating strategies of BIs linked to local demands

(2) Well-defined policies and procedures for screening and supporting activities

(3) Expertise of BI managers and staff members

(4) Organizational structure such as decision-making process and roles of board

(5) Size and sources of budget and degree of self-sufficiency

(6) Contents and effectiveness of services

(7) Entrepreneurial network with external experts and financial sources

BIs were started and have been well developed in the United States. The National Business Incubators Association's 1998 State of the Business Incubation Industry Study showed that since their inception in North America, nearly 600 BIs have added some 19,000 companies and more than 245,000 jobs to the economy. The NBIA study showed that BIs are offering a wider variety of services to their clients, including fundamental ones – such as building management teams or drafting realistic marketing plans – and more specialized ones. For instance, 58 per cent help connect their companies to investors and strategic partners. The study revealed the average incubator offers full incubation services to 20 in-house and affiliates companies; NBIA member incubators serve an average of 24.

Recently the Republic of Korea's economy is recovering very fast, especially financial performances of large high-tech companies are very good, while many venture firms are still suffering from shrinking market condition and conservative venture capital firms. Also, the rate of new venture creation is decreasing, but still many new ventures are being created every month. However, the Government is implementing several policies to promote new venture creation and entrepreneurship.

B. Business/technology incubation in the Republic of Korea

1. Policy on promoting business/technology incubation

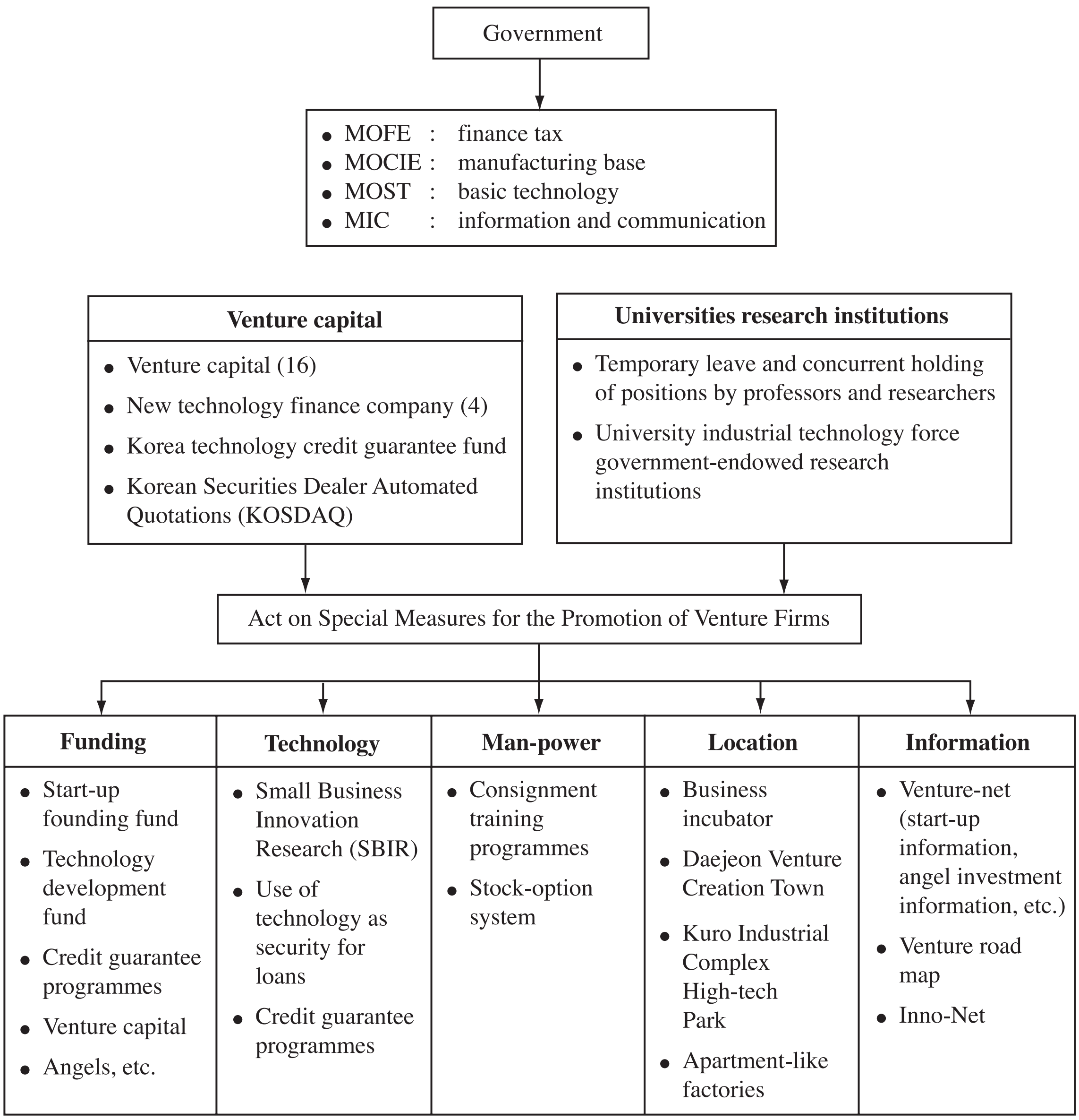
The ‘Support for SMEs Establishment Act’ and the ‘Act on Special Measures for the Promotion of Venture Firms’ put into practice in August 1997 stipulate various support systems for start-up companies including business incubators. Table 2-V-1 and figure 2-V-1 show the support structure of the Central Government.

Table 2-V-1. Venture support policies of the Central Government

Support programme		Contents
Location support	Districts for promoting venture enterprise development	• Designate Districts for promoting venture enterprise development as national and provincial industrial parks • Tax exemptions after building park
	Deregulate restrictions on location	• Give exceptions on state and public land • Expand construction area and exempt from getting permission for use diversion
	Reduce expenses on location	• Acquisition and registration tax exemption • 50% reduction on property tax/Composite land tax • Deregulate restrictions on large companies investing on venture firms
	Build technology R&D park	• Build techno-park • Deregulation on par with districts for promoting venture enterprise development
Funding support	Diversify funding source	• Allow pension funds to invest on venture firms • Liberalize foreign companies to invest on venture firms • Ease the restriction on large companies to invest funds on venture firms
	Deregulate direct financing	• Allow to issue stocks with the nominal value of 100 won and more
	Vitalize venture capital	• Raise the upper limit on venture capital’s issuing of corporate bonds • Tax exemption • Vitalize angel capital
	Found specialized venture capital	• Found venture capitals specializing on specific industries
	Over-the-counter market	• Vitalize over-the-counter market for venture firms
Technology and manpower support	Introduce support systems by ministries	• Support technology development by small and medium companies by government ministries
	Increase the manpower working in venture firms	• Allow researchers and professors to take temporary leave when work for venture firms
	Build connection between technology suppliers and demanders	• Operate technology transfer agency • Construct database of venture related technologies and businesses
	Funding for technology development	• Use of technology as security for loans • Credit guarantee programmes

Source: Gun-il Seo, *Study on promotion of small and medium venture firms* (Korea Small Business Institute, 1997).

Figure 2-V-1. Support structure for venture start-ups



Note: MOFE – Ministry of Finance and Economy.

After the financial crisis in 1997, the Government decided to concentrate its support for small and medium companies on promoting creation of high-tech and risk-taking start-up companies, which may survive highly competitive global market. The Government decided to increase the number of new start-ups by providing financing, manpower, technology and marketing support, to supplement the weakness of small and medium companies.

The Ministry of Science and Technology (MOST) supports high-tech industries; the Ministry of Commerce, Industry and Energy (MOCIE) and the Small and Medium Business Administration (SMBA) support general manufacturing; and Ministry of Information and Communication (MIC) aids software industry. The stepwise support system is shown in the table 2-V-2.

Tax benefits for business incubators are shown in the table 2-V-3. Article 6 of the *Exceptional Taxation Restriction Law* stipulates that income tax or corporate tax shall be reduced by 50 per cent for the first taxation year following the date of creation of a firm (or the date of confirmation in case of new venture SMEs) and the same favour shall be applied until the taxation year which ends in five years from the beginning date of the taxation year after the first taxation year.

Table 2-V-2. Stage-wise support structure by government ministries

Stages	Support measures	Related Ministry
Pre-founding	• College venture club • Business plan competition • Venture road show • Venture creation seminars	• MIC, SBMA • SBMA • SBMA
Founding	• IBRD • Agency for founding registration • Business plan approval programme • Business incubator • Angel	• SBMA • SBMA • SBMA • MOST, MOCIE, MIC, SBMA • MOFE
Growing	• Venture Capital • Technological support • Manpower support • Location support	• MOFE, MOST, SBMA • Policy funds of 6 ministries • Use of technology as security for loans • Stock option system • Temporary leave by professors and researchers • Consignment training programme • MOST, MOCIE, MIC, SBMA
Maturing	• KOSDAQ • Foreign Investment, listing on NASDAQ	• MOFE, SBMA • MOFE, SBMA

Table 2-V-3. Tax exemption

Tax	Exemption	Law
Corporate tax/ Income tax	• Tax shall be reduced by 50 per cent for the first taxation year following the date of creation of a firm and the same favour shall be applied until the taxation year which ends in five years from the beginning date of the taxation year after the first taxation year.	Article 6, Exceptional Taxation Restriction Law
Acquisition tax/ Registration tax	• One hundred per cent of acquisition tax as well as registration tax shall be exempted for the business properties acquired for the use of business incubator.	Article 280, Provincial Tax Law
Property tax/ Composite land tax	• 50 per cent shall be exempted for the business properties acquired for the use of business incubator.	Article 280, Provincial Tax Law

Articles 113 and 114 of the *Exceptional Taxation Restriction Law* and Article 280 of the *Provincial Tax Law* stipulate that 100 per cent of acquisition tax as well as registration tax shall be exempted for the business properties acquired for the use of business incubator. Article 115 of the *Exceptional Taxation Restriction Law* and Article 280 of the *Provincial Tax Law* stipulate that 50 per cent of property tax and composite land tax shall be exempted.

Also, the provincial taxes are reduced when a factory is built. New companies with the approval will be exempted from the development tax according to the *Recovery of Development Benefit Act*. The Article 2 of the *Special Act on Development of Agriculture and Fishery* and the Article 3 of the *Forest Act* stipulate that 50 per cent will be reduced from the arable land diversion tax and forest diversion tax, which usually comes to 20 per cent of the declared value by the Ministry of Construction and Transportation (MOCT).

Support measures for the business incubators differ according to the supporting ministries. MOCIE through SMBA assists business incubator in the following areas up to the 80 per cent of the required funds with the upper limit of 1 billion won, such as: (1) funds for the building or renovation of business incubation centre, (2) rental deposit and rents when a building is leased longer than 10 years to be used as an incubation centre, (3) expansion expenses up to 0.5 billion won when the composition of tenant firms require expansion of the centre, and (4) funds for the purchase of manufacturing, testing and measurement equipments.

MOST operates TBI/TIC, providing technological and financial support, and it cooperates with the Korea Technology and Banking (KTB) and venture capital firms to promote creation of companies by researchers and professors. MIC promotes the creation of start-ups by researchers in the government-endowed research institutions, by providing up to 50 million won, no more than 50 per cent of founding capital. MIC also promotes founding of venture capitals and venture investment clubs. It also assists the activities of college venture clubs.

2. Government's support

Business incubation in the Republic of Korea has been led by the Central Government. In particular, the SMBA and MIC played the central role. Also, there are TBI programme by MOCIE, MOST, Korea Culture and Contents Agency of the Ministry of Culture and Tourism (MCT), and BI programmes of the Provincial Governments. There are 355 business incubators and 4,723 tenant firms as of June 2002.

Table 2-V-4. Current status of BI designated by the Central Government

Designated by	BI			Tenant Firm
	Total	In operation	In construction	
SMBA	294	274	20	3 657
MIC	59	59	–	886
MCT	1	1	–	58
MOST	1	1	–	122
Total	**355**	**335**	**20**	**4 723**

Source: SMBA.

(a) SMBA

Even though the first business incubator, Ansan Business Incubator Centre, was established in 1993, it was not until 1998 that the number of BIs started to grow rapidly. There were 12 BIs designated by the SMBA at the end of 1997. However 18, 112, 98 and 35 new BIs were established in 1998, 1999, 2000 and 2001 respectively. 243 BIs are operated by universities or colleges and 18 BIs are operated by research institutes.

SMBA provides funds for the building or renovation of business incubation centre as well as funds for the purchase of equipments with the designation of BI. SMBA has been providing more indirect support to improve the incubation capabilities of BIs (table 2-V-5). Through the establishment of Korean Business Incubation Association (KOBIA), SMBA is promoting the better networking of BIs as well as the development of BI Manager training.

(b) MIC

MIC provides support to software start-ups through Korea IT Industry Promotion Agency (KIPA), with 7 Software Support Centres nationwide supporting 200 companies. This programme supports only the start-ups in software industry, within 2 years after the founding of the company.

Table 2-V-5. The budgets of BI programme of the SMBA
(Million won)

Project	1997	1998	1999	2000	2001	2002
Total	**3 400**	**8 868**	**55 994**	**49 526**	**29 166**	**29 725**
• BI establishment	2 077	7 414	53 611	47 400	22 771	22 200
• Operation expenses	1 323	1 454	2 383	2 126	6 395	7 525

It provides spaces, facilities and equipments needed for the development of software, information on new technology and management consulting service. Also, MIC provides support colleges and universities to establish and operate business incubator in the IT industry through IT/BI Programme. MIC is supporting 28 IT/BIs operated by universities, which are provided with funds for the establishment as well as operation for 3 years.

(c) MOCIE

BI programme by MOCIE is managed by Korea Institute of Industrial Technology Evaluation and Planning (ITEP). This programme provides funds for prototype production and commercialization, and it is more about financial support than business incubation. Originally, ITEP designated universities to operate TBI, and start-ups were to apply for funds through TBI. However, this programme was merged with the SMBA's programme. As the result, SMBA provides incubation service while MOCIE approves the grant of funds.

(d) MOST

The business incubation programme of MOST is managed by the High-Tech Venture Centre (HTVC) in KAIST. HTVC operates a business incubation centre and MOST provides funds for technology development to tenant firms in the HTVC/BI as well as BIs in the Daeduk Science Town.

(e) MCT

Korea Culture and Contents Centre was established in 2000 to provide business incubation to start up in culture industry such as game, animation and music industries. An incubation centre for creative animation was established with the space of 10,000 sq m providing high-priced equipment, technical support, information and data service and management consulting service.

(f) Provincial Governments

Starting with Seoul in 1995 and Dajeon in 1998, many provincial governments also operate business incubators. Seoul City established Seoul Business Incubator in Kangseo District and commissioned Seoul National University to manage it. Dajeon City established Dajeon Metropolitan City Business Incubator and manages it through Dajeon Metropolitan City Small and Medium Business Support Centre.

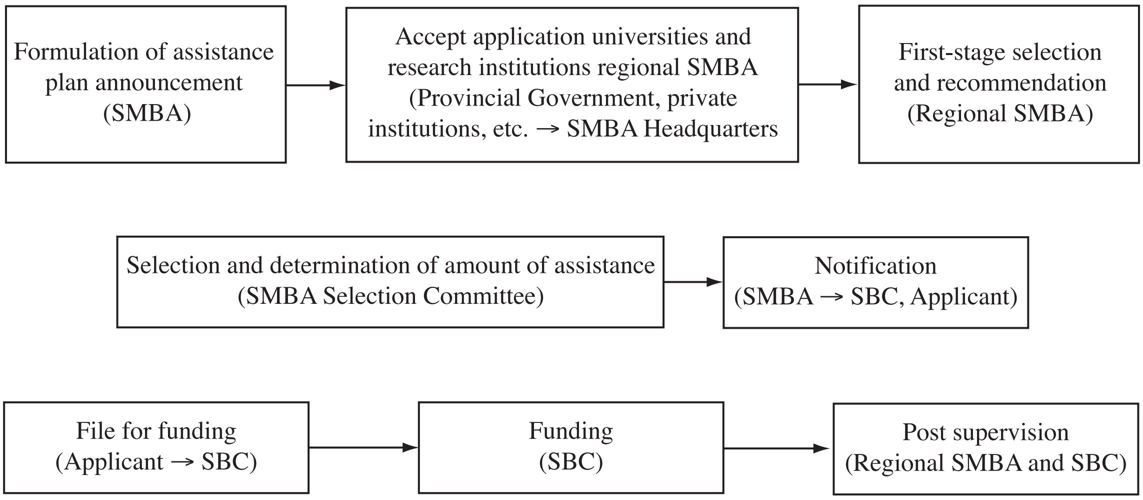
(g) KOBIA

The Government has shifted focus of support from large corporations to small companies, especially high-tech start-ups, due to the rapid change in the global environment in the 21st century as well as the experience of IMF rescue after the financial crisis. SMBA and other offices of the Government helped universities and businesses to establish business incubators.

In order to promote cooperation and mutual success, business incubators formed KOBIA, which shares information and members jointly participates on governmental projects.

KOBIA will promote and vitalize government-supported programmes by forming cooperation structures among regional business incubators, government and other support institutions. KOBIA will build database system and promote the sharing of technology, manpower, information and R&D equipments among regional business incubators. KOBIA will recommend venture supporting policies to the Government and build educational and research infrastructure for start-ups. KOBIA will form cooperation structures among regional business incubators, which are working to develop technology and venture start-ups, promote and vitalize government-supported programmes, build database system and promote the sharing of technology, manpower, information and R&D equipments among regional business incubators, with the eventual goal of contributing to the national economic development.

3. Process of incubator establishment



Source: Small Business Corporation (SBC).

4. Statistics of incubation

As of June 2002, there are 355 designated BIs (by SMBA, KIPA, MIC, MOCIE, MOST), and they are distributed regionally as shown in table 2-V-6.

Table 2-V-7 summarizes the regional distribution of business incubators, in which the incubators seem relatively concentrated around the Seoul Metropolitan Area and the Daeduk Science Town consisting of Seoul, Kyung-gee, and Dajeon/Choongnam, respectively.

Table 2-V-6. Annual designations of business incubators

Year	Before 1997	1998	1999	2000	2001	2002
Selected	23	63	182	287	333	355

Table 2-V-7. Classification of operators for business incubation by SMBA

Region	Seoul	Pusan/ Ulsan	Taegu/ Kyungbuk	Kwangju/ Jeonnam	Taejeon/ Choongnam	Kyung-gee	Incheon	Kangwon	Choongbuk	Jeonbuk	Kyungnam	Cheju
Selected	38	26	35	27	39	47	7	19	16	16	20	4

The business incubators can be classified as shown in figure 2-V-2 in terms of their operators. The business incubators in the Republic of Korea are mainly operated by universities, which can provide research resources and experimental facilities to help business start-up more efficiently.

The 57 per cent of Korean incubators specialized by technology and figure 2-V-3 shows the specialization ratio of incubators. Korean incubators determine specialization area, and try to incubate firms in specialized area, thereby contributing to the incubator, university, and the regional economy. Among the areas of specialization, 25 per cent chose software, while another 24 per cent picked IT.

Figure 2-V-2. Status of operators

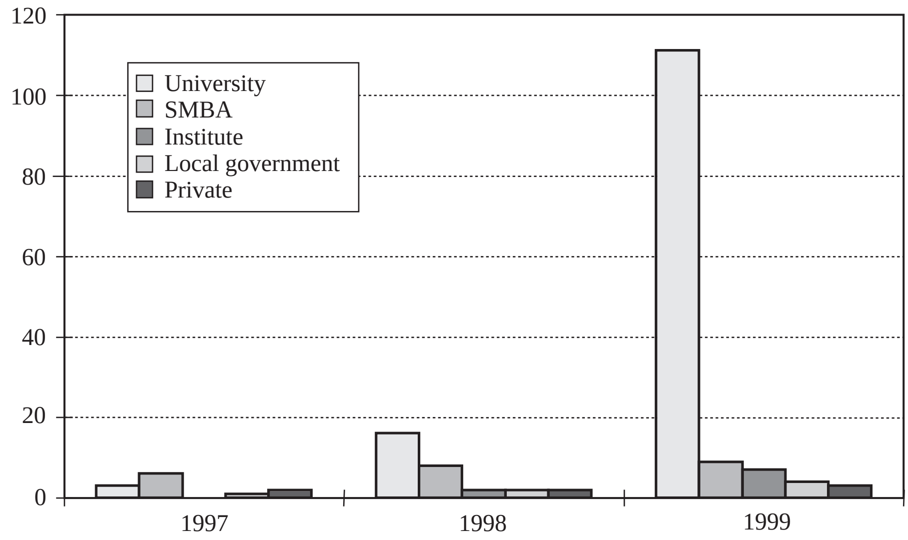
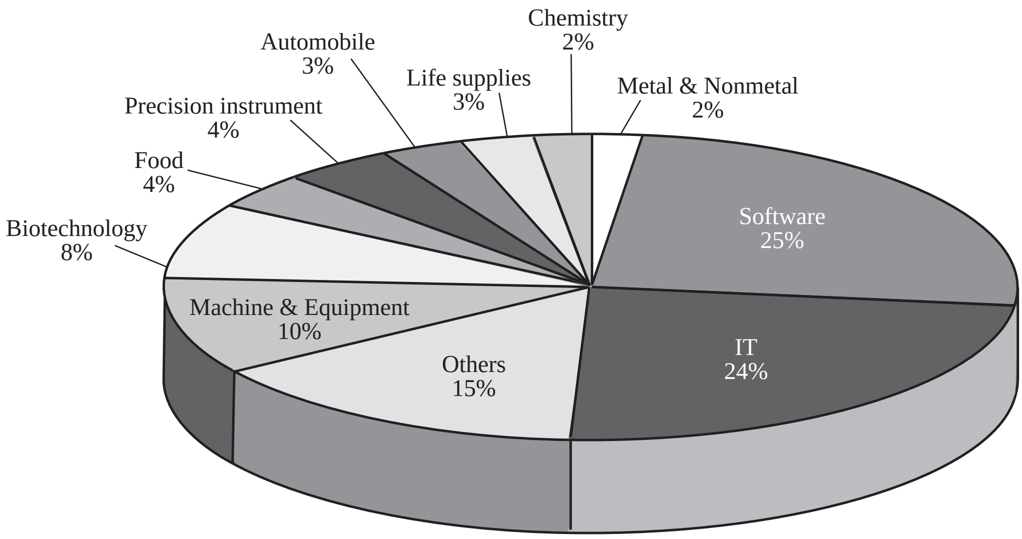


Figure 2-V-3. Classification of incubators



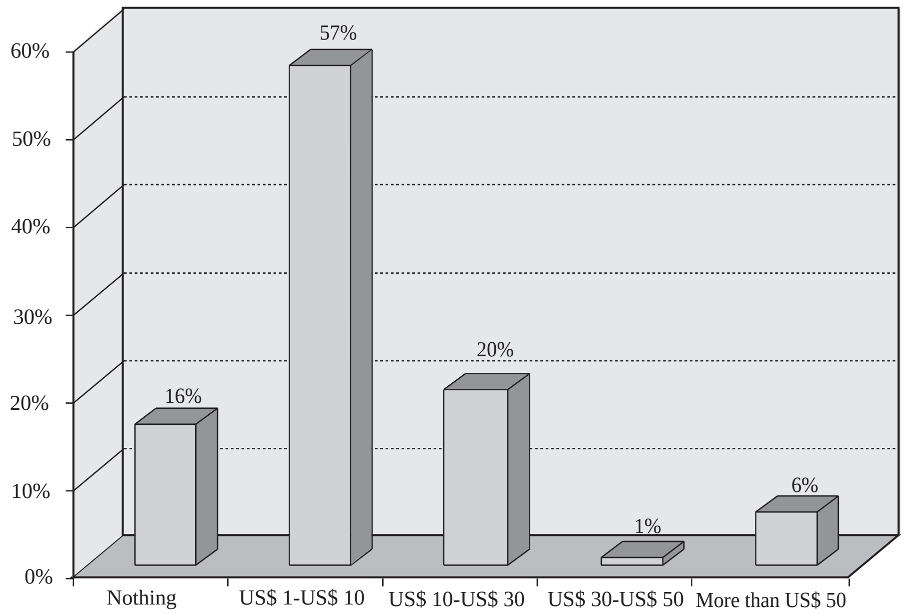
5. Conditions and services

Many of the business incubators now in operation tend to accept less than 2 year-old up starters or to-be-up starters. The averaged deposit per BI centre is US$ 71 per sq m and the averaged monthly rent is US$ 4.54 per sq m, indicating that office space is provided at a lower cost. As illustrated in figure 2-V-4, 57 per cent business incubators are surveyed to have a monthly rent of US$ 1-10 per sq m.

The business incubators in operation are surveyed to provide their tenants mainly with office space, but little of management, technical, marketing, and legal service. Still, it is found that those business incubators equipped with professional resources (e.g. BI managers) provide the systematic BI supportive services for their entrepreneurial companies.

BI Managers assist tenant firms utilizing inside infra- (technology support, management support, management training, etc.) and outside infra- (lawyers, certified public accountants, patent lawyers, management consultants) on market development and marketing, business strategy, funding, etc.

Figure 2-V-4. Distribution of monthly rent for business space



BI conducts regular interviews with tenant firms to find out their needs, and expel or force firms for early graduation that do not meet requirement after certain number of warnings. Table 2-V-8 summarizes incubator management systems.

Table 2-V-8. Incubator management systems

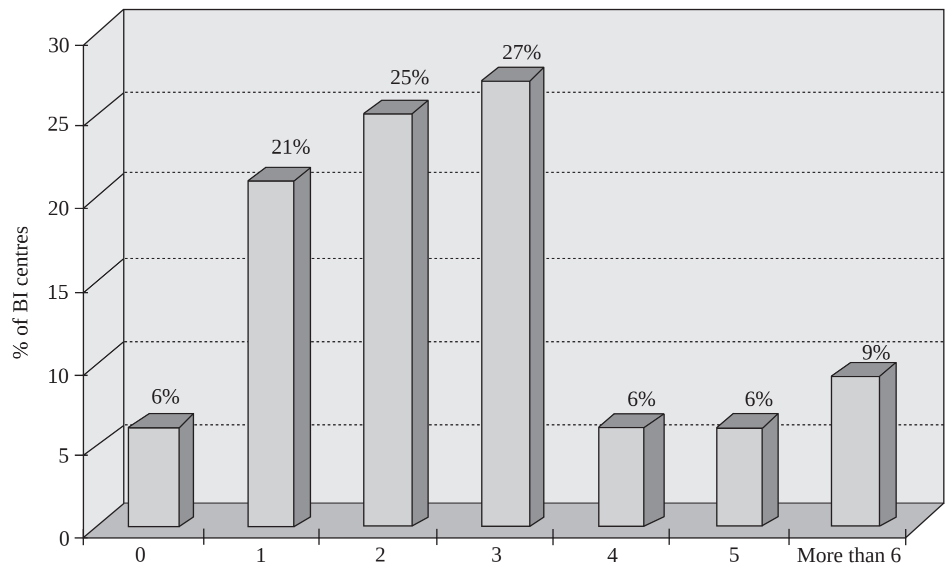
Rent	Fees	Length	Infrastructure	Assistances
• Monthly US$ 0-40 per sq m	• US$ 50-150 per month (Include of electrical charges, LAN fee, etc.)	• 1-2 years period renewable on request	• Inside infra: Many require specific equipment (computing, testing, rapid prototyping, manufacturing machine, etc.) • Outside infra: Lawyer, CPA, related institutions	• Hands-on management assistance • Access to financing • Business and technical support services • Business analysis and counseling

The current status of responsible workers employed in the business incubators is provided in figure 2-V-5 below. Greater achievements in BI works are shown to be made by the following business incubators who have human resources practically responsible for the works.

On the other hand, many of supervisors in the business incubators, including the directors, show the lack in expertise. There are some centres, which do not have manager designated or a systematic training and education programme implemented. Other centres provide their entrepreneurial companies with a certain type of incubator doctor system for technical support.

The use of exterior organizations for funding, accounting, legal, and patent consultancy is limited to a few universities. Other centres do not provide such services or consultancy.

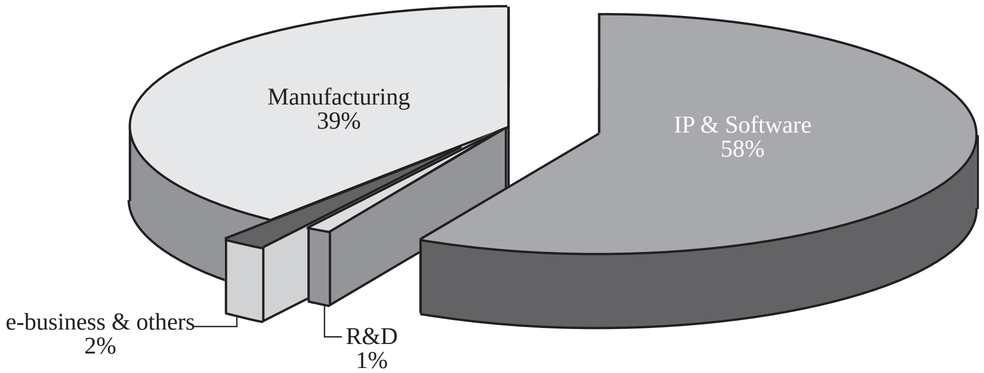
Figure 2-V-5. The number of staffs in a business incubator



6. Entrepreneurial companies

Among the entrepreneurial companies in these business incubators, as shown in figure 2-V-6, 39 per cent of the tenants are in the manufacturing sector, while the remaining 58 per cent are in the service sector including information provision and software development.

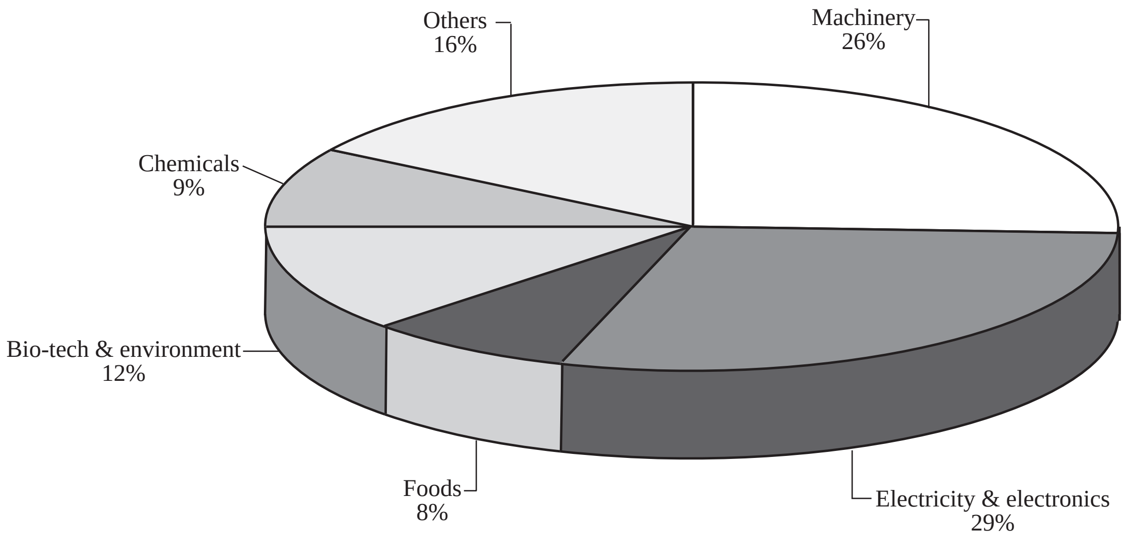
Figure 2-V-6. Business types of entrepreneurial companies in business incubators



By the year 2001, the status of incubation is as follows:

- The number of tenant firms: 3,657
- The number of companies graduated from incubators: 1,690
- The number of employees: 20,024
- Sales volume: US$ 540 million (average about US$ 2.06 million per incubator)

Figure 2-V-7. Business types of entrepreneurial companies in manufacturing sector



7. Economic effect

According to the operation evaluation of business incubators conducted by KOBIA from March to May 2002, the average number of tenant firms was 16 also, the average number of employees was 76.7, which means that each tenant firm has on average 4.7 employees. The success rate was 55.7 per cent, which is quite high considering the short history of incubators.

As shown in figure 2-V-8, 16 per cent of firms have sales volume of more than US$ 2 million. Also, 46 per cent of tenant firms have no sales revenue. With the support policies of the Government, the revenues are expected to grow rapidly.

Figure 2-V-8. Current sales of the business incubator

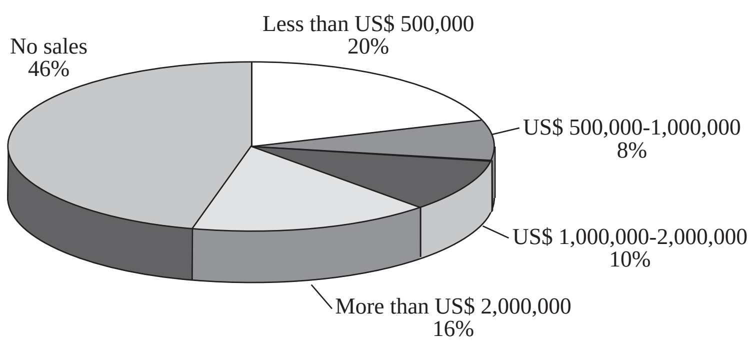


Table 2-V-9 shows the new firms' creation ratios (A:B) are rapidly increased from 3.4 in 1997 to 16.9 in 2001. It means business incubation support system was great influence on new venture creation and economic situation in the Republic of Korea.

Table 2-V-9. New venture creation ratio

Year	1997	1998	1999	2000	2001
New firms (A)	21 057	19 277	29 976	41 460	39 609
Bankrupt firms (B)	6 132	7 538	2 429	2 800	2 349
A:B	3.4	2.6	12.3	14.8	16.9

Source: Bank of Korea, Annual Report of Seoul, Busan, Daegu, Dajeon, Incheon, Kwangju, Ulsan, Pohang.

C. Case study: Business incubation at KAIST

KAIST HTVC, which was started in 1994 with the support of the Ministry of Science and Technology, is the first and the largest business incubator in the Republic of Korea. HTVC hosts 116 high-technology start-up companies (July 2002) and 3 companies for supporting fund raising, advertisement and education. Since 1994, 121 companies left HTVC.

Among them, 62 companies (51 per cent) successfully graduated, and 5 (4 per cent) are in KOSDAQ. Out of 116 companies in HTVC, 51 (44 per cent) are in the area of information technology (IT) and electronics. Total capital of all 116 companies is about US$ 48 million and 1,235 employees are working. HTVC offers consulting services to its tenants by employing 5 business consultants who visit HTVC every 2 weeks.

To join HTVC, a company should be a high-technology start-up and donate 1 per cent of its equities to KAIST. A start-up company can stay in HTVC up to 6 years (3 years of incubation and 3 years of post-incubation).

In 2001, there were 5 technology transfers and 11 joint research projects (US$ 1.7 million) between KAIST and HTVC companies. In addition, HTVC companies used KAIST equipment about 800 times in 2001. KAIST has been the source of knowledge, new technology and distinguished manpower in the Republic of Korea and will serve as the centre of venture network.

1. Environment for technology-based ventures business

(a) KAIST

KAIST is a research-oriented university founded in 1971 by Government of the Republic of Korea. It has about 400 faculty members, 4,000 graduate and 2,500 undergraduate students. KAIST was ranked at the top by *Asia Week*, which is an English magazine published at Hong Kong, China among Asian universities in 1999 and 2000. The main campus of KAIST is located at Daeduk Science Park in Dajeon, which is about 200 km. south of Seoul. Another campus hosting a business school is located in Seoul.

The funding for R&D at KAIST was about US$ 65 million in 2001, and about 20 per cent of its R&D fund were from industry. KAIST is a top-notched university in Asia and aims at a world-class research university in the 21^{st} century.

KAIST has emphasized the development of innovative technologies and entrepreneurship. As a result, there are about 300 technology-based ventures founded by KAIST graduates, and some of them are the most successful venture companies in the Republic of Korea.

(b) Daeduk Science Park

Daeduk Science Park was founded in 1971 as a research park in Dajeon located in a central region of the Republic of Korea. At present, there are 68 research organizations in Daeduk Science Park including 20 national research institutes, 25 industrial research centres, and 4 universities. In addition, Daeduk Science Park encompasses about 700 technology-based venture companies, which are mainly spin-offs from its research organizations.

The strength and weakness of the venture environment in Daeduk Science Park is as follows:

- It is easy to cooperate with research institutes;
- Good universities such as KAIST provide excellent graduates;
- Pleasant living environment;
- Daeduk Science Park is not close to Seoul in which major market is located;
- There is no world-class industry in the neighbourhood of the park.

2. Business incubation

KAIST/HTVC helps its faculty members and students start new technology-based ventures. In addition, it supports outside start-ups which are mainly spin-off companies from research institutes in Daeduk Science Park. Currently about 30 per cent of HTVC companies are from KAIST and the rest are from outside.

(a) Tenant company

Table 2-V-10 shows the number of tenants in HTVC since 1994. At the beginning, the number was 5, but it was increased to 135 in 2001. There is a sudden jump between 1998 and 1999. This happened because the Government strongly promoted high-technology ventures in 1998, in an effort to overcome the difficulty in the economy, and supported HTVC to incubate additional companies. Since 1998, SMBA started to give certificate to qualified-ventures (such certified-ventures have some benefits in taxation, funding, etc.), and 50 per cent of HTVC companies were certified by SMBA.

Table 2-V-10. Number of companies in HTVC

	1994	1995	1996	1997	1998	1999	2000	2001	July 2002
Residents	5	15	17	23	39	118	128 (77)	135 (71)	116 (53)
New tenants	5	10	4	8	24	89	31	43	23
Graduate and drop	0	0	2	2	8	10	21	36	42

Note: ( ) Represents number of government certified ventures.

Table 2-V-11 shows some numbers of interest. Since 1994, HTVC has supported a total of 237 companies, among which 121 companies left and the rest are currently with HTVC. Out of 121 companies which left HTVC, 62 companies successfully graduated (51 per cent) and 5 companies are listed at KOSDAQ. It is noted that the rate for successful graduation is not sufficiently high. One reason why this happened is that some companies that were not qualified-ventures joined HTVC during 1998-1999 periods, when HTVC was expanded considerably (Table 2-V-10).

Table 2-V-11. Some numbers of interest

Total (1994-2002)	Left HTVC	Successfully graduated	In KOSDAQ
237 companies	121 companies	62 companies	5 companies

For listing at KOSDAQ, our companies needed at least 3 years: one company named NeoWiz, which provides Internet solutions, was founded in 1997 and listed at KOSDAQ in 2000. It appears that the rapid success of NeoWiz is due to Internet booming in the Republic of Korea. All five companies in KOSDAQ (IT Inc., IDIS Co., NeoWiz Co., Incom, GC-Tech) are in the areas of IT and electronics (high-speed data transmission equipment, digital security monitoring equipment, internet solution and games, etc.). It is expected that 2 additional HTVC companies will join KOSDAQ in 2002.

Table 2-V-12 shows business areas of the tenant companies. Note that 44 per cent of the companies are in the area of IT/electronics that has the largest market. The total capital of 116 companies is about US$ 48 million. These companies employ a total of 1,235 employees.

Table 2-V-12. Business areas of the current tenants

Areas	IT/ Electronics	Semiconductor/ Materials	Energy/ Environment	Bio/ Medical	Machines	Other	Total
Numbers	51	18	16	15	9	7	116
Per cent	44	16	14	13	7	6	100

(b) Services provided by HTVC

HTVC offers the following services:

- *Space:* There are two independent buildings (10,000 sq m) for companies. The rental fee for incubation is about 50 per cent of outside buildings. A start-up company can stay up to 6 years (3 years of incubation and 3 years of post-incubation).
- *University facilities:* Libraries and gym can be used without extra charge. Computer network is provided with a minimal change. University research equipment can be used at actual expense (in 2001, tenant companies used KAIST research equipment about 800 times).
- *Consultation and support:* Companies can get free consulting services from 5 business consultants who visit HTVC every 2 weeks. HTVC provides its companies with some funds for technical consultation and for joining an exhibition.
- *Education:* A lecture regarding venture business is presented by experts every 2 months. The graduate school of management at KAIST offers the Advanced Venture Management (AVM) programme.
- *Supporting companies:* There are 3 companies in HTVC that can help ventures. They are a venture investment, an advertisement and a cyber-education companies.

(c) Cooperation with KAIST

To join HTVC a company should donate 1 per cent of its equities to KAIST. In turn, KAIST provides the services stated above. Table 2-V-13 shows the number of technologies transferred from KAIST to tenant companies and the number of research projects jointly performed between KAIST and the companies. These numbers and the fact that HTVC companies used KAIST research equipment about 800 times in 2001, indicate that there is an active cooperation between KAIST and HTVC ventures.

Table 2-V-13. Technical cooperation with KAIST

Number of technology transfers		Number of joint research projects	
2000	2001	2000	2001
2	5	22	11 (US$ 1.7 million)

3. Evaluation and future development

These days, KAIST/HTVC is trying to enhance its services by building networks, named KAIST Venture Network (KVN) and HTVC Brain Network (HBN). KVN connects about 800 KAIST-related ventures and HBN consists of outstanding business consulting companies. These networks should help HTVC companies obtain valuable information about marketing and management.

It is believed that business incubation at KAIST has been reasonably successful. This is due to the following factors.

- *Strong government support:* HTVC provides with its companies various cost-free services and furthermore some funds for consultation and exhibition. These services have been possible due to strong government support to HTVC.
- *Technical cooperation with KAIST and other research institutes:* Collaboration between HTVC companies and research organizations in Daeduk Science Park has helped develop new products.
- *KAIST graduates:* Many KAIST graduates naturally joined HTVC companies. KAIST has been a source of outstanding manpower.

D. Conclusions and recommendations

1. Factors of successful ventures

The success factors of venture in the Republic of Korea such as business item, start-up team, ledge market, outsourcing, and entrepreneurship.

(1) Business item

The successful companies must have the income and growth model of business. During the last several years, Internet, information and telecommunication, and semiconductor industries expanded their market volumes and therefore any related items get the better sales volume. Market entry of new technology provided a lot of opportunity for engineers or technopreneurs to reduce the risk. In 2000, bioventure companies were attracted by venture investors.

(2) Strong team of start-ups

Start-up team must have not only business mind and professional attitude, but also unity and common goal. Entrepreneur should be open-minded, and may have a better distribution of benefits and maintain the partnerships.

(3) Ledge market

Ledge market, of which large companies cannot take the merit, is the main target of venture, but the stability and success opportunity of the initial stage would be increased if blessed by large companies.

(4) Outsourcing

All the venture companies need also supply the resources for products and employ them efficiently and cost-effectively. The small companies, however, cannot have all of necessary resources, but it is supplied by outsourcing even all the human resources and facilities.

(5) Entrepreneurship

The entrepreneur must have the desire, leadership and vision of business as well as the technology foresight. The leadership is very important to make the uncertain project successful.

2. Policy recommendations

In the Republic of Korea, several ministries are involved with the business incubation, and as the result, there has been duplicating investments. It will be better for one ministry providing support for the business incubation.

The Republic of Korea aims for the establishment of business incubators for the high-tech companies. However, as a still developing country, the Republic of Korea may be better off to establish business incubators for simple processing technology as well as incubators for high technology.

It is essential to secure and train BI managers from the start of business incubators.

Support for business incubator should be stepwise such as securing incubation space and infrastructure, operation expenses, and funding of tenant firms. Also, the business incubator should seek financial independence after 5 years.

It is more desirable to establish business incubator in cooperation with universities or research institutions with the research and development capabilities. Business incubators should specialize according to their operators.

3. Lessons of experience

Because majority of BIs in the Republic of Korea are in the infant stage, there are many rooms for possible improvement. Based on the identified problems faced by BIs, following policy directions are suggested:

First, for the activation of BIs, several supporting activities for tenant companies such as management and technical advisory services should be strengthened by broadening the scope of services offered and hiring eligible incubator managers.

Second, management systems for BIs should become professional. Screening process to select new tenants should be improved by inviting external experts in the committee and by emphasizing business opportunities rather than technical performance as screening criteria. Also new investment mechanisms between BIs and tenants can be devised. For example, BIs can invest to tenants and tenants can pay stock option instead of rent.

Third, specialized BIs in term of tenants' business areas can be more effective by providing business-specific supports and increasing synergy among tenants. Therefore the government or government agencies should promote establishment of specialized BIs relevant to regional characteristics.

Fourth, many cases of successful incubation – success stories of tenant companies during incubation and after graduation – should be developed and publicized to encourage new venture creation of potential entrepreneurs and to attract many capable tenants into BIs.

Fifth, incubation activities should be linked to support mechanisms for potential entrepreneurs before founding and growth companies after graduation. For potential entrepreneurs, BIs can provide several services such as business planning guide, information providing, space rental such as preliminary moonlighting incubator, and training services. For growing companies graduated from BIs, STIPs or technology parks can accommodate them so that they can contribute to regional economic development and job creation by utilizing benefits of STIPs.

Sixth, networking among BIs is very important as an arena to exchange information and management knowledge. For example, the role of KOBIA can be activated based on the benchmarking of NBIA of the United States.

Seventh, BIs should be served as the framework to strengthen university-industry cooperation and to activate spin-off from universities, industries, and research institutes. In addition, globalization of BIs through international cooperation with incubator in the world should be promoted to support the entry of tenants into foreign countries.

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PART THREE

COUNTRY PRESENTATIONS

I. PROMOTING BUSINESS AND TECHNOLOGY INCUBATION FOR IMPROVED COMPETITIVENESS OF SMALL AND MEDIUM-SIZED INDUSTRIES THROUGH APPLICATION OF MODERN AND EFFICIENT TECHNOLOGIES IN BANGLADESH

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A. Introduction

The SMEs play dominantly important role in the national economy of Bangladesh by making up over 90 per cent of industrial enterprises, providing employment to 4 out of 5 industrial workers and contributing to over one-third of industrial value-added to GDP. The relative SME share in manufacturing value-added is much higher and estimated to vary between 45 to 50 per cent of total value-added generated by the manufacturing industries sector. Further as important sources of new business creation and developing new entrepreneurial talents, these industries provide the much needed dynamism and vitality to the national economy.

However, as is well known, the SMEs because of their scale barriers and liquidity problems suffer from various operational constraints of which technological backwardness, low technical efficiency, low labour productivity and limited market access are most serious. These in turn impede their competitive strength and sustainable growth. These problems are likely to be further aggravated by the competitive challenges globalization and the freer trading regime which throw the SMEs in the midst of risks and uncertainty of the fiercely competitive national and global markets. It is thus imperative that these industries should achieve a reasonable level of technological standards and competitive strength to withstand challenges of the global market and survive and grow in a much more uncertain and unstable business environment both at home and abroad. This underscores the rationale and importance of the present study which is devoted to analysing the need for enhancing the technological capabilities and market competitiveness of the SMEs in Bangladesh through promoting business and technology incubation systems. As a prelude to the analysis of this main theme, we set to provide a brief review of the economic profile and technological situation of Bangladesh.

1. The Bangladesh economy

The Bangladesh economy is currently at cross-roads cruising along the twentieth century and entering the twenty-first where a globalized world economy offers many opportunities and throws as many challenges to the Bangladesh economy. To meet the new competitive challenges and take advantage of the new market opportunities arising from globalization, the economy must build higher technological capabilities, achieve higher technological and product standards, and develop new technology and knowledge-intensive industrial enterprises. The most immediate and difficult challenge facing Bangladesh is to graduate from the status of a low-income to a middle to high-income country by achieving a higher rate (7 to 8 per cent per annum) of economic growth on a sustained basis over a long period of time. This is required to exit from the endemic poverty which is still widespread as nearly half (roughly 63 million) of the country’s population remains below the poverty line and suffers from social deprivations.

Recent growth performance of the Bangladesh economy

There has been a spate of studies (Bhattachariya 2001, Mujeri 2001, I.R. Rahman 2002) on the GDP growth in Bangladesh, most of which have shown an accelerated pace of GDP growth in the country during the last decade.[1] In terms of GDP growth the performance of the Bangladesh economy has shown perceptive improvements in the 1990s compared to seventies and eighties. Under the market oriented economic regime, the GDP growth achieved by the country improved from 3.5 per cent in the 1980s to 4.8 per cent in the 1990s. The average annual GDP growth rate improved further during the second half of the 1990s, and averaged 5.5 per cent per annum. Estimating the trend rate of growth of GDP during 1986-2001 (divided into three sub-periods) I.R. Rahman (2002) confirms an acceleration of the GDP growth rate, which increased from 2.51 per cent during 1986-1991 to 4.5 per cent during 1991-1996 and to 5.29 per cent during 1996-2001. Besides moderate GDP growth achieved with considerable microeconomic stability,[2] Bangladesh also achieved notable success in many micro aspects such as high rates of literacy, life expectancy at birth, decline in infant mortality, increase in primary enrolment, child immunization and female empowerment, etc. These are positive improvements but

[1] A.R. Khan (2001) however, expresses reservations about the optimism for high growth and cautions that the expected acceleration may not be real.

[2] For example, the rate of inflation has been quite low throughout the second half of 1990s, hovering around 3 per cent. Recently the inflation rate has declined to as low as 1.58 per cent, with the corresponding point to point figure being 1.66 per cent despite uninterrupted high monetary growth (Bhattachariya 2002).

more needs to be done to achieve the momentum of a continued high growth and prosperity for the common people. In order to sustain the acceleration in the GDP growth a favourable change in sectoral composition of GDP is required whereby the importance of primary production will decline and that of the industrial and service sectors will expand. The rationale behind this expected structural change is clear. The manufacturing and the tertiary sectors offer prospects of a continuous high rate of economic growth propelled by technological progress and higher productivity. We discuss the pattern of sectoral growth next to see whether a desirable structural change is taking place in the Bangladesh economy.

2. Pattern of sectoral growth

(a) Agriculture

Despite having vulnerability to fluctuations due to dependence on nature, the recent growth performance of the Bangladesh economy has been largely driven by the robust growth in the agriculture sector during the second half of the 1990s. The average agricultural growth rate during fiscal year 1996-2000 stands at 4.9 per cent and has continued to remain the highest average growth rate for any five years since independence. However, agriculture's performance still centres round food grains as nearly two-thirds of the sector's value added comes from cereal production. Rapid diversification and growth of non-farm activities thus remains an important challenge.

(b) Manufacturing

The growth in the manufacturing industries sector has been more unstable and erratic than that in agriculture. The sector recorded an annual compound growth rate of 8.20 per cent in the first half of the 1990s which sharply declined to 4.25 per cent during 1996-2000. Further, the growth rate of the sector is still narrowly based on a handful of industries, especially export oriented ready-made garment (RMG). The export industries also faltered during the second half of the 1990s due to a variety of external factors and a revival of overall manufacturing growth to its normal levels is poised to be a long and arduous task.

(c) Services sector

Another important feature of the recent growth process of the Bangladesh economy is the high growth of the services sector throughout 1990s. Except real-estates, all other service components have experienced steadily high growth in the range of 5 to 6 per cent.

(d) Structural change

A modernizing structural transformation of an economy is generally reflected in the rising share of manufacturing industries in the GDP and a declining share of agriculture. As expected the share of agriculture in GDP had been falling, though slowly, throughout 1990s (i.e., from 29.2 per cent in 1991 to 25.6 per cent in 2000). On the other hand, the share of manufacturing sector increased marginally during the same period (i.e., from 12.9 per cent in 1991 to 15.4 per cent in 2000). While this is indication of a small redistribution in the sectoral shares of GDP between agriculture and industry the continued dominance of the service sector (49.7 per cent in 1991 and 48.9 per cent in 2000) in a developing economy is not a very healthy sign of the prospects for sustained long-term growth and dynamism.

(e) Domestic savings and investment

The sustainable growth of an economy is based on an acceleration of domestic savings and investments. Higher rate of domestic savings leads to increase in investment which in turn sets in motion the self-reliant economic growth. The gross domestic savings as percentage of GDP displayed an impressive growth from 13.1 per cent in 1995 to 18.8 per cent in 2001. A similar trend has been displayed by gross investment as per cent of GDP which recorded an impressive rise from 16.9 per cent in 1991 to 23.6 per cent in 2001. The incremental growth in investment throughout 1990s is attributed primarily to surging average private investment, which as percentage of GDP rose from 11.2 per cent in 1991/1995 to 14.7 per cent in 1996/2000. The uneasy feature in the savings-investment scenario is that both the macroeconomic variables widely fluctuate and appear to be irreconcilable with growth performance and other macro-aggregates. But as is well known, a sustained higher and increasing growth is critically dependent upon increased levels of higher and quality investment. The most recent deceleration in the growth of investment from 10 per cent in 1997/1998 to 8 per cent in 1998/1999 is attributed to a decline in manufacturing investment, which exhibits shortfall in investment demand and possible deceleration in long-term growth.

(f) External sector

Trade policy reforms and liberal export-promoting incentives and support measures played significant role in boosting the performance of the Bangladesh's external sector since mid 1980s. There has been spectacular growth of the export sector throughout nineties with the average growth rate increasing from 9.2 per cent in the 1980s to 14.7 per cent in the 1990s. The share of foreign trade in GDP increased from 17 per cent in 1989/1990 to over 29 per cent in 1989/1999. The export to import ratio increased from 31 per cent in 1991 to 67 per cent in 2000. The robust export performance has, however, been propelled primarily by the spectacular growth in apparel exports resulting in a degree of dependence of the export trade of over 70 per cent on a single commodity. Thus lack of both commodity and market diversification has exposed vulnerability of the export sector to external shocks, when the export growth rate slummed to under 3 per cent due to 1998 floods and failed to bounce back to the previous heights during the post-flood years due to global recession and arbitrary trade preferences practised by the United States. The recent export shortfall due to negative growth experienced by RMG exports (-11.38 per cent and -8.03 per cent by woven and knit garments during July-December 2001) is a glaring. This is putting pressure not only on the balance of payments but also on the overall economy. It is thus imperative that there must be significant improvement in the trade augmenting incentives and enterprise level capabilities to take advantage of great market access opportunities in the global market.

This brief review of a selected set of economic indicators suggests that the overall performance of the Bangladesh economy has been encouraging in the 1990s. However, at the prevailing low level of per capita income, widespread unemployment and underemployment, mass poverty and deprivation, the recent economic performance does not provide any room for complacency nor does it assure its long-term sustainability. While sustainability of a higher growth path would require actions on many fronts (i.e., prudent macroeconomic management, stable internal and external balances, removal of infrastructural bottlenecks, etc.), Bangladesh needs to substantially raise her technological capabilities, acquire new technological knowledge and innovations, increase enterprise level productivity and efficiency and competitive strength in order to take advantage of the global market opportunities.

While technological changes and improvements play pivotal role in raising productivity and boosting economic growth and thus contributing to the generation of corporate or national wealth, lamentably the most neglected factor of growth in Bangladesh is technology. This issue is explored next in the subsequent sections of the paper.

3. Technological situation in Bangladesh

Once considered an unexplained "residual," technology has gradually emerged as the driving force behind modern economic growth and development. The unexplained residual makes substantial contributions to productivity growth via its influence on technological changes, economies of scale, human skills and efficient allocation of resources. While R. Solow's pioneering study in 1956 brought the role of technology in economic development at the forefront, a spate of studies (E. Mansfield 1986, E. Division 1974) since then have convincingly demonstrated that technological innovations and advances in knowledge accounted for as much as half of the increase in national output in the major developed countries. The developed countries have consciously built and constantly improved their technological capabilities by investing heavily in R&D activities, which have helped them to achieve their present stage of economic strengths and affluence. While most of the developed countries spend roughly 2 to 3 per cent of their GNP on R&D activities, the proportion is only 0.2 to 0.8 per cent in the developing countries. In absolute terms, a developed country is reported (BCSIR, 1997) to spend on average 40 times more on R&D activities than a developing country which has enabled them to continue to occupy a dominant position in the world of S&T.

In order to redress the widening gap between the developed and the developing countries in respect of science and technological capabilities, control over worlds resources and wealth and standards of living, the

United Nations Conference on Science and Technology for Development (UNCSTD) convened in Vienna in 1979 worked out measures (known as the Vienna Programme of Action) urging the developing countries to formulate S&T policies, set up institutional machineries and allocate increased funds for enhanced R&D activities.

Increased technological competence of the developing countries has turned into a compelling dimension in the context of changing world market conditions resulting from globalization where high levels of technological capability has become a critically important determinant of international competitiveness and structural modernization of the manufacturing enterprises. In the presence of deregulation, privatization and increasing global market competition technology has emerged as the dominant force determining market access, market shares and human development as well as economic and social programme.

Thus in pursuance of the Vienna Programme of Action as well as recognition of the innate strength of S&T to stimulate economic growth and raise social welfare of the people, the developing countries are currently paying increasing attention to the use and application of technology for development. Bangladesh has been no exception to this trend since formulation of S&T policies and building of institutional capabilities are being emphasized and sponsored by the Government to enhance scientific and technological competence of the country. We turn to briefly review the current situation in this respect.

(a) National commitment to S&T development

Implicit recognition to the role of technology in economic development is made in the Fundamental Principles of the State through Articles 15 and 16 of the Constitution of Bangladesh by emphasizing the importance of increase in the productive forces and transformation of the rural economy through agricultural revolution, provision of rural electrification and development of rural industries. However, the first systematic attempt towards formulating a national policy for S&T was made only in 1980. The draft National Science and Technology Policy (NSTP) having ambitions objectives, investment targets and changes in the organizational aspects could not obtain support from all concerned stakeholders and were thus abandoned. Consequently, fresh efforts were made to formulate a more appropriate and comprehensive NSTP a draft of which was circulated by the Science and Technology Division which is presently the Ministry of Science and Information and Communication Technology (MSICT). The draft was approved by the National Committee for Science and Technology (later renamed as the National Council for Science and Technology or the very high-powered NCST). In February 1983, a new NSTP was announced with the broad objective of attaining scientific and technological competence and achieving self-reliance.

In order to ensure effective application of S&T for national development, integration of science and technological considerations with the overall development strategy of the country is accorded high priority in the NSTP. The detailed application of S&T for accelerating the pace of development is dependent on a comprehensive and coherent NSTP, which will emerge, based on a number of major components, manifesting the important aims and objectives of the NSTP.[3]

One of the twelve major elements of the NSTP was the establishment of national capability for development of indigenous technology and attainment of a national capacity for assessment, selection, acquisition, adoption and adaptation of foreign technology. While the technology policy was envisaged to cut across different policy areas and different sectors of the national economy and society, the basic objective of the policy was geared to the development of indigenous technology and efficient assimilation of imported technology. However, despite good intentions the NSTP aims and objectives remained unmet and the country continued to suffer from the consequences of low levels of technological development. Lack of close integration of technology planning with national development plans, lack of allocation of adequate resources for technological development, absence of necessary legal support and above all lack of serious national commitment towards technological development are considered as the major barriers to Bangladesh's technological progress. The implication is that technology has not been seriously linked to the development process as a strategic variable and other priorities took precedence over technology whenever a choice between alternatives confronts the planners.

The ambivalence of the successive Governments towards bringing technological development at the centre stage of the development process is clearly reflected in the meagre allocation of resources for the development

[3] Details on the aims, objectives and strategies are available in Government of Bangladesh, National Science and Technology Policy 1986.

of the S&T sector. This is suggested by the data presented in table 3-I-1, which shows the percentage shares of the S&T sector in the total public sector outlays of the various Five-Year Development Plan. It will be noted that contrary to a priori-expectation the share of the S&T sector in the total public sector outlay continued to decline overtime and suffered from resource constraints. Besides paucity of resources, the policies, incentives and institutional infrastructures required to develop a strong technological base are also considered weak and inadequate.

Table 3-I-1. Percentage of financial allocations for science and technology during successive Five-Year Plan

Plans	Allocation for S&T (Tk in million)	Percentage of Total plan outlay
1st Plan (1973-1978)	223	0.58
Two-Year Plan (1978-1980)	392	1.20
2nd Plan (1980-1985)	1 290	1.16
3rd Plan (1985-1990)	600	0.24
4th Plan (1990-1995)	540	0.16
5th Plan (1997-2002)	5 051	0.58

Source: Five-Year Development Plan, Ministry of Planning, Government of Bangladesh.

(b) Technology infrastructure, technology climate and technological capability of Bangladesh

It is commonly agreed that little progress has so far been made in Bangladesh in education, research or development of indigenous technological capabilities. While educated and skilled manpower provide the basic foundations for technological progress, our human resource development efforts have been basically geared towards promotion of liberal arts than science and technological subjects. For example, out of a total 76,499 students enrolled in ten functional public universities in the year 2000 only about 41 per cent were enrolled in science and technology subjects.[4] Correspondingly, the share of technical education in the national development budget for the education sector is also negligible as it is estimated (K.N. Islam 2001) to be around 3 per cent.

The overall R&D infrastructure in the country is also weak and R&D activities in the universities are limited. The research works carried at the universities are funded mostly by the University Grants Commission (UGC) and relate to student thesis and limited research projects undertaken by the faculty members. While small number of research projects are also sponsored by donors and other sources their number is limited and varies from year to year. Of the total financial (Tk 339.75 crores) grants received by the twelve public universities from the UGC during fiscal year 1999-2000 only Tk 3.1 crores or 0.8 per cent constituted research grants (UGC 2001).[5]

Thus, the funding of research at the higher education levels is very meagre and highly variable between year to year. In addition to meagre funding, there is critical shortage of technically qualified manpower in the universities which is further aggravated by the problem of brain drain (K.N. Islam 2001).

The formal technical education offered by the Vocational Training Institutes (VTIs), Technical Training Centres (TTCs), polytechnics and monotechnics, and the Bangladesh Institutes of Technology (BIT) also suffers from various shortcomings. The upgradation of faculty standards, laboratory facilities, teaching curricula and instruction materials is hampered by funds constraints and lack of initiatives. The courses offered are in most

[4] In fact, a declining trend is noticed in the enrolment of the students opting for science education at various levels. For example, while the percentage dropped from 44 per cent in 1991 to 27 per cent in 1995 at SSC levels, only 14.6 per cent enrolled for science at HSC levels and 5.3 per cent at the degree levels in 1993. (Z.R. Chawdhury 2002)

[5] In order to reduce the gap between allocation of funds and requirements for R&D funds of the scientific community, the budget head for R&D was separated from the total budget allocation since 1997 and the MSICT arranged to allocate a special grant of Tk 12.00 crores every year from revenue budget since 1997-1998 in addition to general allocation for research for the universities and R&D organizations. This is a welcome change in government attitudes towards encouraging science technology development in the country.

cases traditional and not designed to meet the changing requirements of the industry and the job market. All these combined with the problem of brain drain contribute to the shortage of technically qualified and competent scientists, engineers and skilled technicians.

(c) Research and development organizations

A well-organized and adequately funded and equipped research organization network is an important prerequisite for effective functioning of the R&D set-up in any country. According to the latest available Bangladesh National Scientific and Technical Documentation Centre (BANSDOC) survey (BANSDOC 2001) on the research organizations, 73 research and development organizations (including the science department of various universities) are engaged in R&D activities in the country.[6] The absence of an organized and well-planned research management system is noted by the researchers (K.N. Islam and other 1999, K.N. Islam 2001 and ADB 1989) as a serious limitation affecting most such R&D organizations. As a result, except in agriculture, the research efforts are uncoordinated, fragmented and generally unrelated to the long-term development objectives and needs of the country. Research activities in the agricultural sector are coordinated by an umbrella organization, the Bangladesh Agricultural Research Council (BARC) which plans, funds and coordinates research activities of its component organizations. It also carries out regular review and assessment of the research outputs of the different agricultural research organizations. On the contrary, due to lack of effective programme planning and review mechanism, the research projects undertaken in the R&D organizations of the country are not subject to any formal techno-economic evaluation. Though overall S&T planning and effective coordination of activities of different R&D institutions has been stressed by the national planners, there has been a lack of direction in guiding the R&D activities towards short and long-term goals. Even in the pioneering research organizations like Bangladesh Council for Scientific and Industrial Research (BCSIR) and the Bangladesh Atomic Energy Commission (BAEC), absence of comprehensive research programme planning has been a critical problem for a long time with the research projects being selected and carried out on the basis of judgment, choice and specialization of the individual researchers (ESCAP-UNDP Forum, 1989). There has also been lack of coordination and synchronization between S&T planning and national development goals between R&D institutions and industries which has led to limited transfer of research results to the potential users in industries and other potential users. As a result, the research findings or newly developed technologies did not reach beyond the premises of the research organizations. Another shortcoming has been the absence of satisfactory linkages between the universities and the industries. Consequently, the local industries continued to remain satisfied with the know-how of imported technologies and did not take any serious initiative to gear up their won R&D activities.

In addition to lack of planning and coordination, the R&D organizations also suffer from the shortage of manpower and allocation of funds. As will be noted from table 3-I-2 based on the manpower data of 73 research organizations including 10 universities only 3.3 per cent of the R&D organization staff had Ph.D. in 1997. Though the proportion was relatively high (31 per cent) in the universities, the R&D organizations including those of the universities had only 8.2 per cent of their total manpower with Ph.D. Unfortunately, this is the category which is most badly affected by the problem of brain drain, aggravating the problem of shortage of competent scientists, engineers and technicians.

Table 3-I-2. Human Resources in R&D Organization and Universities in Bangladesh, 1997

Academic levels	R&D organizations		Universities		Total	
	No.	%	No.	%	No.	%
Ph.D.	458	3.3	924	31.0	1 382	8.7
M. Phil/M.Sc.	586	4.1	256	8.6	824	4.9
Post-graduate	1 433	10.5	547	18.6	1 980	11.9
Graduate	1 623	11.8	288	9.7	1 911	11.5
Technical	3 606	26.4	219	7.4	3 825	23.0
Non-technical	5 970	43.7	737	24.8	6 707	40.0
Total	**13 658**	**100.0**	**2 771**	**100.0**	**16 627**	**100.0**

Source: K.N. Islam 2001.

[6] A list of major R&D organizations is put in Appendix 1.

In an environment of overall stringent resource position at the national levels, the R&D institutions continue to suffer from resource constraints. The national R&D expenditure as percentage of GDP shown in table 3-I-3 clearly demonstrates the paucity of funds available for R&D activities. The situation appears to be worse when we compare Bangladesh's position in this respect with other countries in the region. For example, Japan and other East Asian countries are reported (Government of Bangladesh, undated) to spend 2.3 per cent of their GDP on R&D activities. This percentage is 0.5 for China and 0.6 for India.

Table 3-I-3. Resource availability for S&T and R&D expenditures

Year	S&T expenditure as % of GDP	R&D expenditure as % of GDP	R&D expenditure as % of total S&T expenditure
1994/1995	0.24	0.01	5.93
1995/1996	0.19	0.01	7.84
1996/1997	0.18	0.01	7.85
1997/1998	0.24	0.02	8.54
1998/1999	0.24	0.02	8.54

Source: K.N. Islam 2001.

While funding of the R&D institutions is met entirely from the public exchequer, no specific provision is made for R&D activities. Consequently, very little is left for R&D activities after meeting the revenue expenditures. In tandem with high priority attached to national technological development, the 1986 S&T policy has set a higher target for R&D expenditure at 1 per cent of the GDP. However, the situation is not likely to improve much without private participation in the funding of R&D activities which runs up to as high as 80-90 per cent in countries like China; the Republic of Korea and Taiwan, Province of China. This is critically dependent upon effective linkages between R&D institutions and industries, which is still seriously lacking in Bangladesh.

(d) S&T information system

While the S&T information system now plays critically important role in research, we are yet to develop an adequate infrastructure for collection, processing, storage and dissemination of information and knowledge. The development of the Internet and World Wide Web and search mechanisms has facilitated easy access to latest developments in almost any field. But there are still serious lack of Internet facilities and web sites in our R&D institutes and universities. The huge amount of information available through these facilities cannot be adequately accessed by the majority of our researchers. However, the problem should be gradually tackled by the implementation of the IT policy which is being formulated on a priority basis.

As we shall see in the later sections, since the existing policies and institutions are not adequately conductive towards generation of indigenous technologies and transfer and adoption foreign technologies, especially both at national and sectoral levels, the overall technological base is low and technology industry linkage is weak and ineffective.

B. Status of business/technology incubators

1. Government policy relating to S&T and SMEs

It is necessary to review the Government's industrial policy and technology policy to outline the Government's measures to support SMEs in technological upgradation. Given the focus on technological incubation, this section briefly reviews the policy stances of the MSICT charged with development of policies and the Government's strategies for developing SME as delineated in the Poverty Reduction Strategy Paper. The section also briefly touches on the policies relating to information technology, part of which is administered by the Ministry of Telecommunications.

The Government of Bangladesh has taken various steps for the development and effective application of science and information and communication technology.[7] In order to ensure that the policy formulation in S&T and their applications in various sectors proceed in a coordinated manner the Government constituted the NCST in the year 1975 headed by the head of the Government.[8]

Increased emphasis and priority attached to the advancement of S&T by successive governments is reflected through policies and strategies envisaged for the sector in the Five-Year Development Plan of country. For example, among many elements of declared policies and strategies strengthening of science-based education through establishment of 12 new technical universities, raising public sector allocation to S&T development by 2 per cent of GDP and enhancing student enrolment to 60 per cent at secondary level and to 40 per cent at graduate levels are some of the policy measures and strategies proposed in the Fifth Five-Year Development Plan. However, the Government commitment towards accelerating the momentum of S&T development will be critically dependent upon successful implementation of the proposed measures and programmes.

In the financial year 2001-2002, the MSICT and its organizations have taken 54 development projects. The budget allocation and expenditure since fiscal year 1991-1992 to 2001-2002 is given below (Table 3-I-4). With occasional ups and downs the increased financial allocation and expenditure made by the MSICT speaks of Government's commitment towards up-scaling the intensity of R&D in the country.

Table 3-I-4. Resource allocations and expenditures for S&T development

Financial Year	No. of projects	Allocation (Lakh Tk)	Expenditure (Lakh Tk)
1991-1992	11	753.50	511.28
1992-1993	14	878.79	632.10
1993-1994	13	1 911.26	1 787.43
1994-1995	27	3 189.00	2 532.65
1995-1996	30	2 028.00	1 595.91
1996-1997	31	3 790.00	3 194.70
1997-1998	37	2 840.00	2 115.82
1998-1999	52	2 223.23	2 136.49
1999-2000	53	7 620.00	7 487.17
2000-2001	55	9 870.00	8 205.99
2001-Feb 2002	54	7 749.00	1 449.497

Source: MSICT.

The price of ICT equipments has been falling sharply due to ICT-friendly taxation measures taken by the Government with a view to creating positive impact on enhancing ICT capabilities of the country. Despite all the positive signs, by 2001, the country had only 250,000 personal computers as stated in an International Telecommunication Union (ITU) statistics which is far behind compared to other regional and international developing countries.

In Bangladesh, Telecom Regulatory Commission (TRC) has been functioning since January 2002 and an updated Telecommunication Act has been enacted. It is expected that regulatory measures will help to create conducive atmosphere for ICT investment and can contribute to narrow the digital divide.

The Government has also initiated necessary steps for formulation of the draft IT policy and is now under the process of finalization. The draft ICT policy (2002) has already been discussed and reviewed at high level meetings of the Government under the chairmanship of the Prime Minister and remains to be finalized and adopted soon.

The Government has a plan to set up an information technology village (ITV) at a total cost of Tk 550 million (US$ 10 million). The Government has already allocated 47 acres of land for ITV in Dhaka,

[7] The information given is from MSICT 2002a.

[8] Details of the MSICT's efforts in varlans directions to promote a modern science and technology infrastructure in Bangladesh are available in MSICT 2002b.

alongside the Mahakhali earth station of Bangladesh Telegraph and Telephone Board (BTTB). The primary objectives of the IT village are to (a) facilitate need based arrangements for the IT investors and (b) establish latest and modern telecommunication set up to enable the experts to have ready market access.

ITV is a place where all sorts of IT related modern facilities like high-speed communication infrastructure, multi-platform computing, data processing, etc. will be available. The ITV will provide one-stop service. All government approvals for export of software, data entry services and IT-enabled services will be accorded through this window.

The Government has undertaken a project called Hi-Tech Park which will host high-tech industries involving high-tech IT products, electronics, telecom, optical equipment, biotechnology and so on. 400 acres of land has been allocated for this project alongside the Talibabad Satellite Earth Station of BTTB in Kaliakoir, 50 km from the capital. To produce world-class computer programmers/trainers, government has allocated Tk 15 crores to the five public universities namely Dhaka, Bangladesh University of Engineering and Technology (BUET), Rajshahi, Khulna and Shahjalal S&T universities to conduct diploma courses on ICT.

Potential industries such as agro-biotechnologies and genetic engineering, IT enabled services, bio-informatics, computer hardware and software, pharmaceutical and clinical products, etc. have been earmarked for development in the Park.

2. Developing small and medium enterprises

Quite appropriately, indeed, the SMEs are generally recognized as having tremendous development potentials as sources of relatively low-cost employment growth, skill and technology development, entrepreneurship development, industrial decentralization and export promotion. Reference to the important roles played by these industries in employment generation, industrial value-added and poverty alleviation is consistently made by the planners, the policy makers and the international development partners, but most of these boil down to rhetoric's there being no specific comprehensive policy formulation and implementation and development of appropriate institutional network to cater to their promotional needs. The support services provided to them through Bangladesh Small and Cottage Industries Corporation (BSCIC) are neither comprehensive nor adequately effective to boost up their growth especially as competitive and dynamic enterprises capable of maintaining and increasing their market shares in the global market.

However, the SMEs occupy economically significant position in the national economy of Bangladesh by accounting for over 98 per cent of industrial enterprises, contributing to over 80 per cent of total industrial employment and roughly 40-45 per cent of industrial value-added. These industries are also growing overtime (at a rate of 7 per cent per annum during early 1990s and at over 5 per cent during the late 1990s) even under various operational constraints caused by financial, technological and marketing bottlenecks.[9] But as is emphatically recognized by most researches (i.e., Kamal 2002, Sarder 2000, and Imran 2002), the role of SMEs should be enhanced by providing them with adequate and appropriate support assistance through formulating and implementing comprehensive pro-active policies. In particular, building and upgrading their technological capabilities are critically important to raise their market competitiveness, productivity growth, and ensure their long-term sustained high growth.[10] Unfortunately, there is no special provision for catering to the technological service needs of the SMEs in Bangladesh. Though some of the BSTI and BCSIR facilities are relevant and useful to the SMEs, these services are neither tailor-made to fit SME requirements nor are especially designed for them. However, as discussed later, the SMEs avail such services and facilities as and when required. But this is far from adequate to equip the SMEs properly to become technologically competitive and face the challenges of the global market. Lack of comprehensive and close interaction and linkages between R&D institutions and universities and industries in general works as important barriers to free flow of information about development and diffusion of improved technology and technology transfer and adoption. Because of absence of linkages between R&D institutions and industries, the results of research carried by relevant institutions and individuals are of limited use to the industries.

[9] An elaborate account of current state of art of the small industries sector in Bangladesh is available in Ahmed 2002.

[10] In this context, the detailed suggestions put forward by Kamal 2002 merit special consideration for fostering technological growth of the SME sector in Bangladesh.

There is thus an urgent need to develop S&T programmes package for supporting development of the SMEs. Such arrangements exist in the United States where the small business incubators (SBIs) are located at various university campuses which provide low-cost support services like office and laboratory facilities, computer facilities, professional consulting services, etc. to the newly established tenant companies housed in the SBIs. The BUET, especially its Institute of Appropriate Technology (IAT) and the newly established technical universities can play pivotal role in providing such services to the SMEs in Bangladesh through establishing close linkages between universities and industries.[11]

Development strategy of SMEs has been articulated in the Government of Bangladesh's Poverty Reduction Strategy Paper (PRSP) as a key element in pro-poor manufacturing growth. It acknowledges that creation of a vibrant SME sector would require pro-active policies to address their persisting structural weaknesses through removal of policy biases. These include: increased public investment in SMEs in areas of training, extension, research and market promotion; provision of finance and preferential fiscal measures; legal reforms to expand and simplify the use of non-real estate security for facilitating access to institutional finance; and implementation of an effective credit guarantee scheme.

For addressing credit problems, the Government espouses reforms in financial and fiscal sectors. It states of encouraging the financial institutions to use cash flow rather than asset ownership as the criterion for creditworthiness. As regards the fiscal policy the PRSP says of removal of existing discriminations (e.g. in value added tax (VAT), wealth tax and provisions for tax holiday). The access to resources by SMEs would be enhanced through several means like creating incentive for financial institutions, supporting SMEs and micro-enterprises along with expanded role of the NGOs, expanding sources of financing through viable schemes such as loan guarantee scheme, venture capital, and promoting leasing industry; improving management capacity of institutions providing business advisory and extension services and restructuring government training agencies to create strong links with SMEs.

The Government would implement programmes to improve knowledge, entrepreneurship, and productivity of SMEs and support new entrepreneurs (business start-up). The Government's overall approach would be to remove unnecessary regulatory barriers and simplify required laws and regulations since the impact of regulations falls unevenly on the SMEs compared with their large-scale counterparts, because of the formers' scale barriers and difficulties of entry into both factor and product markets.

MSICT's proposal for development of incubation centres

The Ministry of Science, Information and Communication Technology is contemplating to develop incubation centre for enhancement of technology development activities in the country. By establishing such centres the process of "shaking-out" new business venture from academic and research establishments can be encouraged and made more certain, thus adding to the industrial infrastructure of the nation, both qualitatively and in terms of diversity of technology.

The objectives of technology incubation centres are as follows:

- To encourage and facilitate the formation and growth of new business based upon the research knowledge and expertise available within the country;
- To build and establish infrastructure of capable, modern subcontracting companies;
- To provide a source of self-employment and entrepreneurship development for talented youths;
- To help create close links and better understanding between universities, research institutes and industries;
- To enable new technology-based companies to get expert advice on business development, financing and technical matters from the universities/research institutes;
- To provide a conducive working environment for research and development.

The Government is contemplating to establish a joint management team consisting of MSICT, Bangladesh Computer Council (BCC), BUET, Bangladesh Online Limited (BOL), BTTB and Bangladesh Export Processing

[11] An account of how the SMEs can benefit from the favourable effects of University Industry Interaction through establishment of small business incubation centres for SME development is available in M.N. Islam 1998.

Zones Authority (BEPZA) representatives to provide high quality services to facilitate the operation of incubator centre for:

- Providing business development services such as management and technical consultation;
- Information network services through a worldwide network of databases;
- Access to overseas technologies, expertise and environment;
- Assistance to obtaining accredited technical standards;
- Liaison with statutory bodies;
- Access to seed or venture capital fund;
- Access to the marketing network and distribution channel.

3. Institutional arrangements for promoting business/technology incubators

While a wide array of both public and private sector institutions are involved in providing support services to the SMEs[12] those cragged in serving R&D promotion and innovative activities are almost conspicuously absent. In fact, there is no specialized institution devoted to catering to the R&D service needs SMEs in Bangladesh. The two major S&T oriented organizations which provide technical assistance to industries in Bangladesh and are thus of some relevance to SME development are the Bangladesh Industrial and Technical Assistance Centre (BITAC) and the BCSIR. The services delivered by these two institutions towards technological development of industries are briefly highlighted below.

(a) Bangladesh Industrial Technical Assistance Centre (BITAC)

Bangladesh Industrial Technical Assistance Centre otherwise known as BITAC has been established by the government to: (a) train industrial personnel to upgrade their skills, (b) render technical advice to industries, (c) disseminate modern know-how and improved techniques among industrial personnel, (d) manufacture and supply spare-parts, tools and machines and (e) develop equipments tools and processes. Established in 1962 as an autonomous organization under the Ministry of Industries, BITAC has been playing vital role by transferring appropriate technology to the industrial sector in general and developing human resources through its technical skills development training programmes in particular for the large and medium industries.

Services rendered and tools, equipment and process development: This is one of the most important areas of interest in which BITAC has already gained recognition. BITAC recently manufactured, installed and commissioned 3 units of Green Jute Plant Chipper with capacity of 15 metric ton per hour. Besides, BITAC is also manufacturing conveyer systems like inclined conveyer, screw conveyer, link conveyer, shuttle conveyer and cyclone and vibratory type chips and washing plant for the green jute pulp making line. BITAC is also making commendable efforts towards manufacturing other machines and equipments like fiberizer, hydroflakers, drying units, high density pumps, etc. for paper mills. It has successfully developed electroforming technology. With the evolution of this process, a new area for intricate mould making has opened. BITAC has developed and manufactured Gate Hoisting Gear Boxes for Tista Barrage and Magura Irrigation project, oil cooling system for Kaptai Hydro Electric Project and Cyclo-drive units for fertilizer factories, which could not be carried out elsewhere in Bangladesh. All sorts of security embossing seals exclusively used by the government are also developed and manufactured in BITAC.

Design, development and manufacture of import substitute spare parts: In line with the Government policy of efficient and economic production of import substitute products, BITAC has been making and delivering replacement spares and critical fittings for both public and private sector industries in limited quantities. The technical know-how and manufacturing process is ultimately transferred to local manufacturing units for commercial production. BITAC has developed and manufactured over four hundred items of spare parts, tools and equipment for different industries during last five years. It is regularly providing technical services by developing and making precision and intricate import substitute spare-parts for fertilizer complexes, sugar mills, jute & textile mills and power generation plants.

[12] A succinct discussion of structural and functional characteristics and level of efficacy of their service delivery to the SMEs is available in Ahmed 1985 and 2002.

Advisory and Consultancy Services: With the Government policy of increased participation of private sector and foreign investment in the country, BITAC's engineers and experts render pre-investment advisory and consultancy services in the selection of machinery and equipment, plant lay-out, installation of machinery and equipment, etc. with due emphasis on economies of production, use of indigenous raw materials and application of appropriate technology.

Training and manpower development: BITAC conducts three times a year a 14-week Advance Technical Training Course in the following trades: machine shop, mechanical drafting, automobile, auto-electricity, welding, electrical maintenance, machine maintenance, heat treatment, electroplating, pattern making and foundry practice.

BITAC has imparted upgrading training to 1,760 personnel during the last five years while its Plastics Technology Centre trained 304 persons comprising entrepreneurs, managers, supervisors and technicians by organizing 23 special training courses. While the BITAC services are useful and important, the facilities are deemed to have gone mostly to large and medium-scale industries. Due to scale barriers and inadequate dissemination of information the majority of the SMEs are not in a position to avail BITAC services.

(b) Bangladesh Council for Scientific and Industrial Research (BCSIR)

As the largest as well as the pioneering industrial research organization of the country, the BCSIR is devoted to initiate, promote and guide scientific industrial and technological research and help establishment and development of industries and such other activities as the Government may refer to it. Overtime, the BCSIR has developed and leased out to more than hundred products and processes to both public and private sector enterprises in such fields as food, leather, jute, plastics, glass, ceramics and paper and chemicals, etc. With increased emphasis on end-use of its research outcomes through greater attention towards communication and dissemination of information and coordination with their promotional agencies (i.e., BSCIC) and the private enterprises, the BCSIR can make important contributions towards stimulating technological progress and innovative activities of the SMEs. The BSCIC takes initiatives towards developing and maintaining links with the BCSIR in terms of popularizing commercial application of various processes and products (i.e., vegetable die, biogas, etc.) among the small enterprises.

In addition to BCSIR and BITAC, the other two organizations engaged in providing technical assistance to industries in the form of testing product quality and supplying product standards are the Central Testing Laboratories and the Bangladesh Standards Institution (BSI). However, the services provided by both organizations have no special provision for the SMEs.

The Design Centre and the Skill Training Institute of the BCSIC are playing important roles in design improvements, product development, skill development and in providing access to information on technology, products and processes. However, the services provided from these centres are limited compared to the requirements, and need to be enhanced and decentralized.

Not surprisingly the enterprise level, technological capability and standards of the SMEs in Bangladesh continue to remain weak leaving enough scope for change and modernization. A critically important role remains to be played jointly by the relevant stakeholders consisting of the academic institutions engaged in S&T education and research, R&D organizations and the engineering and industrial enterprises. The "triangular linkages" suggested and indicated here by Islam and Haque (1999) is regarded though critically important for developing national technological infrastructure and capability is regarded to be weak in Bangladesh partly due to lack of adequate Government patronization and partly due to lack of serious innovative efforts by the industrial entrepreneurs to absorb and adopt new technologies and carry out in-house R&D activities.

4. SME entrepreneurship development programmes

The employment generating potentials and the sector's particular suitability for development in the socio-economic realities of Bangladesh prompted successive governments to put special emphasis in their policies and programmes to foster rapid growth of the SME sector. As such, the emphasis in policies and programmes put on the development of this sector has led to the design and implementation of an increasingly wide range of support services for the small-scale industries. The range of such services include the provision of information, pre- and post-investment counseling, finance, technology and marketing assistance, training, industrial estates facilities and various extension services.[13] To extend these support services, a network of institutions have been created and nurtured in the public sector (i.e., BSCIC, Bangladesh Handloom Board [BHB], Bangladesh Sericulture Board [BSB], etc.) as mainstream SME development agencies. As a result of Government encouragement for initiating private sector participation in the overall industrialization process over the last two decades, some private sectors agencies have also become involved recently in the promotion and development of SMEs (Mannan 1993, Ahmed 1999). The major private sector support agencies include Micro Industries Development Assistance and Services (MIDAS), Bank of Small Industries and Commerce (BASIC) and various NGOs.

Altogether, there seems to have been a noticeable proliferation of service agencies providing support to enterprises and entrepreneurship development in the SME sector. However, the real issue is to assess what has been the achievement as a result of efforts put forward towards development of SMEs in Bangladesh. While this is beyond the scope of this paper, a few comments based on the findings of some studies (i.e., Sarder 2000) may be in order.

The general comment is that despite substantial efforts put in by the wide array of agencies and institutions, the SME sector languishes under various operational constraints and their overall growth is low and unstable. The implication is that the services delivered have not been properly “tailor-made” and have not reached all members of the extremely diverse SME families.

Second, the service package is termed as being predominantly supply-oriented with the demand issues (i.e., marketing, backward and forward linkages, etc.) remaining neglected.

The third general comment is that the SME support services in Bangladesh is biased towards creating enterprises as against entrepreneurship. The dominant concern with supply of credit, infrastructure facilities, training and other extension facilities in terms of advice and information offered especially by the BSCIC are directed more towards creating new businesses. The services such as technology upgradation for productivity increase, development of management skills, provision of access to R&D facilities and markets and motivation to innovate, etc. which enhance entrepreneurial performance and ensure increased competitiveness, higher growth and long-run dynamism seem to be insufficiently addressed in Bangladesh.

The SME entrepreneurship development programmes are undertaken by various public and private sector agencies such as MIDAS, Bangladesh Institute of Management (BIM), Bangladesh Awareness Society (BAS) etc., other than BSCIC which are also reported to be producing good results. The women entrepreneurship development programmes of MIDAS, for example, is widely acclaimed for its success in bringing considerable numbers of women into small businesses which are performing well. The national award for best women entrepreneur received by Mrs. Rehana Quashem, Director, Shatrang Handcrafts Fashion in 2002 is a good example in this regard. The WIDP run and operated by BSCIC since 1981 has had important positive impacts on development of women entrepreneurship particularly among poor women in the rural areas. Finally, the training programmes run by the Small and Cottage Industries Training Institute (SCITI) of the BSCIC are also quite elaborate and useful for encouraging development of SME entrepreneurship. However the outreach of the programmes run is still limited compared to the needs and the courses and the contents are rather general and textbook oriented.

Assessing the overall support services structure geared to SME development in Bangladesh, Sardar (2000) remarks “there is an indication of limited success” of the assistance measures designed to promote and develop the SME sector in Bangladesh.

C. Government policies in promoting business and technology incubator

1. Technology incubators: What are they?

The technology incubation system is a new initiative developed to create high-tech based enterprises through promoting and nurturing them in the initial phases of their growth. The main concern of the TIs is to bolster the technological development through completing technological ideas for technologies currently under development. More specifically, TI aims at nurturing and supporting technopreneurs in developing their

[13] A discussion on the effectiveness of these support services and the institutions created to deliver them is available in a large number of studies. The major ones include: Ahmed 1985, Ahmed and others 1990, Rahman and others 1979 and Sarder 2000.

technologies from the stage of infancy to take-off stage for its commercialization. Thus, the TIs are strictly involved in nurturing technologies rather than businesses or enterprises.

The incubation systems range from simple business incubators to higher complex establishments in the form of science parks, research and development parks and industrial parks. According to OECD studies,[14] BIs generally host new start-ups business and provide various benefits and services for promoting and supporting SMEs. They help in increasing the survival rate of SMEs, reinforce the application of technological innovations, create new businesses and revitalize economies through providing focused assistance within a supportive environment. The services provided generally include advice of business planning and management, office facilities, finance and access to accounting and legal services.

TIs on the other hand, offer such services as sending specialists as technical guides, joint development, financial support, use of technical support in using machinery equipments and computers. According to OECD studies, TIs take a range of institutional forms both as integrated or separate organizations within science parks, universities and innovation centres. While TIs also concentrate on serving the start-up firms and SMEs, they generally provide technology-related services including support assistance on intellectual property and legal issues. The business incubator and technology incubator system converges with each other when they support the twin movements: (a) the emergence of SMEs as instruments of economic growth and (b) acceleration of the pace of technological change.

The technology incubator centres conduct R&D activities and promote technological innovation required by industries. The technology business incubator is a joint venture of universities, public research institutes, local government and private institutions to produce and bolster a new technology extensive enterprise.

The science parks have large areas of land, which allow space for accommodation of research facilities and R&D enterprises that originate in the incubators. Through research and technological developments carried out in close cooperation with universities and other institutions of higher learning they try to promote creation of technology-intensive enterprises. The basic aim of such parks is promotion of interregional development.

Then there are R&D parks which accumulate research facilities of universities and public testing centres, conduct research exchange functions, enhance regional R&D capabilities and attract R&D enterprises from outside the region. The purpose is thus primarily promotion of interregional economic developments.

The technology incubation systems and facilities developed over the last two decades in the advanced industrialized countries like the United States, the United Kingdom, Germany and Japan have also spread recently in countries such as the Republic of Korea, Philippines, Uzbekistan and Malaysia where there are strong S&T infrastructure and government patronage of various forms (government grants, tax incentives, venture capital, legal and patent services, etc.) while the spread of the technology incubator systems in the developing countries is dependent upon S&T activities sponsored by public support as well as private initiatives. Developing countries such as Bangladesh, Nepal, Sri Lanka, etc. are yet to evolve effective TI strategies and initiate actions to set up them.

2. Public sector initiatives for promoting business technology incubator system in Bangladesh

In tandem with the recent global trend towards identifying knowledge-based industries, especially those related to information technology and biotechnology as top priority sectors for helping transition from agro-industrial to information economy, the Government also identified IT as the “thrust sector” to enable Bangladesh to embrace the information age and become an important actor in the global market in information, knowledge and other high-tech areas.

The Government decided to develop a hi-tech park at Kaliakoir, about 40 km from Dhaka city in an area of 119 hectares (with additional 55 hectares available for future expansion), which is envisaged as an integrated and ultra-modern techno-township, with a view to enabling Bangladesh to embrace the information age and to become an important player in the global market in information and other high technology sectors.

[14] Quoted in ESCAP 2001.

The proposed hi-tech park is located just beside the national highway and is well connected to the rest of the country through roadway. The under-construction railway line to Jamuna Bridge passes through the Park. The area is situated on relatively highland and most part of it is virtually free from normal seasonal flooding.

The major objectives of the park is to attract foreign companies to set up operations in Bangladesh in order to (a) develop indigenous technological capability for the development of the local industries, and (b) to enter into foreign market by exporting state of the art technology products.

Entry into the export market in high technology area is very restrictive in many ways. However, strong plus-points to overcome the barriers are delivery of products with state of art technology, innovation content and cost advantage. Considering the huge trade imbalance of Bangladesh it would be equally useful if the country could produce import substitution products in the park. For either case, be it for export or import substitution product, the potential industries must be supplied with appropriate manpower. It is already pointed out that the country must have plentiful supply of educated and knowledge-rich manpower.

Given the economic conditions of Bangladesh, it is always better if the park can attract labour (knowledge-worker) intensive industries. By default labour intensive industries are relatively less capital intensive. It is also advantageous to local entrepreneurs who have less investment capability. By definition, high technology industries are knowledge intensive industries. From this consideration, industries where good parts of the value addition come from knowledge workers are considered to be potential candidates for hi-tech park.

Most hi-tech parks are highly populated with information and communication technology-related industries. This type of industries are knowledge-worker intensive. However, to attract such industries the country's infrastructure readiness must be very high. It includes very good telecom infrastructure, good transportation infrastructure and good legal protection of intellectual property rights. In the Science Park I and II in Singapore, there were 226 TI companies followed by those in electronics in 1997. Besides 7,000 research engineers, scientists and other support staff in the science park, there is high concentration of knowledge-based innovations comprising R&D companies, R&D institutes and centres, etc. which offer on-sight services to the SMEs.

Keeping the above points in view, a feasibility study done by the BUET has identified potential industries for the Park. The identified industries are grouped into different categories as below:

1. Agro-biotechnology and genetic engineering (R&D)
2. Automobiles and metal industries (R&D)
3. New and advanced materials (R&D)
4. Medical supplies and devices (R&D)
5. Pharmaceutical and clinical products (R&D)
6. Garments and textiles (R&D)
7. Plastics (R&D)
8. Merchandising and machinery (R&D)
9. Design of electronic products
10. Manufacturing and assembly of electronic products
11. Computer hardware
12. Computer software
13. Communications hardware
14. Communications software
15. IT enabled services
16. Human resource development institute
17. Design and consultancy
18. Bio-informatics

Priorities and facilities must be there to stimulate growth of high-tech SMEs in the park as has been done in other countries. Considering the types of companies, which will choose to locate in this park, infrastructure, business and support services will be required. Keeping this in mind, the entire park has been divided into five land-use blocks, which are described below:

(a) Development plan

Considering the types of companies, which will choose to locate in the area, infrastructure, business and administrative support services that will be required in the Park and the time frame for the implementation of the plan, the whole park has been divided into five land-use blocks. Total area available above 10 m contour level has been considered for development to avoid inundation even by a 100-year flood. The land-use blocks are described below:

Block-I: This block will have ready to occupy offices, laboratory facilities, incubators and factory spaces for hi-tech industries (mainly IT and electronics). Administrative, business and infrastructural support services including housing provisions, community services and recreational facilities will also be located in this block. Companies having insufficient capital to build their own factories will find this block serving their needs. This block is adjacent to the national highway leading to the Jamuna Bridge and is directly accessible from the Dhaka-Tangail Road. Development of this block will be completed in Phase-I.

Block-II: This block is meant for mixed type of development targeting a broad range of companies including information and communication technology, electronics, as well as companies intending to carry out research and development activities on textiles, garments, plastics, metals and metal products, etc. This block will have mainly ready-to-occupy plots for the types of companies mentioned above. This block will be developed in Phase-II.

Block-III: Build-to-suit facilities and ready-to-occupy plots will be available for electronics and IT companies in this block. Larger electronics and IT companies needing larger space and wishing to build their own facilities would find this block serving their needs. Smaller companies starting initially in Block-I and growing bigger gradually may find the existing space limited. Such companies faced with the need for expansion would also be able to move to this block.

Block-IV: This block would be reserved exclusively for medical and biotechnology related companies such as medical equipment, medical devices, pharmaceuticals, biomedical research, agri and food research, etc. A separate block has been reserved for such companies because of the need to keep them separate due to the nature of their activities.

Block-V: This is the institutional block, which will house the institutions of higher learning for producing highly skilled knowledge workers for industrial and entrepreneurial needs. Institutions focusing on information technology, multimedia and telecommunications, engineering, biotechnology, etc. may be set up in this block.

(b) Establishment of an IT incubator at Karwan Bazar

At the initiative of the Ministry of Science, Information and Communication Technology, the first ever IT incubator has been established at Karwan Bazar of the capital city of Bangladesh at a cost of Tk 360 million covering a land area of nearly 70,000 sq ft. This is indeed an important landmark in the IT development efforts of Bangladesh which will provide support services to the software making companies and ICT service providers of the country. The overall management of the incubator will be in the hands of the BCC in association with the Bangladesh Association for Software and Information Services (BASIS).

The newly set-up IT incubator will provide low-cost rental facilities to the small software companies in its premises, ensure availability of 24-hour cost-free internet services and advice on business plan, technical know-how and marketing strategies which should allow the new companies to operate smoothly and profitably. However, as a new venture, the IT incubator itself faces the difficult task of running it as a commercially viable and economically efficient enterprise.

The BASIS is reported (Financial Express, 4 December 2002) to have already received application from over 50 companies for space inside the incubator. The Secretary of the BASIS, expects that given proper utilization of the subsidized facilities, the new IT incubator should be humming with brisk activities of the budding as well as experienced software developers of the country. The incubator running full capacity should generate employment opportunities for at least a thousand professionals and multiply our current foreign exchange earnings of US$ 30 million a year by several times from software exports.

3. Private sector and NGO initiative in promoting business incubators and venture companies

Private sector participation in developing technology incubation facilities does not seem to be a common practice even in the industrialized countries of East and South-East Asia where the technology incubation system is gradually taking roots. Even in the Republic of Korea, Malaysia and Singapore where the incubation system is progressing fast, the facilities appear to have developed under public policy initiatives and patronage. However, S&T education, computer education and training facilities, and national R&D efforts, etc. should be enhanced both in public and private sector on a partnership basis. Large corporations, private universities, training and R&D institutions, industrial and trade associations and multinational companies should promote technology incubators independently or jointly with the relevant government agencies in the developing countries like Bangladesh. While MIDAS, the National Association of Small and Cottage Industries of Bangladesh (NASCIB), the Federation of Bangladesh Chambers of Commerce and Industry (FBCCI) and various chambers such as Dhaka Chamber of Commerce and Industry (DCCI) and Metropolitan Chamber of Commerce and Industry (MCCI) have SME support and assistance programmes, these organizations have not moved towards technology incubator development programmes. Similarly venture capital financing of new business is also conspicuously absent in Bangladesh as no specialized banking or non-banking financial institution engages in risk-prone lending practices. However, the top priority attached by the government on human resources development in the IT sector has encouraged and facilitated participation of the private sector in education and training facilities. A large number of private organizations now offer various types of short courses on computer technology and internet systems in addition to degree and diploma courses offered by the universities and polytechnics on computer technology to produce skilled technicians. The leading private sector organizations offering computer training and IT education facilities include Asian Institute of Management and Technology (AIMT), Bengal Information Technology Ltd. (BITL), Information Institute of Bangladesh (IIB) and Techno-haven, and Worldwide Institute, etc. which are playing pivotal role side by side with the government in developing skilled-manpower and technology in computer technology in the country.

The NGOs can contribute to the technology and knowledge intensive SME development process through providing extension services geared to development of new products, processes, and improvements in technological and quality standards of small businesses. The Intermediate Technology Development Group (ITDG) involvement in SME promotion in Bangladesh is briefly presented below as a case in point.

ITDG-Bangladesh's Small Enterprise Programme:

ITDG-Bangladesh's Small Enterprise programme aims to develop sustainable small business opportunities for small-scale producers, especially women, with the help of selected NGOs.

The first programme cycle (1995-1999), during which ITDG worked with 21 partner NGOs, has just come to an end. After the initial selection process, the following support was provided to NGOs:

- preparation of baseline profile of each NGO
- development of tailor-made capacity-building plan
- training on small enterprise planning and management
- skill training on various production/processing technologies
- equipment supply
- business extension services

In order to increase the information available to NGOs, small-scale producers and other interested parties on sustainable small business, ITDG-Bangladesh has developed profiles of 28 different income-generating activities (income generating activity [IGA] profiles). It also runs an enquiry services which field enquires on technical matters from a wide range of individuals and organizations.

A new five-year programme was launched shortly promoting regional networks representing the Government, NGOs and the private sector with the aim of sharing business knowledge and skills for small enterprise development. A new programme started in July 2001 to enhance the performance of farm power enterprise in Jamalpur and Dinajpur district by increasing their skills, business planning and management capacity.

ITDG-Bangladesh has just completed a three-year action research project working with owners, employees and customers of more than 150 small-scale metal workshops in Faridpur town. Project activities have focused on strengthening the small metal workshops by increasing their capacity and capability to produce goods and reach a wider market with a greater range of better quality products.

Extensive support has been provided to metal workshop owners and artisans, especially through the Metalwork Development Centre that was established in Faridpur in 1999. Training of two different kinds has been given: technical (to improve skills and aid the development of new products) and business-related (to develop entrepreneurial and management capacities). Other production related assistance has included tool hire and information on raw materials, technical processes, tools and products.

A new programme started in 2001 which aims to promote more effective use of farm power machinery in small farm systems through technical collaboration between national agricultural research institutions, small local manufacturers and small marginal/landless farmers.

4. Institutional arrangements for promoting business/technology incubators in Bangladesh

The MSICT is playing the key role in boosting scientific and technological development of the country through encouraging and rapidly spreading science education, stimulating R&D efforts and promoting utilization/application of computer and information technology. The most laudable and remarkable step taken by the Government in the development of ICT industry is the formal approval of a national ICT policy by the cabinet on 7 October 2002. It is also encouraging to note that the Government is taking necessary steps to facilitate private sector participation in its efforts towards developing the S&T sector on a priority basis. Side by side with increased allocation of funds to the R&D organizations of the public sector, different non-government scientific and technological organizations (i.e., science societies and institutions) are also being allocated special funds to encourage them to conduct R&D activities.

The Government has recently formed an Information Communication Technology Business Promotion Council incorporating the private sector computer professionals to boost ICT trade and services at home and abroad. The Ministry of Commerce plans to set up two more such business promotion councils for diversifying and stimulating faster growth of export trade.

The planned setting up of more IT villages, IT parks and incubator facilities at different locations of the country reflect strong commitment of the Government, towards developing and building technology infrastructure and creating technology climate and capabilities at a faster rate, to achieve sustained economic development and improve quality of life of the people. However, attempts have to be made to attract large corporations, private business houses and TNCs to strengthen and bolster government efforts towards S&T development, technology transfer and diffusion and adoption.

5. Financing of SMEs

The problem of accessing institutional finance remains the biggest hurdle facing the SMEs both in initiating as well as running and/or expanding a business. That lack of unhindered access to institutional credit is a perennial problem and constitutes the most serious binding constraint to SME growth and expansion is substantiated by a large number of recently undertaken major studies (Ahmed 2002, Sarder 2001, Rahman and Jamal 2001, Hossain 2002). Ironically, this has continued to be the predicament of the SMEs in Bangladesh even after the establishment of BASIC in 1989 and intervention by some of the big NGOs (i.e., Grameen Bank) in SME financing. Contrary to a priori expectation, the financial problems of the SMEs have aggravated further in the 1990s as revealed by the information presented in tables 3-I-5 and 3-I-6.

It is seen from the table that the SMEs in general have remained marginalized in the commercial banks' term lending portfolios even during periods of credit expansion. Throughout 1990s, the SMEs are seen to account for only 4-5 per cent of total commercial bank outstanding advances of the term loans to manufacturing industries.

Table 3-I-5. Outstanding Advances to Industries (in percentage) (other than working capital loans) 1990-2002

Industries	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Large + Medium industries	94.65	96.41	93.70	94.63	94.63	93.75	95.95	94.89	94.81	94.86	94.39
Small and cottage industries	3.77	4.30	5.35	5.37	6.24	5.35	4.05	5.11	5.19	5.14	5.60
Small industries	2.16	3.30	4.14	4.24	5.28	4.46	3.41	4.53	4.32	4.60	4.26
Cottage industries	1.31	1.00	1.21	1.12	0.95	0.88	0.64	0.58	0.87	0.51	1.34

Source: Bangladesh Bank, *Bangladesh Bank Bulletin* (Quarterly), various Issues (Dhaka).

Table 3-I-6. Outstanding Advances to Industries (in percentage) (working capital loans) 1990-2000

Industries	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Large + Medium industries	87.60	87.95	86.53	86.56	87.75	85.64	87.79	87.68	86.96	88.83	88.04
Small and cottage industries	12.40	12.05	13.47	13.44	12.24	14.36	12.20	12.32	13.04	11.17	11.96
Small industries	7.43	8.48	9.49	10.50	9.37	10.91	9.71	11.56	10.83	10.25	9.70
Cottage industries	4.97	3.56	3.99	3.29	2.88	3.45	2.49	0.76	2.21	0.92	2.16

Source: Bangladesh Bank, *Bangladesh Bank Bulletin* (Quarterly), various Issues (Dhaka).

Though the position is somewhat better in case of working capital loans with 12-14 per cent of such loans going to SMEs, their relative share still remains far behind that of their large and medium scale counterparts. This reiterates our assertion that the SMEs are starved of adequate availability of institutional credits which prohibit them from using modern technology, undertaking R&D activities and improving their innovative capabilities.

Besides scale barriers and high administrative and legal expenses associated with small loans, the practice of collateral based lending followed by banks and other financial institutions (both government and private sector institutions) acts as a severe obstacle to SMEs who often does not possess assets generally considered to be acceptable as collateral by the institutional lending agencies. The earlier quoted study by Rahman and others (2002) of financing of 183 small rural enterprises reveals that lack of good collateral ranked as the most important reason (followed by lack of enough assets and complex procedures and extensive documentation requirements) for refusing SME loan proposals by the commercial banks and other financial institutions. On the contrary, the large enterprises can easily obtain loans because of their superior ability to offer asset based securities.

Thus in a situation where the SMEs are in general unwelcome customers to banks as well as to the non-bank financial institutions, financial support of any form required to pay for the services of a technology incubator or for setting up an enterprise, based on new technology or technologies acquired and upgraded, would be hard to come by. While there exists varieties of financial support systems (i.e., financial grants, low-cost loans, venture capital, specialized banks for SMEs, etc.) for development of technologies and supporting new and emerging technology-based enterprises in the developed and in the newly industrialized countries, no such facilities are available in Bangladesh. It is thus imperative that the Government of Bangladesh should come in a big way to provide such financial facilities to promote technopreneurs and develop modern technology-based and knowledge-intensive SMEs.

D. Conclusions and recommendations

The economy of Bangladesh is growing at a modest rate with reasonable macroeconomic stability. Considerable progress has been achieved in selected micro aspects which need to be further consolidated and sustained. However, the formidable challenge facing the country is to graduate from low to a middle-to-high income currently achieving a faster and higher rate of sustained economic growth required to force an exit from endemic poverty. In the present environment of intense global market competition, achievement of high and sustained economic growth requires building of a strong and competitive industrial-base which is critically dependent upon development of higher technological capabilities and standards. Unfortunately, the current industrial- and technological-base of Bangladesh is narrow and weak and technology industry linkage is also at a low level. While increasing attention is now being paid to national science and technological capability building through Government interventions of various levels, lot remains to be done to broaden and strengthen overall technological base of the country.

Given the narrow resource base, inadequate availability of technically qualified manpower, underdeveloped S&T infrastructure, weak R&D and innovative capabilities of the present S&T institutes, the Government may concentrate on developing a dynamic and internationally competitive modern technology-oriented SME sector which appears to have significant potentials for augmenting poverty-focused growth and thereby achieving the millennium development goal of alleviating poverty by half by 2015.

SME development is crucial for Bangladesh to achieve falser rate of growth and sustainable development. Stakeholders including the businesses, chambers, financial institutions as well as the Government need to join hands to develop the SMEs by formulating and adopting SME friendly policies and practices.

Recognizing the importance of the SMEs sector, there is an emerging consensus that new approaches are needed to improve the effectiveness of the programmes supporting SMEs. Most SMEs in Bangladesh face a number of interrelated difficulties including severe shortage of short and long term finance, modern technology, marketing problems and lack of promotional support services such as various supply and demand driven business development facilities. To overcome these problems, the SMEs need a wide array of support assistance comprising both financial and non-financial services. These may include a comprehensive and pro-active SME development policy, easy access to finance, technological support, accesses to R&D facilities and to domestic as well as international market. As the priority is on the evolution and development of a new technology-based SME sector, the SME policy package must put greater emphasis on constant technology ungradation facilities, improvements in management efficiency, skill development and dissemination of market information.

As such, the following recommendations are made to create SME development friendly environment in general and encourage growth and development of new generation of modern technology-oriented and knowledge intensive small enterprises in particular.

1. Immediate steps needed to bolster SME Development in general

(a) Development of an appropriate regulatory environment: Access to finance is the major problem for the SMEs as commercial lending institutions typically ignore the financial requirements of the SMEs primarily due to their weakness in offering fixed assets as collateral. It is suggested that introduction of the concept of moveable asset based financing systems would greatly benefit both the SMEs and the financial institutions. To this end, Government may promulgate necessary statutes.

(b) Promoting information technology in both public and private sectors: It is of immense necessity to work both in public and private sectors to promote the use of information technology (IT) with a view to effectively establish linkages with the SMEs. Interlinkages between universities, research organizations and industries need to be carefully and consciously developed, if needed through introducing statutory regulations.

(c) Access to technology, training and market: SMEs typically lack access to new technologies and to improved management techniques. The entrepreneurs who own and manage small business lack management skills, do not have access to technology, resulting both in low productivity and poor-product quality and further lack ready access to markets for their output. To expand the local market for the SMEs, it is essential to arrange local trade fairs as well as assist in SME participation in numerous trade fairs in countries such as Japan, the

United States, the United Kingdom, Australia, South Africa, the United Arab Emirates, Singapore, Italy, Germany, etc. Furthermore, there is a need for detailed structured initiatives for development of programmes for encouraging exports by SMEs, imparting technical training to the workers and numerous technology transfer workshops.

(d) Cluster-based backward linkages for export-oriented SMEs: Individual SMEs experience difficulties in achieving economies of scale in the purchase of inputs such as machineries, equipments, raw materials, finance and consulting services. They are also often unable to take advantage of market opportunities that require large production quantities, homogenous standards and regular supply. However, it is clear that many of these obstacles are results of their isolation rather than their size. Therefore, closer cooperation among them not only helps to overcome these problems but also creates backward support linkages for larger exporting SMEs.

(e) Development of trade associations and linking them to mainstream financial institutions: Micro-enterprises do not have access to recognized associations to help them in widening their access to financial institutions on the one hand, and receive business development services on the other. These enterprises may therefore be encouraged and assisted to form their own associations to be able to access various business development services.

An appropriate and effective institutional network is vitally important to ensure efficient delivery of SME development assistance services. A separate institute for modern technology-oriented enterprise growth and technopreneurship development, and provision for training and research activities may be developed with built-in arrangements for effective partnership between public and private sector. For example, BSCIC and FBCCI may fruitfully cooperate in developing internet facilities and web sites for the SMEs to facilitate easy access of these enterprises to knowledge, information, technology and markets.

2. Recommendations for development of technology incubation systems

(a) Government policies

1. *Inclusion of development of technology incubators as an objective in S&T policies:* Development of technology incubators should be explicitly included as an objective in S&T policies to promote and nurture high technology-based enterprises along with provision for specific financial outlays since promotion of technology incubators is generally absent. There is a need for well-coordinated and united efforts, with clear distinctions and responsibilities for various organizations and agencies involved in the process. Similarly, various policies related to the incentives, tax structure, real estate development, skill-development and education programmes, and development of SMEs should be evolved in consultation with the technology incubator promotion agencies. Consortia approach between various relevant stakeholders may be a useful approach.

2. *Focusing on the development of simple business incubators with technology as a central theme:* In least developed and developing countries, initial focus may be on the development of simple business incubators with technology as a central theme and located in industrial estates and industrial clusters as opposed to nurturing new technologies of generic nature through sector specific incubators mostly located in or near a university or an R&D institution, with the ultimate objective of developing new SMEs.

3. *Enhancement of national R&D expenditures in both public and private sector:* The national R&D expenditures, both public and private, should be enhanced continuously so that R&D facilities and expertise in universities and R&D institutions are strengthened, and researchers/academicians are encouraged to become entrepreneurs. At the same time, young technopreneurs should be trained and supported to nurture their technology-based businesses. Mechanisms need to be evolved to cover or share the risks in high-tech businesses. Some of the R&D institutions may be corporatized as in Japan.

4. *Government encouragement for setting up and networking of technology incubators associations:* Government should support and encourage the setting up and networking of technology incubators associations within and outside the country. Exchange of experiences, organization of trade fairs and exhibitions for technologies and products of incubatees, at national and international levels should be encouraged. Since incubator and graduated companies are generally small and have limited resources, such activities would assist them in marketing and promoting cooperation. Preferential access of the new

generation SMEs to these facilities will be a critical determinant of high-tech based SME growth in the country.

5. *Encouragement of inward and outward FDIs for SMEs with related technology transfers:* Inward and outward FDIs for SMEs with related technology transfers should be encouraged through TIs. TIs may even be technically involved in selection and acquisition of technology by large corporations in public and private sectors. Concerted efforts should be made on a long-term basis to develop trained and skilled manpower. Mobility of S&T personnel between industry and R&D institutions should be encouraged. There should be no disrespect to researchers who have been unsuccessful as technopreneurs.

6. *Protection of intellectual property systems:* Intellectual property systems including patent literacy, search and filing facilities should be encouraged through training, etc. and financial support should be given to file patents abroad through the TIs. Incubatees and graduated enterprises should be encouraged and supported for international certification such as for ISO-9000 and ISO-14000, quality management and energy conservation, etc. In fact, TIs themselves should be encouraged to obtain such certifications.

(b) Private sector initiatives

- *Large corporations, private universities, training institutions, R&D institutions, industrial associations, export promotion councils and trade development agencies* should also promote technology incubators independently or jointly with government agencies with focus in their respective areas of operations. Private financial support agencies and investors, etc. should also actively associate themselves with the government supported or privately promoted incubators.

- *Foreign companies and TNCs* should support TIs in specific areas to augment their R&D and technological capabilities, as is being done by Oracle in Singapore. TNCs can also set up R&D centres or centres of excellence in developing countries, as in India, which can be linked to TIs. R&D costs in developing countries are usually much lower than those in developed ones. However, generation of knowledge and skills is important to attract TNCs.

- *Large corporations and SMEs* should seek the services of TIs during technology transfers and also source their requirement of goods and services from TIs or their graduates. Large corporations can subcontract their R&D or technology development projects to TI companies and also source their requirements of goods and services from TIs or their graduates.

(c) Regional/Subregional

International promotional agencies should assist national governments in developing trained-managers and human resources or establishing and operating technology business incubators in the developing countries like Bangladesh to adopt best practices or to enable them to evolve their own practices and models.

ANNEX

List of major R&D institutes*

Organizations	Scientists and technologists	Technicians	1996 Budget (million Tk)
Bangladesh Agriculture Research Institute	762	74	444
Bangladesh Jute Research Institute	261	169	90
Soil Resources Development Institute	117	8	95
Bangladesh Tea Research Institute	39	16	22
Bangladesh Space Research and Remote Sensing Organization	60	30	18
Bangladesh Forest Research Institute	107	71	36
Bangladesh Livestock Research Institute	107	57	88
Bangladesh Post Graduate Medicine and Research	251	380	–
International Centre for Diarrhoeal Diseases Resources	219	130	–
Atomic Energy Research Establishment	287	184	130
Bangladesh Council for Scientific and Industrial Research	318	298	85
Bangladesh National Scientific and Documentation Centre	10	10	24
Institute of Nuclear Medicine	32	4	7
River Research Institute	53	75	22
Institute of Appropriate Technology (IAT), BUET	–	–	–

Sources: Bangladesh National Scientific and Technical Documentation Centre (BANSDOC).
Note: * This list is not complete.

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II. PROMOTING BUSINESS AND TECHNOLOGY INCUBATION FOR IMPROVED COMPETITIVENESS OF SMALL AND MEDIUM-SIZED INDUSTRIES THROUGH APPLICATION OF MODERN AND EFFICIENT TECHNOLOGIES IN CAMBODIA

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A. Cambodia's facts and figures

Area:	181,035 square km
Political form:	Constitutional monarchy
Population:	13 million (2000)
Population growth rate:	3 per cent
Adult labour force (male: female):	47: 53 per cent
Gross domestic product:	US$ 3,054 million (1999) and US$ 3,090 million (2000)
GDP growth rate average:	4.8 per cent per annum
Per capita income (nominal):	US$ 300
Major industries:	Garments and footwear
Major exports:	Garments and footwear
Major imports:	Gasoline, industrial machinery
Inflation:	0.5 per cent (2000)
Total FDI inflow:	US$ 453 million (2000)
Data source:	Ministry of Economic and Finance

B. Industrial economy

According to the 1996 data collected in the World Bank Report of June 1997 entitled; "Progress in recoveries reform" the industry and service sectors of the economic have been contributing interesting to GDP from 1991 to 1996. The agriculture on the other hand, has been experiencing a decline in contribution to GDP over the same period. Certainly the fastest growing sector of the economy is industry averaging 11.38 per cent over the past 6 years and outperforming growth of the economy almost twice the rate of the same period. Agriculture has been experiencing a declining rate of growth. Only the industry sector has shown an increasing rate of growth. The growth of service sectors has mostly remained constant except for 1992 certainly due to the present of United Nations Transitional Authority in Cambodia (UNTAC). All indications, table 3-II-1 and table 3-II-2 as per reference shown that the industry sector will continue to lead the growth of the economy from now on to the endless future.

Table 3-II-1. Contribution of sectors to GDP

	1991 (%)	1992 (%)	1993 (%)	1994 (%)	1995 (%)	1996 (%)	Average (%)
Agriculture	51.80	49.30	46.90	45.10	44.60	42.70	47
Industry	15.10	16.30	17.70	18.30	18.70	19.90	18
Services	33.10	34.40	35.40	36.50	36.60	37.40	36

Table 3-II-2. Growth rate of the economy sector

	1991 (%)	1992 (%)	1993 (%)	1994 (%)	1995 (%)	1996 (%)	Average (%)
Agriculture	6.70	1.90	1.00	00.00	6.40	1.80	2.63
Industry	8.80	15.70	13.10	7.50	9.90	13.30	11.38
Services	8.50	11.20	7.00	7.50	7.80	8.80	8.47
Average	7.60	7.10	4.10	4.00	7.60	6.50	6.15

C. Technological situation in Cambodia

The National Institute of Statistic Programme (NISP) of UNIDO collected information from 116 large and medium-sized industries using the provincial office of the Ministry of Industry, Mines and Energy (MIME). Based on limited information, UNIDO produced a brief report entitled "Directory of large and medium industries 1996" (defined to mean those with greater than 50 employees). In June 1997, MIME updated this report to include 315 firms. On the other hand, referred to the statistic available at MIME in 1996 there were some 25,620 micro and small-scale industries (capital in US$ not more than 200,000) in 22 provinces.

These establishments employed some 68,000 persons (49,000 males: 19,000 females). Compared to the figures collected during the UNIDO industry sector review mission in January 1992, these appeared no growth in the number of such establishments, nor in the number of people employed by them. A large share of these establishments is rice mills and small-scale food-processing enterprises. Other significant industries are textile and garment (in some provinces), non-metallic and mineral processing (in most provinces) and fabricated metal (all provinces).

Only 9 per cent of the registered establishments are licensed at the national level by MIME, 33 per cent are licensed by provincial departments of MIME, whereas 58 per cent are not licensed at all.

According to their size, MIME estimates that the figures collected by 22 provincial departments represent approximately 90 per cent of small industrial establishments. The MIME statistics reveal that the heaviest concentration of micro- and small-scale enterprises is founded in Kompong Cham province (labour force above 18,500 particularly in agro-processing and textile/garment, followed by Phnom Penh (9,000), Kampong Thom (5,000), Takeo (9,000) and Kandal (5,000). Some provinces such as Kep, Preah Vihea, Mondul Kiry reports virtually no micro- and small-scale industrial activities. The majority of industrial workforces are male in the enterprises other than textile and garment. Female workforces are dominated in garment and textile enterprises and trade.

Although medium-scale industry is important new form of employment generation in some urban area, it appears that the contribution of micro and small-scale industry establishments, employment generation and diversification of the economy has not increased after the liberalization of the economy in the early 1990's.

D. Technology acquisition

The majority of the existing locally invested enterprises either micro, small-scale or even medium enterprises usually applied the traditional technology in their product processing activities. A great number of micro and small-scale industries customary are applying the traditional left-over technology from their ancestors for product processing such as fish sauce, soybean sauce, fish paste (prahok), tomato sauce, chilli sauce, canned meat, and fish product, alcohol and vinegar, etc.

The Khmer distillery company (SKD) that produced alcoholic products of different variety also applied the left-over technology and equipment from the French protectorate since the early 1930's and has closed its door for some time due to the high production cost and cannot compete with the cross-border smuggling product from the adjacent neighbouring countries where they applies modern technology of low production cost and the eventual indigenous alcohol production community in the remote areas of the country.

The case of tire factory in Kandal province is the same. It has forced itself to close its door permanently because of non-competitive product even in the local market because the out-of-date technology that was not prominent to produce quality product for even the local market demand.

The case of flour mill in Kbal Thnal where the successive manager kept applying the same and traditional technology producing poor quality products have suffered from the same condition and finally has been out of operation since the early 1980's. There were a great number of SMEs of the kind that have been faded-out successively. Some other of the kind is trying hard to survive and is also underway to extinction.

Quality success:

Only those that have acquired modern processing technology from abroad such as parent company, equipment, machinery suppliers, overseas joint-venture partners, overseas distributors, etc. have enjoyed successfully their business opportunity because they produce competitive quality products that are also suitable for export standard such as fruits juice products, Angkor beer, condensed milk, winery products and generally foot-wear products and garment. Even though these SMEs produce products of quality best serving the local demand and for export, but they still have the hardship facing with the cross-border smuggling products from the adjacent neighbouring countries and from some other countries in the region.

We may all aware since the day of liberalization of economy, 4 August 1994, up to date, there is still no "Law on domestic product protection" being passed nor enforced. This is the main problem that needs to be solved sooner or later, without it even the micro enterprises, the small and medium enterprises will face the hard time to fight for their subsistence.

E. Government priorities and plans

The first Socio-economic Development Plan, 1996-2000 has established the "framework for the medium-term development of the country". The plan has a clear focus on poverty alleviation and at the same time, lays down some investment priorities with a view to promoting longer term development and industrialization. The major priorities expressed in the plan are: reducing poverty, developing human resources, increasing domestic self-reliance, and strengthening absorptive capacity and regional cooperation.

The main elements of the Royal Government's Development Programme – in the plan that are particular relevant to SMEs development are:

(a) Employment generation
(b) Rural development
(c) Development of the productive-base
(d) Human resource development
(e) Investment in physical infrastructure
(f) Macroeconomic stability
(g) Legal and administrative framework
(h) Reintegration in to the global economy

1) Generation of employment through labour intensive manufacturing for export, the promotion of small-scale industry and the urban informal sector and the development of tourism

This is clear expression of the Government priority endorsing the need for micro and small enterprises development. It is compatible with the overall focus on poverty alleviation with the key to any long term and sustained attack on poverty (as well as any attempt to decrease dependence on external assistance) is a growing economy and particularly the growth that generates employment and enhances livelihood.

The plans further point out that the promising development of medium-scale formal sector manufacturing is not enough to absorb the annual increases in urban labour-force resulting from natural increase and migration as well as the planned civil service retrenchment and demobilization. Therefore, a substantial contribution to labour absorption will have to come from small-scale enterprises and informal sector activities of all kinds.

The SMEs development strategy specifically includes the focus on labour intensive, export-oriented industry and industries with linkages to tourism. The development of tourism-related industries, for which the Cambodian potential is large and the micro and SMEs could potentially play a big role, could be an important means of generation jobs, income tax revenue and foreign exchange quite rapidly in the short term.

2) Achievement of poverty alleviation and broad participation in the development process through a focus on participatory rural development

Micro and SMEs activities are means for people to participate in development through day-to-day effect in improving their standard of living. It would also facilitate the improvement of people livelihood and self-reliance.

Also the development of micro and small-scale enterprises is one of the important components of rural development to achieve increase in (commercially-oriented) farm and non-farm income and to help limit rural-urban migration and the transfer of more poverty to the urban areas.

3) Development of productive base of economy (through rice production, livestock production and of the commercial agricultural sectors)

Some of the micro- and small-scale enterprises in rural areas are engaged in agricultural and livestock activities. The agricultural, forestry and fishery sector also have an important relevant to micro- and small-scale enterprises in term of potential backward linkages.

The small-scale and micro-enterprises produce farm instruments, tool and machinery and buy agricultural livestock, forestry and fishery products as their raw materials. It is also important to note that higher income of rural population generates larger market for micro- and small-scale enterprises.

4) The upgrading of the human skills and their adaptation to those that are commensurate with a modern market economy

Skill is simply necessary to operate micro-, small and medium scale enterprises and to generate income. Human resource development is furthermore important for Cambodia to meet the challenges of the market economy in managing enterprises, adapting and developing technologies and to compete effectively with enterprises of neighbouring countries, particularly because such capacities were deliberately destroyed in the late 1970's. It will be essential, as the economy will be more reintegrated into the regional and global market economy.

5) Substantial investment in the upgrading and development of physical infrastructure, particularly rural roads

Improving road network in quantity and quality will reduce costs of transporting goods and people and result in more economy activities. It will facilitate the expansion of local and international trades and thus the commercialization of agriculture.

6) Establishment of macroeconomic stability and creation of institutions, instruments and policies necessary for prudent long term economic management

Macroeconomic stability and sound economic management is a prerequisite for SMEs development as well as the private sector development since productive investment, either small, medium or large, domestic or foreign, is made only in a stable economic environment.

The Government aims to establish an "enabling environment" for domestic and foreign investment achievement of macroeconomic stability and appropriate legislative-base and provision of generous incentives for investment and physical infrastructure including electricity.

The present predominance of small and medium scale industries is one of the factors that make it difficult for the Government to secure government revenue, which needs to sustain its programmes.

7) Reform of the administrative and judicial institution for the state, through the reorganization of public service and more effective liaison between central and provincial administration

Because the capacity to implement laws and regulations constitutes an essential part of an "enabling environment". Let's just say the implementation of the law and regulation and its enforcement on "cross-border product smuggling" if any, would be greatly helpful to the local SME's products as well as to sustain their subsistence, etc.

8) Reintegration of the Cambodia economy into the regional and global economy and liaison with regional institution

Cambodia is situated in strategic location with an increasingly dynamic subregion and within the East Asian region as a whole is seen to offer great opportunities for the longer-term development. But it could pose as a threat because of the potential competition from the economically powerful neighbouring countries. The Government has taken on policies that will direct towards the reintegration of the Cambodia economy into the regional and global economies.

In successful coping with the challenge that this objective poses raising the educational and skilled-level of workforce is essential. The industrial sector is particularly important for micro and SMEs development. The plan includes specific industrial development strategies, which involves the incorporation of the following key parameters:

- Export-oriented industries (with GSP entitlement and MFN status as incentives)
- Labour intensity (broadening from garment industries)
- Natural resource-based industries (agro-wood-fisheries and non-metallic mineral based industries)

Selective import-substitution of consumer goods (based on locally available minerals)

Large versus small-scale industry (shift from large, for instance in rice milling, vegetable oil processing, animal feed production, furniture-making and brick and tile manufacture)

- Rural industries (including technical and business advice, vocational training)
- Urban informal sector is employment promotion (emphasis on small scale enterprises)
- Tourism-related industries (such as building materials, furniture-making and other wood-based industries, metal working, food industries, handicrafts)
- Downstream industries based on petroleum (provided that the current exploration on- and off-shore leads to concrete finds)

In order to stimulate industrial development, the Royal Government will pursue a policy of identifying and fostering selected urban areas as “growth centre”. These will be supported through the provision of facilitating infrastructure such as industrial zones and export processing zones (Phnom Penh and Sihanouk Ville).

Battambang with its hinterland richly endowed in terms of agricultural and fisheries resource and favourable location is expected to play an important role as a focal point in regional economic growth in the west of Cambodia. Tourism-related industries are expected to develop in Seam Reap and Kampong Cham is expected to lead the development in eastern part of the country based on the large rural population, significant rubber plantation and processing plants, sugarcane, tobacco, soybean and banana cultivation. The plan particularly outlines the following constraints to be addressed during the period of 1996-2000.

- Strong competition from countries in the region requiring industrial policies encouraging establishments to operate successfully within a highly competitive domestic and international market environment
- Low level of education of workforce compared to other countries in the region
- Cost of energy, water and telecommunication and access to service industrial land
- Administrative delays in securing import of machinery, spare-parts and material
- Inadequacy of the primary road network
- Scarcity of credit, particularly for rural and urban small-scale industry

It is worth noted that in the Government priorities and plans as stated above, no technology incubation system has been mentioned except the adaptation of development technologies to challenge the competition in Section D.

F. Institutional supports/arrangements for R&D and other innovative measures for SMEs

As we may all aware the emergence of socio-economic development in Cambodia had just started up from its infant stage after the long lasting twenty years of civil war. However, when speaking in terms of R&D capability, Cambodia is far from reaching because such capacities were deliberately destroyed by the war in the late 1970's.

As a result, Cambodia is at present desperately facing with the shortage of human resource to serving the R&D sector because Cambodia is virtually deprived of competent scientists engineers to contribute in the R&D development programme.

In reality, Cambodia is up to date has no technology transfer institution, no joint research centres at national universities for academic and private sectors cooperation, no research institutes, no national research laboratory programme to identify and support small-scale industries laboratory, except one out-dated laboratory under supervision of the Technical Department of the Ministry Industry, Mines and Energy which is responsible for product quality control and inspection and title offers service for quality improvement due the limited knowledge and capacity of its personnel and mostly the out-dated equipment and instruments available in this laboratory

After all there is no public private research institutes or universities concentrate their R&D effort on the socio-economic development if we are dealing with the "Promoting business and technology incubation system for improved competitiveness of small and medium scale industry through application of modern and efficient technology in Cambodia".

G. Other arrangements/supports for entrepreneurship development programmes

No particular arrangement/support for entrepreneurship development programmes especially on business and technology incubation has been mentioned in the Government policy framework except the following:

1. Cambodia's first Socio-economic Development Strategy, 1996-2000 sets out a framework of nine guiding principle for industrial policy making. Components of this framework are as follows:

   - *The promotion of export-oriented policies:* It is argued that because of the relatively small domestic market, import substitution as a strategy for industrial development (such as support of infant industries supplying the domestic markets or protectionism) will not work. Experience has shown that the protectionism inherent in an import substitution policy does not nurture the creation of competitive industries. Industries that have grown up behind the tariff walls because of import substitution policies do not have a record for accomplishment that fares well in competitive walls. Furthermore export opportunities afforded by the granting of MFN and GSP entitlement augur well for the future of export-oriented policies and for rapid growth of industries in Cambodia. The growth of the garment industries is just one example of how successful an export-oriented policy can be. This policy is also consisted with the export-oriented policies of countries in the region and will facilitate Cambodia's integration into the regional and global economies.

   - *The promotion of labour intensive industries:* With other countries in the ASEAN region experiencing rising industrial wage levels and quotas in their labour intensive exports, pressure is mounting on firms to relocate to countries with lower wage and whose intensive exports are not subject to quotas. Cambodia, Myanmar and Laos People's Democratic Republic stand to gain from this pressure. Nowhere is this truer than in the garment industry that is now the fastest growing manufacturing sectors in Cambodia.

     This industry now employs the largest number of workers engaged in manufacturing. The challenge now is to attract more such labour-intensive industries such as assembly of electronic goods to create more employment opportunities (garments and electronic assembly are the two major traditional labour-intensive industries fueling growth in developing economies).

The history of industrial development has shown that countries often start out with simple assembly operations for export and gradually move to higher technology-oriented operation as the countries physical infrastructure and human capital evolve to higher standards.

- *The promotion of natural resource-based industries:* Industries based on national resources such as forestry, agriculture, fishery, minerals deposits, non-metallic minerals and oil and gas offer much potential for developing countries of high added values. Natural resources-based industries are generally located in regions and provinces outside the more build-up areas are a good way to stimulate regional development.

- *The promotion of a selective import substitution strategy for industrial development:* There is some scope for selective protection in import substitution industries particularly in the areas of consumer goods. This idea however, is in contradiction to an export-oriented strategy. Extreme caution is urged that in development scarce resource to such purpose as costs of such intervention may very well overweigh the benefits.

- *The promotion of micro and small-scale industries:* Micro- and small-scale enterprises constitute a major part of the industry sector, yet there is no specific policies programme of the Government to assist this sector.

  The first Socio-economic Development Plan (SEDP) acknowledges this fact and wishes to remedy this situation. The most comprehensive scheme for SMEs support is operated by Association of Cambodia Local Economic Development Agencies (ACLEDA), an indigenous non-governmental organization that provides limited training and credits facilities.

  There is much scope for intervention particularly by NGOs. It is also a useful way to attract the problem of regional development. MIME has a MSE unit within the ministry and is the logical focal point for such Government intervention. The needs of SMEs are different from those of medium and large industries that are prepared and equipped to help themselves.

  Assistant in identifying markets, obtaining new and better technologies, training (business and technology incubation) and access to credit are all areas where intervention can be beneficial in reaching not only that segment of industry but also some medium-scale industries that are least able to help themselves.

- *The promotion of rural industry:* Plans are being made to assist in the promotion of rural industrial development through the provision of technical and business advice, through vocational training and through increasing the availability of credit. As necessary as this intervention is, rural industries seldom flourished only because of such intervention. The most effective way to stimulate rural development in a market economy is to stimulate demand for their products. Study have shown that when income in rural areas arises, the elasticity of demand for goods arises more than proportionally in these areas resulting in greater demand that in turns stimulate greater production. This area warrants additional investigation and research on how this may be best accomplished.

- *The promotion of informal sector employment in urban areas:* This is the counterpart of the above rural industry employment promotion. Recommended interventions are deliberately vague. The best that Government should do is not to interfere with the natural evolution of informal employment in the urban areas to the extend public interest will allow.

- *The promotion of tourism-related industries:* The development of tourism industries has substantial linkages with the rest of the economy, particularly the construction, food, metalworking, furniture, wood and handicraft sectors. Tourism looks especially promising owing to Cambodia culture and natural assets of international appeal. There is definite potential to make a substantial contribution to income and employment over a long period of time for a large number of people. Encouragement of tourism is a direct and effective way to stimulate demand for industrial goods there by encouraging the development of industrial structure.

- *The promotion of downstream industries based on petroleum:* Current exploration activities leading to significant finding will present possibilities for downstream industries. Such finds would provide significant revenues to the Government needed to cover the recurrent costs of social and economic development programme.

2. Other arrangement and support for entrepreneurship development programme (especially for investment) may include the following:

- Apart from facilitation and support at the national level, attention is also being given by the Government to open up access to international source of finance for private sectors investment. Cambodia is already a member of the Industrial Finance Corporation (IFC) and Multilateral Investment Guarantee Agency (MIGA), and is currently applying for membership to the International Centre for Settlement of Investment Disputes (ICSID). It has also signed agreement with ADB, providing private sector investor with the opportunity to obtain funding for their investment project from this international financing institution[1] and the investment incentive.

- The Law on investment provides the following incentives to investment project in Cambodia:

  (i) A corporate income tax of 9 per cent except for the exploration and exploitation of natural resources, including timber, oil and gas, gold and precious stones.

  (ii) A corporate tax exemption of up to eight years is depending on the characteristic of the project and the priorities of the Government.

  (iii) Loss is carried forward up to five years.

  (iv) Non-taxation on the distribution of dividends, profits or proceeds of investment, whether transferred abroad or distributed within the country.

  (v) 100 per cent import duty exemption on constructions material, mean of production, equipment, intermediate goods, raw material and spare-part used by:

  ➢ An export-oriented project with a minimum of 80 per cent of the production set apart for export.

  ➢ Projects located in the designated special promotion zone (SPZ).

  For investment projects excluded in the category covered by both categories above, 100 per cent exemption from duties and taxes is only authorized for the construction of factories and buildings and for a period of one year following the start-up of production operation.[2]

H. Status of business/technology incubation

In Cambodia, the term of “technology incubation” is yet of little familiarity among the responsible authority especially that of MIME. Therefore this term seems to be the new innovative aspect to them. Because of such non-familiarity, the policy makers have unlikely missed to integrating the technology policy and special measures to support the SMEs development in technological upgradation particularly in the Government’s policy on the development and support of SMEs.

Actually, there is no service provider institution related to technology transfer for support measures for the development of SMEs, no joint research centre at national universities for academic and private sectors cooperation, no national research laboratory programme to identify and support micro, small and medium scale enterprises laboratory, no public research institutes or universities concentrate their R&D effort on SMEs development.

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[1] A Guide to invest in Cambodia, Council for the Development of Cambodia (CDC) page 2.

[2] Article 14 of *A Guide to investing in Cambodia,* Council for the Development of Cambodia (CDC). Available at <http://www.cambodiainvestment.gov.kh/Information.asp?PageID=Laws+%26+Regulations%3AInvestment+Law&LevelID=12&DocID=9>.

In short, they are not even familiar with the term “technology incubators” that according to Mr. Dinya Lalkaka, the term “technology incubators” (TIs) has been stated as follows[3]:

> “TI’s main concern is to be bolster the technological development stage. It aims to complete technological ideas for technologies currently underdevelopment. Specific activities by TIs include specialists sent as technology guides, joint development, supporting and raising necessary funds, and the provision of support in using machinery and related experiment/instrumentation equipment and computers. In some cases, TI provides facilities such as office and communication equipment.
>
> Also TIs take a range of institutional forms, operating as integrated or sometimes separate, organization within science parks, universities and innovation centres. TIs present a technology-oriented variant on the business incubators (BI) theme. TIs more frequently provide technology-related services and support on issues of intellectual property and support from law schools and local legal firms. Some incubators focus on attracting branch plants, while other work almost exclusively with start-up firms and SMEs.
>
> TI can help tackle many of the problems such as: capital requirements including venture capital, linkages to sources of knowledge, strengthening research capacities with appropriate interface mechanism, supplementing business management and marketing skills of technopreneurs, technology acquisition skills, market intelligence and strategic planning, etc.”

However the most current innovative feature was the recent introduction of IT not TI in the Government facility that has taken place at the Cambodia/Republic of Korea Forum, on 29 April 2002 at the Intercontinental Hotel, the details of which are as follows:

- Korean technology companies are set to propel Cambodia further on its way into the information-age.
- Database management companies, Uni SQL has confirmed that all 27 governmental ministries will soon be linked to form a state-of-the art e-government.
- SLD telecom, meanwhile, confirmed that it was looking to provide space-age mobile phones to customers in the Kingdom by the end of the year.
- Under an agreement with ASEAN, Cambodia is obliged to develop and maintain e-government. Uni SQL will provide the Government’s administration information system, which includes linking ministries through broadband Internet. That will allow document approval and document exchanged between ministries, as well as land, vehicles and residence registration.
- The project is designed to promote transparency in Government, as well as provide its ability to track and tax people, Managing Director of Uni SQL, Kang Mun Cheol, predicted that the development would prove “significant”.
- Uni SQL’s US$ 20 million project, financed with a soft loan from the Government of Republic of Korea, should be finished by the end of next year.
- SLD Telecom said its mobile phone business, using the 019 dialing code, would be operational within a year.
- In January, the Government awarded SLD Telecom a 35-year license to provide a CDMA (Code Division Multiples Access) service network. SLD Telecom is a joint venture between three sought of the Republic of Korea’s telecom: SK Telecom, LG Electronics and Dong-Ah Elecomm.
- An employee of SK Telecom said that the company wanted to provide the latest technology. He bristled at an earlier report stating that he group would invest US$ 88 million in the project. The capital has yet to be determined. We could not forecast because the market is changing quickly, he said, adding that SLD telecom “might be the biggest company in Cambodia”.[4]

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[3] ESCAP, Strengthening Technology Incubation System for Creating High Technology-based Enterprises in Asia and the Pacific (ST/ESCAP/2137, 2001).

[4] “Kingdom moves towards higher tech”, *Phnom Penh Post*, 10-23 May 2002.

I. Science and technology (S&T) infrastructure

In Cambodia there are few research institutes and more than twenty private and public universities that constitute the S&T present infrastructure in this country. However since the country is predominantly dominated by agriculture, most of these research institutes have been established to provide support service only to this sector such as on rice seed breeding, animal breeding, forest conservation and afforestation, etc.

The most recent project that is now underconstruction and is expected to be in operation in the late 2003 or at the beginning of 2004 is the Inland Fisheries Research institute funded by the Mekong River Commission. This institute will be responsible to identify the most important species in the Cambodian fresh-water fisheries in term of their role in the domestic economy and food security situation, it will be responsible to undertake research and monitoring in view to obtaining biological, technical and socio-economic data comprising:

- Small scale/family/rice field fishery
- Medium scale/mobile fisheries
- Large scale/fishing lot fishery

and assess impacts on the fisheries resources, to develop the fisheries information system and so on. On the contrary there is no major SME's, R&D support institution being established as yet.

J. Technical entrepreneurs (techno-premiers) development

No specific technopreneur institution being developed except the existing public/private universities and vocational schools that provide training relative to curricula training programme as per the following examples:

(a) Institute of Technology of Cambodia (ITC)

It is the Government institute that provides engineering degrees to the young generations who engaged in different specialized field like mining and geology, food chemical engineering, construction engineer, electro-technique engineer, etc.

(b) Royal University of Agriculture (RUA)

The Government university that provides engineering degrees to those who has engaged in diversified field of agriculture.

(c) Royal University of Fine Arts (RUFA)

The Government university that provides architecture degrees to those who engaged in architecture sector, archeology degrees to those engaged in this field and the degrees of arts and crafts and all sort of traditional culture.

(d) Royal University of Phnom Penh

At present, the University offers only the engineering degrees in environment and information technology. According to Mr. Cham Nan, Dean of this University said that more faculties would be opened to the public that is the faculty of Khmer language and that of education. The third faculty will be the "Applied Science and Technology" that deals with the chemical analysis and products productions.[5]

(e) National Institute of Management (NIM)

This Government institute conducts training programme on managerial and supervisory in business management, banking, accounting, marketing, financial management, hotel-tourism management, information technology, marketing and administration.

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[5] In Section B, Column 1, pp. 1-2, *Rasmei Kampuches Daily,* 7 May 2002.

(f) Norton University (NU)

Private university conducting the same training programme as in (4) and there are many more private universities of such kind like the International Institute of Cambodia (IIC), Institute of Human Resource Development (IHRD), Institute of Technology Management (ITM) and many others.

(g) Toul Kork Vocational School, Russeikeo Vocational School, Tuk Thla Vocational School (Government) and Cambodia Institute of Engineering (private vocational school)

These four other vocational schools provide almost similar skill-training such as garment, computer repair, electronic, machine-shop, auto-repair, drafting, etc.

K. Private sector initiatives and activities in promoting business incubator and venture business

Very limited information on private sector initiatives and activities in promoting business incubators available except the following information obtained from various selective business and industrial establishments and from the results of interview with a small group of businessmen and manufacturers.

It is understood that information network (by the time the survey was conducted on information networking under XP/RAS/97/012/11-57, UNIDO) is the most important issue affecting the national economic development and the prospect for the future of SMEs development depends on the identification of areas where further progress is required. For instance, we just take a closer look on the results derived from the above survey as followed:

General data

A large number of institutions are equipped with telephone, mobile phone, fax, e-mail, Internet connected with Telstra[6] and Camnet[7]. As regard to equipment and software, almost all of them are equipped with computers – LAN NT 4 window 95 stand-alone. For those that use e-mail connected Internet, the type of connectivity is SLIP/PPP with a speed of 3.6 kbps for Telstra and SLIP/PPP with a speed of 28.8 kbps for Camnet, the information retrieval and text processing software are usually processed access 97, word 97 and excel 97.

Information resources (Q/A)

(a) Names, scopes and coverage of computerized database used:

- (1) Indigenous – Accounting, mail, information
- (2) Internet (most of them used sites) – E-mail, Explorer

(b) Approximate quantity and type of the primary documents possesses:

- (1) Standard
- (2) Business catalogues
- (3) Authority law and regulations
- (4) Publishing
- (5) Film/video tape

(c) Distribution of languages of primary document:

- (1) 50 per cent national language
- (2) 50 per cent foreign language (English)

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[6] See Annex I.

[7] See Annex III.

(d) Quality and type of document on microfiches:

None

Form III – Inquiry service

III-4. Inquiry services:

- Subject of queries from 5 to 20 markets
- Source used answering external

III-5. Referral service:

- None

III-6. Information extension service:

- None

III-7. SDI (service development institution)

- None

III-8. Current awareness service:

- None

III-9. Preparation of information analysis:

- None

III-10. Technology transfer:

- None

III-11. Training of users:

- None

III-12. Application of computers:

- Establishment of indigenous database
- E-mail
- Internet
- Publishing
- Training

Form IV

IV-1. Users and their needs – approximate number of users for months:

- 10 to 20

IV-2. Quantity and type of users:

- 80 per cent policy/decision makers
- 80 per cent manager
- 70 per cent salemen/sale managers

IV-3. Needs of users technology:

- Specific technology
- Adaptation of technology
- Upgrade of technology
- Technology costs/financing

- Standard
- Quality control
- Skill training
- Technology acquisition and transfer
- Sources of raw material

Form 3

3-9. Objectives and functions of the company:

- Quality success

3-13. Computers used at the company:

- Yes with network operating system, NT 4 WIN 95

3-14. Internet big pond (Telstra) Cament (Camnet)

3-15. Service offered:

- E-mail/FTP/WWW

3-19. Main problem faced by the company:

- Lack of qualified personnel
- Cost of communication is too high

Form 4 – Industry marketing sector (beverage/food industry/sales, garment industry)

4-1. Product processes:

- For domestic market, soft drink, beer and stout, sweeteners, condensed milk, galvanized iron sheet
- For export-textile/garment (100 per cent export oriental). Where: EU, the United States of America, Canada, Mexico

4-4. When a technical problem arises in the company:

- 80 per cent of them attempt to solve it by 50 per cent using in-company resources and 50 per cent using outside resources especially through suppliers.

4-5. Consultant to help business:

- Very few used consultants in management and engineering.

Form 5 – Selling and promoting

5-1. Activities for products serving domestic market:

- Sale staffs
- Public relations
- Exhibition and trade fairs
- Radio, TV, advertising
- Sale agents and distributor

Form 6 – Activities for export-oriented products (garment)

- Public relation
- Sale agent and distributors
- No financial and technical assistant to help the export products

Form 7 – Training

Almost all garment factories used a formal training programme in:

- Manufacturing process
- Advance manufacturing technology
- Product design
- Quality management
- Technical
- Management development
- Financial management control
- Administration system
- Internet (very few)
- E-mail (very few)

Other employees used a formal training programme for its personnel in:

- Manufacturing processes
- Information technology, i.e. word-processing, database
- Marketing
- Market research
- Technical
- Selling
- Management development
- Financial management control
- Administration systems
- Internet

Form 8 – Technology and process:

8-1. 80 per cent are licensed from foreign source, joint venture and own adaptation of readily available technology; 20 per cent are especially micro industries applied traditional technology.

8-2. Type of technology needed:

- 90 per cent of company need skill training
- 10 per cent need:
  - ➢ Technology upgradation
  - ➢ Adaptation
  - ➢ Machinery/equipment
  - ➢ Spare-parts
  - ➢ Skill training

8-3. Mechanism used to keep abreast of technological development:

- 15 per cent access to online information services, Internet or CD-ROM database, other oversea's exhibition
- 65 per cent are equipment suppliers (technical literatures, support through joint-venture partners, product buyer channels)
- 20 per cent has no idea

Form 9 – Financial and administration

9-1. If considering purchasing new equipment, companies applied:

- 100 per cent – own fund
- 50 per cent – some with share holders
- 20 per cent – local bank
- 30 per cent – join-venture with oversea companies

Form 10 – Business information needs

10-1 The companies are interested in information about:

- 100 per cent – from other companies
  - ➢ Products and services offered by other companies
  - ➢ Business opportunities.
- 60 per cent – from other companies
  - ➢ Business and technology institution
  - ➢ Product and services offered other companies
  - ➢ Training opportunities
  - ➢ Customs tariffs and other foreign trade charge
  - ➢ Domestic and foreign markets
- 20 per cent – other companies
  - ➢ Products/Service offered by other companies
  - ➢ Bank
  - ➢ Customs procedures
  - ➢ Transport services
- 15 per cent – only local market (micro-industry)

The response to the questionnaires and the result of interviews with a small group of businessmen and manufacturers reflect an urgent need of technology incubation system to support development of SMEs.

In reality to date, MIME has no legislative and regulatory framework to support the promotion of SMEs and no specific government policy and programme in developing this sector, nor are there specific incentives for the promotion of SMEs. In short MIME has no motivation to promote SMEs due to the lack of support policies and financial support. MIME is still facing the shortage of human resources in senior and middle-class personnel to formulate the regulatory framework and policies to support the promotion of SMEs.

MIME has no information network to meet with SME demand such as information regarding updated modern machinery and equipment, new technology information on financial resources to buy and incorporate new technology, to modernize machinery and equipment for winning competition, lack of information of technology and marketing to improve competitiveness, lack of information of export market, etc. Up to the present, MIME is deprived of all means to support the development of SMEs.

L. Institutional arrangement for promotion of business incubator and adventure business

When talking about business/technology incubation system, Cambodia is far away from reaching because according to ESCAP, the main concern of TI is to bolster technology development stage. It aims to complete technological ideas for technologies under development. They are characterized by institutionalized links to knowledge-sources including universities, technology transfer agencies, research centres, national laboratories and skilled R&D personnel. The aim is also to promote technology transfer and diffusion while encouraging entrepreneurship among researchers and academics. In fact TIs should be looked upon, in the broadest sense, as a mechanism for long-term capability building and regional or local development.[8]

Therefore, if MIME should be responsible to promote business/technology incubators alone, it will probably support tremendous load and will never succeed it unless otherwise cooperating with TNCs of industrializing countries like the Republic of Korea, Japan and Singapore, etc., and through the assistance of ESCAP, APCTT, ADB, JICA and KOICA as well.

To start with, MIME should at first think of the formulation on the possible establishment of an Information and Communications Centre (ICC) by requesting advisory assistance from ESCAP to help in clearing out the path for success.

M. Financial support scheme

As has been stated before, attention has been given by the Government to opening up access to international sources of finance for private sector investment. Cambodia is already the member of IFC and MIGA, and is currently applying for membership to ICSID.

It has also signed an agreement with ADB, providing private sector investors with the opportunity to obtain funding for their investment project from this international financing institution.

According to the blueprint planned by ADB on September 2001, which was signed by Senior Minister of the Ministry of Economy and Finance and Governor of the National Bank of Cambodia, enforcement of International Standard on Auditing (ISA) and International Accounting System (IAS) as follows:

- Phase I (2001-2004)
  - ➢ Establish accounting/auditing standards and enforcement system
  - ➢ Establish standards (IAS/ISA) to all companies in Cambodia
- Phase II (2005-2007)
  - ➢ Strengthen enforcement of accounting/auditing standards
  - ➢ Promote IAS/ISA
- Phase III (2008-2010)
  - ➢ Enhance the enforcement of accounting standards
  - ➢ Apply IAS/ISA to private companies

The promoter of TIs, MIME, in this very first stage, should find an alternative way to possibly set up an Information and Communication Centre, either thought its autonomous basis or joint-venture with private sectors by making reasonable arrangement to obtain funding from the above international financing institution for this project and/or cooperating with prospective TIs of TNCs to obtain soft-loan financing the project, notably though KOICA arrangement for example.

N. Conclusion and recommendation

1. National need and requirement

Cambodia's first SEDP, 1996-2000, set out a framework of nine guiding principles reflecting the Royal Government's approach to industrial policy-making. The main sectors in which investment is strongly encouraged are the following:

(1) Pioneer and/or high technology industries
(2) Job creation
(3) Export-oriented industries

[8] ESCAP, *Strengthening Technology Incubation System for Creating High Technology-based Enterprises in Asia and the Pacific* (ST/ESCAP/2137, 2001), p. 162.

(4) Tourism industries
(5) Agro-industries and processing industries
(6) Infrastructure and energy
(7) Provincial and rural development
(8) Environment protection
(9) Investment in the special promotion zones

With strong determination, national discipline and a clear view of the overall goals, the Royal Government of Cambodia has achieved significant result in just over two years since the early 1994. No doubt, there are still many challenges ahead and problems to be overcome, even those that arise as a consequence of progress made.

2. Efficiency in production

Illiteracy, lack of appropriate standard of education, technical and professional training, the lack of managerial and organizational skills and instrument to support sustainable economic development especially ICC had impeded the growth of productivity in some sector of the economy notably SMEs sector.

Of course in Cambodia, the clear change in production has substantially been made through the inflow of FDI. A number of old, broken state-owned enterprises have been privatized, renovated and equipped with new production line. For example, Apsara condensed-milk factory, Angkor beer brewery, soft drink, winery, cigarette, textile/garment factories have been put into operation and increased in both quantity and quality.

These enterprises can even compete with foreign products and a number of them have even come to export their products to overseas, but the lack of physical infrastructure has hampered the inflow of FDI. Cambodia is also facing the challenge to attract FDI to increase productivity, to strengthen and upgrade industrial, technological and commercial activities. There is still no access way to build business-to-business bridge in view to create lasting, long term opportunity for free enterprises to ensure sustainable economic development of the country.

In addition to the above stated, the loose collaboration between ministries such as between MIME and the Ministry of Agriculture, Forestry and Fishery (MAFF), the Ministry of Economy and Finance (MEF), the Ministry of Public Work (MPW), the Ministry of Rural development (MRD) and the Ministry of Meteorology and Waterwork Resource may also slow down national productivity in terms of agro-based enterprise sector.

3. Major Internet/e-mail service provider

Actually there are two major Internet/e-mail service providers in Cambodia. The common services they provide customers are:

- Communicate worldwide instantaneously via e-mail;
- Use the World Wide Web (WWW) to do research for work or school projects, learn about new products, read reviews, access information on other countries, their universities and businesses, make travel arrangement and so on;
- File Transfer Protocol (FTP) to transfer files between remote computers or to download shareware items (software, font, game, etc.);
- Access a search engine to find an Internet site with information on specific topic we are interested in.

4. Full Internet access

Full access includes complete Internet access via WWW, Gopher, FTP, Telnet and most importantly, e-mail is included in the full access package.

Even though there is no connection on systematic, integrated orientation towards proper sustainable economic development especially to support the promotion of SME sector because of the non-existence of “Information and Communication Centre”. Therefore almost all business enterprises are keeping information resources under one’s roof for there is no proper and reliable communication system between the related Ministry, MIME, and its under-supervised manufacturing units. In fact, at present, we have no access way to strengthen and upgrade industrial, technological and commercial activities for SMEs at all.

Obviously, almost all manufacturing enterprises are aware of these needs. According to the business enterprises response to the questionnaires, we have noted that the majority of them are equipped with Internet/E-mail fax phone, Photocopy machine, mobile phone and computers. These will facilitate the relational network between MIME and SMEs and their clients. Naturally, we understood that all manufacturing enterprises are facing with the shortage of skills and qualified personnel that will require training assistance.

They are also in need of technology acquisition/transfer, upgrading technology, skill training, standardization, quality control, specific technology in order to ensure the products quality and improve productivity. Also it will require mechanism to keep abreast technological development. In this initial stage, an access to online information services, Internet or CD-ROM database will be beneficial for such need.

To this extend, we may recommend MIME to find an alternative way to set up an Information and Communication Centre so that services could be rendered to SMEs enabling them the increase of their productivities.

The main objectives are:

- To set up the backbone for a national information infrastructure with global link via Internet
- To strengthen and upgrade industrial, technological and commercial activities in Cambodia
- To enhance professional capabilities in related spheres through training, motivation and access to modern technology
- To facilitate the sharing of knowledge and skills among various information technology professionals and end-users local and international in private sector as well as government agencies and training institutions
- To provide a window of opportunity to foreign investors and entrepreneurs seeking information on Cambodia
- To provide comprehensive technology transfer to the industrials and entrepreneurs of Cambodia

5. Training

In order to achieve the above-enumerated objectives, MIME, through the assistance of ESCAP, should develop a broadly based human capital to serve this sector. We would suggest the training assistance from ESCAP for MIME's personnel in the following specialized areas:

- 1 Manager
- 2 Database programmers
- 2 Home-page programmers
- 4 Computer specialists
- 2 Information specialists
- 2 Marketing specialists
- 1 Trainer

6. Equipment and software needed

- 1 Internet server, 1 router, 1 line server, firewall
- 1 Database and Internet LAN administration server, hub
- 5 Workstations
- 2 Printers
- UPS
- Windows, NT 4.0, Window 95, Back office, MSOffice Pro, outlets
- Internet/Intranet

ANNEX I

Telecommunication Network

Current status

Currently, there are approximately 52,177 telephone subscribers in Cambodia. Of these numbers, 11,609 subscribers are connected to the Public Switched Telephone Network (PSTN) with approximately 7,944 Wireless Local Loop subscribers and the remainder cellular mobile 85 per cent of these subscribers are concentrated in Phnom Penh.

The local exchanges consist of an AXE-105 (ERICSSON), an E 10B (Allocated) and an NEAX-61 (NEC). In March of this year, a completely digital Fujitsu exchange (FETEX-150) was commissioned in central Phnom Penh. This exchange has a capacity of 10,000 lines and was constructed by NTTI in conjunction with the Government of Japan bilateral grant aid of approximately US$ 17 millions.

The national network is supported by a domestic satellite system originally by the United Nations. The system consists of 3.5 metre earth-station located in every provincial capital. It is commonly referred to as the UNTAC system and provides local network facilities through the use of small rural switches supporting between 250 and 500 subscribers in each location. Local, national and cross-border services are available over the network and there is interconnection to the existing PSTN and mobile networks. The system was upgraded and is operated by Camintel, which is a joint venture with the Ministry of Posts and Telecommunication of Cambodia (MPTC) and PT Indosat, an Indonesian Company. There are currently, approximately 2,745 subscribers to these services.

The international services from Cambodia are operated under a Business Cooperation Contract (BCC) with Telstra over the INTELSAT system using a standard “A” earth-station terminal. An AXE-105 exchange with C No. 5 signaling is the international exchange for this link. This exchange has changed to CCS No. 7 signaling. This facility has approximately 370 circuits in operation and is connected to the MPTC main centres through a 140 mb optical fibre link. The operating contract with Telstra will be in effect until the year 2000.

At present the station is equipped for 370 voice channels, with direct channels as follows:

Australia	120 channels	Singapore	30 channels
Thailand	45 channels	Japan	20 channels
Malaysia	16 channels	Hong Kong, China	24 channels
France	29 channels	United States of America	16 channels
China	8 channels	Republic of Korea	24 channels

Currently, there are four cellular operators and one wireless local loop operator providing services in Cambodia, predominantly, Phnom Penh. One of these is providing his service using GSM technology and, therefore having cross-border capability. These five operators are all licensed by MPTC through joint venture arrangements.

In May of this year, two Internet services were introduced in Cambodia. The one service is provided by MPTC with the second service being provided by a joint venture with Telstra and MPTC.

Future plans for telecommunications development

In early 1997, the Government of Cambodia approved a fifteen-year Master Telecommunications Development Plan. Telecommunications was the first sector in Cambodia that has an approved Plan. This Master Plan has three major objectives:

(1) To provide the Government of Cambodia with the basic to plan all major elements of a National Telecommunications system over the next fifteen years;

(2) To improve the penetration rate and quality of services concurrently with the introduction of new services within the country. To assist MPTC in achieving its target penetration rate of 3 per cent over the next five to ten years;

(3) To improve the human resources, organizational, management and administrative practices. To improve overall performance and service orientation of the administration.

The first five years of Master Plan implementations has been organized into the following five projects and is commonly referred to as Plan 2003. These projects are summarized as follows:

(4) Expansion of the Phnom Penh network up to 60,000 lines, including the installation of 7 local exchanges and 2 remote switching units with the necessary Customer Access Network (CAN). A tandem exchange and national truck centre is included in the programme as well as the construction of fibre optic junction cable network;

(5) Establishment of 22 exchanges in the provinces along with the CAN. The transmission networks and the district RSUs are included in projects 3 and 4;

(6) Long-distance network providing for optical fibre links connecting 14 provinces and digital microwave links two centres, plus cross-border links to Thailand and Viet Nam, the remaining six provincial centres would be served by satellite;

(7) District rural networks, covering the development of about 70 rural networks, including RSUs, transmission links and the CAN;

(8) Encouragement of the private sector to participate in these investment programmes using various forms of investment, including, but not limited to joint ventures, Build Operate and Transfer (BOT) and Build Transfer Operate (BTO).

By the year 2003, the objective is to have a network capacity of 125,000 links. This would increase to approximately 400,000 lines at the end of the 15 years' period.

The cost of the undertaking over the first five years is currently estimated at US$ 260 million. In addition to the private sector MPTC is looking to bilateral grand aid and the donor community for the needed financial resources.

On a more immediately note, but consistent with the above, NTTI is currently in the final phases of the construction of a fully digital NEC exchange in western Phnom Penh and an RSU in the vicinity of Pochentong International Airport. These switching facilities will have a capacity of 6,000 and 800 lines respectively. They are being funded through Government of Japan bilateral grand aid totalling approximately US$ 13 million. These exchanges are expected to be commissioned by March 1998.

In March of next year, work will begin on the construction of an optical fibre transmission link between Phnom Penh and Bangkok. The transmission between Phnom Penh and Poipet will be direct burial type of 8 cores of fibre optic cable, having a capacity of STM-1 (155mb/s rate) with implementation of Signaling System No. 7, ISUP. Poipet will be linked to Aranya Prathet by microwave until a fibre link can be constructed. Representative from MPTC and TOT met on 17 February 1997 to discuss the issues related to this project and have planned a future meeting to finalize all technical matters and to discuss tariff issues. The project is being managed by KFW of Germany and is scheduled for completion in mid of 1999.

Concurrently work will also begin on the construction of an optical fibre transmission link between Phnom Penh and Svayrieng, Viet Nam and will provide a direct transmission route to Ho Chi Minh City. The 8 fibre cable will link at the border closed to the Phumbavet 2 ADM station. This interconnection shall be implemented using the back-to-back SDH 155 mb/s terminal configuration, since both domestic systems are using advanced SDH technology, Representatives from MPIC and DGPT/VNPT met on 27 February 1997 and planed to meet in the future with a joint working group to discuss on project implementation details. This project is also being managed by KFW of Germany and is scheduled for completion prior to the end of April 1999.

Also of significance is the initiation of the development of the second International Gateway in Cambodia. In early June, MPTC signed a joint venture agreement with Royal Millicom, Ltd., to construct and operate a satellite earth-station, which will provide backup and competition for the current Telstra operate gateway. Operation is scheduled to begin in the early part of the year 2000 and is expected to also result in the moderation of tariffs for this service.

ANNEX II

Phnom Penh Chamber of Commerce

Main objectives

(1) Support for commercial enterprises:

- Encouraging the establishment and development for new commercial enterprises;
- Reception, formalities, database on commercial enterprises, accounting, fiscal, legal and regulation information, and advise to business people;
- Prospecting new market, research for local and foreign partners, export regulation, organization of trade missions;
- Reception of foreign trade missions;
- Arbitration in commercial disputes.

(2) Advise to Government and local authorities in the matter of economic and commercial regulation:

- Advice on law and regulation projects
- Advice on large-scale projects and infrastructure development
- Advice on fiscal and custom law

(3) Professional training and business education

Article 11 of the law provides for this activity, leading to participant of the Chamber of Commerce in the matter of:

- Training of responsible business people
- On- and off-the-job training and technical expertise development for enterprises employee and business houses
- Seminars and workshops for Heads of commercial enterprises

(4) Development and equipment:

According to articles 10 to 13 of the law, the Chamber of Commerce shall participate in deliberation and action on the development of necessary infrastructure for commercial enterprises.

In particular cases, the Chamber of Commerce should participate in the management of infrastructure, such as commercial port, exposition parks, industrial estates, and also to participate in public tendering processes.

ANNEX III

Welcome to CAMNET
The first Cambodia Internet service provider

Camnet is a cooperative effort between MPTC and IDRC (International Development Research Centre of Canada).

We have brought the world to your doorstep, with up-to-date news from all over the world research and entertainment. For business or for pleasure, the Internet is for you!

For those who are new to Internet

The Internet – What is it?

The Internet is a common worldwide network that connects several million businesses, schools, research foundation, individuals and other networks. Anyone with access can log on, communicate via e-mail, and search for all kinds of information. Imagine being linked to 25,000 computer networks, 3 million host computers and 40 million people in over 140 countries.

Common Uses of the Internet:

- Communicate worldwide instantaneously via e-mail.
- Use the WWW to do your research for work or school projects, learn about new products, read reviews, access information on other countries, their universities and businesses, make travel arrangements and many more.
- FTP (File Transfer Protocol) to transfer files between remote computers or to download shareware items (software, fonts, games, etc.).
- Access a Search Engine to help you find an Internet site with information on a specific topic you are interested in.

Camnet Internet Services:

The Following Internet services are currently available from Camnet.

- *Electronic Mail*: E-mail is the most popular Internet service. It is the last, fastest and surest way to keep in touch with family, friends, associates, customers and others at overseas. You can receive new letters from special interest groups via e-mail. Internet is a transmission worldwide.
- *Full Internet Access*: Full Access includes complete Internet access via the WWW, Gopher, FTP, Telnet and much more! Most importantly, e-mail is included in the full-access package. (See <http://www.camnet.com.kh/brocher.html>)

III. PROMOTING BUSINESS AND TECHNOLOGY INCUBATION FOR IMPROVED COMPETITIVENESS OF SMALL AND MEDIUM-SIZED INDUSTRIES THROUGH APPLICATION OF MODERN AND EFFICIENT TECHNOLOGIES IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

Presented by Mr. Chandeng Keopaseuth,
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A. Introduction

1. Background

The Lao People's Democratic Republic is one of the least developed countries in Asia. It is a small landlocked country with a land area of 236,800 sq km stretching more than 1,700 km from north to south, and between 100-400 km from east to west. It has eastern border of 2,069 km with Viet Nam, western border of 1,835 km with Thailand, southern border of 435 km with Cambodia, northern border of 505 km with China and 236 km with Myanmar[1].

The population is about 5.2 million with density 21 persons per sq km, of which more than 80 per cent lives in rural areas and are engaged in rice-based agriculture and harvesting of forest products. The annual Gross Domestic Product per capita is just US$ 350, the share of the industrial sector in GDP is 22.36 per cent, the life expectancy is about 59 years, infant mortality rate is 82/1.000[2].

The Lao People's Democratic Republic has become a membership of ASEAN on 23 July 1997 and became the 19^{th} and newest member of Asian Productivity Organization (APO) on 18 June 2002. At present, the Government is preparing some conditions for submittal to become a member of WTO in the future. Joining the WTO is a logical continuation of the open-door policy.

2. Economic and technological situation

The economy of the country is based on agriculture and forestry. The people's living conditions are low compared with living standard of the world. The Government has made a great effort to overtake the national economic development through the people ownership and the international cooperation for leading the country out of under-development and maintain firm political stability, peace and social order.

(a) Economic situation

The Lao People's Democratic Republic is a poor country, but it has never experienced famines with mass-mortality, and most of people's life is based on agriculture and forest products.

Since the new economic mechanism was adopted in 1986, the policy objective is open-door which means the transition from central planning to market economy mechanisms with a socialist orientation, and good relations and cooperation with the rest of the world.

In the Fourth Five-Year Socio-economic Development Plan (1996-2000), the Government has launched eight national socio-economic priority programmes for some sectors for studying and implementation such as:

(1) *Food production:* The objective of this programme emphasizes to become self-sufficient in paddy production and basic foodstuffs. The increase of agricultural productivity is the key to improving living conditions and ensuring the sustainability of agricultural investment.

(2) *Commodity/Commercial production:* The objective of this programme focuses to increase the domestic production of consumer products for import substitution and for some exports.

(3) *Stabilization of shifting cultivation:* The objective of this programme aims to stop slash-and-burn agriculture, allocate and settle sedentary professions with productivity.

(4) *Rural development:* The objective of this programme focuses on the creation of farmer's household economy, expanding the number of model families, setting up an economic-cultural group, in which there is an expanding production of goods, developing the people's self-mastery, encouraging and promoting people participation in various economic sectors, and improving the living conditions in remote areas.

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[1] Ministry of Interior.

[2] National Statistical Centre, *Basic Statistics of the Lao People's Democratic Republic* (Vientiane, May 2002).

(5) *Infrastructure development:* The objective of this programme emphasizes to modernize the communication and telecommunication systems, upgrade the quality of national highway system stretching north-south and east-west, construct roads to districts and to villages, ensure direct telephone links between capital and provinces as well as international contacts and develop the national communication systems such as roads, rivers, railway and air.

(6) *Expansion of external economic relations and cooperation:* The objective of this programme is to increase cooperation with neighbouring countries and others countries, to open the economic relations and cooperation worldwide, to learn the progressive lessons in terms of production, management and the use of technology from the world, to attract foreign investors, and to promote and regulate the trade with international communities.

(7) *Human resource development:* The objective of this programme is to reform the school year system of general education, regime of compulsory primary education, raise the level of moral education, intellectual education, art education, physical education and labour education, upgrade the capacity building, training the personnel and cadres on management, technique and foreign language.

(8) *Services development:* The objective of this programme implies that any service sectors need to be closely emphasized regarding improvement and development such as trade, banking, restaurant, hotel and guesthouse, opening up natural and cultural tourist destinations, tourist infrastructure and services must be improved to facilitate and impress tourists.

The Government has encouraged domestic and foreign direct investment in many fields. The law on promotion and management of foreign investment was adopted by the National Assembly in April 1988 and was amended in March 1994. A year later, the law on promotion of domestic investment was issued in October 1995. The number of foreign investment, up to June 2002, reached 937 approved projects with the amount capital of US$ 7,299,605,288, of which the industrial sectors have got investment licenses for 360 projects with capital of US$ 5,563,693,403. In parallel with the industrial sector, the investment on infrastructure and services sector are also interested by local and foreign investors (see table 3-III-1).

In 1998-1999 the paddy production output of 2.1 million tons rendered the country self-sufficient in rice[3]. In recent years, the rice production has met the average domestic demand and had some reserved.

Table 3-III-1. Report on foreign investment in Lao PDR
(Summary by sector from 07/12/88 to 20/06/02)

No.	Sectors	Number of projects	Project cost (US$)
1	Electric power	7	4 582 000 000
2	Industry and handicraft	191	589 396 307
3	Wood industry	37	166 115 632
4	Mining, oil	34	138 492 764
5	Textile and garment	91	87 688 700
6	Telecom, transport	17	638 427 047
7	Hotel, tourism	52	630 273 792
8	Agribusiness	94	130 155 674
9	Services	187	103 678 921
10	Banking, insurance	12	83 800 000
11	Trading	132	72 581 913
12	Construction	39	68 404 466
13	Consultancy	44	8 590 072
	Grand total	**937**	**7 299 605 288**

Source: Department of domestic and foreign investment, Committee of planning and cooperation.

[3] Government report on the first six months of Fiscal Year 1999-2000, Vientiane, 23 March 2000.

There has been a rapid expansion of industrial sector output, particularly in manufacturing led by garments, textiles, assembly operations, material constructions, energy power and mineral resources. The industrial sector plays a crucial role in economic growth, especially electricity which included the construction of hydropower dams, transmission and distribution lines. The hydropower dams have produced about 218 mega watt (MW) of electricity in 1995, which has increased to 644 MW in 2000. More than 80 per cent of the electricity have been exported to Thailand for earning foreign currency.

(b) Technological situation

Even though the Government has launched the policy on three reformations since 1978, in which the education and S&T reformation is the opening key to modern country in economic development. The overall of industrial development in Lao People's Democratic Republic, particularly the development of industrial sector, mineral sector and energy power, compared with neighbouring countries, is still slow in terms of new technology. It needs to be pointed out that, up to now, the Lao People's Democratic Republic has still not received any company applications to joint the ASEAN Industrial Complementation Scheme (AICO) schemes, the reason is the problem of the company capacity status and the technology level.

In the last decade, the Government has paid a lot of attention to human resources development, in particular the state personnel has to be trained and upgraded for ensuring or playing a decisive role in the success or failure of state policy. The national education system is also being upgraded and gradually modernized to meet the needs and conditions of the country socio-economic development.

The new technology implementations were applied in economic development for projects such as hydropower dams, cement factory, electronic appliances, irrigation systems, telecommunication systems and so on.

3. Government policy on SMEs, technology policy and special measures to support SMEs in technological upgradation

The national economy is not only based on agriculture sector, but also based on other sectors such as industry, communications, and services, etc.

The Government recognizes the importance of entrepreneurs who are the people who start new business and make them grow by identifying opportunities for new products and services based on demand in domestic, regional and international markets. At the same time, the Government intends to support the development of micro, small and medium enterprises.

Article 10 of the *Manufacturing Industry Law* in the year 1999 has classified small factories as those with 10-50 employees or machinery with power between 5 to 50 horse power, or the lowest environment impact; medium factories as those with 51 to 200 employees or machinery with power between 51 to 200 horse power or the medium environment impact.[4]

The small and medium enterprises cover a majority in the business sector and create many jobs to the people. In industrial sector, more than 95 per cent are small and medium industries which create a lot of employment (see table 3-III-2).

(a) Government policy on small and medium enterprises/industries

In March 1996, the Sixth Congress of the Lao People's Revolutionary Party mentioned and set out the policy on SMEs which the objective had indicated to encourage and promote the development of light industry, small scale industry and handicrafts, with the aim of processing agriculture and forestry products as well as processing existing raw materials for daily use items and construction materials.

In March 2001, the Seventh Congress of the Lao People's Revolutionary Party also discussed and accepted to promote activities of the people's cooperative economy, currently emerging in the fields of agriculture, handicraft and services, and should have an appropriate policy on finance, credit and marketing to support their activities.

[4] The Manufacturing Industry Law No. 01/99/NA dated 3/4/1999.

Table 3-III-2. Number of Manufacturing Establishments in 2000

No.	Name of provinces	Number of establishments				Number of employees
		Large	Medium	Small	Total	
1	Vientiane Mun	58	133	1 525	1 716	30 120
2	Phongsaly	0	0	1 228	1 228	1 035
3	Luangnamtha	0	13	400	413	987
4	Oudomxay	0	12	1 431	1 443	1 937
5	Bokeo	0	10	488	498	1 015
6	Luangphabang	1	25	1 916	1 942	9 106
7	Houaphanh	0	4	381	385	503
8	Xayabouly	0	36	1 118	1 154	2 238
9	Xiengkhouang	0	8	961	969	1 517
10	Vientiane	1	59	2 417	2 477	6 130
11	Bolikhamxay	5	29	1 479	1 513	4 525
12	Khammouane	17	23	1 753	1 793	7 818
13	Savannakhet	9	60	2 395	2 464	7 875
14	Xaysomboune Special Zone	0	4	213	217	314
15	Saravanh	1	11	1 213	1 225	2 142
16	Xekong	0	15	298	313	840
17	Champasak	3	61	1 537	1 601	4 878
18	Attapeu	0	9	209	218	505
	Grand total	**95**	**512**	**20 962**	**21 569**	**83 485**

Source: Ministry of Industry and Handicrafts, *Industrial Statistic 2000*.

Besides, there should also be a concentration on developing the agro-forestry sector by linking it with industrial and service sectors.

The Congress has examined the public saving for development, which is an important and fundamental measure towards a self-reliant and self-resilient development. Therefore, all people must focus a great effort on augmenting production in three areas, namely:

- The production of rice, foodstuff and food
- The production of consumer commodity to supply domestic demand
- The production for import substitution and for export

The Fifth Five-Year Socio-economic Development Plan (2001-2005) emphasizes the need to develop SMEs and to mobilize people’s resources for investments in agro-forestry processing, consumer goods manufacturing, handicrafts for export, and order industrial sub-sector based on locally available input materials such as construction material, agricultural tools and service industries like tourism, transportation and packaging.

The domestic and foreign investors should exploit and increase the potential and the strength of each economic sector for contribution to the national development. From the Government’s Development Plan, Ministry of Industry and Handicrafts has established the policy on Industrial and Handicrafts Development Plan from the year 2001-2005 as follows: Pay attention to the development of electricity, processing industry from agro-forestry products, mining exploration and also the handicraft activities. Therefore we can, not only create some basic factors for future industrialization and modernization, but also be able to solve the poverty eradication and upgrade the conditions of people’s living standard.

In real situation the largest sector by number of establishment and persons engaged was the commercial sector and retailers which constituted about 90 per cent of the total within this sector. The second largest sector was manufacturing, with wood processing and textiles as predominant activities.

In recent years, the industry and handicrafts sector pays a lot of attention to small mini-hydropower and to set up the transmission and distribution lines to villages for supplying electricity to develop the socio-economic in remote areas. In parallel, the Government should also set up some business on processing industry from agro-forestry products (pulp of paper, textile, vegetable oil), and business on construction materials (iron steel, cement, crushing rock, tile and brick, ceramic pottery).

The Government's authority levels should carry out the promotion and encouragement the domestic and foreign investors to run their business on small and medium industries/enterprises as well as supporting and facilitating the investors to maintain and manage the existing factories to be sustainable and progressively develop for their own benefit and the national economic development.

Ministry of Industry and Handicrafts has prepared the law and regulations to ensure the development of small and medium enterprises; Water and Water Resources Law (1996), Electricity Law (1997), Manufacturing Industry Law (1999), Mining Law (1997), Regulation on Factory Establishment (1992), Regulation on Implementation of Mining Law (2002).

(b) Technology policy

The technology issues, nowadays, play a significant role in the field of economic development. Various research institutes have studied a number of fundamental issues to contribute to economic management efficiency.

The technology policy of the Government in the coming year is to raise the sense of self-responsibility in undertaking personally scientific studies and researches, as well as creativeness in the utilization of achievements of science and technology in the country's economic and social development, and the amelioration of the people's quality of life.

All the people, in particular, the cadres of state officials and private sector must strive to learn from scientific, technical and technological achievements of the world, and apply them appropriately, so as to continuously raise productivity and the people's living conditions, combining the traditional technology with new modern technology without harming the environment.

For technology and machinery, the Government encourages to apply the advance and appropriate technology in the process of industry and handicraft production to ensure the effectiveness and to avoid negative environmental impact. At the same time, the Government will appropriately invest in the development of science and technology to proceed to industrialization and modernization.

The Ministry of Industry and Handicrafts sets up the environment and technology policy to support the small and medium industries and the promotion activities as follows:

- Business applied the appropriate and advance technology for natural resources processing, cost production and product quality to be able to compete in the market.
- Business should not cause the natural environment impact and should not disturb social environment and the community.

The application of new technology in economic development requests the qualified manpower who is well-educated. In order to upgrade further the quality of education, we should have a right attitude towards the research and use of scientific and technological progress. The Government has invested in the education sector at least 12 per cent of national budget to build up the capacity building of personnel for successfully implementing the economic development objectives.[5] In 1996, the Lao National University was established by combination of ten faculties:

(1) Faculty of Education

(2) Faculty of Sciences

(3) Faculty of Socio-Sciences

(4) Faculty of Letter

(5) Faculty of Economy and Management

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[5] Strategy for Socio-economic Development to Year 2020, 2010 and the Fifth Five-Year Socio-economic Development Plan 2001-2005.

(6) Faculty of Forestry
(7) Faculty of Agriculture
(8) Faculty of Medical Sciences
(9) Faculty of Engineering and Architecture
(10) Faculty of Law and Administration

Many faculties have researched in specific technology and methodology, one of them is the Faculty of Engineering and Architecture, in which they study and research in the field of new technology. Some line ministries have established their own institutes or research centres for dealing in their own expertise, looking for new technology and developing their own sector to modernization.

The Ministry of Labour and Social Welfare has established the Vocational and Development Skills Centre in 1998 with the objective to train the profession and vocation to young unemployment.

(c) Special measures to support SMEs/SMIs

The Government accords an important role to the development of private SMEs as a source of domestic investments in producing goods for domestic consumption and exports, and as a source of budget revenues through taxation and commits to facilitating the conditions for their development. The SME sector makes a significant contribution to employment generation.

All the levels including central and local governments try to effectively promote and develop all economic sectors, promote particularly family business, mixed business and people joint venture business to enable them to respond to demands from local, domestic and export markets.

In 1999-2000, the Ministry of Industry and Handicrafts received assistance from Viet Nam to prepare the master plan on development of industry and handicrafts in northern part of the country, focusing on small and medium industries. The study has determined the directions and some issues to pay attention to the northern part. The development of industry and handicrafts should be based on the potential of natural resources and labour force in the areas i.e. plantation of agro-product for industry, fruit and vegetables, livestock and cattle to be raw materials for industry processing. The study has suggested that the establishment of the main micro or small enterprises should appropriate with the existing raw materials and the mountainous transportation, individual production, cottage industry and household clusters.

In the year 2002, the Ministry of Industry and Handicrafts has received technical assistance from UNIDO for an integrated programme for industrial development. The objective of this project includes, among other things, to study the strategy and prepare the policy framework on small and medium-sized enterprises/industries. The strategies for small and medium enterprises are identified by 3 sub-objectives:

(1) Creating an enabling business environment.
(2) Developing programmes and projects for facilitating the effective provision of financial and non-financial services to SMEs to increase enterprises competitiveness.
(3) Institutionalizing public-private partnerships for SMEs development in line with Government's decentralization policy and with an aim to enhance people's participation.

From the initiative strategy, at present, the National Economic Research Institute (NERI) is currently developing manuals containing guidelines for the setting up and operation of micro finance schemes in rural areas.

The Ministry of Industry and Handicrafts has initiated a small revolving fund to subsidize interest rates by issuance the regulation on Provisional Decision on Subsidy Loan Interest No. 093/MIH dated 19 January 2002. Article 5 of this Decision indicated that the entrepreneurs of handicraft processing and micro/small industries who will get the subsidy loan interest are pertained to the principles as follows:

- Not more than 80 per cent of loan interest rate that the bank lends to the project.
- Subsidy along the budget conditions which the Government approves each year and the Bank lending period.

The Government has not yet issued a high level policy document that recognizes the importance of small and medium enterprises, and that provides for support measures to the implementation of SMEs development.

4. Institutional support/arrangements for research and development and other innovative measures for SMEs

The policy framework on small and medium-sized enterprises/industries development which the UNIDO experts are preparing about the SMEs' responsibility institution together with the Ministry of Industry and Handicrafts staff are mentioned many alternatives for consideration:

(1) *Central Government Level:* The Government will create a National Authority to coordinate support for micro, small and medium industries/enterprises to be responsible for the research and development. The Government intends to assign the Ministry of Industry and Handicrafts to undertake this responsibility and coordinate with the related ministries as well as the Lao National Chamber of Commerce and Industry.

(2) *Local Authority Level (Provinces):* Some provinces which have the potential on industries/enterprises and convenient conditions can set up support/organization to promote business activities in the area.

(3) *Private Sector Level:* Some private and large companies which have the good financial status and well known in the international market can also established the own research and development centre to take care of the progressive companies.

(a) Institution for research and development

The Government recognizes the necessity for research and development institutions, especially of new technology/methodology and the development of sustainable economic for the wealth of the people. Therefore some line ministries organize their own centres for research and development to carry out research, study important issues, formulate the new programmes and apply the result of their achievements.

(1) *Committee for planning and cooperation:* The National Economic Research Institute established in 1997, plays the role of setting the directions/guidelines for national economic development in the short term and long term by discussing and collecting the information from concerned ministries. Their administrative and regulatory institutions ensure that the rules of the games are applied equally and fairly.

(2) *Ministry of Agriculture and Forestry:* National Agriculture and Forestry Research Institute was established in 2001 and comprises 7 centres. The main purpose of each centre is studying and researching for specific areas:

- Agricultural Research Centre
- Forestry Research Centre
- Soil Survey and Land Classification Centre
- Livestock Research Centre
- Fishery Research Centre
- Fruit Tree and Vegetable Research Centre
- Coffee Research Centre

(3) *Ministry of Industry and Handicrafts:* The Centre for Industrial Research and Development, established in 2000, is a services institution that carries out research regarding necessary financial, training, consulting, information services to the micro, small and medium industries. This Centre has got the technical assistance from UNIDO, and experts are working together with local staff to prepare a policy framework for SMEs.

The Manufacturing Industry Law has mentioned in article 27 the institution or centre for industrial and handicrafts research and development by which the Government promotes the private sector and organizations to invest in establishment of technical research centres or institutes for developing productivity, specific industries and handicrafts, cottages industries and industrial standardization, environment and services.

(4) *Lao National Chamber of Commerce and Industry:* Established in 1989, is a national business representative organizations who plays the role of uniting the domestic and foreign investors to run their business under the Lao laws and regulations. They have created several business groups such as:

- Construction group
- Construction materials group
- Hotel group
- Garment group
- Handicraft group
- Vehicle group
- Foodstuff group
- Petroleum group
- Pharmaceutical group
- Furniture group
- Coffee association

Each group has duty to make a research for their own activities, design, quality; look for their markets and safeguard their own products.

(b) Other innovative measures for SMEs

The Government has the policy to safeguard and promote domestic production with tax and duty policy for new industrial investment on import substitution, for having time on management, production and marketing improvement.

The concerned line ministries make efforts to simplify the existing regulations for facilitating the entrepreneurs to carry out fairly their business. Ministry of Industry and Handicrafts has promulgated the master plan of industrial and handicraft development through mass media and sent the staff officers to the provinces for disseminating the objectives, the main contents and the implementation procedures. Department of Industry with the collaboration of some departments from related ministries try to formulate and establish the industrial development fund, especially to support the micro, small and medium industries.

At present, the Ministry of Industry and Handicrafts is drafting some regulations related to small and medium enterprises development, and will issue the important decrees and regulations on industrial development:

- Decree on implementing the manufacturing industry law
- Industrial Zone Law
- Regulations on industrial environment
- Regulations on industrial standardization

5. Arrangements/supports for entrepreneurship development programmes

The Party and the Government have identified that the people's cooperative economy is a form of production organization based on voluntary basis by working people.

In the past, the Ministry of Industry and Handicrafts has tried to support and make the arrangements to promote the development of domestic entrepreneurs. During the years 1994-1999, the Ministry of Industry and Handicrafts implemented a joint project on Small Enterprise Development with the Government of Germany (Deutsche Gessellschaft für Technische Zusammenarbeit – GTZ), which began its orientation phase in December 1995 with the following tasks: (i) to complete a National Baseline Survey on Small Enterprises, (ii) to conduct training needs assessment studies, (iii) to identify any gender sensitive areas in small business development and training, (iv) to train counterparts as trainers, (v) to develop training materials, (vi) to train entrepreneurs, (vii) pilot test counselling and advisory services, and with the objective of testing different approaches for promoting small entrepreneurs and then on the basis of this experience, to formulate a larger project to improve the ability of small entrepreneurs to start and run their enterprises[6].

[6] Small Enterprise Development Project, Phase 1, January 1997 to December 1999.

They had organized 9 training courses, more than 40 persons have been trained as trainers, 113 entrepreneurs were trained in the provinces and approximately 250 women are of local professionals.

For the next plan of operation, the intention was to train approximately 500 entrepreneurs, but the project could not carry on because of misunderstanding about the institutional framework responsibility.

At present, the Department of Handicrafts takes position to train the micro and handicraft entrepreneurs for having knowledge of doing the business. They organize the training courses in the provinces and arrange handicraft exhibitions to promote the local handicraft products. The National Handicraft Centre was re-established in 1999.

Besides the above project, some ministries and other organizations also support and have established training centres with the aim to upgrade the capacity building to micro- and small entrepreneurs and also to unemployed young people.

- *Ministry of Education* has 3 vocational education schools: Pakpasak Technical School was founded in 1936, Lao-German Technical School was founded in 1964, Vocational Education Development Centre was established in 1983, that have educated technical knowledge, provided short, medium vocational training to the young people.
- *Lao Woman Union* has got the grant aid from the international organizations to arrange seminars and training courses to women in provinces about the traditional weaving, natural dyeing and regional handicraft.
- *Lao Youth Union* has the Lao Youth Vocational Development Training Centre which was established in 1995. The purpose of this centre is to provide training for young people who cannot attend university or college after leaving senior high school and who want re-education, to build healthy bodies among young people by providing a place for them to learn basic specialist skills to achieve self-reliance.
- *Ministry of Labour and Social Welfare* has Centre for Skill Development which was established in 1983 with the assistance of the Russian Federation. The purpose of this centre is to provide short re-education for unemployed and civil servants, and to strengthen the business course designed to train clerical personnel.

B. Status of business and technology incubators

1. Government's policy in promoting business and technology incubation

The Lao People's Democratic Republic is a least developed country. The level of economic development is under the people's aspirations. Nowadays, the Government's policy emphasizes to strive the implementation on the poverty eradication, to quit as one of the poorest countries in the world in the year 2020. In term of promoting business and technology incubation, there are only a few people who understand the meaning and the evolution of this business.

According to the definition of business/technology incubation system at the Regional Consultative Meeting on Strengthening Technology Incubation System for Creating High Technology-based Enterprises in Asia and the Pacific, which was held in Seoul during 29-31 August 2000, the business/technology incubator is a new concept for Lao People's Democratic Republic. The Government has not yet established a business/technology incubation system, because of the lack of information, small economy, low competitiveness of enterprises and low technology knowledge.

From experience of developed countries, business/technology incubator is very useful and necessity for small and medium enterprises to access the world competitive market. The Government and the private sectors are going to learn and pay a lot of attention on new technology to increase the national economic development by carrying out activities as follows:

(a) The awareness of incubation system

In the past, we did not understand the business/technology incubator concept. We only knew about incubators in the field of livestock. This is a new issue for Lao officials and also the private sector.

The businessmen and entrepreneurs need to take this opportunity to learn and study about the business/technology incubator, the institutional infrastructure, the line-coordination, the roles and responsibilities, the rights and obligations.

As a first step, the Government will assume the responsibility to promote the business/technology incubator by assigning some National Institution to carry out the pilot project. The National University of Lao should gather the professors and researchers to indirectly support the business activities by giving consultations, new technology introduction, working methods. Private sectors should closely work/run their business with the National University by assisting some funds for research operations.

The research and development centre of some line ministries that have enough resource persons can ask the high ranking authority to set up the incubation unit to start working on technology incubation system.

(b) Laws and regulations

The law in Lao People's Democratic Republic is not enough for the demand of social activities' administration. At present, the Government has only promulgated 49 laws and some regulations. The present economic situation needs many laws and regulations to deal in the economic areas.

Regarding business technology, the Government has not yet had the law on business technology. Almost all laws are related to the economic sectors, and have minor clauses and articles mentioning about technology implementation. Nevertheless, the law and regulation regarding technology are still under preparation, so that it does not occur any hurtfulness on technology issue.

The economic sectors as well as related ministries are making efforts to submit draft laws and regulations for the Government's approval. The decrees on the implementation of law and ministerial decisions also need to be issued. In the future, the law or regulation on technology will be examined and adopted.

(c) Investment opportunity

Based on the Law on promotion and management of foreign investment/domestic investment and the decrees on implementation, the Government had improved and amended some clauses, conditions which were not appropriated in real economic situation. The main objective is to simplify, facilitate and make attractive to general investors.

The foreign investment law and the decree on implementation has mentioned the scope and activities promoted to the foreign and domestic investors: activities open for foreign investment, activities open with some conditions, activities closed for foreign investment and activities/professions reserved for national investment[7].

The Government has also classified the list of business and manufacturing industries to be promoted for foreign and domestic Investment, which it can create a lot of information, alternative business sector, investment application procedure and good climate for investment.

2. Private sector's initiatives and activities in promoting business incubators and venture business

The private sector in Lao People's Democratic Republic is still not familiar with business technology incubations, they still have not any information about this concept. Discussing about business technology incubations, there is rare people who know and understand its roles and its obligations.

[7] Decree No. 6/PM regarding the Implementation of the Law on Promotion and Management of Foreign Investment.

The promoting business incubator is new for private sectors as well as the Government levels. In order to access the process of globalization, everybody and every sector must learn about world technology achievements and use them in an effective way to try to close the gap between the least developed and developed countries.

(a) The private sector's ownership

The private sectors are the main target to develop themselves in running the efficient business. The positive results and profits of their activities contribute directly and indirectly to large revenues of the national budget and national economic development.

In order to compete in the international market, the Government with collaboration of private sector and business investors make efforts to study, understand and organize the business and technology incubation system for the benefit of people and national economic development.

The Lao National Chamber of Commerce and Industry as the representative of private sector has the competence to arrange the establishment of business technology incubations for undertaking consultation, recommendation and technical assistance in various field of business activities.

(b) The promotion of new technology

The progress of technology development in the world is so fast, especially in the developing countries; that the least developed countries have difficulties in catching up and acquiring and using appropriate technologies.

The Government recognizes the importance of new technology to apply in the economic development. In the real practice, the application of new technology is not with full capacity. It has some limitations because of the cadres and personnel lack of experience and know-how. Therefore, the new technology and technology transfer in Lao People's Democratic Republic are still in the low or medium level.

The Party, the Government Report and Plan of Action have always mentioned about the necessity and the benefits of national economic development by using advanced technology appropriately to the economic situation.

3. Institutional arrangements for promoting business and technology incubators

Up to present, Lao People's Democratic Republic has not any institutions or agency to work on the promoting business and technology incubators. Because of the new concept, the small market and low competitiveness in the country, this issue is still not popular and of little interest to the business investors.

At the macroeconomic level, the Government agencies have established institutes or research and development centres for the purpose of analyzing/studying their own fields. They still do not research how to support the technical assistance, encourage financial credit and recommend the best alternative way of doing business to the entrepreneurs/domestic and foreign investors. The business operations depend on the entrepreneur's intelligence, experiences, financial status and influential character.

The national institutions need to accelerate their responsibilities for playing the role of leading economic development by creating and taking advantages on science and technology achievement.

(a) Ministries concerned

Nowadays, it is due time to speed up the development of human resources in order to respond the utilization of high technology in the best way.

The National University, which is under the Ministry of Education, has the potential to undertake the establishment of a business/technology incubator. They have many faculties, many professors, researchers and scientists who have experiences in technology/knowledge transfer.

Some line ministries have capacity to improve and upgrade their own research centre in setting up the business/technology incubator for assisting and consulting in specific sector.

(b) Chamber of Commerce and Industry

The Lao National Chamber of Commerce and Industry plays the role as the representative of employers/private sectors who actually run the business in Lao People's Democratic Republic. They have many hundred members who can operate the successful enterprises. Even though they cannot set up the business/technology incubators by themselves, their business activities can still perform well despite of small market and low competitiveness.

In order to access the global trading networks, the Chamber of Commerce and Industry cannot stand in the same situation as at present. It needs to look forward to gather all the members and examine the business/technology incubator concept for their benefit in running their own business.

4. Financial support schemes

Because of the non-existence of business and technology incubator, the Government has not yet arranged any financial support to business and technology incubation, but there is an agricultural promotion bank, which gives the services on agriculture, and small industries/handicrafts' credit development.

The Ministry of Industry and Handicrafts has taken initiative to establish the Centre for Industrial Research and Development with the mandate to formulate the strategy and policy of industrial development, including the micro, small and medium industries, to give services to the entrepreneurs by consulting, suggesting the means of production of business and to deal with the productivity/competitiveness by organizing the training courses, collection of all databases and useful information for SMEs. The role of this Centre, in the near future, will be possible to spread the activities for supporting the SMEs/SMIs, especially to set up the pilot project of business/technology incubator.

Nevertheless, the Ministry of Industry and Handicrafts has issued the Provisional Decision on Subsidized Loan Interest Rates No. 093/MIH dated 19 February 2002 regarding the support and arrangement the loan credit to the micro, small/medium industries by discount and subsidized interest rates.

5. Other incentive measures

Due to the lack of information about business and technology incubation system, the Government needs some more time, prior to deciding on issuance of any law or regulations concerning the incubation systems. At present, the Government has not yet the incentive measures to support, promote and establish the business/technology incubator for assisting the micro, small and medium enterprises/industries.

C. Conclusions and recommendations

The issue of business and technology incubator is a new concept in Lao People's Democratic Republic. In the past, the business activities have been based on the preference and talent of the entrepreneurs.

The Government intends to support the development of micro, small and medium enterprises. The dissemination of legal, regulatory and administrative information to SMEs should be perceived as one of the primary responsibilities of central and provincial level authorities and appropriate capabilities should be built. Central and local authorities can work with partners, such as the national and local Chamber of Commerce and Industry (CCI) in carrying out their regulatory information dissemination responsibilities.

The Government has tried to create an enabling environment for production and business activities by issuing appropriate policies of encouragement. Laws, regulations and some policies have always promulgated every year.

1. Government

The Government should invest, more than in the past, in the field of education for the development of human resources, the capacity building of the cadres and personnel to ensure the success of implementation on the Government goals.

The Government should appropriately set the credit priority relating to tax and duty, as well as appropriate professional training for each target in order to generate employment, encourage production business in many economic sectors with various scale and at different levels, especially the promotion of small and medium scale enterprises which require small funding and technical level suitable for our people in various regions.

The Government should also concentrate on the potential of the industrial and services sectors of our country, especially in electricity generation and services, agriculture and forestry processing, and mining; expand transit services and tourism to prepare for future industrialization and modernization.

The Government should concentrate on linkage between the services and industry sector and agriculture sector, aiming at increasing the effectiveness and the volume of production.

The Government should revise the policies and regulations that promote investment, stimulate improvements to the structure of government organizations, regulations and procedures for approval of investment.

The line ministries concerned should carry out the research and propose to issue laws and regulations to regulate and facilitate the establishment and development of small and medium-sized industries.

The Government should encourage the establishment of agencies and institutions to provide services to investors through provision of training, advisory services, information, assistance in conducting product research and development and transfer of technology.

The Ministry of Education with its affiliates should emphasize the acceleration of human resources development through training of workers and managers of SMEs.

The Ministry of Commerce should revise the business law and existing regulations to facilitate business establishments and operations, and implement effectively the consistent regulations.

In the long term, SMEs funding with preferential rates is recommended for productivity and quality improvement, research and development, technology improvement and environment protection.

2. Private sector

The Lao National Chamber of Commerce and Industry is the representative of business investors. It should encourage and organize the training, counselling, advisory and consulting services to assist the SME owner-managers for their business achievement. As the same time, they should be responsible to develop the business environment for small and medium-sized enterprises.

The banks and large private companies with the consultation of CCI can take part in establishment and the provision of development funds for private enterprises. In the medium term, they will have potential to set up the business and technology incubator for supporting their business in the international market.

3. Local and regional authorities

As mentioned in the Instruction No. 01/PM dated 11 March 2000, the Government's decentralization policy is to build up the province as the strategic unit with responsibilities including international cooperation, the districts as the planning and budgeting, and the villages as the implementing unit with requirement in setting up evaluation systems to monitor the development plans that they have formulated. The local authorities should be master in the enhanced management over the economic business units located in their areas.

All personnel in the local and regional agencies should facilitate and create the good investment climate to the entrepreneurs who can create jobs for many people at the grassroots level.

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IV. PROMOTING BUSINESS AND TECHNOLOGY INCUBATION FOR IMPROVED COMPETITIVENESS OF SMALL AND MEDIUM-SIZED INDUSTRIES THROUGH APPLICATION OF MODERN AND EFFICIENT TECHNOLOGIES IN MONGOLIA

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A. Introduction

In social and economic development of every country, small businesses play a significant role. This can be explained in one hand by the advantages of small businesses. On the other hand, however, it is associated with the present economic situation that mainly depends on rapid market changes.

Currently Mongolian SMEs have little opportunity to gain access to development and investment capital, especially from sources outside Mongolia. Organizations and agencies, which provide services to SMEs, are immature and still require support to improve their skills and expertise. The perceived priority needs of foreign assistance to Mongolia are in the area of technical assistance for skills development and capacity building, and capital investment to support economic growth.

Currently there are about 40,000 registered business entities in this country, 96 per cent of which represent small and medium enterprises. 55 per cent of all SMEs are engaged solely in trading business (Government of Mongolia 2001b).

The largest burdens for the development of SMEs in Mongolia are the lack of financing and high energy price, which increase the cost of end products.

B. Economic and technological situation of the country

1. Economic situation

Mongolia is a country undergoing simultaneous political and economic transformation. Ten years after changing to a democratic form of government and a market economy, Mongolia is still a country in transition. Mongolia began its transition from a centrally planned economy to a market-oriented economy in 1990. The disintegration of the Russian Federation and of the socialist trading system, threw the Mongolian economy into hardship. The Russian Federation's decision to trade only on a hard currency basis was particularly devastating, especially because Mongolia imports most of its petroleum and energy from the Russian Federation. In addition, Russian assistance to Mongolia was cut off rapidly in the early nineties. These, among other factors, led to a decline of GDP until 1993. In response to this situation, prices and tariffs were liberalized, and the decision was made to implement a free exchange rate system, create a new social welfare system, and accelerate restructuring and privatization activities. Tight monetary and fiscal policies were also put in place to enable macroeconomic stabilization by decreasing hyperinflation, as well as budgetary and current account deficits. Within the framework of legal reform, new legislation on economic relations such as budget, taxes, foreign investment, foreign currency, statistics, social insurance and the regulation of unfair competition were passed and implementation began. The Government of Mongolia announced the year 2001 as a National Industry support year.

As a result of these policies, Mongolia started to recover gradually. The GDP growth rate was 2.4 per cent in 1996, 3.2 per cent in 1999, and 1.1 per cent in 2001. In 2001, GDP growth has fallen to 1.1 per cent due to the effects of a harsh winter in 2000 as well as that summer's severe draught. Per capita GDP (at current prices) has reached 477.6 thousand Tugs. The inflation rate has been reduced from 53.1 per cent in 1995 to 8.0 per cent in 2001. Output of leather products and footwear was increased by 36 times compared to previous year. Combed down cashmere, camel woollen blanket, scoured wool, felt boots, and knitted goods' production has increased by 43.9 to 89.8 per cent.

Intensification of structural reforms led to large-scale privatization in the fields such as construction, trade and livestock production. This resulted in private sector production being equivalent to 70 per cent of GDP in 2001 compared to 10 per cent in 1990.

With the resumption of stabilization and reform measures after the installation of the new Government, prospects for stronger economic performance have improved. However, as a whole, the economic and social situation still remains difficult. There are many urgent remaining problems i.e. the budget deficit remains large, the situation is still deteriorating in the fields of energy, raw material processing, land cultivation and some social aspects. The collapse of the command economy and the subsequent steps in the transition to a market economy, including privatization, led to severe unemployment, as well as to reduced public provision of health, education, and other social services, weakening the scope of the social safety net.

Sound macroeconomic policies, supported by the donor community, have allowed Mongolia to weather the worst of the Asian financial crisis, despite several drops in world prices of Mongolia's key exports: copper, cashmere, and gold.

New firms are emerging rapidly in Mongolia. In 1998 textile and garment exports were larger than mineral exports for the first time in Mongolian history. Due to the relative stability of Mongolia, some American firms have established operations here, using Mongolia as a base for operations in Siberia. The modest trend is expected to continue as firms begin to realize the strategic location of Mongolia. In addition, the informal sector is emerging as a major engine of growth and employment and may account for 13 per cent of the GDP (ADB 2002a).

Falling international copper prices in 2001, and a drop in cashmere exports depressed overall export growth, which had picked up significantly in 2000 (UNDP 2001). Increases in textile exports offset some of the losses. Purchases of capital equipment in the first two quarters of 2001, and the need for Dzud relief have kept imports high, which constituted to trade deficit of US$ 169.6 million.

Continued expansion in the nonagricultural sector, especially in mining industry, is expected to dampen the impact of continued slow global growth on economic performance in Mongolia in 2002. GDP growth is expected to increase to 3.0 per cent in 2002. Following table shows key statistical indicators regarding industrial development (Government of Mongolia 2002).

Key Indicators	**1995**	**1999**	**2000**	**2001**
GDP per capita (in thousand Tugs)	246.2	392.2	436.9	477.6
Industrial composition of GDP (%)				
• Agriculture	38.0	37.0	30.9	26.0
• Mining	12.0	8.6	11.2	11.7
• Manufacturing	12.1	5.9	6.0	7.2
• Electricity	1.8	3.6	2.4	2.4
• Construction	1.7	2.5	1.8	2.0
• Wholesale	17.0	20.7	23.3	24.6
• Hotel and restaurants	0.7	1.3	1.3	1.4
• Others	16.7	20.4	23.1	24.7
Output of selected industrial commodities				
• Electricity, million kW hours	2 628.0		2 946.0	3 017.0
• Thermal energy, thousand Gkal	6 816.8		6 885.4	6 597.2
• Crude oil, thousand barrel			65.5	73.7
• Coal, thousand tons	5 019.0		5 185.0	5 145.0
• Copper, ton			641.1	1 475.9
• Copper concentrate, thousand ton	346.4		357.8	381.4
• Gold, ton	4.5		11.8	13.6
• Bricks, million pieces	21.5		17.3	21.0
• Combed-down cashmere, ton	420.8		450.9	608.4
• Camel woolen blanket, thousand metres	19.4		28.5	43.1
• Scoured wool, million ton	1.2		1.4	2.1
• Carpet, thousand square metres	595.7		704.8	614.8
• Knitted Goods, thousand pieces	522.7		1 233.5	2 315.7

Although the economy of the country is experiencing many transitional difficulties, it has been undergoing radical structural changes providing conditions for multifaceted economic relations. The private sector role in the economy has been increasing with the continuing privatization of state assets. During the past five years Mongolian economy has been transformed from a state-owned to a private-owned one.

In general, previous stage of privatization of state ownership had few of the positive implications for operations of the enterprises that might be expected. The creation of effective corporate governance is a three-stage process: voucher issue, auction, and shareholder consolidation through secondary trading. And yet, very few companies in Mongolia have gone through the entire process. So far, there has been no capital infusion to the newly privatized firms and very little changes in the management structure. The privatization process for many of these firms represents a change in legal ownership with little or no corresponding change in corporate governance that usually accompany a change in ownership.

This has been the result of three complementary trends:

- Private enterprises have performed far better than state enterprises in sector after sector, and agriculture, which is almost entirely a private sector, has been the leading growth sector.
- New private companies have been contributing more and more to economic output
- A sustained broad privatization programme has shifted significant number of enterprises from state to private ownership.

Development of export-oriented, internationally competitive industries through the efficient exploitation of Mongolia's comparative advantage is one of main requirements for sustainable development. However, the development of many potentially competitive industries is severely constrained by insufficient development of the banking system and of non-bank financial intermediaries, which precludes many businesses, especially SMEs from obtaining the longer-term financing needed to modernize their plant, equipment, technologies, financial and accounting procedures and managerial expertise. Access to working capital is also severely constrained.

According to a feasibility study that has been prepared by Ministry of Industry and Trade, on the basis of a diagnostic study of the industrial sector, conducted jointly with JICA, the following indicates the needs of economic development and growth of SME sectors:

- **Manufacturing**

  For the last ten years, gross industrial production rate has fallen by 31.2 per cent, but it increased by 11.8 per cent in 2001. The manufacturing decline stopped and production has increased by 22.7 per cent in 2001.

- **Skin and hide processing industry**

  The leather industry is one of Mongolia's most important animal product industries. Mongolia's animal herd sizes, especially of goats, cows and horses have been increasing over the past several years, providing a steady supply of hide and skin for domestic processing. Mongolian leather product output was 368.3 million Tugs in 1999, 668.6 million Tugs in 2000, and 707.7 million Tugs in 2001. There are currently 66 skin and hide processing SMEs.

  For further development of this industry, the following measures need to be taken: improvement of the manufacturing capacity, production of environmentally sound products, quality improvement and recycling.

- **Cashmere processing industry**

  Cashmere – one of the finest natural fibers, is Mongolia's specialty product. As a comparatively rare product, cashmere has unique physical characteristics, and due to this, it is one of the most valuable among others. World market price for washed and de-haired cashmere today is about US$ 45-50 per kg, which makes it highly transportable. Cashmere is a number three product for Mongolia in terms of export earnings, after copper and gold. In 2001 production of combed-down cashmere has increased 51.1 per cent, cashmere tops – 81.3 per cent. The industry's capacity has expanded from only one state-owned factory over the past several years, with the establishment of 84 new processing firms. The majority was established with foreign investment. In addition, several existing firms (Gobi, Buyan and Altai Trading) have invested in equipment. All cashmere firms are private concerns, with the exception of Gobi and Mongol Amical. Production is currently about 600 tons of combed-down cashmere and 43.1 thousand metre of camel woolen blanket a year. Exports of cashmere and cashmere products have decreased sharply over the past two years, due to the fall in world market prices, and the institution of a tax on the export of unprocessed cashmere.

- **Wool processing industry**

Mongolia produces 2,100 tons of wool a year. In 2001 this sector of industry has produced 45.6 tons of spin thread, 38 thousand metres of woolen fabrics, 2.3 million pieces of knitted garments, 33.4 thousand pairs of felt boots, and 614.8 thousand square metres of carpet. Only 30 per cent of installed capacity is utilized, since knitting and spinning enterprises have largely ceased operations. An increase of the world price of chemical floss-silk has led to changes in the composition of output. Currently, carpet production plays an important role in the wool industry. Production of felt and felt boots has increased in 2001 by 10.8 per cent and 180 per cent respectively. There is a comparative advantage for this sector since there is an increasing demand of local market for felt and felt boots. Main issues of this sector of the industry are, decreasing the export of raw materials, improvement in the quality of raw material pre-processing, establishment of wholesale network throughout the country.

- **Sewing industry**

For the last 10 years, the United States and the European Union have offered favourable prices for Mongolia's exported sewn products, leading to increased output and foreign investment. Joint ventures with firms from the Republic of Korea; Hong Kong, China; and China have been established. Currently, 100 enterprises are operating in this sector. They receive inputs from foreign customers; outputs are exported to consumers in the United States and Europe. In 2001, 91.7 per cent of the goods produced for foreign customers' orders were exported to the United States alone. Opening up of new markets, creation of favourable conditions for export increase, improvement of management skill are the key problems of this sector of industry.

- **Wood processing industry**

Mongolia's forests cover 129,000 sq km (12.9 million hectares) or 8.2 per cent of the country's land area. Although percentage of the forest area is low, in absolute terms, it equals or exceeds forest areas of major timber exporting countries like Finland or New Zealand. The forests are comprised mostly of pine (Pinus sibrica) and larch (Larix sibrica).

Harsh climate determines very slow growth rate of 1.5 m^3/ha a year, compared to at least 10 m^3/ha in tropical regions. On the other hand, Mongolia's forests are located in the critical zone for forest growth and are extremely precious from a global environment protection point of view. Deforestation is the most serious problem facing the wood cutting industry in Mongolia. According to sources, Mongolia's forests are shrinking by approximately 136,000 hectares per year, mainly due to forest fires, diseases and other natural reasons. Woodcutting does not appear to be the primary cause of deforestation, and even complete stop of cutting would only marginally slow down the process.

Until 1989 the annual cutting limit was established by the Government at 2.5 million cubic metres. Sawn timber represents the largest portion of wood processing output, historically representing 70 per cent of the value of the wood sub-sector. Since late 80s sawn timber output has also fallen significantly, although exports revived after decline.

In 1990, the wood-processing sector employed 10,000 people in 27 big state enterprises, with a capacity to produce 500 thousand cubic metres of sawn wood, and 417 thousand square metres of construction materials; a small portion of production was exported. At present, the industry employs 4,000 people in 106 SMEs. Exports of wood and wood products have expanded. A current objective of the industry is to meet market demand through the full use of trees and forestry products, such as conifer needles, resin, bark, and scrap. In addition, to further develop the industry, a number of projects aim to produce goods from tree substitutive materials, and to process auxiliary wooden products. However, due to lack of financial resources, these have not yet been implemented. Introduction of modern technology, expansion of wood products in quality as well as in product types and quantity are the emerging issue of this sector of industry in Mongolia.

- **Metal processing and repair industry**

Currently, 16 enterprises and 70 repair shops are operating in the metal processing industry. Most of the equipment and machinery in this sector are obsolete, and this industry is dependent on importing about 90 per cent of its raw materials. Production and employment have decreased substantially from the levels achieved in 1990. Nonetheless, the Darkhan Metallurgy Plant installed new equipment to convert scrap metal into marketable products, with a positive impact on sector performance. Main problem of this sector of industry is high price of energy, which is making an end-product cost too high compared to Russian Federation and China.

- **Glass and porcelain industry**

In 1990, Mongolia had the capacity to produce 4,000 tons of glass and 4 million pieces of porcelain products. At present, most of the equipments are obsolete, and only 25 per cent of nominal capacity is utilized. The industry has been fully privatized. There is a great demand in glassware and porcelain products. Regarding the estimation made by Ministry of Industry and Trade, demand is for 20-26 million pieces glass products per year.

- **Meat processing**

Before the transition into the market economy started, Mongolia was one of the major suppliers of meat for Russian East Siberian region. In 1997 export of meat came down to 8,000 tons from 45,900 tons in 1980, when meat was number two export earner for the country. The initial decline was caused by the collapse of the Council of Mutual Economic Assistance (CMEA) markets, but the inability of the Mongolian industry to readjust and develop new export markets has been affected by the inexperience of agro-processing management and marketing, problems in product quality and shortage of funds for purchasing raw materials. Regaining the 1980 export volume at the current price of beef at about US$ 1.0 would mean additional of almost US$ 40 million in export earnings.

Meat factories are generally divided into four categories: slaughterhouses, meat refrigerators, sausage and canning, and meat packaging facilities. Animal slaughtering for urban areas and for export in Mongolia is concentrated at major 6-7 slaughterhouses. These factories' operations are highly seasonal, and inefficient, and cannot meet international quality and health standards. Production of meat by these large facilities has fallen sharply since 1990. It has been substituted by the development of very small, family owned slaughtering shops or yards, where animals are slaughtered without equipment using traditional techniques.

- **Mineral resources**

At present, over 20 per cent of Mongolia's territory has been licensed for mineral exploration and development, and more than 160 small and medium-sized firms are actively engaged in extracting gold, ferrous and non-ferrous, saline and other minerals. These include 8 state-run, 3 share-holding companies with majority state ownership and 4 joint ventures with state participation, which together account for 80 per cent of mining activity in terms of output and employment. Private firms include 126 gold, 1 molybdenum, 1 copper-molybdenum, 2 tin, 2 tungsten, 3 polymetallic, 12 fluor spar, 15 bitumen, lime and granite, 1 precious stone and 1 phosphorus mining operations. The main mining concern, Erdenet, a joint venture between the Government and the Russian Federation, came on stream in 1979. It has produced 1,475.9 tons of copper, 381.4 thousand tons of copper concentrate, 3,028.0 tons of molybdenum concentrate in 2001. Numerous copper deposits with an estimated total of 15 million tons of copper reserves have been identified; however, only Erdenet-Ovoo and Ovoo Tolgoi deposits have undergone in-depth geological surveys. Gold extraction has increased substantially over the past several years. In 2001, Mongolia produced 13.7 tons of gold.

2. Technology situation

As a developing economy in transition, Mongolia is interested in the transfer of technology and know-how, modern management and learning skills through foreign investment. Moreover, Mongolia has a limited experience in technology transfer in the context of new market economy. Therefore, the future of technology transfer depends on suitable capacity being created and institutional arrangements being established for successful implementation of appropriate policies. In order to develop the necessary conditions for the investment and transfer of technology, national capacity building is required (UNDP, 2001).

Moreover, at present stage, industrial sector in general is suffering from obsolete machinery and technology, and a lack of the latest scientific and technological advances. Research carried out on the current situation of industrial machinery and technology in the country reveals that only 40 per cent of all equipment within the industry has been utilized for less than 5 years. The process of equipment modernization has been slow in major industrial sectors.

Application of advanced technologies during the recent decade has been mainly concentrated within the industries of mining, power supply and construction materials production, although the progress in those industries remains inadequate.

Application of the achievements in science and technology to production is usually faced with obstacles due to the lack of proper research and testing facilities in most industries other than the mining and light industry sectors, coupled with weak development of innovative design facilities. In this industrial sector, there is a growing need to implement highly effective national technologies coupled with cost-effective, environmentally friendly and waste free foreign technologies in order to develop ecologically clean production.

C. Government's policy related to small and medium enterprises, technology policy and special measures to support SMEs in technological upgradation

1. Small and medium enterprises

In social and economic development of every country, small businesses play a significant role. This can be explained in one hand by the advantages of small businesses. On the other hand, however, it is associated with the present economic situation that mainly depends on rapid market changes.

Since the transition into the market economy, the Government of Mongolia has set up a new policy, and been taking the concrete measures for supporting the national SMEs.

Mongolia has made significant strides in responding to market demands, particularly in the SME sector in the processing of agricultural products and in the rapidly expanding area of gold-based jewellery production.

However SME development is still lacking adequate legislation, business networks (particularly international) and the various support services, financial, legal and marketing. In particular, access to badly needed venture capital for the creation of new, and the continuance of present SMEs is lacking. Interest rates on loans remain far too high, and repayment periods are far too short for SMEs to flourish.

Currently small and medium enterprises cannot make big progress because of weak developed infrastructure, insufficiency of electric power, high energy price, water and industrial space, as well as other reasons such as enterprises are not developed in financial and economic context, their management and organizational practice are not sufficient.

The continuing of the enterprise reform process and reinforcement of the SMEs is largely depending on international aid agencies and foreign countries assistance. Technical Assistance to the Commonwealth of Independent States (TACIS) has provided support to help Mongolia develop competitiveness and promote its international trade through enterprise restructuring and support. Mongolia has emphasized the role of small and medium-sized enterprises in leading the reconstruction of the economy. TACIS has provided assistance to boost their business planning and information access, and to enhance their capacity to attract foreign investment, through the establishment of a network of regional Business Advisory Centres.

In 1999, the Government of Mongolia ratified the Programme on promoting development of SMEs by the Government Degree 10. This programme defined social and economic needs of promoting of SMEs development under following basis:

- Production and services based on natural recourses, and creation of new job opportunities that facilitates the improvement of living standards
- Improvement of allocation of raw material and human resources, and market supply and demand
- Creation of fair competition within industry and service range, stimulate into more creative and active business environment
- Discovering new business opportunities for economic growth, and provide the equal opportunity for the development of the regions
- Development of new branches of production and services with high market awareness and flexibility
- Constitution of multi-ground economic system and increasing the amount of taxpayer

The purpose of the programme is to create favourable conditions for SMEs development that can be achieved by introducing the following objectives:

- To improve management and human resource development, and information technology
- To develop infrastructure in rural areas in order to facilitate creation of suitable conditions for the SMEs development
- To facilitate elimination of SMEs technical and technological backwardness, reduction of negative effects on environment and humans, and improvement of product competitiveness
- Support business linkages and cooperation between large firms and SMEs
- Promote domestic and foreign investment for the development of SMEs as well as foreign cooperation

Furthermore, the priority will be given to:

- Meet the demand of import-substitute goods and personal service in regional and rural areas
- Production of export-oriented products that will be able to compete on international market
- Production and service with high intellectual capacity and advanced technology
- Energy, road, water supply, communication and construction SMEs
- Full use of natural resources and recycling of industrial wastes

It should be noted that reliable statistics on the growth of the economy could promote and strengthen both public and private investments, particularly in the SME sector. In order to assist the Government in its plans for SME development, future external assistance shall also support enterprise restructuring and privatization. Private entrepreneurship shall be promoted, as well as industrial cooperation and joint ventures between Mongolian and foreign companies as key elements of economic development. Thus, in 1999 with the assistance of European Union, Foundation of small and medium enterprises was established.

This will involve know-how transfer, twinning, facilitating access to finance and management training initiatives. Encouraging both public and private investments, and continued assistance in the establishment of a sound banking system and structural reforms will be critical elements in the realization of this objective, and key priorities for the next period of international assistance to Mongolia.

The Ministry of Industry and Trade of Mongolia is taking the following measures that will be taken to create favourable environment for the further development of small and medium enterprises:

- Divide the territory by zones and implement the tax concession policy to ensure the industrial growth and investment, particularly in far rural areas. Create favourable living conditions in rural areas by implementing investment and loan policies for rural areas.
- Few non-banking credit systems were established to support the financing of SMEs, such as "Micro Credit Fund".
- Take measures to create legal environment for small and medium enterprises.
- To improve the managerial skills and organizational structure, regular training and retraining is being provided to the management staff of SMEs.

Although the environment for SME is still not favourable, there are some positive shifts that have emerged over the past years: the share of SME in the national economy is constantly growing. As by 2000, the SME's generated over 2,000 new job opportunities (Government of Mongolia 2001b).

Since 1992, the SME's have been provided with loans totalling 2 billion Tugs. Moreover, certain amounts of foreign loans and grants have also been allocated for the financing of SME's. Disposable syringe factory, traditional medicine producing factory and several food processing enterprises are among those that were established on foreign loans.

The government policy on promoting and encouraging the development of SMEs is being discussed by the working group under the Cabinet. The following actions are planned to be undertaken:

- Make the necessary modifications to create legal condition
- Invalidate the rules, regulations and procedures that prevent SMEs development
- Investigate tax and loan policies and implement projects to improve their flexibility
- Improve knowledge and skills of SME entrepreneurs in the development of business plans and projects, in finance and accounting, and their training
- Support initiatives and activities for development of SMEs and decrease bureaucracy of governmental organizations

The Government of Mongolia acknowledges the important role that foreign investment can contribute for growth through economic development in the country through employment creation, the provision of new capital and technology, the introduction of new management skills, generating foreign exchange earnings and the provision of opportunity and choice to the Mongolian people. In this regard, the Government of Mongolia is willing to open up the economy to different funds of foreign investment.

2. Technology policy

In 1987 Ergas introduced the concept of mission and diffusion-oriented policy design to classify and analyze national system of innovation. According to him, mission-oriented systems are characterized by centralization and the concentration of policy on a small number of government priority R&D, unlike diffusion-oriented systems which concentrate their efforts on increasing an economy's capacity of innovating by concentrating on the scientific infrastructure, technology transfer and cooperation, i.e. formal and informal relationships between different actors etc. According to Ergas, the technology policy can be classified as mission- or diffusion-oriented by examining several criteria concerning (i) the share of public funded research institutions, (ii) the specific design of educational system, (iii) the opportunities for cooperative R&D, (iv) standardization efforts, and finally (v) the share of military research. With the criteria introduced above, Ergas concludes to characterize countries according to their respective policy design.

The developed world accounts for 95 per cent of total global R&D spending. It is technological uncertainty, which makes R&D expensive in a technology-leader. The key issue for R&D in developing countries, then, is not how much R&D, but what R&D. R&D is largely D even in technology-leaders. Over 80 per cent of industrial R&D expenditures are devoted to improving products that already exist (Rosenberg 1996). There are at least four reasons why developing countries should do R&D. First, formal R&D effort can usefully complement process thrown-back-from-the-work innovation. Most problems, which arise on the shop floor, are best solved right there. But some need an organized and focused R&D team effort. Second, R&D teams can play a crucial role as the firm's 'learners' of knowledge produced elsewhere. R&D might instead function as the firm's formal learning unit. Third, doing R&D can have intangible spin-off benefits for the rest of the organization. R&D can set the tone for discourse on technology and can play a role as a change agent for a firm. Fourth, and increasingly importantly, moving up the value-chain to more attractive markets depends on a firm's ability to develop proprietary product designs. Development of new products not based on new technology, but certainly new product conceptualizations: in short new designs. Products range from homogenized low cost, usually mass-produced items, to high value-added items. Incremental innovation, process innovation, designs for manufacturability, and optimizing the supply-chain are all critical at the homogenized end. The high value-added end offers some of the most attractive opportunities, but at that end, the firm must be able to define design specifications.

Mongolia's attempted transition to a market economy is calling into question the role of its national research system. Mongolia's national research system has undergone profound changes with the collapse of the socialist regime. Radical but premature reforms of the structure of the R&D system were introduced in 1997 that changed the legal status of the most ministerial R&D units, merging many of these to the universities or forming new R&D corporations. The intention was to encourage them to either become self-financing or to be absorbed into the university. However, enterprises lack the resources or inclination to invest in R&D in unstable economic environment. The S&T policy bias in favour of mission oriented R&D carried out by government scientific institutions was pronounced. The university system performed very little research and the Academy of Sciences was fully supported by government budget. Most public R&D expenditures continue to support institutions designed for a centrally planned economy. R&D funding is largely used to pay salaries and maintenance cost. Almost no new investment has been made in equipment or staff training.

Mongolian Parliament and government made several decisions toward reforming national research system in Mongolia: Establishment of Science and Technology Foundation (1997), Government Policy for Science and Technology (1998), Law on Technology Transfer (1998), Status of Mongolian Academy of Sciences (1996), National Programme for Science and Technology Development for 2000-2010 (2000).

Mongolia's national research system has been in a constant state of flux since 1997 when the science policy structures of the socialist period were dismantled. It's three principal institutional systems responsible for fundamental and applied research and advanced scientific training are described here: higher education institutions, Mongolian Academy of Sciences (MAS), and R&D corporations. In 1990, MAS administered a large network of 130 institutes, centres and research units. Nearly 6,500 researchers and high-level staff were employed in these institutes, which mostly undertake fundamental research in physical and natural sciences, the social sciences and the humanities.

In comparison to 1990, number of scientists declined by 1.8 times, and the average age of them is over 40, while number of young researchers aged under 30 dropped by 20 per cent. Despite the sharp decline in the number of R&D personnel since 1990, which has been largely spontaneous, the network of publicly funded research institutions is still too large to be adequately supported by the resources the Government can make available. From the survey conducted by the Academy of Sciences, it is noted that although scientific organizations were equipped with 2,000 types of more than 3,000 units of equipment costing US$ 1.1 million with the aim to hold laboratory analysis and experiments, 50 per cent were maintained during 1950-1980, more than 30 per cent during 1981-1990, and 18 per cent – since 1991, which shows that investment drawn to this sector is sharply decreasing.

The Government decision in beginning of 1997 to merge and abolish research institutes now make it imperative to rationalize the size of national research system. Significant steps are being taken to reform the funding of academic and fundamental research. Since 1993, new form of funding of research projects was introduced.

R&D projects

Year	Continued	Launched	Executed total	Completed
1993	212	170	382	120
1994	262	78	340	33
1995	307	24	331	195
1996	136	193	329	104
1997	225	107	332	52
1998	280	27	285	165
1999	120	116	236	58
2000	178	41	219	94
2001	125	77	202	99

Even though according to Mongolian legislation on state budget, scientific works are entitled to 1.5 per cent of GDP, presently not more than 0.3 per cent is being used for this purpose. Additionally, science and manufacture sectors have weak ties, collaboration is insufficient, and participation of private sectors in science is poor.

As it was stressed above, the allocation of the state budget into the sector was 1.8 billion Tugs in 2000, 2.8 billion Tugs in 2001, and gone up to 3.5 billion Tugs in 2002.

Priority areas of R&D development in Mongolia, defined by the Government of Mongolia as follows:

- **Information technology**

  The Government of Mongolia focuses its attention to ICT as a prime mover to socio-economic development. The main strategy is contained in the ICT Vision 2010 which aims to provide favourable conditions for the development of government – legislation framework, business-economic framework, and people-society framework and on the necessity to establish state policy and regulatory regimes. The medium-term development strategy for ICT supports the ICT Vision 2010 by presenting different approaches and projects implementation schemes to realize the vision.

- **National traditional technology**

  Pasture agriculture as a fundament of whole economy has developed in equity/balance with environment and became the great contribution made by our country into the history of world civilization. Traditional technology such as processing of animal origin raw materials, medical plants, minerals, development of livestock and agricultural sector, ability to forecast weather etc. is becoming unique advantages of the country.

- **Biotechnology**

  This trend of the global science and technology development also has a great future in Mongolia. The Government of Mongolia supports every effort in biotechnology, bioengineering in agriculture, light industry, mining and medicine.

- **Chemical technology**

  Much needed field in Mongolian industry. There is a great need to learn to process and use local raw materials and minerals, as well as to produce the environmentally sound products and to meet the demands of the international and domestic markets by applying chemical technology.

- **Metallurgical and machinery technology**

  Development of efficient technologies on production of metallurgical items such as vehicle parts, machines of easy assembly etc., is needed for national development. There are several entities such as Mini-metallurgical enterprise in Darkhan city, Erdenet company, Energy equipment Repairing Plant, and Erel company's metal processing workshop.

In reforming its R&D system, Mongolia is grappling with serious issues. The issues have to do with ill-defined reporting relationships for R&D institutions within the policy and administrative systems, lack of clear framework for autonomy and effectiveness, a tradition of political and bureaucratic micro-management of R&D activities, and absence of overall strategy for economic reform in which a reconstructed innovation support system would facilitate dynamic adaptation to market liberalization. Reform of the Mongolian national research system must solve two critical problems: the research system must be made affordable through cost reduction and revenue diversification, and it must be responsive to emerging needs. The Mongolian R&D system, which appears to cost about US$ 3 million of expenditure, requires reform to become financially sustainable. Mongolia is facing high investment costs to rehabilitate its institutional arrangements for support of basic and strategic research in the universities and the MAS. The rational expectations of public support for basic and strategic research must be clarified, and institutions for servicing and supporting competitive, peer-allocated research must be created. Steering mechanisms can be a combination of core budget financing of institutes, competitive grant-based funding allocated according to scientific merit, strategic or targeted funding programmes, and special instruments such as matching grants or income-sharing arrangements to increase private financing of public sector research.

A large part of the national research system has an economic development mission and must be coupled with the enterprise sector, which is itself undergoing reform. Articulation of R&D system reform with reform of industrial sector is ideal. However, reform of the industrial sector is proceeding unevenly and is proving to be complex. This poses the difficult issue of how to undertake concurrent reforms in different policy spheres.

Four interrelated steps must be taken to reform the research system. First, the size and cost of public research network must be substantially reduced, with most applied R&D institutes to be privatized, transferred to the enterprise sector, or abolished. Second, a new range of initiatives is required to provide innovation support to small and medium firms through technology upgrading arrangements, procurement policies, tax incentives, and export market development, including establishment of quality control and technology extension services in key industries. Third, new funding structures are needed to stimulate competition for resources among suppliers of research in the public and nascent private sector. Fourth, the policy system must attempt achievement of policy concurrency for R&D and the enterprise sector, and link investments in R&D reform with enterprise reform as comprehensive as possible. This will require enhanced policy analysis and implementation capability, new approaches to privatization and enterprise sector development, and a willingness to address innovation issues at the sector and possibly firm level. Overall, disincentives of R&D investments must be removed and replaced with incentives for enterprises to develop R&D capacity or acquire technological expertise and services from external suppliers. Also, roles for the public sector in R&D must be reconsidered. Necessary reforms will affect the size and composition of R&D establishment, change the way public subsidies are distributed and, thus, reforming the over-centralized structures for managing the national research system that have their origins in those developed for planned economy.

Here are some areas of concern for R&D reform in Mongolia.

Shift from mission-orientation to diffusion orientation. It means we have to concentrate more on D than on R. This will create a new financial opportunity for fundamental research. Also R&D contribution to the national development would be widely recognized.

Unique product orientation. In Mongolia, there are many unique biological and biotechnological resources. We need to support the R&D project in these areas.

Networking. We need to make networking of scientists and professors from universities in being involved in international professional societies and implement international joint research projects as much as possible.

Creation of environment for R&D. It can be technology incubators, industrial parks, science parks etc. Also universities should go to meet the industry needs and strength the university-industry linkages.

3. Institutional support and arrangements for SMEs

Accounting for about 70 per cent of GDP, the private sector in Mongolia has become a driving force in promoting growth and development. The role of the private sector in day-to-day economic operations, particularly in those industries that were once predominantly state-owned (e.g. crops production), should be emphasized, as should the institutional and regulatory frameworks. In social sectors, including education and health, private sector participation in providing service, needs to be developed.

A private sector assessment was scheduled in 2001 to prepare a comprehensive strategy for promoting private sector development in Mongolia. In order to promote the private sector and provide a link between the Government of Mongolia and the private sector and to ensure a more favourable macro-environment for the business community, the Government of Mongolia, the Mongolian Chamber of Commerce & Industry and the Central Bank of Mongolia have recently signed a Memorandum of Cooperation. The first stages of the Memorandum are being implemented, and the institutional mechanisms for cooperation have been set up in the form of a Consultative Committee for Economic & Business Development, representing the government and the private sector equally.

The Government of Netherlands funded, UNDP implemented, US$ 2.8 million, Enterprise Restructuring Project (ERP) began at the end of 1998 and ended its first phase in June 2002. ERP worked with 9 large ex-state privatized companies important to the Mongolian economy and assisted them to restructure their management and operations so that they can adapt to and profit from the developing market economy in Mongolia and in the international marketplace. The focus of the project on enterprise restructuring and business improvement was unique in Mongolia and highly valued by all people involved. Several of the companies have made huge advances in the way in which they manage themselves and, as a result have improved greatly many aspects of their operation, including their product quality, product range, marketing and profitability. The project also made the companies much more attractive to investors.

The Foreign Investment and Foreign Trade Agency (FIFTA) of Mongolia is the government agency responsible for the promotion and facilitation of foreign direct investment and foreign trade in the country. Prime Minister of Mongolia appoints Chairman of FIFTA. Predecessor organizations of FIFTA were the Foreign Investment Department of the Ministry of Trade and Industry, 1990-1996, and the Board of Foreign Investment (BFI), 1996-1998. In 1998 FIFTA was formed in order to handle trade and FDI issues of the country, and it operates under the authority of the Ministry of External Relations.

The Small and Medium Enterprise Support Office of FIFTA is operating since January 2000. SMESO provides information related to legal aspects of business, accounting, banking, site development and licensing regulations.

Furthermore, for private sector development there is an urgent need to upgrade and develop a common information technology network to facilitate trade and investment, thus ensuring the effective use of resources in Mongolia. In this regard, cooperation between Mongolia and Japan is based on a combination of Mongolia's abundant natural resources with Japanese high-tech industry.

In frame of the TACIS project "Strengthening of Services to Support SME Access to Foreign Investment, and Support for the Establishment of a Network of Regional Business Advisory Centres" that Mongolia implemented from 1999 to 2001, some attempts to strengthen access to foreign investment for Mongolian SMEs has been done. As a result of this project, the following has been achieved:

- Established Business Development Unit (BDU) with six trained consultants, capable of providing efficient and income generating services
- Trained SME managers, capable to act as adequate partners for foreign investors
- Established RBA network (up to 10 advisory centres)
- Established access of MBDA to international cooperation programmes for SMEs
- Established contacts with SME-organizations in the CIS

German Agency for Technical Cooperation (GTZ) supports the efforts of the Government of Mongolia to improve socio-economic and environmental policy of the country and welfare of its citizens. Together with its local partners, GTZ is carrying out 13 projects in the fields of family health and planning, living condition improvement, environment protection, market economy legislation, private business development and labour force qualification. One of these projects is the Small and Medium Enterprise Development Programme implemented by GTZ since 1998, and FIFTA is their official local partner.

The overall objective of the programme is to support Mongolian small and medium enterprises in 5 selected sectors, improving their products and services in the local and international markets.

ACDI/VOCA established offices in Mongolia since August 1998 to launch exciting programmes to support development in our country. ACDI/VOCA endeavours to provide Mongolia with the capacity to build and strengthen its nascent private sector.

Most of the technical assistance for carrying out this programme is provided by the Worldwide Farmer-to-Farmer Programme. This programme recruits about 25 short-term volunteer experts from the United States each year to advise Mongolian agricultural enterprises, arranges tours to the United States for Mongolian farmers and agricultural processors, and uses in-country staff to teach agricultural marketing, production and management courses.

In leather, tourism and printing sectors there are permanent German experts, assisting companies in technical matters.

The main component of the Global Technology Network (GTN) project, which provides a trade lead linkage service, is designed for Mongolian companies wishing to purchase products of the United States or manufacturing technology, companies seeking joint venture opportunities with the United States companies, and companies wishing to represent products of the United States. GTN–Mongolia specifically identifies, but is not limited to, business opportunities in four sectors and sub-sectors critical to the development process in Mongolia:

- Agricultural technology
- Communications and information technology

- Environmental technology
- Health technology

Mongolian Chamber of Commerce and Industry (MCCI) promoted strengthening of the institutional support and the services offered to SME in the framework of a partnership project with the Berliner Absatzorganisation (BAO)/Berlin Chamber of Commerce and Industry during 1999-2000.

D. Status of business and technology incubators

There are few initiatives related to technology diffusion in terms of technology and business incubation in Mongolia. The knowledge of the decision makers and stakeholders about the business and technology incubators are very weak. Also, lack of human capital with the required technical knowledge and skills is barrier for technology development and transfer. Poor maintenance of equipment is a common problem, which affects their performance. Therefore, education and training of the related people is essential.

Efforts of bilateral and multilateral organizations should focus on the creation of capacity. Essentially, these efforts would involve the development of knowledge networks that combines know-how in selected organizations with responsibility for implementation of suitable choices of technology in other organizations.

MAS has established a Centre for Technology Transfer, which is just starting the collection of materials, organization of workshops, and cooperation with other international organizations, such as APCTT.

The Mongolian University of Science and Technology is fully committed to do diffusion-oriented R&D projects and starting to make a new links and agreements with local industries. The Mongolian University of Science and Technology is the only engineering and technology university with more than 17,000 students and 700 teaching staff. There are about 140 professors who are mostly working in technology areas.

In May 2002, the Government of Mongolia made a decision to establish an IT park, which will support IT incubators, venture businesses and IT development. This is the first real step towards establishing technology incubators in Mongolia.

The Mongolian National Productivity and Development Centre (NPDC) undertakes the measures of promoting nascent small and medium industries development, as a crucial aspect of the national economy. It provides permanent assistance to companies for achieving a total approach to productivity improvement, encompassing both the human and non-human aspects of productivity through harmonious labour management relations.

E. Conclusions and recommendations

The state has a major role to play during the creation of a market economy such as:

- Sustaining growth and aggregate investment, creating the institutions necessary for a market economy to function efficiently, investing directly in physical infrastructure and human capital
- Creating a monetary and financial system that facilitates private investment, and intervening directly to help the poor when all else fails

To implement the opportunities for technology transfer, the following preparatory actions should be undertaken at a national level:

- Identify technology needs for main sectors
- Evaluate in-depth the priority mitigation technologies
- Identify the opportunities to promote the technology diffusion
- Identify the priority of barriers and practical steps to remove them from the development and transfer of technologies
- Establish a capacity building and institutional arrangements

- Identify the ways to participate in the bilateral and multilateral mechanisms for technology transfer
- Promote the participation of the private sector in technology transfer

The establishment and growth of small and medium-sized enterprises is the major contribution to the generation of new jobs in Mongolia. Business incubators seem to have a significant impact on the survival rate for start-up SMEs.

Moreover, it is obvious that SMEs are crucial for industrial restructuring, and are an important element of the reform process. Therefore Government role is crucial in the development of support services for SMEs. Such services should be indispensable in view of the essential role of SMEs in the growth and transition period. But, most of these support institutions are in the beginning phase in Mongolia. However, some institutions have acquired a vast experience of both success and failure, which needs to be analyzed. Experiences should be exchanged by similar organizations, and lessons drawn for the future.

As shown in foreign country practice, such support institutions, business incubators, innovation centres, industrial parks and techno-parks have to be effective instruments for assisting entrepreneurs in starting a new business, nurturing young enterprises, and helping them to survive during the start-up period when they are most vulnerable.

From political and social points of view, assistance to SMEs has been considered both by national governments and international donors as a step towards economic growth, and assurance against unemployment and poverty alleviation through self-employment.

Today it is also seen as a means to strengthen the private sector and a way to foster the reduction of regional disparities through decentralized and local/regional development.

Even though the Government of Mongolia has already set the goal of developing SMEs, support for the private sector, the promotion of the infrastructure, and technology incubation is rather weak and is still in an infant phase.

Last but not least, research & development have to survive the transformation of their institutions to a market economy and are aiming to catch up with their competitors in advanced market economies. Decreasing government support for R&D makes it vulnerable to use their innovative and creative thinking with which they develop their ideas for marketable products and/or services.

Inclusion of representatives from leading private sector, industrial units and NGOs in policy formulation and implementation is a backbone of successful transfer of technology.

Technology transfer is not merely a movement of hardware and equipment. Hardware or physical capital only embodies one element of an entire economic process covering the subject of technology in its entirety. If successful technology transfer is to take place, then a local capacity establishes and adopts, and if necessary adapts and uses appropriate technologies to reduce environmental burden on the earth. Local capacity can be built essentially by two sets of activities. The first relates to training and human resource development, and the second focuses on the software aspects of technology, which are often ignored.

Technology transfer incorporation with some of the key elements of the country's sustainable development strategies will lead to an economic development, opening up of new markets for products and services and technology sharing between countries.

The main economic sectors and sub-sectors where environmentally sound technologies can be transferred are as follows:

- **Power and heat generation**

  End-use efficiency improvement, system loss reduction efficiency improvement, coal gasification, etc.

- **Renewable energy development**

  Solar, wind, hydro and bio-mass energy for small appliances and in remote areas with long-term goal of development of large-scale renewable energy system, etc.

- **Mining and natural resource processing industries**

  Efficiency improvement of energy use, technologies upgrading, etc.

- **Transport sector**

  Fuel efficiency standards and consumption testing programmes, vehicle taxation policy, etc.

- **Arable farming**

  Change planting dates, use different varieties of spring wheat, and apply the necessary amount of nitrogen fertilizer at the optimum time, improve vegetation cover through soil fertilization and seeding of perennial plants, etc.

- **Livestock**

  Change the technology of pasture use and livestock breeding, generate extra feed supply, change cattle breeding technology, generate new type of livestock more adapted to changed climate and refine the method of regeneration, establish the type and number of animals for selected region regarding to the dynamic of pasture and extra feed production capacities, improve the water supply for watering and water management policies, and develop policy to protect soil from overgrazing and desertification, etc.

- **Forestry sector**

  Minimization of further reduction of forest area, development of better reforestation and a forestation methods, balanced utilization of forest resources, development of wood harvesting methods, development and strengthening of forest management and forest protection measures, etc.

- **Waste management**

  Development of municipal and industry waste management system

- **Competitive advantages**

  Cashmere and leather are the very competitive raw materials of Mongolian industry. There are needs for technology incubation for improvement of the quality and design of products using modern technologies

- **Unique resource development**

  Mongolia has many unique natural biological and biotechnological resources, such as rock-salt, horse fat, medicinal plants, enzymes etc. Mongolian rock salt has been known for some time among limited number of people as an extremely good cooking salt in Japan and Republic of Korea. Increasing number of traders are importing and selling Mongolian rock salt as “Sweet Rock Salt”, “Uncontaminated Sweet Salt, Rich in Minerals”, etc. for about US$ 5.0 for a 350 gram package, unfortunately in limited amounts only. The specific horse fat is generally known to be very similar to human’s skin fat. Specially purified Japanese horse fat serves as a raw material for quality skin care products. For example, 30 grams of high-quality horse fat is sold at about US$ 40 as women’s skin-care cosmetics. To produce water-transparent and completely odorless quality products, the use of micro-filtration technology is essential. The specific horse fat from Mongolian horses has never been analyzed, but it is now is underway at the Mongolian University of Science and Technology. Mongolia has 300-500 medicinal herbs grown in the wild, many of which are widely used as herb medicine and food supplements in large markets such as China, Japan and Republic of Korea. Some are grown in a small commercial scale, but eco-plant has started to produce selected herbs in Ural-Altai in a full commercial scale, but no efforts seem to be done to export directly to large foreign markets.

Today, in Mongolia, a significant system of academic, research organizations, and higher education establishments with great intellectual potential has been formed. There is a lack of linkages between research and industry. In this respect, there is a great need for creating a system of venture financing of innovation and R&D projects, development of a “spin-off” system as well as of network of technology business incubators.

It is encouraging to note that the concept of incubators in Mongolia is just being introduced to the country. It is hopeful that, in the near future, Mongolia can build some well-established and successful incubators with assistance of international agencies.

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V. PROMOTING BUSINESS AND TECHNOLOGY INCUBATION FOR IMPROVED COMPETITIVENESS OF SMALL AND MEDIUM-SIZED INDUSTRIES THROUGH APPLICATION OF MODERN AND EFFICIENT TECHNOLOGIES IN NEPAL

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A. Introduction

The world has witnessed the significant progress in business and technology incubation used for creating and developing ideas, technologies and innovations through R&D and academic exercise. These ideas and innovation have been converted into commercially viable enterprises over the years. Because of these results, many developed and developing economies have been nurturing and supporting to technology-based entrepreneurs or technopreneurs in their early stages of development through various types of services available at the technology incubators. Despite the strong need in the country, Nepal has not yet been able to create this type of environment.

It is true that economies in transition and developing countries should think of developing generalized technology incubation and sector specific incubation system to support the restructuring of traditional economic sectors, including industrial clusters and estates, besides commercializing of new technologies and supporting technopreneurs. However, in least developed countries, the focus has not yet been initiated in developing a simple business incubation system with technology as a central theme.

Technological innovation is generally a dynamic and complex process involving a wide range of activities. New technologies are selected through a complex of interaction between economic factors, industry demands and the effect of government policies. The important areas in the successful innovation process include: understanding and meeting the need of the user, effective internal coupling between R&D and market needs, effective linkage with external sources S&T expertise, committed entrepreneur, efficient after sales services and raining of user.

The technology business incubator and similar initiatives are the latest in the evolutionary line to provide advisory training and information services, management and marketing support, linkages to research faculty and facilities, access to capital, thereby greatly enhancing the chances of success of the early stage technopreneur (Lalkaka 1996).

In some countries such as the Republic of Korea, Singapore and Malaysia, a number of ministries/ departments are already involved in the promotion of technology incubation systems. They are now putting efforts to have well-coordinated and complementary approach. Various policies related to the incentives tax structure, real estate development, operations, skill-development and human resource development programmes and development of SMEs, among others are being suggested to take them in place so as to encourage technology incubator promotion agencies.

1. Background

Agriculture sector has remained always a prominent source of employment providing employment to almost 90 per cent of population in Nepal despite the increasing share of other sectors of economy to GDP. The contribution of agriculture sector to GDP is 40.1 per cent. The manufacturing sector has also not been contributing as planned. The agriculture sector, nowadays, has been severely affected with decreasing production rate due to unfavourable climatic condition and of course insurgency.

The manufacturing sector also has not grown as desired, contributing about 10 per cent (2001) to GDP of which SMEs alone contribute around 9.3 per cent. Creation and development of enterprises is indeed important because this sector not only contribute in income generation however, could provides employment for additional 0.3 million people entering job market each year.

2. Small and medium-sized enterprises

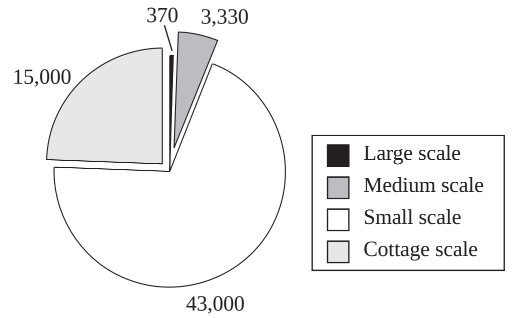
Irrespective of the development level of countries, SMEs are an integral part of the economy all over the world. In many developing countries, the SMEs have played a significant role in the economic development especially after the Second World War. This has been true in the context of Nepal too.

In Nepal, SMEs play a pivotal role to accelerate economic development of the country. Various studies have indicated that usually in the developing countries, the SMEs are found to contributing 40-60 per cent of the total output or value added to the national economy (Centre for Development and Governance 1999). Emphasis to be given in the promotion and development of SMEs in the country like Nepal is much more urgent where 47 per cent people are unemployed (CBS 1997).

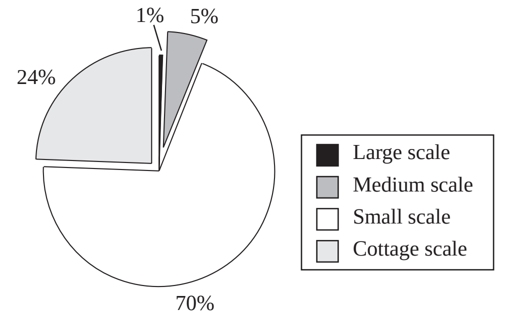
3. Total registration of industrial establishments

The Pie Chart given below reveals that out of the total registered industrial establishment, 43,000 (70 per cent) industries fall under small scale whereas, 15,000 (24 per cent) industries are of cottage level. Only 370 industries are registered as large one that is only 1 per cent of the total registered industrial establishment. It also indicates that cottage, small and medium industries consist of about 99 per cent of the total registered industrial establishment.

Estimated number of registered industrial establishment (in number)



Estimated number of registered industrial establishment (in percentage)



Source: Linkage between training providers and SME, report and documentation on the regional workshop held in Kathmandu, Nepal, 5-9 June 2000, prepared by Matthias Jaeger.

In Nepal, most of small industries are located in rural areas. Small manufacturing industries have been providing gainful employment to a large number of people. This sector also accounts for a large share of industrial output and plays important role in the export sector.

It has also been mentioned in a report on Strategic Alliances in SME Sector in Nepal (Asia Foundation 2000) that industries that employ 10 or more than 10 employees legally consisting of cottage and small industries, account for 96 per cent of the total industrial establishment, which produce 59 per cent of the total industrial output, create opportunities for 83 per cent of the total industrial employment and make up 9.22 per cent of the GDP. It was also mentioned in the same report that 73 per cent of the enterprises employed less than 50 workers and 92 per cent of the total manufacturing industries had less than 10 employees contributing 19 per cent of the output, 39 per cent of the employment and 20 per cent of the fixed assets.

4. Registration of cottage and small industries

The number of cottage and small industries registered from the year 1997/1998 to 1999/2000 is in increasing trend however, the pace of increment is quite slow. In the year 2000/2001 the industrial registration is in decreasing trend. Same impact can be observed in total capital investment however, in the case of employment and annual production the trend is slightly in the negative side despite the increased number of registration.

Registration of Small and Cottage Industries

Year	Number of industries	Total capital investment	Annual production	Employment
1997/1998	9 650	8 960	20 800	93 081
1998/1999	9 990	9 620	19 290	89 164
1999/2000	10 127	10 340	NA	NA
2000/2001	6 587	4 820	NA	NA

Source: Central Bureau of Statistics, 2002.

5. Private sector development

Realizing the important role of private sector in creating employment opportunity, promoting investment and increasing income, the Government has strongly emphasized on private sector development in its policy guidelines. A strong private sector is considered capable to face the changes that have come up mainly due to rapid pace of globalization. The private sector led economic development has been proved the most effective way and sustainable as well. To develop industrial sector and attract foreign direct investment, availability of skill human resources is prerequisite together with entrepreneurial initiatives and disciplined labour force. For it, sound measures need to be initiated so as to develop and update human resources leading to overall competence enhancement with active private sector participation. This is equally applicable in the context of Nepal too.

6. Business Development Services

Over the last several years, the business development services (BDS) field has experienced a major shift in strategy. There is now a great deal of support for the idea that developing markets for business development services is the best way to enable a large proportion of small enterprises to obtain the business services they need and want.

The availability of BDS, their quality and outreach, are the major factors that determine the growth or failure of enterprises. Years old training packages through supply driven approach are mostly being offered to SMEs in Nepal. Stipend has been one of the integral parts of the training programme and without it most of the programmes cannot have adequate trainees for training courses. Evidences elsewhere suggest that there is a positive correlation between usage and volume of quality BDS products consumed and industrial development. This is also true in the context of Nepal.

Dr. N.K. Bista's country paper suggested the underlined BDS activities for the country like Nepal:

(1) *Information* on technology, markets, regulations, sources of supplies, training facilities, etc.

(2) *Training* in business creation and development and skills training.

(3) *Advice and consulting services* in choice of products and processes, finding new markets, improving quality, increasing productivity, business management, skills training, accessing financial services.

(4) *The provision of specialized services* in product testing, technology upgrading, leasing of equipments, capacity to better organize and participate in trade fairs, advocacy/representation, information technology (computer), etc.

(5) *Incubation services* in business, technology, etc.

7. Business and technology incubation in Nepal

Business incubator, evolving from experiences with other business development services, has the purpose of assisting the new venture creation process. Due to the significance of technological innovation and entrepreneurship in shaping the future, business and technology incubation is regarded means of commercializing technologies and developing high value-added products, processes and services.

In 1980, offering space as basic infrastructure for establishing enterprises was considered as development process of incubator. In fact it was the first generation of business incubator introduced. In the 1990s the need was recognized for counselling, skills enhancement and networking services followed by new third generation incubation models from early 1998.

The various enterprises operating in the industrial estate of Nepal can be considered as first generation business incubation model. The IT Park in Nepal, which is in progress, is considered as an information technology-based incubator in Nepal which is yet to be established and made functional. In true sense, incubation activity in Nepal is not in practice to date.

Like other BDS, incubators also need to be assessed in terms of its performance. But the desired outcomes to be assessed depend upon the motives of the leading sponsors e.g. government, community, university/research institutions, outwards looking sponsors, international donors, private/for-profit based, etc.

Likewise, the main areas in which incubators performance needs to be assessed are impact, outreach, effectiveness and sustainability.[1]

B. Catalytic factors for supporting and expediting business and technology incubation for improved competitiveness of technology-based enterprises

Policies and programmes on S&T and BDS being introduced in Nepal are described below:

1. National policies in industry and technology

(a) National development plans

Nepal, for the first time, had initiated planned effort in 1956 as the **First Five-Year Plan (1956-1961)** where budget was allocated for industry and mining. **The Second Plan (1963-1965)** concentrated on institutional change and infrastructure development. Agriculture and industrial sector had been given high priority and provision was made to promote industries through pilot projects in the industrial districts located at Balaju and Patan during the Plan period. The **Third Plan (1965-1970)** emphasized on developing infrastructure so as to accelerate the pace of economic development in the country. So, substantial budget was allocated for the development of transportation base, electricity and agriculture production. High priority was given to transportation and agriculture sectors in the **Fourth Plan (1970-1975)** compared to industry sector. The **Fifth Plan (1975-1980)** gave due attention in the production of mass consumption goods, optimum utilization of human resources and promotion of regional balance and integration. The plan also gave emphasis on improving quality of industrial products. As a result, a Nepal Standardization Board was set up.

The **Sixth Plan (1980-1985)** stressed in increasing industrial production at a faster rate in order to address poverty and unemployment. The plan also aimed at fulfilling the basic minimum needs of the people. The **Seventh Plan (1985-1990)** further emphasized in the planned growth of industrial and commercial sectors. Realizing the importance of private sector, the plan encouraged this sector to take lead role in the promotion of industries so as to attain the anticipated goal of import substitution and export promotion. At the end of the seventh plan, the Government observed some key constraints in the process of industrialization and also realized that the industrial sector could not get momentum due to policy distortion, lack of transparency, over control and complicated process for licensing. With these in mind, the **Eighth Plan (1992-1997)** was formulated with objective of promoting of medium and large size industries in order to substitute imports and improve cottage and small-scale industries using locally available resources to meet the internal demand. The Plan stressed the following policies for the promotion of SMIs: (i) development of import substituting and export promoting industries; (ii) priority of private participation; (iii) emphasis on the development and expansion of cottage and small-scale and agro-based industries; (iv) institutional arrangements to familiarize the cottage and small-scale industries with market, technology, skills, etc.; (v) strengthening the existing financial institutions and establishing new ones to assist cottage and small-scale industries.

It was estimated that the contribution of the industrial sector would be 8.5 per cent of the total national production with export from the textile sub-sector being the highest. The Plan estimated creation of 181,000 additional employment by the end of the Plan period.

The Plan estimated 1,000 small industries to be registered during the period and 300,000 people in rural areas were supposed to be employed in the cottage and small-scale industries. During the Eighth Plan period, industrial production increased annually at 5.23 per cent only against the target of 12.4 per cent. The contribution of industrial sector to the GDP was 9.22 per cent at the end of on the other, the plan failed to create conducive environment for survival and growth of industries.

The **Ninth Plan (1998-2002)** with core objective of poverty the Plan period. The country, despite planned efforts of last three decades, could not create much impact in economic development of the country on

[1] Nirmal Bista, *State of Business and Technology Incubation in Nepal* (2001).

the one hand, alleviation put emphasis on promoting cottage and small industrial activities in rural areas based on local raw materials, labour and skill. It was envisaged that this would be instrumental in generating employment and alleviate poverty. The Plan has emphasized to increase industrial production with a view to meet the domestic needs and to diversify and expand domestic and foreign markets.

The plan has targeted to 6 per cent annual increment in industrial production and Rs 35 billion as the total domestic and foreign investment during the Plan period. It is also estimated that about 0.35 million additional jobs will be created during the plan period and the industrial sector's contribution to the GDP is expected to reach 14 per cent by the end of the Plan period.

The policies adopted by the Plan are:

- To expand and diversify industrial production by commercializing agriculture, forest and mining and by enhancing their coordination with the industrial sector
- To attract foreign investment in sectors of competitive advantage
- To remove the weaknesses in existing policies and laws for attracting private sector investment
- To activate the one-window policy and strengthen it to include provision of infrastructure facilities to the private sector
- To develop, expand and integrate necessary technical and support services required for cottage and small industries
- To produce high quality exportable goods by means of policy thrust for commodity-based industrial village, technology park and export processing zone
- To broaden the capital bases and attract investment from national and foreign financial companies for rapid industrial development
- To declare special industrial zones where physical infrastructure is developed and to encourage private sector to develop them
- To introduce and implement laws relating to anti-dumping, anti-trust/monopoly and restrictive trade practices
- To introduce and implement laws relating to anti-dumping, anti-trust/monopoly and restrictive trade practices

The plan proposed to improve production, productivity and quality control measures and prepare project profiles on the basis of industrial feasibility and market study. Marketing promotion strategy will be prepared on the basis of need assessment study of 10 urban areas of the country and 6 urban areas of the neighbouring country. Feasible industries based on existing resources will be identified in 20 districts. Project profiles, brochures, industrial statistics and trademark directory will also be published.

The plan aims to set up technology shops in various districts and a technology park with private sector involvement to develop and export software. To promote and expand cottage and small industries, 0.1 million people will be trained in different skill development programmes, 12,000 people will be encouraged to establish and expand industries in rural areas through integrated rural entrepreneurship development programmes. Additional 0.2 million-employment opportunities will be created.

The plan envisages tax-free export zones near inland container depot areas. Export Import Bank to provide facilities for foreign trade promotion will be established, in involvement of the private sector. Integrated package programme for products of cottage and small industries will be implemented. Exchange visits programmes for business and industry representatives are proposed. Revolving fund facilities will be provided to promote export trade. Implementation of Multi-model Trade and Trade Facilitation Project under IDA assistance will be continued.

(b) Industrial Enterprise Act and Industrial Policy

The **Industrial Policy, 1992** recognized the key role of private sector in industrial promotion. The Policy stressed on privatization, market oriented pricing of industrial products, determining wages on the basis of productivity and protecting industries through custom duties. The main characteristics of this policy are briefly outlined below:

- Emphasis to develop industries which use local labour, skill, and resources and which are of national significance
- Increase the pace of the development of the economy through the export of industrial products
- Attract foreign investment, and lay emphasis on the transfer of higher technology and efficient management

The **Industrial Enterprise Act, 1992** was amended in 1997 that changed the definition of cottage industries and the traditional industries utilizing specific skills or local raw materials and resources, labour intensive and related with national tradition, art and culture and industries with fixed assets up to two hundred thousand rupees. Small industries are defined as industries with fixed assets of up to an amount of thirty million rupees. Industries with fixed assets between thirty million rupees and one hundred million rupees are defined as medium industries. The amendment of Industrial Enterprise Act, 1992 has introduced 20 per cent corporate tax system and abolished the income tax exemptions to industries except cottage and national priority industries.

Import substitution was the major area of concentration of the Industrial Policies of 1974, 1981 and 1987. National industries were protected from external competition through the import tariffs, customs valuation and quantitative restrictions.

Promotion of small and medium industries needs an appropriate industrial policy framework. Industrial policies were amended several times and each amendment intended to add more facilities and simplify the procedures for industrial development. After the policy reformations introduced with a goal to move towards market-oriented economy, deregulatory regime has been adopted both in industrial and trade policy. In the present deregulatory regime, enterprises are given the opportunity to grow with minimum interference by the Government. The industrial policies highlight the following deregulatory regime:

- No license required for establishment, expansion and modernization (except for defense, public health and environment)
- Generous income tax holiday ranges from 5 years to 15 years
- Industries will be protected through tariffs
- One window system will be operational zed to provide all facilities to industries
- Additional incentives to entrepreneurs will be provided if they want to reinvest their earnings in their own industries or in other industries
- Cottage and small industries are reserved for Nepalese national but transfer of foreign technology in such industries is allowed
- Export oriented industries are exempted from income tax on actual export
- Facilities will be provided to industries established in foreign capital
- Sale of the shares of the foreign investment can be taken out
- Total dividends earned from foreign investment can be taken out
- Principal and interest repayment of the foreign loans is allowed to take out
- Up to 75 per cent of the remuneration income of the foreign expert or technician is permitted to take out

(c) The Foreign Investment and Technology Transfer Act, 1992

The Foreign Investment and Technology Act, 1992 was enacted with a view to attract foreign investors to invest in Nepal so that production capacity of the country is enhanced with good opportunity for employment on the one hand. On the other hand, it is regarded as an instrument to transfer technology from developed countries to Nepal.

If, a foreign investor put his money in any industry in the form of equity is defined as foreign investment. The Act also defines 'foreign investment' for those investments made by a foreigner in any industry in the form of equity through reinvestment of the earning derived from earlier equity participation and loan or loan facilities. 'Technology Transfer' is defined transferring technology under an agreement between an industry in Nepal and a foreign investor on the following:

- Use of any technological right, specialization, formula, process, patent or technical know-how of foreign origin
- Use of any trademark of foreign ownership
- Acquiring any foreign technical, consultancy, management and marketing services

The feature of this Act in terms of facilities and concessions provided to this process are as follows:

- No income tax shall be imposed on the interest income earned by a foreign investor from foreign loans. Income tax at the rate of 15 per cent only shall be imposed on the income earned by a foreign investor through foreign technical and management services fees and royalties.
- A foreign investor making investment in foreign currency shall be entitled to repatriate the following amount outside Nepal: The amount received by the sale of the share of foreign investment as a whole or any part thereof, the amount received as profit or dividend in lieu of the foreign investment, the amount received as the payment of principal and interest on any foreign loan.
- A foreign investor shall be entitled to repatriate outside Nepal the amount received under an agreement for the transfer of technology in such currency as set forth in concerned agreement.

In addition to the above, the act has the provision for the arbitration for the settlement of disputes that may arise during or after agreement period.

(d) National Science and Technology Policy, 1989

The National Science and Technology Policy, 1989 was enacted with a view to create favourable situation for scholars, scientists and entrepreneurs to work on this field in a systematic and effective way. This policy emphasizes in implementing the following programmes:

- **Resource and Development**

  Assessment on utilization and development of domestically available technology, enhancement of capabilities to develop industrial technology, enhancement of level of S&T by utilizing available opportunities and modern technique in R&D activities.

- **Technology Transfer**

  Encourage domestic technology, emphasis on software and intermediate hardware technology in case of importation, experiment on TT, evaluation, selection and regulation of transfer of technology in order to develop technology adaptation capacity.

- **Quality Manpower Development**

  Adequate investment in education and skill development, encourage human resources available with academic and scientific institution to involve in S&T research.

- **Promotion and Extension**

  Secure social participation in S&T development, create linkage between scientists/technicians and entrepreneurs/business community.

This policy document has recognized the insufficient acknowledgement of S&T sector manifested by inadequate investment, inefficient usage and distribution of available resources and lack of vision in relation to the overall development of this sector. It has been envisaged through this policy that following programmes are to be implemented.[2] (Dr. N.K. Bista, State of Business and Technology Incubation in Nepal).

The policy has a thrust of accelerating pace of development of science and technology in the country through integrating all but relevant process and establish a base of information and knowledge dissemination. The National Planning Commission is assumed to take responsibilities in the formulation of policy, preparation of programmes, monitoring and coordination of these activities by taking support and advice from National Science and Technology Council. The role of Royal Nepal Academy of Science and Technology (RONAST)

[2] Nirmal Bista, *State of Business and Technology Incubation in Nepal* (2001).

assumed in the Policy is to provide support in the monitoring activities by acquiring updated knowledge and technology development achieved within and outside Nepal. The Policy also seeks cooperation from business communities, international communities, bilateral agencies in the process of technology development and transfer.

(e) National Policy on Technical Education and Vocational Training, 1999

The policy was formulated realizing the need for a nation-wide coordinated effort to put for developing human resources and infrastructure in the field of technical and vocational sector and which will be instrumentals in addressing poverty issue of the country by enabling the people to get employment or self-employment and thereby contribute in promoting economic development of the nation. For it, coordination will be established among various concerned ministries and other organizations. The various objectives as mentioned in technical education and vocational training (TEVT) policy are as follows:

- Make sure that manpower needs in the country is met on the one hand and on the other, investment made in this sector is productive enough to provide reasonable returns in the both short and long run
- Ensure the maximum involvement of private sector, local government and business community in the operation of TEVT institutions by minimizing the role of government in the operation of these institutions
- Increase the access of TEVT services to poor and underprivileged group of the country

(f) Information Technology Policy, 2057 (2000)

The world's least developed countries including Nepal have availed themselves of the opportunity to rapidly develop education, health, agriculture, tourism, trade and various other sectors using information technology. The extensive application of this technology will engender economic consolidation, development of democratic norms and values, proportional distribution of economic resources and enhancement of public awareness, thereby raising living standards and eventually contribute significantly to poverty alleviation. With this in mind, this policy was formulated with underlined objectives, strategies and action plans.

The information technology policy shall be formulated to achieve the following objectives:

- To make information technology accessible to the general public and increase employment through this means
- To build a knowledge-based society
- To establish knowledge-based industries

Strategies:

The Government will regulate and facilitate in conducting R&D, developing human resources, disseminating information on technology. The policy will initiate strategies to place Nepal on the global map of information technology, encourage domestic and foreign investment for the development of information technology and the related infrastructure, promote information technology industry and e-commerce & e-governance. The policy has further emphasized on placing Nepal on the international market through information technology and thereby increase export of services related to information technology (software and hardware).

Information Technology Policy:

The following policies shall be followed up for the implementation of the aforesaid strategies:

- To declare information technology sector a priority sector
- To adopt one window system for the development of information technology
- To prioritize research and development in the field of information technology
- To create an atmosphere conducive to attracting investment in the private sector, keeping in view the private sector's role in the development of information technology
- To provide Internet facilities gradually to all village development committees of the country

- To assist educational institutions and encourage domestic and foreign training to fulfill the requirement of appropriate manpower at various levels pertaining to information technology
- To computerize the system in all government offices and build their web sites for the flow of information
- To encourage the use of computers in private sectors
- To develop physical and virtual information technology parks at various places with private sector's participation in the development of information technology
- To use information technology to promote e-commerce, e-education, e-health among others, and to transfer technology to rural areas
- To establish a National Information Technology Centre
- To establish a fund at the national level by mobilizing resources from His Majesty's Government, donor agencies and private sectors so as to promote research and development of information technology and other related activities
- To establish a venture capital fund with joint participation of public and private sectors
- To include computer education in the curriculum starting from the school level and broaden its scope
- To establish Nepal in the global market through the use of information technology
- To enact necessary laws for providing legal sanctions to the use of information technology
- To use information technology gradually in all government activities and provide legal sanctions to them

Institutional Provisions:

The National Information Technology Development Council has been constituted under the chairmanship of the Rt. Honorable Prime Minister. The National Information Technology Council reviews and revises information technology policy, appraises annual progress and solves problems.

National Information Technology Centre shall be set up under the Ministry of Science and Technology to act as a data bank of information and the secretariat of the National Information Technology Development Council and the National Information Technology Coordination Committee together with other promotional and R&D function.

Information Technology Park Development Committee:

This committee shall function as a separate body under the Ministry of Science and Technology. It shall manage and coordinate parks to be built in various places in the country and coordinate the construction and implementation of info-cities and info-villages.

2. Institutional infrastructure in science and technology

Most of underdeveloped countries have very weak infrastructure in S&T field. There could be several other reasons for not been able to develop S&T infrastructure in Nepal however, the investment made in this field as given below clearly indicates that the Government has not yet realized the importance of this sector.

Allocation of budget by HMG/N on R&D in S&T

Year	GNP (Amount in million Rs)	R&D (Amount in million Rs)	GNP (Percentage)
1995/1996	254 349	686	0.270
1996/1997	204 899	655	0.327
1997/1998	214 939	703	0.327
1998/1999	225 894	752	0.333
1999/2000	236 771	801	0.338 Projected
2000/2001	247 573	851	0.347
2001/2002	258 306	901	0.349

Source: N.K. Bista, *State of Business and Technology Incubation in Nepal* (2001).

(a) Research Centre for Applied Science and Technology

The Research Centre for Applied Science and Technology (RECAST) working under Tribhuvan University was established in 8 September 1977. RECAST is one of the research centres created with a view to take academic/scientific findings to the application of it by the users for better and efficient production of goods and services. RECAST also functioned as the secretariat of National Council for Science and Technology (NCST) of His Majesty's Government of Nepal until June 1999.

Main objective:

The main objectives of RECAST are:

- To undertake research in identification, development, utilization and dissemination of indigenous technology
- To identify exogenous technologies appropriate to Nepal and explore their technical aspects of technology transfer and application
- To undertake researches on basis and applied sciences

RECAST conducts research projects as well as designs and fabricates prototypes for various agencies based on contract agreements. It also offers consultancy services in the areas of its expertise and provides various instrumental and analytical services in its laboratories.

RECAST organizes national and international seminars, workshops and training on its own and in collaboration with donor agencies or collaborating institutions.

Beside of this, it provides its laboratory facilities and technical supervision for graduate and post graduate students from various Central Departments of Tribhuvan University to undertake research works for their M.Sc. and Ph.D. dissertations. The Documentation Unit provides services mainly to the RECAST researchers. It also responds to external requests from other science and technology related institutes and university faculties of science and technology.

Main activities:

RECAST has been conducting research and development activities on the following areas:

- Energy: solar, biomass, biofuel and improved cooking stoves
- Natural products development
- Food technology
- Crop science and biotechnology
- Natural dyes
- Medicinal chemistry
- Solid waste management
- Building materials and low-cost housing
- Technology testing and transfer

Issues:

- RECAST is trying to commercialize its activities but in spite of high demand of services provided by RECAST, the market is not much ready to pay for it.
- Applied research is need of the country but achievement is not to the desired level due to resource constraints.
- It was also reported that the frustration among the scientists, due to inadequate facilities and working environment in the country, is causing difficulties in research, innovation and development of technology.

(b) *Information Technology Park*

IT Park in Nepal was initially placed under the umbrella of the Industrial Enterprise Development Institute (IEDI) Act in 1996. During that period arrangement was made for the physical acquisition of land in cooperation with local government, municipality and community in the place called Dhulikhel/Banepa some 25 km east of Kathmandu. IT Park was then shifted to Ministry of Science and Technology after few years. The objective of developing IT Park in Nepal is to create favourable environment by providing basic infrastructure in IT sector so that entrepreneurs both from Nepal and outside could be attracted to start and run their business venture in the park. It is quite obvious that the services of IT Park will help create number of IT businesses and enable country to earn income from software exporting.

The IT Park has two phases with time bound. The first phase is in progress and the activities such as land for Park in Dhulikhel/Banepa awarding contract amounting to Rs 190 million has been done and foundation work has been completed. If implemented properly this could well become an incubation centre in the field of information technology-based business development

(c) *Royal Nepal Academy of Science and Technology (RONAST)*

RONAST established in 1982 is an autonomous institution formed under special Act approved by both houses of parliament. RONAST aims at developing National Science and Technology Policy of Nepal and provide advice to the Government as national S&T apex body in the country. It is expected to act for the advancement of S&T for all-round development of nation, improve and promote the indigenous technologies, encourage research in S&T and, identify and facilitate in transferring appropriate technology.

In fact RONAST has been trying to identify and launch various activities with its limited resources so as to bring momentum in the field of S&T. However, despite all these, RONAST has not been able to bring satisfactory result and also to generate interest in it from business community. Whatever research and development activities done in the past with the coordination of RONAST, the result has not sufficiently reached the work place or production place. RONAST has been undertaking some research works in the field of biotechnology, natural products, environment, scientific instrumentation, radiation monitoring, alternate energy, high altitude S&T etc. In collaboration with national and international agencies, it is providing some fellowship and research grants to individual and institution in addition to the support services like Central Research Laboratory, Instrumentation Centre, Radiation Monitoring Unit, Computer Unit, Library and Documentation Centre, Electronic Database and Information Centre.

(d) *Balaju Yantrashala Pvt. Ltd.*

The Balaju Yantrashala Pvt. Ltd. (BYS) established in 1960 with an aim to contribute in the process of industrialization by attracting private sector to extent possible. BYS is in fact a joint venture project of Nepal Industrial Development Corporation (NIDC), an industrial development bank in public sector, and Swiss Association for Technical Assistance (SATA), now converted into HELVETAS.

BYS has strength of more than hundred human resources and is equipped with necessary machineries and tools together with other ancillary services units. So, it is now regarded as a leading mechanical engineering Pvt. Ltd. Company in Nepal. The turnover of this company in 1999 was Rs 42 million from the services rendered in the field of hydropower technology, steel construction, machine construction, sheet metal products and repair and maintenance.[3] It might be interesting to mention here that many of its staff have started their own businesses especially in the field of production of turbine for micro hydro project, solar heater, etc.

(e) *Council for Technical Education and Vocational Training*

The New Education System Plan (NESP) introduced in 1971 attempted to establish vocational education in every secondary school throughout the country. The formal system of providing technical education has evolved since its initial beginning in 1980 with the establishment of Karnali Technical School in Jumla as the first technical school. In 1982 a Technical and Vocational Education Committee was formed for the management

[3] Nirmal Bista, *State of Business and Technology Incubation in Nepal* (2001).

of technical schools. The Karnali Technical School was followed by seven more technical schools by 1994. The Council for Technical Education and Vocational Training (CTEVT) is the outcome of various efforts made by the Government for producing basic and middle level skilled manpower in Nepal. The council was initially formed under the Technical Education and Vocational Training Education and Vocational Training Council Act (First Amendment) of B.S. 2049 (1993).

CTEVT is as an apex body of TEVT sector and is supported by His Majesty's Government of Nepal, Government of Japan and Government of Switzerland. It formulates policies, ensures quality control, coordinates all the technical education and vocational training related stakeholders and provides services to facilitate TEVT programmes in the preparation of basic and middle level skilled human resources for economic development of Nepal.

The current activities of CTEVT are as follows:

- Operation of twelve technical schools, two schools of health science, two rural training centres and one technical teachers training institute
- Carrying out manpower needs assessment programmes
- Granting recognition and accreditation to other TEVT programmes and institutions
- Development of skills classifications, skills standards and conducting skill testing
- Development of curriculum for long-term and short-term technical training programmes

Major Accomplishments:

Over a period of 12 years, technical schools have been established by His Majesty's Government of Nepal in 10 of the 14 zones of the country (Jeri, Dhaulagiri, Rapti, Bheri, Uttarpani, Lahan, Karnali, Seti and Balaju Technical School). These technical schools provide training in various areas such as agriculture, health, mechanical, construction, electrical, sanitation and tourism.

TEVT sector is a huge area in which CTEVT alone cannot fulfill to national needs, CTEVT has already granted provisional affiliation to over 100 private institutions to operate TEVT programmes. CTEVT is in acute shortage of skilled-instructors on the one hand and on the other, the CTEVT graduates are not recognized as the graduates of other academic institution. CTEVT has further plan of providing its affiliation to more private sector institutions.

(f) Department of Cottage and Small Industries

Department of Cottage and Small Industry (DCSI) of Ministry of Industry, Commerce and Supply was re-organized into two major working areas – Cottage and Small Industries promotion and Cottage and Small Industries Administration in the year 1993. The Cottage and Small Industries Promotion Section of DCSI operates at central level as well as through specified 27 district level. The department offers its services for potential and existing cottage and small entrepreneurs.

Main Activities:

DCSI is providing short-term and long-term Technical Skill Training for about 10,000 people every year and is responsible for industrial consultancy services. Industrial scheme preparation and distribution, technical analysis of potential industries and skill development. In addition to this, DCSI operates the central level projects like Leather Product Promotion Project, Ceramic Promotion Project, Ready Made Garments and Nepali Paper Project, Population and Education Project, Industrial Promotion Project.

Issuing licenses to specified industries, registration and renewal of cottage and small industries, facilitating the industries through incentives, operating cottage and small industries inside prison production of badges are major activities carried out by DCSI.

Issues:

- Supply driven approach
- Inadequate programme for regular upgrading of DCSI trainers
- Inadequate fund for technology support programme
- Lack of updated information in DCSI to disseminate to the entrepreneurs

(g) Cottage and Small Industry Development Board

His Majesty's Government, through the notice published on 28 June 1993 in Nepal Gazette established Cottage and Small Industry Development Board (CSIDB) under the Development Committee Act of B.S. 2013 (1957). CSIDB working under Ministry of Industry Commerce and Supply, Nepal basically provides support services for the promotion, expansion and strengthening of cottage and small industries in Nepal through its 48 branch offices including 12 main branch offices and 36 sub-branch offices.

The Board offers services to potential and existing cottage and small entrepreneurs. As the main activities the Department organizes skill development training, entrepreneurship and business development training, industrial feasibility studies, radio programme for creating awareness on entrepreneurship industrial exhibitions and exposure visit, registration and renewal of cottage and small industries, recommend and facilitate beneficiaries to get loan and other incentives and facilities, etc.

Major accomplishments of the Board:

Central level:

Skill Development Training	Target – 2,660	Achieved – 3,160
Enterprise Development Training	Target – 280	Achieved – 238

District level:

Skill Development Training	Target – 6,880	Achieved – 7,194
Enterprise Development Training	Target – 780	Achieved – 797

In the year 2057/2058 a total of 1,909 industries were registered in the 48 districts under CSIDB (the working area of CSIDB) providing employment to the 9,385 people where as in the year 2057/2058 a total of 937 industries were registered in whole Nepal. Out of them cottage and small industries are 968 and 8,349 respectively. On the country, 10,127 cottage and small industries were registered in the year 2056/2057.

Issues:

- Supply driven approach
- Inadequate programme for regular upgrading of DCSI trainers
- Inadequate fund for technology support programme
- Lack of updated information to disseminate to the entrepreneurs

CSIDB is a well-established organization and a technical skill provider to SMEs. It hires the professional skilled trainers from various different sectors as per the requirement. Lack of initiation to update and upgrade the skill of the trainers and at the same time poor incentives provided often make difficult to retain the professionals.

(h) Industrial Enterprise Development Institute

Small Business Promotion Project (SBPP) was as an independent programme that came about from the Nepal-German Bhaktapur Development Project in 1983. It was jointly implemented by the Ministry of Industry and GTZ – the German Agency for Technical Cooperation.

SBPP targeted existing and potential micro and small entrepreneurs from all areas of manufacturing, processing and service oriented businesses. The approach pioneered and developed in Nepal is being marketed abroad by GTZ under the name of CEFE (Creation of Enterprises, Formation of Entrepreneurs) in over 70 countries in Asia, Africa and South America.

Taking note of the achievements of the SBPP and the need to multiply the impact of the approach, His Majesty's Government of Nepal and the German Government decided to institutionalize the project as a permanent and autonomous institution. His Majesty's Government approved the formation of the Industrial Enterprise Development Centre (IEDC) in May 1995. SBPP was active in enterprise development in Nepal for about 13 years.

IEDI Today:

SBPP was transformed into IEDC in 1995, to give continuity to the successful approach of enterprise development. IEDC was envisaged as an institution to enhance the capability of service delivery institutions in the small enterprise sector so as to provide quality services to the cottage and small industries in Nepal. As need was felt to provide sustainability to this approach in Nepal, the project was then institutionalized in the form of IEDI in 1996.

As a successor to SBPP, IEDI has adopted the unique approaches developed by the project in its business development services. SBPP's achievements have been well documented and recognized in an impact study conducted by a group of independent consultants in 1998. The survey has shown that success rate among new business creation (NBC) trainees and the enterprise survival rate are more than 50 per cent. From a project that used to implement programmes itself with the target group, IEDI now plays the role of supporting institutional development.

At present, IEDI does not have permanent donor support as in the past. Therefore attaining a greater outreach throughout the country with multiple market-based services is its new focus, in order to maintain institutional professional stability and to provide services to a maximum number of enterprises. With this in mind IEDI's main thrust has become to contribute to the capacity development of intermediary organizations. For this it carries out research and development, testing and dissemination of demand-based programmes of business development services, suitable to the different regions in Nepal.

The Institute has a network and working relations with several national and international organizations. It has a staff strength of more than 30 professionals and other administrative and support staff. There are 4 Branch offices of the Institute located in various parts of Nepal viz. Narayangadh, Pokhara, Butwal and Nepalgunj, which work in close cooperation with local organizations and business communities and implement the programmes in their respective regions.

Objectives:

- To assist organizations, institutions, industries and enterprises through need-based services such as training and training of trainers, entrepreneurship and management development, feasibility studies and consultancy
- To provide quality support services to industry/enterprise development
- To carry out need-based action research to provide quality services for enterprise promotion and development
- To conduct need-based programmes to develop technical, entrepreneurial and management related know-how and skills
- To carry out research and development related activities
- To establish and develop projects and organizations for enterprise development

Structure:

The Institute has a governing body of 9 executive members representing the private and government sector and specialists in the management and environmental field. The Minister for Industry is the Chairperson of the Board and Secretaries of the Ministry of Finance; Ministry of Industry, Commerce and Supplies; Presidents of Federation of Nepalese Chambers of Commerce and Industries (FNCCI); and Federation of Nepalese Cottage and Small Industries (FNCSI); a business person; a management expert and an environmental expert are the members of the Board. The Executive Director of the Institute is the member secretary.

The Executive Board formulates the policies and strategies to meet the IEDI's objectives. These objectives are then implemented by IEDI along with the organizations under it.

Since a coherent balance between the Government and private sector in the governing board is expected to address both the Government priorities as well as private sector interests. IEDI encourages better coordination between the two to help them understand and consolidate each others viewpoint and direction.

IEDI Services:

(1) *Services for the potential entrepreneurs* in new business creation (NBC), entrepreneurial competency development, business identification and selection, business planning and feasibility study, micro enterprise creation (MEC) and business awareness.

(2) *Services for existing entrepreneurs/enterprises* in training on production, management, productivity improvement, marketing, salesmanship, financial management, accounts, business, management, business, expansion/growth, micro enterprise development (MED) and management consultancy

(3) *Services for the intermediary organizations* in training of trainers of MECD/NBC, training of business consultants, training on training skills improvement, training on training management, business potentiality and training needs assessment, training programme on project development, start and improve your business (SYB), market and impact study of BDS and research and feasibility studies on varied sectors.

Networking:

IEDI has been working hand in hand with several National and International organizations to bring about positive changes in the field of enterprise creation and business development in Nepal. IEDI has already worked with more than 50 national and international organizations.

(i) Other support organizations

There are numbers of other institutions working directly or indirectly in providing BDS so as help in creating SMEs. Organizations such as Federation of Nepal Chamber of Commerce and Industries, Federation of Nepalese Cottage and Small Industries, Women Entrepreneurs' Association of Nepal (WEAN), Association of Craft Producers, Intermediate Technology Development Group, Nepal, other Commodity Association and private sector. These organizations provide business services in order to help entrepreneurs expanding their business and market, improving the efficiency and quality of product/services, diversifying activities, and developing new products.

Besides these organizations, Nepal Bureau of Standard and Metrology (NBSM) under Ministry of Industry, Commerce and Supplies provides support to entrepreneurs by issuing Nepal Standard (NS). NS mark awarded enterprises are comprised of food, chemical, construction materials, beverages, steel, paints etc. This organization is the national focal point in the field of all ISO related activities. NBSM has regularly been conducting workshop and awareness training on ISO.

3. Enterprises based on foreign direct investment

Investment plays a crucial role in promoting industrialization. So, the Government has been trying with all measures to attract domestic or foreign investors in the country. To attract foreign investment in the country, investment procedures and rules & regulation need to be friendly and simple. Now, in the present context, the economy of the country is controlled by market that is globalized so, the country has to have measures to attract and retain FDI to the extent possible. Despite several measures in terms of policy and programmes, Nepal has not been in a position to have desired result and is far below than the initial interest and enquiry. The following tables show the categories of industry in which investment is made and also the volume of investment and generation of employment from these investment projects.

Summary sheet of foreign investment projects in Nepal – category-wise from the beginning to July 2000
(in Rs moillion)

Types of industries	Number of industries	Total project cost	Total fixed investment	Foreign investment	Total employment
Agriculture	11	341.54	304.46	79.48	811
Manufacturing	297	26 845.86	20 818.90	5 980.57	50 320
Tourism	144	14 521.07	13 857.27	3 663.80	12 779
Service	123	10 057.04	8 474.98	3 800.60	8 753
Construction	5	293.59	262.06	93.42	570
Energy-based	9	15 988.51	15 198.34	2 746.04	4 074
Mineral-based	3	1 153.14	1 068.32	45.98	1 129
Total	**592**	**69 200.75**	**59 984.33**	**16 409.88**	**78 436**

Source: Department of Industry, His Majesty's Government of Nepal.

C. Major gaps

- **Insufficient infrastructure:** The institutional together with other infrastructure base is quite in primitive stage to address the need of business and technology incubation services in Nepal. Most of institutions responsible for technology transfer and development have been failure to meet desired outcome. Those innovations made by these institutions in the field of technology are also not commercially viable and production efficient.
- **Weak base of human resources:** This is another pinching part of the country because of which not only business and technology sector but most of sectors have been very much affected. There is no clear-cut policy and support programmes to encourages people to be trained and educated in this sector and also start business and technology incubation as their own business entity.
- **Inadequate awareness:** It is quite true that level of awareness in Nepal about business and technology incubation is very low. The developed economies have already developed, tested and adapted different models of incubation however, Nepal has not yet been able to just initiate even the first model. This is result of lack of awareness among the decision makers and business communities as well.
- **Less prioritized sector**: Because of low level of awareness among the policy makers this sector has always been neglected and kept always in low profile while developing plans and policies and also allocating budget. The case of IT Park might be an example in this case because it was initiated from 1996 but only foundation work of the Park has been completed to date. Similarly, the business communities have also not fully realized the importance of business and technology incubation thus, they have also different priority while lobbying with government.
- **Less coordination among organization**: Various organizations have working in the field of BDS and technology transfer and development sectors. But these institutions are providing services without having information of services of other organizations working in the same location or region. It is also true that in many forum, the problem of coordination was strongly raised by various people at the different level however, not so much progress has been made so far.

D. Recommendation for future action

In view of the above and general situation where there are virtually no technology incubation activities, some of recommendations are outlined below:

- The pace of developing the infrastructure for IT Park is significantly slow thus, needs to be accelerated so as to provide support as soon as possible.

- The **IT policy** needs to be reviewed and updated in accordance with the change in environment.
- Government should take initiation to develop business and technology incubation centre in the different parts of the country. For it, some incentive system needs to be initiated to encourage people to start and run incubation centre as enterprise.
- The research and R&D activities done in Nepal particularly in the science and technology are not sufficient however, whatever innovations done within the country and information updated from other countries are not even been accessed by business communities and other users. So, a certain mechanism needs to be initiated for it to have a coordinated efforts among the concerned institutions and business communities.
- SMEs is Nepal, in most cases, are using outdated and inefficient technology mostly bought from neighbouring states of India to Nepal with limited information on technology. This is happening because of lack of institutions within the country to provide technology or related information. So, it demands quick and serious effort to be put for developing technology-related policy as well as programmes.
- It is quite important to explore potential of some organizations so as to promote them as institutional infrastructure for the promotion and development of business and technology incubation centres in true sense so that access to these services can be enhanced in a wider spectrum and also efforts could be made more focused and coordinated.
- Networking among various agencies is crucial so as to make BDS and technology transfer and development more demand driven and tailor-made. The tailor-made and demand driven services have better prospect of being paid by the users particularly SMEs.
- Efforts have to be made to develop linkage and network between the university/college, laboratory and business and industrial communities so as to exchange experience and updated information.
- There might be several successful and effective incubation model outside Nepal which can immediately replicated in Nepal with minor adaptation.
- Review of policies related to BDS and technology transfer and development need to be done periodically so that change if required can be done immediately so as to address the need in true sense.

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VI. PROMOTING BUSINESS AND TECHNOLOGY INCUBATION FOR IMPROVED COMPETITIVENESS OF SMALL AND MEDIUM-SIZED INDUSTRIES THROUGH APPLICATION OF MODERN AND EFFICIENT TECHNOLOGIES IN VIET NAM

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A. Introduction

1. Economic situation

(a) Background

Since 1986, Viet Nam has wholly carried out Doi Moi or "renovation" policy in all fields of its economy in order to set up open-door economy and integrate into the region and the world. The contents of these reforms include (i) a shift of central economy to a market economy under the State Management, (ii) development and diversification of international economic relations, and (iii) reform of the State Administration. Thanks to the Doi Moi policy, Viet Nam has gained an important achievement in its economy. The average GDP growth rate for period 1990-1995 is about 7.5 per cent, reached the highest at 9.5 per cent in 1995. The economy of Viet Nam is also suffered through a regional economic crisis in the late 1990s. GDP growth rate dropped from 8.2 per cent in 1997 to 4.8 per cent in 1999. However, it is estimated that the economy growth will still remain stable compared to other ASEAN countries.

(b) Stagnation development

The influence of the Asian economic crisis came to Viet Nam about one year after it reached neighbouring Asian countries. Since the Vietnamese capital market was not liberalized, the direct influence from the economic crisis was small. However, due to the sudden fall of the economy of neighbouring Asian countries, export and foreign investment became stagnant and GDP growth rate dropped from 8.2 per cent in 1997 to 5.8 per cent and 4.8 per cent in 1998 and 1999 respectively.

Main Economic Indexes

Main Indexes	1995	1996	1997	1998	1999	2000
GDP (US$ billion)	*20.7*	*23.26*	*25.5*	*26.0*	*28.6*	*30.5*
GDP Structure (%)						
• Agriculture	27.2	27.8	25.8	25.8	25.4	24.3
• Industry& construction	28.8	29.7	32.1	32.5	34.5	36.6
• Services	44.1	42.5	42.2	41.7	40.1	39.1
Annual Growth Rate (%)						
• GDP	9.5	9.3	8.2	5.8	4.8	6.7
• Agriculture	4.8	4.4	4.3	3.5	5.2	4.0
• Industry & Construction	13.6	14.5	12.6	8.3	7.7	10.1
• Services	9.8	8.8	7.1	5.1	2.3	5.6
Foreign Direct Investment (US$ billion)						
• Total registered capital	6.5	8.5	4.7	3.9	15.7	19.9
Trade balancing (US$ billion)						
• Export	5 548	7 255	9 185	9 360	11 523	14 308
• Import	8 155	11 143	11 592	11 499	11 636	15 200
• Balance	-2 706	-3 887	-2 407	-2 139	-113	-892
Consumer price index (%)	*12.7*	*4.5*	*3.6*	*9.2*	*0.1*	*-0.6*
Unemployment in Cities (%)			*6.0*	*6.9*	*7.4*	

Source: Viet Nam Yearbook 2000 (GSO, 2001).

After the introduction of the market-oriented economy system, Viet Nam has proceeded with active reforms including agriculture reform, reduction of the double price system, reduction of subsidies to State-Owned Enterprises, utilization of the private sector and expansion of external economic relationship. Viet Nam has been steadily succeeding with these reforms. In the mid 1990's, Viet Nam achieved relatively high annual growth rates of 8 to 9 per cent, thanks for steady increases of foreign investments. However, massive inflow of foreign investment resulted in sharp expansion of real state demand in urban areas, and causing high escalation in land prices.

In the five-year economic plan covering the period 1996-2000, the economic bubble burst at the same time the Viet Nam economic policy line changed to a moderate one. In that period, real estate values in urban areas dropped sharply, domestic consumption cooled down, foreign investment sharply fluctuated before taking big jump in 1999 and 2000. The Asian financial and economic crisis were the driven force of these turmoil and fluctuations. Growth of the industry and service sector declined rapidly from 1998 to 1999, clearly indicating substantial magnitude of the influence of the Asian financial and economic crisis. In particular, growth rate of the service sector was 5.1 per cent in 1998 and 2.3 per cent in 1999. At the same time, the downturn of market was reflected in the consumer price index, which was 0.1 per cent in 1999, a sign of inflation. In the meantime, unemployment rate increased gradually, reaching 7 per cent in the urban area in 1999 from 6 per cent in 1997.

Since 2000, Viet Nam economy has shown signs of recovery and economic growth is returning to the right track. In this year, GDP growth rate reached 6.7 per cent while industrial growth of 15.7 per cent and service growth of 6.0 per cent were recorded. Export also regained its momentum with more than 25 per cent increase. Only consumer price index was 0.6 per cent which was a result of dramatic decline in food prices caused by both increase in foodstuff production and stagnation of food exports.

(c) Budget, revenue and expenditure

The average government budget deficit of Viet Nam was at around 3 to 4 per cent of GDP during the period from 1995 to 1998.

Budgetary operations

(Billion D)

	1995		**1996**		**1997**		**1998**	
	Real value	**Share (%)**	**Real value**	**Share (%)**	**Real value**	**Share (%)**	**Real value**	**Share (%)**
Revenue and Grant	53 374	23.3	62 387	22.9	64 264	20.5	68 000	18.4
Expend	62 679	27.4	70 539	25.9	76 381	24.5	80 000	21.7
Balance	-9 305	-4.1	-8 152	-3.0	-12 567	-4.0	-12 000	-3.3
GDP	228 892	100.0	272 036	100.0	313 623	100.0	368 690	100.0

As shown in the table below, revenue in 1996 comprised 41.5 per cent from state enterprises (including tax revenues and other transfers), 16 per cent from tax revenue from non-state sector, 24.2 per cent from tariff revenue, and others. In 1998 and 1999, the revenue growth from the state enterprise was stagnant (GDP share decreased from 23 per cent in 1995 to 17 per cent in 1999). Due to the tariff reduction as an action of the participation in AFTA, the share of tariff revenue is decreasing, however still account for 20 per cent.

Government revenue
(Percentage)

	1995	1996	1997	1998	1999
State-enterprises	41.1	41.5	41.6	39.7	39.3
Taxes	38.1	40.2	41.6	39.7	39.3
• Profit tax	11.2	12.4	13.9	12.3	13.4
• Turnover tax	10.9	11.9	11.3	12.0	9.0
• Special consumption tax	4.7	5.1	4.9	5.0	4.6
• Natural resources tax	4.4	4.9	5.1	4.7	5.8
• Other taxes	6.7	5.8	6.5	5.8	6.4
Transfer	3.0	1.3	0.0	0.0	0.0
Non-state sector	14.9	16.0	16.2	16.2	15.4
Agriculture tax	2.9	3.0	2.6	2.8	2.6
Non-agriculture tax	12.0	13.0	13.6	13.3	12.8
• Turnover tax	3.8	4.2	4.6	4.3	4.0
• Profit tax	2.7	3.0	3.2	3.2	3.6
• Personal income tax	1.0	2.2	2.0	2.6	2.2
• License tax	0.4	0.4	0.5	0.5	0.5
• Commodities tax	0.0	0.0	0.0		
• Wholesale tax					
• Slaughter tax	0.2	0.2	0.2	0.2	0.0
• Land tax	0.6	0.6	0.5	0.4	0.4
• Other	3.4	2.5	2.4	2.1	2.1
External trade	24.9	24.2	20.4	21.6	20.9
Export and import tax	24.9	24.2	20.4	21.6	20.9
VAT (import)					5.8
Surtax				2.5	1.6
Joint venture	4.0	4.8	5.7	6.5	5.2
Other revenue	12.1	11.0	12.1	10.7	9.2
Grants	3.0	2.5	3.9	2.8	2.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Tax reform was commenced in 1999. The Value Added Tax (VAT) Law and the Cooperate Income Tax (CIT) Law were enforced as replacement of the turnover tax and profit tax used until then. In the first year of the VAT and CIT application, tax revenue did not increase due to the economic stagnation. However, in the year 2000, as the economy turned around due to increases in crude oil prices, number of tourists etc., tax revenue exceeded the planned target by 14 per cent.

(d) Investment and savings

In 1998, due to decrease of FDI inflows and delay in ODA disbursement, the ratio of investment to GDP dropped slightly. It was slightly recovered in 1999 along with the increase of government investment throughout mobilizing capital by issuing bonds.

Investment and saving

	1996	1997	1998	1999
GDP growth rate (%)	9.3	8.2	5.8	4.8
Domestic saving (% of GDP)	17.2	20.1	21.5	23.6
Government saving (% of GDP)	6.1	5.9	5.8	
Private saving (% of GDP)	10.5	12.1	12.7	
Investment (% of GDP)	28.1	28.3	26.7	26.3
Domestic investment (% of GDP)	19.9	18.2	17.2	17.6
Money supply (% of GDP)	25.0	27.0	28.0	23.0
Consumer price index (%)	4.5	3.6	9.2	0.1

Investment by Source/Ownership

	1997	1998	1999
State budget	21.2	21.5	25.2
Government credit	13.1	15.4	16.8
State-owned enterprises	13.7	16.7	18.1
Private sector	20.6	21.3	21.9
Foreign investment	31.4	25.1	18.0

2. Science and technology in Viet Nam industry

(a) *Institutional organization for R&D*

It is estimated that there are nearly 30,000 people involved in various forms of research and experimental development (R&D) in Viet Nam. More than 22,000 of these are employed in national centres for R&D and by ministries and government agencies. Others are working mainly in universities and other institutions. Only a small fraction of the country's R&D scientists are working in industrial enterprises.

Subject area and location of R&D institutions in Viet Nam

	Number	Portion (%)
Subject Area		
Natural Science	55	18.6
Medicine, Social and Culture research, education	76	25.8
Agriculture, fisheries and forestry	52	17.6
Engineering	84	28.5
Economic, Finance, trade	28	9.5
Total	**295**	**100.0**
Location		
Hanoi	226	76.6
Ho Chi Minh City	34	11.5
Other	35	11.9
Total	**295**	**100.0**

The general institutional set-up in Viet Nam for research and experimental development can be divided into three main categories:

(1) *Laboratories and other R&D units within the government ministries or under control of governmental agencies*

There are about 180 such R&D units, located in the whole country. In Viet Nam, due to financial difficulties and the centrally planned mechanism, industrial firms rarely build their own facilities or development work and have very little experience with R&D. Among the exceptions to this rule is the State-owned Viet Nam Petroleum Company, which runs four of its own laboratories.

(2) *Universities and other higher education institutions*

Only limited number of faculties and academic department in Viet Nam's universities and colleges have equipment and resources to perform serious research and undertake experimental development. Among them, there are two national universities and two largest Polytechnic universities, all located in Hanoi and Ho Chi Minh City, considered as the most research-intensive parts of this academy system.

(3) *The national institutions for research which are directly under the control of the Government*

These are designed to act as national networks of the Viet Nam technology society, and are placed under Government office. The most significant of these national institutions is the National Centre for Natural Science and Technology. It performs advanced researches mainly in two areas: mathematics and theoretical physics. Another important institution is the National Centre for Social Sciences and Humanities, which has similar structure, but only half of staffs and involved in social science research.

(b) Current technology level at industrial enterprises

(1) *General evaluation*

- Equipment and machines in manufacturing industry for capital and intermediate goods are of low level and backward technology.
- There are weak linkage between R&D institutions and the productive sectors.
- On labour side, finding from a survey of more than 1,000 enterprises (including of SOEs, private firms, joint-venture) indicated that there is a generalized shortage of appropriate trained and skilled technicians, engineers and labour, and that enterprises must contented with low productivity due to an excess workforce of unskilled and semi-skilled labour.
- The existing technical, engineering and management training institutions are not producing human resources with skills and aptitudes required for firms needing to compete and upgrade.
- Management capabilities to manage firms in competitive market economy are particular lacking.
- Other factors hindering technological change and upgrading that are indicated in these studies are the relative lack of financing, including access to credit on reasonable terms, unsuitable and complicated taxation system an unstable policy climate with regard to trade regulations which generates confusion, discourage new investment and an inadequate legal framework.

(2) *Status of technology in SMEs*

Technology level across the SMEs in Viet Nam is assessed as being two, three or more generation behind comparable regional and world technologies. Assessments of the Ministry of Industry on this are as follows:

- Coefficient of equipment use is very low (25-30 per cent). Technologies are being upgraded on average at only 7 per cent annually.
- Coefficient of fuel and material consumption per unit of product is estimated at approximately 1.5-2.0 times higher than average world level.
- Quality of finished products is generally low and there are few indications of either product innovation or enhancement.
- Factor analysis indicates the value of technology-finished products at only about 10-20 per cent.
- Quality control system, suffering from technological weakness and deficiencies in technologies especially those required for measurement, experimental and certification is not operating efficiently.
- Skill level of labour is currently inadequate to support technological upgrading and there is very little R&D appropriate to support such upgrading, while technological rules and regulations are not strict.
- There is little in the way of a market-oriented relationship between the production sector, R&D institutions and universities.
- Endogenous capacities for the management and leadership of technological change are weak.

(3) *Current technology priorities of the Government of Viet Nam*

About five years ago, there emerged a clear ranking in the form of four national priority programmes for high-technology. Each is viewed by the Government as important to modernization. High-level inter-ministerial committees monitor and coordinate the four national programmes that are in (i) information technology; (ii) biotechnology; (iii) new materials; and (iv) automation.

B. Small and medium enterprise, business and technology incubators in Viet Nam

1. Small and medium enterprise in Viet Nam

(a) Current status

For decades, Viet Nam economy was of centrally planned nature and even until recently, concept of SME was unfamiliar to most of Vietnamese. With the "Doi Moi" (renovation) policy introduced in 1986, the country economy has been transformed into a market-oriented one and, along this process a deep and wide restructuring of enterprises have been taking place. In the centrally planned economy, most enterprises were state-owned. Several new forms and types of enterprises came into official recognition in the restructured economy. According to government statistical data, by August 1997, the overall situation of enterprises of all categories looks as follows.

No.	Enterprise Type	Quantity	Percentage
1	State-owned enterprises	6 000	12.11
2	Cooperatives	10 441	21.08
3	Private companies	20 419	41.23
4	Limited companies	8 392	16.94
5	Joint-stock companies	189	0.38
6	Joint-venture companies	1 078	2.15
7	100%-Foreign-owned companies	499	1.01
8	Contracted business cooperation	11	0.22
9	Foreign representative offices	2 400	4.88

The official definition of SME has been recognized in the Government of Viet Nam Document No. 681/CP-KTD issued in 20 June 1998. According to this definition, an enterprise with less than 200 employees and registered capital of less than 5 billions Viet Nam dong (about US$ 380,000) is qualified as a SME. The SMEs are prevailing in both state-owned and privately-owned enterprise.

In its Socio-economic Development Strategy for 2001-2010, the Government of Viet Nam has clearly pointed out the development direction as "Accelerating industrialization and modernization in the socialist orientation and creating a foundation for Viet Nam to become an industrialized country by 2020". Specific objectives highlighted in the strategy for this period include:

- Doubling of GDP
- Export growth rate will be more than double that of GDP
- Agriculture should contribute 16-17 per cent of GDP, industry 40-41 per cent and the service sector 42-43 per cent

On one hand, the strategy calls for strengthening of leading role of the State economy and restructuring of state-owned enterprises (SOEs) to increase their efficiency. Along with the process of Viet Nam Economy restructuring, the number of SOEs in Viet Nam has drastically decreased in recent years, from about 12,000 in 1990 down to 5,960 in 1995 (1,953 enterprises under government management, about 4,000 under management of local authority) and 5,280 in 2000. It is planned that this number is expected at 2,000 in the year of 2005. Priority form of restructuring is equitization and merger. About 1,498 SOEs will be equitized as of 2003 and 380 other SOEs will be merged.

On the other hand, the strategy also calls for the strong development of private firms and entrepreneurs. The Government has clearly accepted that private sector (and more specifically, private sector SMEs) offers the best prospects for:

- Generating employment for new workers and those made redundant by the reform of SOEs
- Generating economic growth

Private SME is seen by many as essential if domestic private investment is to rise from its current 7 per cent of GDP to the 12-15 per cent of GDP as required to achieve the objectives of the strategy. Presently, it is generally regarded that the development of SMEs in Viet Nam is still slow and unstable. This is due to the several reasons such as lack of capital, obsolete technology, poor management, no information system for market and marketing, limited export capacity, just to name a few.

(b) Promotion of small and medium enterprise in Viet Nam

In Viet Nam, since 1998, many initiatives have been launched in favour of SMEs. Centres for promotion of SMEs have been established in several Government bodies (e.g. the Ministry of Labour, War Invalids and Social Affairs), in non-government organizations, e.g. the Viet Nam Chamber of Commerce and Industry (VCCI). Another example is the set-up of some professional associations to have dialogue with the Government agencies on tendency of non-discrimination treatment between state-owned and private-owned companies, between SMEs and larger corporations and so on. For SMEs support, there is a need of elaborating policies on legal framework, organization, founding family enterprises, land management, export promotion and the last but not least promotion of technology and complementary industries together with human resource development.

In order to promote technology and complementary industries for SMEs, the following tasks have been planned and taking place:

- Improving production management and product quality control
- Diversifying and openly contacting large enterprises and foreign-owned enterprises
- Supporting production of prototype
- Assisting accession to all information sources
- Developing industrial cluster
- Broadly applying traditional technology
- Promoting technology transfer from SOEs, foreign-owned enterprises to SMEs

A big leap forward in the development of all kinds of enterprises in Viet Nam in general and SMEs in particular occurred after the release of the Law on Enterprise which has been approved and promulgated by the National Assembly on 12 June 1999. The Law on Enterprise was the merging of the two preceding laws: the Law on Company (released in 1991 and revised in 1994) and the Law on Private Enterprise (released in 1990). The (new) Law on Enterprise has been updated several times to meet the latest demand on creating a more and more favourable environment for enterprises. In this relation, many Government decrees and circulars have been released to guide and ease the implementation of the law such as Government Decree No. 03/2000/ND-CP and Document No. 34/CP-DMDN on 20 February 2000 and 22 May 2000, respectively, on guidance for implementation of the Law on Enterprise; Government Instructions No. 29/2000/CT-TTg and No. 28/2001/CT-TTg on 31 December 2000 and 28 November 2001, respectively, on intensifying of the implementation of the Law on Enterprise and creating favourable environment for enterprise's development. This all has created a boom in establishment of many new SMEs in a relatively short period of time. In details, the most recent data shows that there are now about 70,000 registered enterprises of which 63,000 is SMEs (accounting for 90 per cent) nationwide. Among them, there are about 400 enterprises (360 SMEs) belonging to the Ministry of Industry.

As the latest effort of the Government of Viet Nam to the development of SMEs was the Decree No. 90/ND-CP released on 23 November 2001 for promoting of SMEs development in Viet Nam. The Decree sets the framework for Government support for SMEs and describes the encouragement policies to be utilized in their support. It will be vital that the new government SME support infrastructure moves rapidly to ensure that some of the existing support instruments are revised to provide genuine support to SMEs. Thanks to this, the number of SMEs has been on a dramatic increase. In the years 2000 and 2001 alone, about new 20,000 SMEs were established each year.

Despite enormous effort of our Government, however, SMEs in Viet Nam are lacking capital, human resource and expertise. There is number of problems to be resolved in order to further develop SMEs in Viet Nam. Those problems lay in several areas as follows.

(1) *Policy Area:* The following issues relating to the policy environment for enterprises in Viet Nam are identified.

- Policies do not discriminate SOE and non-SOE sectors but in their implementation, this spirit was, in cases, not reflected.
- Some policies are not transparent and/or consistent.
- Policies are changed frequently with little advanced warning.
- There are contradictions between policy documents and their implementation guidelines, specifically those issued by lower agencies or local authorities.
- There is a gap between policy formulation and policy implementation.

(2) *Legislative and Regulatory Area:* The following issues with respect to the legislative and regulatory system in Viet Nam are identified.

- Lack of consistent and clear legislative and regulatory framework for SME promotion.
- Legal forms of business can be defined by different laws which is a factor making the business environment unequal for all kinds of business.
- There are contradictions among legislative and regulatory documents, especially between legislation and the implementation guidelines.
- Issuance of guidelines for legislative and regulatory documents were usually delayed and not detailed as needed.
- There is a gap between the regulations and their implementation in practice.
- There is too much discretionary power with respect to the implementation of laws and regulations.
- Procedures for establishment of professional and industrial associations are not transparent.

(3) *Support Instrument Development:* Viet Nam lacks effective instruments to support SMEs. Essentially, SMEs do not know where to go once they are faced with a problem. There is almost no existing national support programme for SMEs, although there is need for SMEs support service, such as consultation, information, technology, marketing, planning, etc.

(4) *Institutional support structure development:* Presently, some ministries, government agencies and organization are concurrently undertaking various aspects of SME promotion. Many of these agencies have authority to formulate policy that impacts upon SME promotion. However, there are no bodies that are engaged in policy formulation for SME development in a systematic and trans-ministerial fashion. In summary, the following problems concerning the current institutional structure for SME promotion.

- Absence of a comprehensive SME promotion organization
- Inadequate cooperation between the existing organizations
- Discrepancies among localities
- Uncertainty over the continuity of SME support projects financed by donors

In the circumstances as mentioned above, the task of improving the competitiveness of SMEs may find very good solution in promoting business and technology incubation systems through application of modern and efficient technologies.

2. Business and technology incubators in Viet Nam

(a) Some general issues on nationwide scope

Despite the fact that incubators have been successfully developed and implemented in many developed countries for the last 20 years, in this Country Report, we would like to emphasis that incubator, either business or technology incubator, is something very new in Viet Nam. Scattering around the country, here, there, somewhere else, there exist things, at different level, similar to business and technology incubator. People and corporations have never been so far introduced to the concept of incubation and they just do very many incubator-like things without awareness and proper knowledge.

All of this does not necessarily mean that there is no available vehicle for business and technology incubation. In our opinion, Industrial Zones (IZ), Export Zone (EZ), Industrial Park (IP), High-Tech Parks and Computer Software Parks could be seen as good vehicles for incubation since most of them are offering favourable business and technological conditions such as good infrastructure, management assistance, discount of land and facility cost, exemption of tax for some first years since starting business in IZ/EZ/IP. At the moment, there are a total of 66 such zones, in which there are 3 EZs and 63 IZs. Furthermore, there are two national Computer Software Parks, one in Hanoi and another in Ho Chi Minh City. These parks are designed specifically for development of Viet Nam software industry. Then apart from those usual benefits from IZ and EZ, they are offering more technological and business advantages for those newly established software companies such as super information highway. In the legal area too, in order to encourage the country information technology and software industry and to develop them into one of key economical sector in the whole nation economy scheme, the Government is offering 0 per cent VAT and Corporate Tax Exemption for those computer software companies in the first 4 years from the date of their business start.

(b) Incubator development at the Ministry of Industry of Viet Nam

Only in the year of 2000, Ministry of Industry of Viet Nam was invited by ESCAP to take part in the Regional Consultative Meeting held in Seoul, the Republic of Korea, during 29-31 August 2000. The Meeting entitled "Strengthening Technology Incubation System for Creating High Technology-based Enterprises in Asia and the Pacific" was designed to draw policies guidelines and recommendations for creating high technology-based enterprises through technology and business incubators. There, for the first time, a representative from the Ministry of Industry of Viet Nam was properly and systematically introduced to the incubation, current situation of incubator development in many countries in the region.

After the Meeting, the Ministry of Industry of Viet Nam decided to take its first actions in introducing and promoting business and technology incubators in Viet Nam in general and in industrial sectors in particular. A survey on incubator was conducted in the form of questionnaire which was sent out to about thirty largest corporations and research institutes under the Ministry of Industry (see the English version of the full text of the questionnaire originally in Vietnamese). Eleven responses came back among them only two organizations declare that they have incubators. Responses to the questionnaire of these two organizations would deserve a special mentioning, hence they were translated into English and shown in the Annex of this report. On the other hand, all those eleven organizations express their little knowledge on incubation for the time being, voice out their interest in and support for this new method for improving the competitiveness of Small and Medium Enterprises in Viet Nam. They all call on the Government, the Ministry of Industry to promote it.

Since then, some companies under the Ministry of Industry of Viet Nam have been taking their individual effort, experimenting with business and technology incubators. However, achievement is quite rare and limited. In such rarity, a moderate success has been credited to the Technology Research Institute (TRI), a member company of the Viet Nam Engine and Agricultural Machines Corporation. The TRI has a successful research in pilot production of ductile iron used in manufacturing insulated parts of high – voltage power transmission lines. The quality of new products has been internationally accepted. The TRI is intending to establish an enterprise which would run the business based on the new technology to meet demand from the domestic market and possibly for export.

The Ministry of Industry of Viet Nam would like to ask the ESCAP for more help in introducing, educating/training and promoting incubation to Viet Nam. The up-coming National Workshop on Incubation and this associated Country Report are the first result of cooperative work between ESCAP and the Ministry of

Industry. With the help from ESCAP, we would like to receive good knowledge on incubation, experience in implementation, development, and maintenance of business/technology incubators. We would also like to learn the role of state management, policy-making in order to promote business and technology incubator for improved competitiveness of SME through application of modern and efficient technologies.

QUESTIONAIRE FORM

Questionnaire on Business and Technology Incubator

Organization:
Address:
Tel:
Fax:
E-mail:

1. Awareness about business and technology incubator at your organization:
   - No idea: ☐
   - Little understanding: ☐
   - Good understanding: ☐
2. Presence of business and/or technology incubator at your organization:
   - Yes: ☐
   - No: ☐
3. If YES for the question No. 2, please fill in the following table:

No.	1996		1997		1998		1999		2000	
	B	T	B	T	B	T	B	T	B	T
Profitable Incubator										
Non-profit Incubator										
Total:										

Note: B: Business Incubator; T: Technology Incubator.

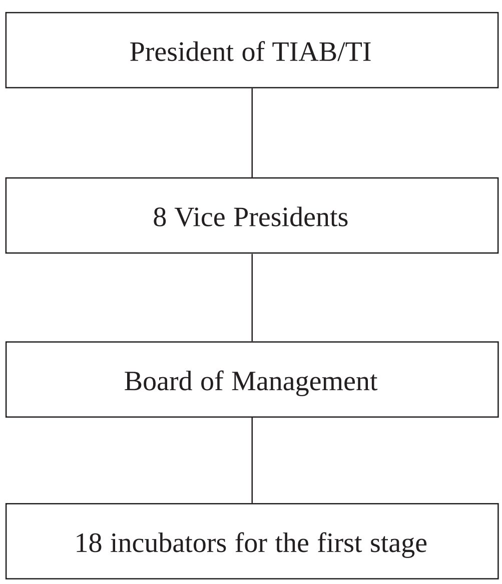
4. Please make detail of the above table on:
   - Number of production/manufacturing incubators?
   - Number of information technology incubators?
   - Number of biological technology incubators?
   - Number of computer software incubators?
   - Number of service incubators?
   - Number of other industrial incubators?
5. Scope of incubator's implementation at your organization:
   - At (or under management of) university? ☐
   - At high-tech parks? ☐
   - At enterprise/corporation/company? ☐
6. Any kind of support from Government? Yes/No ......or from international organizations? Yes/No

   If YES to this question, please justify the effectiveness of the support:
   - Non-effective: ☐
   - A little effective: ☐
   - Very effective: ☐
7. If financial support from Government provided then please state the annual amount of the financial support?
8. The percentage of the Government financial support over the total budget of the incubator at your organization?
9. The economic sector of incubators receiving financial support from the Government.
   - Construction ☐
   - Trading ☐
   - R&D ☐
   - Computer ☐
10. The Government support to your incubators provided in the form of:
    - Non-refundable ☐
    - Loan ☐
    - Tax exemption ☐
    - Other ☐
11. Your comment(s) and/or suggestion(s) for development of business and technology incubators.

Authority Signature and Stamp

C. Conclusions and recommendations

Business and technology incubators are applied in many countries and not brain new forms of encouraging the creative works and applying creations in practice as well as spreading them among small and medium-sized enterprises in the world market, however it is still not popular in Viet Nam now. Pressure of competition in the process of international economic integration requests Viet Nam to apply business/technology incubators as soon as possible. Especially the Government subsidy given to business/technology incubators is not prohibited by WTO rules. As a pioneer and with assistance of ESCAP, the Ministry of Industry of Viet Nam (MOI) initiated some activities for spreading the basic conception of business/technology incubators in Viet Nam in order to establish a developing business/technology incubator system in Viet Nam. Few Vietnamese research and development institutes are running their business as well as research and development work which have similar form to business/technology incubators and reaching certain initial results. Even many government agencies support such initial results, the common definition and conception, the legal criteria and legal framework for setting up business/technology incubators are not accepted by any government agencies yet. The urgent issue to do now in Viet Nam is to prepare a legal documentation on conception, common definition on business/technology incubators and criteria for setting up business/technology incubators and submit them to the Government to ratify. After that the campaign and advertisements on benefit of business/technology incubators, explanation on the way of establishing and running a business/technology incubators would be spreaded widely in broadcasting system and some training courses would be organized in the north, south and centre of Viet Nam. The financing, tariff/trade incentive policies' system would be created for the purpose of supporting business/technology incubators in starting stage which would be more attracting than that have been given to normal SMEs. A time schedule for establishing business/technology incubators would be set up in consideration of each stages of development process, from the beginning through interim reports making, to final report making process with certain experiences gained from implementation and compared with the international business/technology incubators. For managing and rushing such activities a Temporary Inter-ministerial Agency on Business/Technology Incubators (TIAB/TI) approved by the Government should be set up. Organization chart of TIAB/TI would be as follows.



Notes: Presidents: MOI, Director General of Department.

Vice Presidents: MPI (Deputy Director General), MOSTE (DDG), MOF (DDG), MOT (DDG), VCCI (DDG), 3 representatives of Hanoi, Ho Chi Minh and Da Nang local industrial authorities, representative of ESCAP in Viet Nam.

Managing Board: Executive Director from MOI members: Directors or Vice Directors of 11 institutes of MOI, Director or Vice Director of 7 institutes of MPI, MOSTE, MOF, MOT, Hanoi, Ho Chi Minh and Da Nang local authorities representing 18 incubators for first stage.

Business/technology Incubators.

The term of reference of TIAB/TI should be worked out and focusing on objectives of establishing business/technology incubators under certain legal framework, priorities given to SMEs and R&D institutes, operation of business/technology incubators, human resources development and financial support and resources. Financial supports would be provided only for first 2 years by Government budgets of Viet Nam and ESCAP. After that financing would be provided by the Government of Viet Nam and contributed by business/technology incubators.

Reorganizing TIAB/TI would be done after reviewing the activities and operation within 2 years from its establishment. In that occasion a national conference on business/technology incubators and exhibition of products and services made and created by business/technology incubators would be organized in cooperation with international business/technology incubators and ESCAP.

ESCAP should support Vietnamese business/technology incubators and TIAB/TI first of all in creating legal framework to submit to the Government of Viet Nam, transferring experiences on business/technology incubators and financial assistance for running TIAB/TI in the first 2 years from its establishment.

MOI highly appreciate the guidance, supports which ESCAP provided for the time being for the purpose of developing the business/technology incubators in Viet Nam. MOI also welcomes all experiences transferred by international experts in this field. Training courses on business/technology incubators organized by ESCAP or other countries in Viet Nam or abroad would be highly appreciated as well. If MOI could successfully establish and develop business/technology incubators in Viet Nam, MOI would share its experiences with other developing countries. MOI considers that it is a good way to thank ESCAP and its leaders and staff for their very important assistance for business/technology incubators development in Viet Nam.

ANNEX

Two respondents with YES to incubator

Questionnaire on Business and Technology Incubator

Organization: ***Institute of Electronics, Informatics and Automation***
Address: *156A, Quan Thanh St., Hanoi*
Tel: *8456380, 7333039*
Fax: *8231842*
E-mail: *thuytt2000@yahoo.com*

1. Awareness about business and technology incubator at your organization:
   - No idea: ☐
   - Little understanding: √
   - Good understanding: ☐
2. Presence of business and/or technology incubator at your organization:
   - Yes: √
   - No: ☐
3. If YES for the question No. 2, please fill in the following table:

No.	1996		1997		1998		1999		2000	
	B	T	B	T	B	T	B	T	B	T
Profitable Incubator										
Non-profit Incubator									*1*	*4*
Total:									*1*	*4*

Note: B: Business Incubator; T: Technology Incubator.

4. Please make detail of the above table on:
   - Number of production/manufacturing incubators? *2*
   - Number of information technology incubators?
   - Number of biological technology incubators?
   - Number of computer software incubators? *2*
   - Number of service incubators? *1*
   - Number of other industrial incubators?
5. Scope of incubator's implementation at your organization:
   - At (or under management of) university? *4*
   - At high-tech parks? ☐
   - At enterprise/corporation/company? *1*
6. Any kind of support from Government? *No* ......or from international organizations? *No*

   If YES to this question, please justify the effectiveness of the support:
   - Non-effective: ☐
   - A little effective: ☐
   - Very effective: ☐
7. If financial support from Government provided then please state the annual amount of the financial support? *None*
8. The percentage of the Government financial support over the total budget of the incubator at your organization?
9. The economic sector of incubators receiving financial support from the Government.
   - Construction ☐
   - Trading ☐
   - R&D ☐
   - Computer ☐
10. The Government support to your incubators provided in the form of:
    - Non-refundable ☐
    - Loan ☐
    - Tax exemption ☐
    - Other ☐

11. Your comment(s) and/or suggestion(s) for development of business and technology incubators:

- *All business and technology incubators at our organization have been implemented within the frame of R&D projects and so far we do not have any kind of support and/or encouragement from our Government.*
- *The technology incubators are a kind of intellectual enhancement and human resource development, which is very suitable for Viet Nam economy development at present. So our comment and suggestion is that of Government of Viet Nam should support this in different forms such as financial support, development policies, knowledge transfer through successful pilot incubators etc.*

Ministry of Industry
Institute of Electronics, Informatics and Automation
General Director

Prof. Nguyen Xuan Quynh, Dr. Sc.
(Signature and Stamp)

Organization: ***National Research Institute of Mechanical Engineering***
Address: *Thang Long St., Hanoi*
Tel: *7643359, 7644442*
Fax: *8347883*
E-mail: *narime@hn.vnn.vn*

Questionnaire on Business and Technology Incubator

1. Awareness about business and technology incubator at your organization:
   - No idea: ☐
   - Little understanding: √
   - Good understanding: ☐
2. Presence of business and/or technology incubator at your organization:
   - Yes: √
   - No: ☐
3. If YES for the question No. 2, please fill in the following table:

No.	1996		1997		1998		1999		2000	
	B	T	B	T	B	T	B	T	B	T
Profitable Incubator										*1*
Non-profit Incubator										*1*
Total:										*2*

Note: B: Business Incubator; T: Technology Incubator.

4. Please make detail of the above table on:
   - Number of production/manufacturing incubators?
   - Number of information technology incubators?
   - Number of biological technology incubators?
   - Number of computer software incubators? *1*
   - Number of service incubators?
   - Number of other industrial incubators? *1*
5. Scope of incubator's implementation at your organization:
   - At (or under management of) university? ☐
   - At high-tech parks? ☐
   - At enterprise/corporation/company? √
6. Any kind of support from Government? *No* ......or from international organizations? *No*

   If YES to this question, please justify the effectiveness of the support:
   - Non-effective: ☐
   - A little effective: ☐
   - Very effective: ☐
7. If financial support from Government provided then please state the annual amount of the financial support? *None*
8. The percentage of the Government financial support over the total budget of the incubator at your organization?
9. The economic sector of incubators receiving financial support from the Government.
   - Construction ☐
   - Trading ☐
   - R&D ☐
   - Computer ☐
10. The Government support to your incubators provided in the form of:
    - Non-refundable ☐
    - Loan ☐
    - Tax exemption ☐
    - Other ☐

11. Your comment(s) and/or suggestion(s) for development of business and technology incubators:

- *Presently, we are implementing two incubators. They are "Automatic monitoring and diagnostics system for operational capability of equipment of production-line"; and "Unconventional welding and surface treatment for recovery of machine parts" that are of large size or operating in critical working condition.*
- *We would like to ask the Government and the Ministry of Industry to support more to Technology incubators in the period of 2001-2005.*

Ministry of Industry
National Research Institute of Mechanical
Engineering Acting General Director

Prof. Dang Xuan Thi, Dr. Sc.
(Signature and Stamp)

READERSHIP SURVEY

Promoting Business and Technology Incubation for Improved Competitiveness of Small and Medium-sized Industries through Application of Modern and Efficient Technologies

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Thank you again for your cooperation.