ENHANCING THE COMPETITIVENESS OF SMES:
SUBNATIONAL INNOVATION SYSTEMS AND TECHNOLOGICAL CAPACITY-BUILDING POLICIES

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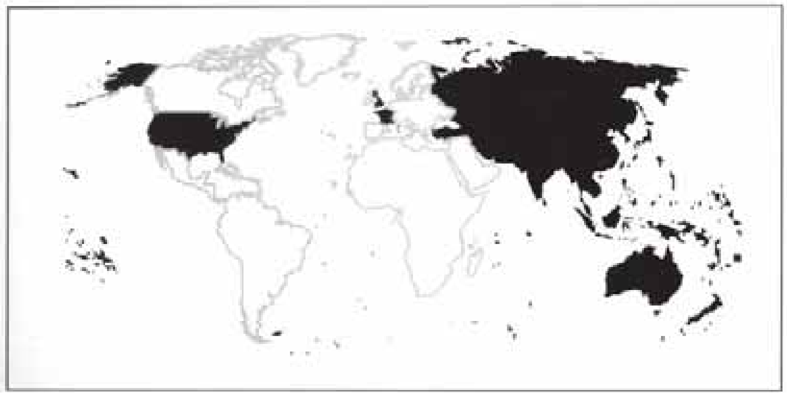

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ENHANCING THE COMPETITIVENESS OF SMES:

SUBNATIONAL INNOVATION SYSTEMS AND TECHNOLOGICAL CAPACITY-BUILDING POLICIES

Proceedings and papers presented at the Regional Consultative Meeting on Subnational Innovation Systems and Technology Capacity-Building Policies to Enhance Competitiveness of SMEs

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ABBREVIATIONS

ADB	Asian Development Bank
AFTA	ASEAN Free Trade Area
AIRT	Agency for Industrial Research and Technology
AMT	Advanced Manufacturing Technologies
ANSAB	Asia Network for Sustainable Agriculture and Bioresources
APBSD	ASEAN Policy Blue Print for SME Development
APCAEM	Asian and Pacific Centre for Agricultural Engineering and Machinery
APCTT	Asian and Pacific Centre for Transfer of Technology
AP&NET	Asia-Pacific Business Network
APEC	Asia-Pacific Economic Cooperation
ASTAR	Agency for Science, Technology and Research
ASEAN	Association of Southeast Asian Nations
ASU	Academy of Science of Uzbekistan
BCSIR	Bangladesh Council of Scientific & Industrial Research
BDS	Business Development Service
BI	Business Incubator
BIM	Bangladesh Institute of Management
BK21	Brain Korea 21 programme
BOI	Board of Investment
BPO	Business Process Outsourcing
BSCIC	Bangladesh Small and Cottage Industries Corporation
BTC	Business Technology Centre
BTIs	Business and Technology Incubators
CCI	Chamber of Commerce and Industry
CCTD	Centre for Commercialization and Technopreneur Development
CDMA	Code Division Multiple Access
CEI	Central European Initiative
CII	Confederation of Indian Industry
CLCSS	Credit Linked Capital Subsidy Scheme for the technology up-gradation of the small-scale industries
CSIDB	Cottage and Small Industry Development Board
DCSI	Department of Cottage and Small Industry
DEA	Data Envelop Analysis
DFIs	Development Finance Institutions
DIP	Department of Industrial Promotion
DRAM	Dynamic Random Access Memory
DRC	Daedeok Research Complex
DSF	Daedeok Special Fund
DSIR	Department of Scientific and Industrial Research
DST	Department of Science and Technology
DST	Daeduk Science Town
EDB	Economic Development Board
EDI	Entrepreneurship Development Institute
EMCs	Export Management Companies

ERP	Enterprise Restructuring Project
ESCAP	Economic and Social Commission for Asia and Pacific
ETPL	Exploit Technologies Pte. Ltd.
ETRI	Electronic and Telecommunication Research Institute
EU	European Union
FDI	Foreign Direct Investment
FISME	Federation of Small and Medium Enterprises
FNCCI	Federation of Nepalese Chambers of Commerce and Industry
FNCSI	Federation of Cottage and Small Industry
FTA	Free Trade Agreement
FTE	Full Time Equivalent
FWEAN	Federation of Women Entrepreneurs Association of Nepal
GATS	General Agreement on Trade and Services
GDP	Gross Domestic Product
GEM	Global Entrepreneurship Monitor
GERD	Gross Expenditure of Research and Development
GET-UP	Growing Enterprises with Technology Upgrade
GIS	Global Innovation System
GMS	Greater Mekong Subregion
GRIs	Government Supported Research Institutes
GTN	Global Technology Network
GNP	Gross National Product
GTZ	Foreign Investment and Foreign Trade Agency
HLCIT	High Level Commission for Information Technology
HRD	Human Resource Development
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 Dispute
ICT	Information and Communication Technology
IDBI	Industrial Bank of India
IEDI	Industrial Enterprise Development Institute
IFC	Industrial Finance Corporation
IFCI	Industrial Finance Corporation of India
IIFT	Indian Institute of Foreign Trade
IIT	Indian Institute of Technology
IKED	International Organization for Knowledge Economy and Enterprise Development
IMF	International Monetary Fund
INSMEs	International Network for SMEs
IP	Intellectual Property
IPM2	Second Industrial Master Plan
IPR	Intellectual Property Rights
IRPA	Intensification of Research in Priority Areas
ISMED	Institute for Small and Medium Enterprise Development

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
ITC	International Trade Classification
ITDG	Intermediate Technology Development Group
ITEP	Industrial Technology Evaluation and Planning
KAIST	Korea Advanced Institute of Science and Technology
KCI	Knowledge Cluster Initiative
KFSB	Korea Federation of Small and Medium Business
KICOX	Korea Industrial Complex Corporation
KIPO	Korean Intellectual Property Office
KITA	Korea Industrial Technology Association
KITF	Korean Industrial Technology Foundation
K-JIST	Kwang-Ju Institute of Science and Technology
KOSBIR	Korea Small Business Innovation Research
KOSDAQ	Korean Securities Dealer Automated Quotations
KOTEC	Korea Technology Credit Guarantee Fund
KPO	Knowledge Process Outsourcing
KTB	Korea Technology and Banking
KTIT	Korean Industrial Technology Foundation
KTP	Kyeongbuk Technopark
LDCs	Least Developed Countries
M&A	Merge and Acquisition
MADHU	Modernisation of Artistic Design for Handloom Unit
MDA	Multimedia Development Corporation
MDGs	Millennium Development Goals
MEDEP	Micro-Enterprise Development Programme
MIDAS	Micro Industries Development Assistance and Services
MIDC	Myanmar Industrial Development Committee
MIT	Massachusetts Institute of Technology
MNCs	Multinational Corporations
MSC	Multimedia Super Corridor
MSCVC	MSC Venture Corporation
MTD	MSC Technoprenuer Development Flagship
NAMA	Non-Agriculture Market Access
NARC	Nepal Agricultural Research Council
NBIA	National Business Incubators Association
NCC	Nepal Chamber of Commerce
NCET	National Continuing Education and Training Framework
NCST	National Council for Science and Technology
NDRC	National Development and Reform Commission
NESDB	National Economic and Social Development Board
NGO	Non-Governmental Organization
NIA	National Innovation Agency
NIS	National Innovation System
NISPASS	National Institute for Science and Technology Policy and Strategy

NISTADS	National Institute of Science, Technology and Development Studies
NISTEP	National Institute of Science Technology Policy
NPC	National Productivity Corporation
NPEDC	National Productivity and Economic Development Centre
NRCT	National Research Council of Thailand
NSC	National Science Council
NSDC	National SME Development Council
NSDP	National Supplier Development Programme
NSTDA	National S&T Development Agency
NSTP2	Malaysia's Second National Science and Technology Policy
OECD	Organization for Economic Cooperation and Development
OSTI	Office of Science and Technology Innovation
OTOP	One Tambon (subdistrict) One Product
PCA	Principal Component Analysis
PCSME	Presidential Commission on Small and Medium Enterprises
POSTEK	Pohang Science and Technology Institute
PPP	Public Private Partnership
PRSP	Poverty Reduction Strategy Paper
R&D	Research and Development
R&DB	Research and Development and Business
RCRC	Regional Cooperation Research Centre
RDA	Regional Development Agency
REMTECH	Regional Emerging Markets Technology Transfer Network
RETDC	Regional Environment Technology Centre
RIS	Regional Innovation Centre
RMB	Renminbi (Chinese currency unit Yuan)
RONAST	Royal Nepal Academy of Science and Technology
RRC	Regional Research Centre
RSEs	Researchers, Scientists and Engineers
RSTD	Regional Specialized and Technology Development
RTIC	Regional Technology Innovation Centre
S&T	Science and Technology
SBA	Small Business Administration
SBC	Small Business Corporation
SCI	Science Citation Index
SCITI	Small and Cottage Industries Training Institute
SEA	Software Enhancement Area
SEEDS	Start-up Enterprise Development Scheme
SEDP	Social Economic Development Programme
SIS	Subnational Innovation System
SMBA	Small and Medium Business Administration
SMEs	Small and Medium-sized Enterprises
SMEPDC	SME Promotion and Development Committee
SMEPDO	SME Promotion and Development Office
SMIs	Small and Medium-sized Industries
SMIDEC	Small and Medium Industries Development Corporation
SOEs	State-Owned Enterprises
SPDC	State Peace and Development Council

SPRING	Singapore Standards Productivity and Innovation Board
SRIC	Specialized Research Information Centre
STEA	Science, Technology and Environment Agency
STEDS	Science and Technology Entrepreneurship Development Scheme
STEPI	Science and Technology Policy Institute
STPs	Science and Technology Parks
TAP	Technology Action Plan
TBIs	Technology Business Incubators
TBT	Technical Barriers Treaty
TCDC	Technical Cooperation Developing Countries
TDF	Technopreneur Development Flagship
TePP	Technopreneur Promotion Programme
TFT-LCD	Thin Film Transistor-Liquid Crystal Display
TI	Technology Incubator
TIC	Technology Innovation Centre
TNCs	Transnational Corporations
TLO	Technology Licensing Organization
TP	Technology Park (Techno-park)
TPM	Technology Park Malaysia
TRIM	Trade Related Investment Matters
TRIPS	Trade Related Intellectual Property System
UNCTAD	United Nations Conference for Technology and Development
UNDP	United Nations Development Programme
UNECE	United Nations Economic Cooperation for Europe
UNESCAP	United Nations Economic and Social Commission for Asia and Pacific
UNIDO	United Nations Industrial Development Organization
VAT	value added tax
VBDA	Venture Business Development Area
VC	Venture Capital
WASME	World Assembly for Small and Medium Enterprises
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

PART ONE

REPORT OF THE REGIONAL CONSULTATIVE MEETING ON SUBNATIONAL INNOVATION SYSTEMS AND TECHNOLOGY CAPACITY-BUILDING POLICIES TO ENHANCE COMPETITIVENESS OF SMES

1. ORGANIZATION OF THE MEETING

With globalization, liberalization of world trade and regionalization trend of the economy, subnational innovation system (SIS) or regional innovation system (RIS) has been widely recognized and some countries adopted it as a vital science and technology promotion policy mechanism for their sustainable economic growth at both provincial and national level. However, compared to the concept of national innovation system (NIS), the SIS concept is relatively a new concept which is still an evolving framework for a practical policy mechanism. As such, currently only limited countries in the Asian and Pacific region such as Japan, the Republic of Korea, China and Singapore adopted a SIS policy for strengthening their local science and technology (S&T) fundamentals to support local economic development.

Meanwhile, the competitive environment for SMEs has been drastically changed and the current stringent global competition forces SMEs seek for most supportive business environment. SMEs thus attempt to organize their production location and innovation processes on a global scale. As production and process become more dependent on technology, innovative firms are placing much emphasis on creating value-added benefiting from R&D infrastructure, qualified human resources and innovative culture. Nowadays, enhancing technology capability of local SMEs is the very pressing issue facing every nation in the region. In order for SMEs to become more competitive, they should take into account changed new environment surrounding S&T and innovation such as shortening product life cycle, globalization of R&D activities and technology flows, and shift of emphasis from manufacturing to knowledge-based economies.

Therefore, the promotion of SMEs with technological competitive-edge built up by knowledge exploitation, linking with global and regional innovation network, and expanding technological capabilities is increasingly becoming a key for a nation and an enterprise to effectively meeting these changed global technology scenario.

Against this background, UNESCAP has been implementing the technical cooperation project entitled "Subnational Innovation Systems and Technology Capacity-building Policies to Enhance Competitiveness of SMEs" starting from June 2005. As part of the project activities, UNESCAP, in cooperation with the Science and Technology Policy Institute (STEPI) and Daedeok Innopolis of the Republic of Korea, organized the Regional Consultative Meeting on "Subnational Innovation Systems and Technology Capacity-Building Policies to Enhance Competitiveness of SMEs" from 18-20 January 2006, in Seoul, the Republic of Korea.

A. Objective

The Regional Meeting was targeting middle and high-level policymakers in both central and local government and administrators from relevant public agencies and institutions and aimed to assist member countries of UNESCAP in developing their unique subnational innovation system policies and SME strategies to strengthen their technology capability, enabling them to respond effectively to globalization and rapid technological change.

The objectives of the Meeting were as follows: (1) to raise the understanding of participants on subnational innovation systems, including its policy concept, evolution mechanism, key elements and facilitating factors; (2) to provide a unique platform for policymakers and innovation related stakeholders to exchange their experiences and good practices on SIS policy and SME promotion strategies; and (3) to explore an enabling policy framework for a sound SIS establishment and enhancement of local SME technological capability.

B. Attendance

The Meeting was attended by senior government officials as well as representatives and experts from private sectors from the following countries: Bangladesh, Cambodia, China, India, Indonesia, Kazakhstan, Lao People's Democratic Republic, Malaysia, Mongolia, Myanmar, Nepal, Republic of Korea, Thailand, Uzbekistan and Viet Nam. The list of participants is attached (Annex II).

Resource persons from Malaysia, Japan, Germany and the Asian and the Pacific Centre for Transfer of Technology (APCTT), UNESCAP consultants from India and Republic of Korea, keynote speakers and special guest speakers from Republic of Korea also participated.

C. Election of officers

The Meeting elected the following persons as moderators to chair each session and to serve as officers:

Moderator (Session I):	Mr. Sung-Chul Chung (Republic of Korea)
Moderator (Session II):	Mr. Joong-Wan Cho (UNESCAP)
Moderator (Session III):	Mr. S.P. Agarwal (India)
	Mr. Avvari V. Mohan (Malaysia)
	Mr. Thomas Stahlecker (Germany)
	Mr. Deok-Soon Yim (Republic of Korea)
Moderator (Session IV):	Mr. Xuan Zengpei (UNESCAP)
Rapporteur (Session IV):	Mr. S.P. Agarwal (India)

D. Programme

The Meeting was preceded as per the programme which is attached as Annex III.

II. OPENING OF THE SESSION

The Meeting was opened by Mr. Seung-Hee Han, Director General for Science and Technology Policy, Ministry of Science and Technology (MOST), the Government of Republic of Korea. In his inaugural statement, Mr. Han pointed out that small and medium businesses are playing increasingly a critical role in the national economic growth and regional balanced development. As such, it is opportune to discuss subnational innovation systems for SMEs to gain the competitive edge in the knowledge-based society and global economy. Mr. Han also emphasized that acquiring differentiated knowledge and unique technological innovation to generate high value-added technology development will lead in the future competition and enhance the national and industrial brand value. In particular, the role of local SMEs with technological competitive-edge should be much strengthened for the regional economic development and the creation of new jobs.

Mr. Han also pointed out that in order to enhance technological competitiveness of SMEs, a subnational innovation system needs to be established through cooperation among the industry, academia, and research institutes. He noted that the Government of the Republic of Korea in recent years put more emphasis on its policy initiatives on SIS-related technological innovation capacity-building of SMEs which includes joint-technology development programme among industry, academia and research institutes for SMEs and establishing innovation clusters and techno-parks. He also introduced "Daedeok Science Town" as the Mecca of technological innovation and new industry creation. Lastly, Mr. Han proposed that we build a new model of regional innovation system to strengthen technological competitiveness of SMEs through mutual cooperation of UNESCAP and 16 participating countries of the project.

Mr. Xuan Zengpei, Director, Trade and Investment Division, UNESCAP, delivered the opening statement. He welcomed all participants to the Meeting and thanked Mr. Seung-Hee Han for delivering the inaugural statement. He also expressed appreciation to Mr. Sung-Chul Chung, President of STEPI and Mr. In-Chul Park, President of Daedeok Innopolis for their cooperation in and contribution to organizing this important event. He further extended his heartfelt thanks to all speakers. In his statement, Mr. Xuan pointed out that in the globalization economy, the competitiveness of SMEs largely depends on their ability to harness and exploit knowledge, information and technology. In particular, innovation is the prime driving force that creates and promotes dynamic and competitive SMEs in both developing and developed economies.

He also mentioned about the policy implications of a SIS: a SIS is nowadays widely recognized and some countries adopted it as an important policy mechanism for the sustainable economic growth at the provincial level as well as overall national economic development. However, compared with NIS concept, this SIS is relatively new concept which is still an evolving policy framework and currently only limited countries in the Asian and Pacific region reflected SIS initiatives in their S&T system or socio-economic development plan. Especially he stressed that a SIS mainly focuses on industrial development and enhancing competitiveness of local or provincial enterprises, particularly SMEs through the overall system restructuring and upgrading, including technology and innovation to support them.

He highlighted that the outcome of the 2005 World Summit organized by the United Nations emphasized the role of science and technology in meeting the Millennium Development Goals (MDGs). The World Summit reaffirmed the vital role of science and technology in achieving the MDGs. At the eighth session of the Commission on Science and Technology for Development (CSTD) held in May 2005 stressed the necessity of reorienting science, technology and innovation policy mechanisms at the national level to ensure that they effectively and coherently serve the needs of development. Particularly, the Commission Session recognized that achieving the MDGs requires the building of a solid S&T base to enable the creation, utilization and diffusion of knowledge through placing science and technology at the centre of national development strategies. In closing, he affirmed that UNESCAP will facilitate national initiatives of individual countries towards developing an enabling policy framework to promote a SIS and is committed to strengthen regional cooperation and networking to enhance SME technological capabilities of member countries of UNESCAP.

The welcome address was made by Mr. Sung-Chul Chung, President of STEPI and he warmly welcomed all participants to the Meeting. He wished that after the meeting there will be enhanced awareness and extended advocacy of participating countries on the importance of a SIS policy approach in promoting local economic growth and SME technology capacity-building which will benefit to participants.

The welcome remarks were made by Mr. In-Chul Park, President of Daedeok Innopolis. He pointed out that Daedeok Innopolis was inaugurated on 1 September 2005 and is a core institution for implementing a vital long-term strategy of the Republic of Korea in terms of both NIS and RIS practice. He made a brief introduction about Daedeok Innopolis: in Daedeok R&D special zone there are 63 R&D research institutes, 6 universities and more than 700 high technology-based start-ups partnered with industry, education, and research institutes which form innovation clusters. The strength of Daedeok Innopolis includes abundant R&D manpower which has more than 10 per cent of Ph.D.s in the country. The number of patents is over 24 per cent of the whole domestic patents. Also, there are 16 innovation clusters over various technologies. In closing, he welcomed all participants to the Meeting and wished this Meeting can be a constructive opportunity to exchange the knowledge and valuable experiences on the technological competitiveness of SMEs among the Asian countries.

III. CONSIDERATION OF ISSUES

After the opening session, there were presentations in the successive three sessions as follows:

Session I: SIS policy mechanism for enhancing competitiveness of SMEs: Its policy implications and prospects in the Asian and Pacific region

1. Perspectives on technological innovation: Lessons from Korean experience

Mr. Young-Rak Choi, as a keynote speaker, introduced and compared economic growth models of the East Asian countries including the Republic of Korea, Taiwan Province of China and Singapore in the national innovation system perspective, and draw upon lessons replicable to other countries. There may be some similarities among those three nations in the practice of innovation system approach as an economic growth strategy as follows: maintain open system of national innovation for global networks and outsourcing; focusing on human resources as a key element; manufacturing-oriented development with some services sector in Singapore; closer government-business relations; good interface between science, technology and innovation policies and economic/industrial policies; strengthening of government's role and firm dynamics in technology innovation; and successful change of management (speed and flexibility).

Lessons from NIS experience of the East Asian countries include: (1) all nations follow second-mover advantage path based on manufacturing; (2) they consider human resources as the utmost crucial factor for national economic growth; (3) continuous and speedy transformation of NIS has been made to meet the rapidly changing environment; and (4) beyond technological learning, there has been a strong government role in the context of clearly defined vision and strategy setting, system establishment, firm commitment and leadership, etc.

Particularly, in case of the Republic of Korea, he illustrated the following characteristics of and lessons from its NIS practice: (1) Strong production capability makes possible for the Republic of Korea to be a world market leader in some selected sectors, even without world class technological novelty and technological breakthrough; (2) Technological learning and absorptive capacity may be important elements, but agile strategies and effective system for technological capability-building are most necessary to be a technological frontrunner; and (3) Technologically known-paths are uncertain and risky to individual firms: in-house knowledge base is very important, but the ability to internalize production activities is more valuable. He finally introduced Samsung's perspective on technology innovation: "Everyone can get the same technology. But that does not mean they can make an advanced product or service."

2. Daedeok Innopolis strategies for SMEs

Mr. Lak-Kyoung Song, as a keynote speaker, introduced Daedeok Innopolis's vision and mission, development plan, and supporting strategies to enhance SME competitiveness. Daedeok Innopolis, the new brand of the existing Daedeok Science Town, will be a world-class innovative cluster with the role playing as a growth engine of the knowledge-based Korean economy in 21^{st} century. Over the past 30 years, it has accumulated ample R&D experiences through multidiscipline as well as nationwide research activities, had high-quality R&D manpower, and created advanced technology spin-offs and high-technology start-ups. Policies for SMEs in Daedeok include commercialization of R&D results, establishment of efficient venture ecosystem, setting-up of global R&D networks, and cooperation with other economic and social areas.

Daedeok Innopolis will commit and concentrate all available resources to fostering market-oriented research capabilities and promoting a global business environment for benefiting SMEs through the provision of following support schemes and incentives: larger investment opportunities such as Daedeok Special Investment Fund; tax reduction including corporate tax, income tax, and custom tax; management consulting programme such as one-stop managerial, legal and marketing service; sharing of expensive R&D facilities; and technology test-bed services and marketability assessment.

3. Subnational innovation systems policy to enhance local SME competitiveness[1]

Science and technology play the key role in developing national economy as well as building core competency of an individual company. Traditional SME policies have been focusing on individual competitiveness factors such as marketing, human resources, financial resource and technological assistance, while SME policies in the global economy became more integrative and self-sustainable policy to upgrade the competitiveness and/or technological capability of SMEs. In this context, there has been a paradigm shift in firm's technology policy perspective in which some governments adopted a SIS approach to promote their local SMEs' competitiveness.

A SIS concept has emerged through historical development of science and technology policy and other related social sciences like economic geography and industrial cluster theories. The SIS concept has powerful implications for SME policies because it deals with subnational region and is closely related to local economic actors like SMEs. A SIS has same characteristics of upper level NIS and more local-specific characteristics due to its local geography, innovation culture and resources. The SIS policy should therefore be considered at the perspectives of not only NIS characteristics but also its local specificities. In the SIS practice, SMEs receive special attention due to their local specificities, and networking/interaction among the actors is more important than single actor's capability. In this respect, the ecosystem for technological innovation is especially important.

Key success factors for promoting a sound SIS include research capabilities, research and business manpower, research and business infrastructure, financial resource, cooperative and competitive culture, management and vision, international player and start-up companies. SME policy directions for designing an effective SIS are as follows: strategic mind setting; long-term and system-oriented policy development; and technology capacity-building.

4. Strategy for enhancing competitiveness of SMEs based on technology capacity-building[2]

NIS and SIS are largely driven by scientific and technological capabilities and policies. The S&T capabilities at the national, local or enterprise level including SMEs are major determinants for competitiveness. The productivity and technology in industrial sector is therefore crucial to enhance the competitiveness of SMEs. SMEs significantly contribute to the total industrial production, exports, employment, and gross domestic product (GDP) in all economies. The number of SMEs may range up to 98 per cent of the total business entities. It is therefore crucial to develop strategies for enhancing competitiveness of SMEs, through their technological capability-building and in conjunction with other support mechanisms.

Some of the best practices include: supporting innovative SMEs in building their technological and management capabilities; development of skills and resources; facilitating access to technology, world trade and technology information; networking and linkage with R&D, academics, and international organizations; encouraging foreign direct investment (FDI) flows, innovative clusters, technology incubators, S&T parks,

[1] *This background paper was prepared and presented by Mr. Deok-Soon Yim, UNESCAP consultant and Research Fellow of Science and Technology Policy Institute, the Republic of Korea.*

[2] *This background paper was prepared and presented by Mr. S.P Agarwal, UNESCAP consultant and Head, Centre for International Trade in Technology, Indian Institute of Foreign Trade, New Delhi, India.*

mobility of entrepreneurs and scientists/experts; encouraging start-ups, innovative financing including technology financing, risk sharing fund, etc. Preparing SME strategies for World Trade Organization (WTO) regime, intellectual property right (IPR) literary and protection are some other areas of supporting SMEs.

Strategies basically relate to the national needs, resources, capabilities and objectives of SMEs, and therefore would vary from country to county. However, some generic approach might include: review of existing policies and incentives; training of policymakers and intermediaries; greater risk sharing and financing with easier access to SMEs; reorientation of educational systems and training programmes; greater IPR awareness, knowledge management and generation; development of intellectual and industrial clusters and technology incubators around R&D and academic institutions; promotion of technology flows with FDI, and management capability-building through linkages with large companies and transnational corporations (TNCs).

Session II: Benchmarking from successful countries and regions: Experiences, lessons and best practices on SIS

1. Regional science and technology policy and regional capacity-building[3]

In general, the "Unit of Region" for the Regional S&T in Japan means the "Regional Governments" such as Prefectures and Specified Cities. Some regional governments in Japan are thought to have potential equivalent to that of a small country in terms of its economic power as well as overall S&T performance. Regional S&T input needs improvement and therefore the national policy is considered to have an important role.

The national S&T policy in Japan has changed from focusing on decentralization of R&D bases led by the central government to the policy which focuses on regional autonomy due to the transition of interests toward regions from the balanced-development of the national land to the international competitiveness. The regions concentrated their international competitiveness and advantages of their own region under the regional competitive environment. Since the 1990s, as each regional government has gradually improved its own S&T and innovation system, their autonomy and active role rather than a complementary role for the central government has been much strengthened. The "Knowledge Cluster Initiative" is one of the good examples of policies implemented by the regional governments.

In recent years, Japan's Regional S&T Policy emphasizes initiatives led by regional governments and stimulates competitive environment among them in the establishment of the RIS. For instance, in the draft of the "3rd National S&T Basic Plan (2006-2010)", there has been included one chapter on the establishment of RIS and revitalization of regions. There are two major initiatives: Regional Clusters to promote world-class clusters with comparative advantages of its regional characteristics; and harmonious development of regional S&T programmes with the regional government playing an active role.

[3] *This paper was prepared and presented by Mr. Takaaki Matsuzawa, Director, 3rd Policy-Oriented Research Group, National Institute of Science Technology Policy, Tokyo, Japan.*

2. Subnational innovation systems and technology capacity-building policies[4]

Since the second half of the 1990s, the federal Government of Germany has paid great attention to the regions in implementing innovation and technology policy measures. Regions are equipped with a specific permutation of production factors, which can only be considered to be optimally allocated if they are made the basis for multilevel and multiactor governance structures. The absorptive capacity of the political administration may vary between regions and regions are not identical functional or political-administrative units, but vary in size, political structure and economic strength.

Examples of programmes and schemes to foster the SIS in Germany include the BioRegio Contest, the "EXIST – University-based Start-ups Programme", and the BMBF initiative "Entrepreneurial Regions" based on five programme pillars: InnoRegio, Innovative Regional Growth Cores, Centres for Innovation Competence, Interregional Alliances for Tomorrow's Markets – Innovation Forums, and InnoProfiles. The experiences being made with these new approaches show that the interrelationship between regional and national governance of innovation can cause additional private initiatives (e.g. regarding network-building, private funding, creative technology-transfer mechanisms, etc.) which are essential for the formation and sustainable development of a SIS. Systemic approaches which integrate "traditional" supporting measures and innovative, regionally-adapted supporting actions (e.g. project-based R&D funding, consulting, provision of information, entrepreneurship education at universities, measures aiming at improving the technological infrastructure, supporting knowledge-intensive business services) gain in increasing importance.

Major challenges for Germany's subnational innovation systems in mature industries (e.g. automotive sector) will be the linking of mature technologies with cutting-edge technologies; danger of "lock-in" to be noticed in many regions; "catch-up" phase of Eastern Germany still in progress: still weaknesses with regard to techno-economic development as well as employment.

3. Promotion strategy for technology-based innovative SMEs – Malaysian case[5]

SMEs in Malaysia represent an important segment of the economy: account for more than 90 per cent of all manufacturing firms, 6 per cent of GDP and export 26 per cent of their total output. Main challenges are market access, advancement of technology, enhancement of innovation and creativity, access to financing, access to information, and human resource development. Therefore, the government's prime concern is to make SMEs enhance their capacity and capability to become regional and ultimately, global entities, and compete for access to global supply and production chains.

One of the regional level SIS initiatives in the information and communication technology (ICT) sector in Malaysia is the "Multimedia SuperCorridor (MSC) Project" and the "Technopreneur Development Flagship (TDF) Programme." The MSC project is aiming to transform the economy from a production-based one to a knowledge-based one by initiating the regional clustering approach and roll it out to the rest of the country. This project is focusing on consortiums or groups of local and foreign companies to

[4] *This paper was prepared and presented by Mr. Thomas Stahlecker, Fraunhofer Institute for Systems and Innovation Research (FhG-ISI), Karlsruhe, Germany.*

[5] *This paper was prepared and presented by Mr. Avvari V. Mohan, Senior Lecturer and Chairman - Centre for Technology Management, Faculty of Management, Multimedia University, Cyberjaya, Malaysia.*

facilitate "learning" and transfer of capabilities to the local large and SME companies while providing market to the foreign technology providing companies. The TDF programme aims to catalyse, nurture, develop and grow technopreneurs and ICT sector SMEs.

Currently, the Government of Malaysia is planning to expand the MSC project (Penang) to other regions and more focus will be given to the "Shared-Services and business processing (BP) Outsourcing" by increasing sub-clusters in the region and globally; developing the value chain of the outsourcing sector in the MSC and "Branding" of the MSC.

4. Technology outsourcing and policy instruments for SME technology capacity[6]

There have been major routes for technology outsourcing such as technology trade, international collaborative R&D and FDI affiliates. Common policy instruments for SME technology capacity-building include grant for innovative ideas, collaborative R&D between industry & research community, R&D tax relief, knowledge transfer networking and one-stop business advisory service. General national policy directions for the enhancement of SME technological capability in a global economy may be summarized as follows: promote S&T infrastructure and an efficient system for the diffusion of innovation; create an enabling climate for fair competition; make good institutional failure; and promote the global level "playing field".

As one of the flagship programmes, APCTT is formulating a national R&D information network project with the objective providing a web-based national R&D information service to R&D communities in the Asian and Pacific region. National R&D information needed to be data-based and serviced includes national R&D programmes and projects, research organizations, leading researchers, salient R&D successes, and international cooperation activities. APCTT has also been implementing the NIS project which was initiated in 2005 to promote national capability to build and explore national innovation strategies in member countries.

Session III: Country presentation on SIS and technology capacity-building policies to enhance competitiveness of SMEs: Its current status and future prospects

1. Enhancing competitiveness of SMEs through fostering RIS[7]

There is a rising demand for seeking a new growth model in the Korean economy as the traditional input-driven strategy faces limit of growth due to increased labour cost, emergence of new competitors like China, India and ASEAN countries, and lack of competitive fundamental technologies. Against this backdrop, the Government of the Republic of Korea is pursuing an innovation-driven strategy as a new growth model as well as growth by building strong regional innovation system (RIS). In this regard, one of the major initiatives is innovation cluster building.

[6] *This paper was prepared and presented by Mr. Se-Jun Yoon, Director, Asian and Pacific Centre for Transfer of Technology (APCTT), New Delhi, India.*

[7] *This paper was prepared and presented by Mr. Hyung-Young Kim, Director, Presidential Committee on Balanced National Development, Seoul, the Republic of Korea.*

An innovation cluster policy needs a comprehensive policy approach incorporating technology, industry and regional development policies. Innovation cluster building is a critical way to accelerate development of a particular region and a successful cluster can facilitate development of other clusters, and lead to development of the whole country. A key to success is to build and strengthen networks among industry, research institutes and universities. Across the country, there are several types of focused clusters in the following: Daedeok Innovative Cluster; 7 industrial complexes now being transformed to innovation clusters; Bio-technopolis in Osong; cultural clusters; IT Complex (Seoul & Incheon); and agricultural clusters (20 sites).

In particular, the initiative to converse the existing seven industrial complexes into innovation clusters brings about a keen much attention. Strategies to upgrade them to innovation clusters are: to build and promote formal/informal networks "Minicluster"; enhance R&D capabilities of concerned actors; improve business and residential environment; and collaborate with advanced innovative clusters abroad.

2. Bangladesh

Bangladesh is an emerging economy experiencing steady growth with the development of infrastructure, supporting policies for trade, investment and huge potential of human resources. There are several national policies for SME technology capacity-building as follows: Industrial Policy (2005), Export Policy (2003-2006), Poverty Reduction Strategy Paper, and Policy Strategy for the Development of SME. Some technology-related actions include strategic skills upgrading, creating enabling environment, networking supply chain for technopreneurship, SME web portal and a virtual SME front-office, e-governance with a human touch, high-performance communications backbone, and international technology-exchange programmes.

Future plan and prospects for enhancing competitiveness of SMEs based on technology capacity-building include selection and acquisition of appropriate technologies for production; upgrade training and skill development facilities; enhance indigenous R&D capabilities; prepare institutional facilities for women entrepreneur; upgrade industrial financing system; strengthen public-private cooperation for the design and implementation of effective business support services; and reorient a differentiated and hassle-free indirect tax system for SMEs.

3. Cambodia

Currently, the Government of Cambodia has not paid much attention to S&T promotion and technology capacity-building. There have thus been not set up NIS and SIS. Problems and issues to be addressed to promote SME technological capability are as follows: lack of human resource, poor infrastructure, and absence of standardization programme for training institutions, lack of technology development programmes for SME, unawareness of NIS or SIS, weak relationship between government and business, and small scale of technical training institutions.

Against this backdrop, the government is planning to set up the "Cambodian-India Entrepreneurial Development Centre" to facilitate technology transfer and promote subsequently innovation system. It is expected that within the period of time the centre will provide specific knowledge and expertise, including technology transfer and information, entrepreneurship development, innovation system establishment and management, technology and business partnership development, and competitive advantages by developing its main industrial clusters.

4. China

The Ministry of Science and Technology was established to build a long-term strategy for promoting science and technology. Major functions are as follows: to formulate national policies to facilitate technology-oriented economic and social development; to identify priorities in technological development and research; to pursue the strategy to build a "chuangxin" (innovation, recreating old technology) structure for enhancing national technological capability. The Innovation Fund for Small Technology-Based Firms was established to promote SMEs and facilitate technological innovation. Major roles of the Fund are as follows: to support technological innovation at technology-intensive SMEs; to help technology-intensive SMEs develop technologies; to commercialize R&D results in high-technology areas; to develop technology-intensive SMEs; and to accelerate development of advanced technology.

Policy areas identified for SME innovation relate to: development of human resources and technology through linkage between industry and educational and research institutions; access to specialist assistance and advice; enhance availability of capital to innovative SMEs; networking and clustering for innovative SMEs; establish appropriate legal and regulatory structures; establish a market consistent economic environment; and develop methodologies for effectively measuring progress in the implementation of innovation programmes for SMEs.

5. National innovation system: Its role and mission[8]

The Government of the Republic of Korea designated the Daedeok Research Complex as a Research and Development Special Zone (Daedeok Innopolis) in 2005, in order to maximize the R&D potential of the Daedeok Research Complex, expedite commercialization, and foster it to become the Mecca of technology innovation and new technology creation. To this end, the government is planning to develop R&D projects exclusive to a special R&D region for promoting fusion and commercialization of technologies, to encourage joint research with enterprises, and to expand customer-oriented R&D projects through the establishment of R&D Business (R&DB) mechanism that reflects market demands.

In addition, the government is introducing a "Technology Support System", where research institutes and enterprises establish alliances in order to facilitate technology transfer, follow-up research, and technology guidance. Also, Daedeok Innopolis is pursuing the direction for market-oriented R&D by putting more emphasis on commercialization of promising technology items; capacity-building of government-supported research institutes (GRIs) and universities for R&D commercialization; capacity-building of enterprises for technology utilization; setting-up of cooperation and networking system among actors; and expansion of infrastructure for technology commercialization.

[8] *This paper was prepared and presented by Mr. Yoo-Sook Kim, Team Manager, Planning Public Relation Team, Daedeok Innopolis, Daejeon, the Republic of Korea.*

6. India

Proliferation of subnational innovation network, a relatively new concept, promises to be an alternative to centralized national innovation system. To be an independent entity, its growth must come from within. Several policies influence S&T activities and each country employs different tools to achieve its objectives. In developed countries there has been a shift in focus: from science policy to technology policy to innovation policy and now competition policy. As the link between technological innovation and economic performance became better understood and more widely appreciated, S&T leading to innovation has become the explicit basis for a series of government programmes.

In India, subnational innovation networks can emerge from two different streams: collective innovation system for clusters and individual innovators support system. Collective innovative system for clusters is a significant element of technological collaboration. The individual innovators support system has proved that technological and institutional innovations developed by individuals and communities can provide a new way of thinking about (a) conservation of diversity, (b) generation of sustainable alternatives for natural resources management through self-supporting viable economic and non-economic options, and (c) augmenting self-reliant livelihood strategies.

The network determines not only access to information, but also constitutes in itself capabilities that support coordination and learning among member firms. The value of a firm is partly derived from the wider network. The capability to speed up commercialization of products seems to rest on the successful exploitation of the knowledge of other firms. Networks are thus often more than relationships that govern diffusion of innovation and norms. Networks contribute capabilities that augment the value chain of a firm.

7. Indonesia

The Government of Indonesia is implementing the National System of Innovation approach. The S&T-related laws and regulations have been promulgated with the objective to create and encourage the S&T institutions to have a close collaborative network among them. The incentive schemes relating to S&T activities that bridges and facilitates researchers into economic scale of activity have also been made possible. Furthermore, the government has also set up incubators as an intermediation body facilitating research to innovation that is expected to expedite the creation of technology-based SMEs.

In 2002, the government enacted the law on the "National System of the Research, Development and Application of S&T" which aims at enhancing the support of national S&T, in order to accelerate the national achievements and to improve national competitiveness, self-reliance and excellence for supporting economic importance. It functions as a guideline to the formulation of the National System of Innovation. In this regard, the role of the central government, regional governments and society especially business players should be in synergy and harmonized in order to develop the national S&T. Furthermore, it also emphasizes the importance of the networking among universities, R&D institutions under the Ministries and the Departments, supporting institutions, aiming to establish the joint cooperation which will need supporting, encouraging, and competing one another.

8. Lao People's Democratic Republic

Science and technology play an important role in the socio-economic development of the country. They are particularly important for the Lao People's Democratic Republic in its efforts to achieve the government's stated goal of preparing the country for industrialization and modernization as well as graduating from the ranks of the least developed countries by 2020. The government has made great efforts to build up socio-economic development capacity of the country. The efforts include acquiring modern science and technology knowledge and seeking funding supports, integrating science and technology activities into the national socio-economic development policies and plans, and increasing investment in human resource development.

The National Policy specifies two types of S&T priorities for the up-coming years. They are national cross-sectoral priorities – the collaboration of sectors in the implementation of works defined in the Policy. The sectoral priorities include the development and promotion of small and medium-sized industries, agro-forestry processing industries and small-scale industry and handicraft units. Some SME promotion policies are: creating an enabling regulatory and administrative environment; enhancing competitiveness; expanding domestic and international markets; improving access to finance; and enhancing entrepreneurship.

The government is developing SME development infrastructure and has a plan to set up local representative offices and centres for SME promotion and development. The SMEPDO in cooperation with the STEA, the national body responsible for S&T will study specific policies to set up a SIS and enhance competitiveness of the SMEs. Possible areas of cooperation with UNESCAP are to assist in formulating a unique SIS policy; transfer best practices from other UNESCAP member countries; and assist in setting up regional and local representative centres.

9. Innovative SMEs and promotion policies in the Republic of Korea[9]

The SME innovation policy in the Republic of Korea, since 2003, has been integrated with a regional innovation policy by building up regional technology service centres for local SMEs, in order to facilitate cooperative R&D and technology transfer among SMEs, universities and public R&D institutes. Fourteen government organizations including the Small and Medium Business Administration (SMBA) perform 230 programmes to support SMEs and the Presidential Commission on Small and Medium Enterprise was organized in 1998 to coordinate and integrate these programmes and organizations. Major government support programmes are composed of: business restructuring and production equipment support programme; R&D and technological innovation support; entrepreneurship training programme; incubation programme; funding programme; human resource supply programme; sales and marketing support programme; and information technology and e-commerce implementation support.

The government set an ambitious goal to increase the pool of innovative SMEs reaching to 30,000 firms by 2008: 20,000 SMEs in manufacturing sectors and 10,000 in service sectors. To this end, the government is recently implementing the following initiatives to promote SME innovation: (1) increasing equity financing for early stage ventures and SME innovation to expand public and private investments in the SMEs innovation; (2)

[9] *This paper was prepared and presented by Mr. Brian H. Lee, Professor, Kwangwoon University, Seoul, the Republic of Korea.*

strengthening collaborative innovation networks to foster SME's demand-driven collaborative R&D activities between SMEs, universities and public research institutes; and (3) restructuring government support programmes and organizations to increase their efficiency and effectiveness as well as transforming many functional support programmes into customer-based integrated support programmes.

10. Malaysia

The Government of Malaysia has made efforts to set up a variety of S&T institutions and other facilities to promote R&D and innovation for industry including technology parks, technology incubators and financial institutions. Compared to the first plan, the Second National S&T Policy (DSTN2, 2002) focuses on the establishment of an integrated S&T development through the partnership between public sector and industries in S&T development; strengthening of the S&T institutional framework; strengthening of the private sector and promotion of entrepreneurship development; S&T capability development based on indigenous technological innovation. The Plan also set the key strategic knowledge industries such as biotechnology, advanced materials, advanced manufacturing, microelectronics, ICT, aerospace, energy, pharmaceuticals, nanotechnology and photonics.

The Government of Malaysia recently formed the National Innovation Council, chaired by the Prime Minister, in order to set and drive the national innovation agenda in which the Ministry of Science, Technology and Innovation (MOSTI) acts as the Secretariat. The foundation of the whole innovation process hinges on a culture of creativity and entrepreneurship. A mind-set that is analytical and questioning as well as that seeks to improve or further improve present conditions, takes risks and seeks for solutions to problems, is imperative for any types of innovation. Since the recombination of existing ideas or knowledge from various disciplines is the primary source of technological innovation, incentives including funding should be provided to promote such innovation.

11. Mongolia

The Government of Mongolia has undertaken a number of measures to facilitate the development of technology transfer through Policy of Science and Technology, Guidelines for the Implementation of Science and Technology Projects, Law of Technology Transfer, and other trade and economic-related laws and regulations. The government's own regulatory actions impose unnecessary costs and burdensome to private enterprises. Therefore, the government is paying a significant attention to the development of SMEs by introducing a new technology and information technology with a right proportion/combination of human resources.

There might be some policy issues and needs for the government to take an immediate action to enhance competitiveness of local SMEs. Those policy packages include: preparing a national action plan on technology transfer; setting up technology transfer centre; introduction of competitive and environmentally sound technology transfer to SMEs in rural areas; and promoting industrial and technology park. The government is ready to cooperate with international organizations and donor countries to implement the proposals and projects on transfer of a new technology and information technology at bilateral and multilateral level.

12. Myanmar

In 1994, the Government of Myanmar enacted the "Science and Technology Development Law" to promote national S&T activities more coherently and systematically. Major principle and direction for S&T promotion stipulated in the Law are as follows: S&T promotion for industrial production; R&D for the increased utilization of domestic raw materials and the promotion of industrial production enterprises based on modern technology; effective technology transfer to improve production process and the quality of goods; fostering S&T human resources and strengthening R&D to improve their qualifications; promoting international S&T cooperation; and appropriate benefits to outstanding S&T luminaries and inventors.

In 1996, the Ministry of Science and Technology, as a central and coordinating agency for S&T, was established to formulate and implement S&T promotion initiatives according to the Law. Since then, several S&T related departments as well as public research institutes were transferred to MOST from other ministries. However, in the aspects of NIS and SIS there may be still a long way for the government to go and an in-depth study for designing and formulating NIS and SIS policies is immediately needed.

13. Regional innovation system and techno-park policy in the Republic of Korea: The Kyongbuk techno-park case[10]

In the Republic of Korea, since the national industrial structure consists of a polarized and metropolitan focused platform, industries and universities in the regions are too disconnected, and thus too weak, regional innovation systems or SIS are required to promote more equitable regional development and SMEs for sustainable development. As one of the flagship programmes, the central and local governments, in cooperation with the private sector, initiated the techno-park (TP) programme in 1997 and until now six TP candidates – Gyounggi, Daegu, Kyongbuk, Songdo, Gwangju and Junnam, and Chungnam – were chosen.

The Kyongbuk Techno-park (KTP), founded in 1998, is a frontrunner and successful one among TPs. Its principal objective is to build a sound and efficient SIS with the regional authority and universities playing a leading role. The main facilities include the comprehensive information centre, the pilot production plant, the specialized research centre, and the incubation centre and relevant facilities. KTP specializes in the fields of mechanical, information, communication, and textiles technologies.

The way forward for KTP to be more competitive and successful is in the following: need to put more focus on strengthening the role of a hub of RIS; improve networking among actors - a complex node-type network combining a horizontal node with a vertical one; need to develop a software system in parallel with the hardware facilities: and promote demand-oriented R&D activities and develop a comprehensive enterprise support system.

14. Nepal

Nepal became 147th WTO member in 2004 and has made a number of commitments which become the major challenges and opportunities to the local enterprises. Particularly, the knowledge of manufacturing & trade, capital market

[10] *This paper was prepared and presented by Mr. Seong-Keun Lee, Professor, Yeungnam University, Gyeongsangbuk-do, the Republic of Korea.*

development, R&D, technology transfer and promotion of private sector all need urgent attention and assistance with a view to developing conditions for long-term development. One way to ensure progress in technology capacity-building and innovation is joint participation and action by all the major stakeholders.

Nepal has felt importance on major three prongs strategic approach for promoting and developing SIS & SMEs competitiveness: revitalizing the traditional attitude of entrepreneurs to the modern business dynamics; supporting for creation of new venture businesses; and improving the sustainability of the existing enterprises and newly created enterprises through technology capacity-building. It may be also necessary to consider creation of synergy among major stakeholders - entrepreneurs, academia and researchers for ensuring progress in technology capacity-building and innovation, and developing "Public and Private Partnership (PPP)" to enhance the competitiveness and technology capacity-building of the SMEs.

15. The Republic of Korea

The Government of the Republic of Korea has devised and implemented the "Comprehensive Plan for Promoting Regional Science and Technology." The first phase of the Plan started in 2000 mainly focused on intensive investment in R&D infrastructure for regions outside the Seoul Metropolitan Area. The Second Plan put in place in 2005 emphasized strengthening of regional indigenous technology capacity and building networks among key strongholds. The importance of a regional innovation policy was also highlighted in the "1st Five-year Balanced National Development Plan" (2004). The government's support policy to promote regional SMEs' innovation capabilities based on the establishment of a SIS is the most integral part of the nation's balanced development plan.

The government created the "Office of Science and Technology Innovation" (OSTI) in 2004, with a view to strengthening linkages and coordination of S&T policy with industry, human resources, and regional innovation policies. The recent major policy for SME promotion is to foster technology innovation-driven SMEs through the Inno-Biz supporting system. It mainly concerns about the selective promotion of firms having future growth potential with technological competitiveness. This policy aims at securing strongholds for nourishing start-ups, strengthening linkages among industry, academia, and research institutes, and creating innovative clusters.

To increase the efficiency and effectiveness of SME support policies and programmes, the government recently adopted differentiated policies according to the modes of firms; namely, innovation-driven SMEs, middle-independent SMEs, and individual-sized SMEs. With regard to the promotion of regional SMEs, the government will establish a regional innovation system centred upon regional specialized industries that dovetails into the regional surroundings.

16. Thailand

In 2003 the Government of Thailand established the National Innovation Agency (NIA) as an autonomous organization to promote various model of cooperation at enterprise, sector and micro levels as well as to foster linkages between different actors in academic, technical, production, financial, investment, and management fronts. Regarding SME promotion policy, the government formulated "the Promotion Plan of SMEs of Thailand

(2002-2006)" as a master plan. Some thrust areas incorporated in the plan are as follows: R&D promotion including the transfer of modern technologies for SMEs as well as the application of modern technology and local know-how; promote linkages and networking among SMEs and large-scale enterprises; and promote SMEs cluster development and IPR support.

There are two main strategies for SMEs: Fundamental Development Strategy and Breakthrough Strategy. SME S&T Fundamental Development is aiming at improving SMEs competitiveness and strategies which include: HR development, improving S&T institutional infrastructure and management system, cluster development, and S&T public awareness. S&T Breakthrough Strategy for SMEs is aiming at establishing S&T intermediary mechanism to promote and speed up the S&T commercialization process. To attain this goal, the following strategies are necessary: strengthen the government's guideline and promotion policy; establish collaborative functional mechanism and technology infrastructure; prepare innovative service system such as fund/financial supports and marketing services; set up information network system; building and training of professional team, consulting & training services; establish unified, open, and competitive system; and promote international cooperation.

17. Uzbekistan

In 2002, 112 innovative projects were completed in Uzbekistan. The budgetary allocation for R&D was US$ 600,000. To mobilize additional resources for financing innovative activities and the commercialization of their products, the Government of Uzbekistan has introduced a principle of participatory financing. The principle of participatory financing has become one of the most effective elements of the commercialization mechanism of such projects. It consists of a flexible combination of budgetary appropriations and finances of branches, regions, enterprises and organizations interested in solving the problems put before scientists.

To further develop the scientific and technological potential of Uzbekistan, the Coordination Council on Scientific and Technical Development was established at the Cabinet of Ministers of the Republic of Uzbekistan in 2002. The Academy of Science of Uzbekistan (ASU) consists of 187 scientific/research institutes and about 6,000 researchers and scientists are employed by the ASU. Private sector development needs are as follows: further development of private sector in industry, organization of a network of small private enterprises for large industrial plants; strengthening of legal culture and increasing of entrepreneurial professional skills; open to private sector for access to foreign markets; introduction of advanced information technologies in trade development; and privatization process "from quantity to quality."

18. Viet Nam

There have been four types of technology innovation policies for competitiveness of SMEs which include the following thrusts: to create/innovate/master technology that is suitable with and required by SMEs; to promote the transfer of technology into SMEs; to provide technological assistance for SMEs in innovation; and to provide financial supports for SMEs in technological innovation. Since 2000, Ho Chi Minh City has been implementing the special programme to encourage the linkage between enterprises, research organizations and local government in order to building technology capacity and enhancing competitiveness of SMEs. Through this programme, an initial stage of SIS was established. However, it is reality that central Government policies and other institutions for SME technology capacity-building could not be implemented in practice in every part of the country and most of local governments do not have their own policies and programmes.

Future policy direction and needs are summarized as follows: establish sectoral innovation system and local/regional innovation system; improve current R&D centres/ institutes and universities; encourage the transfer of technology from R&D institutes and universities into the SMEs; set up a fair benefit sharing mechanism for researchers and their institutes; establish technology transfer offices; create good infrastructure and special environment for start-ups such as incubators, high-tech zones/parks; and improve technology support schemes.

Session IV: Comprehensive discussion and conclusion

In this session, comprehensive discussion on a "Policy framework for SIS establishment and SME technology capacity-building" was made among participants in order to prepare policy actions to be taken at the regional and national levels, and by UNESCAP, in enhancing the implementation of its work programme in national and provincial innovation capacity-building. The following is the summary of the discussion and issues raised.

- A SIS approach needs to be adopted more clearly considering the difference of the concept between NIS and SIS. There might be several kinds of SIS with each one having different characteristics, which can be copied or applicable to other countries or regions.
- There are a number of models and experiences on the SIS practice and this type of policy intervention may be more appropriate in small countries. In this respect, it is noted that the probability of success in SIS practice be high when policymakers take bottom-up approach catering to needs and demands of innovative actors, considering resources and conditions.
- UNESCAP should prepare a general policy framework on the legal aspect such as WTO related technology issues, intellectual property right (IPR), cross-boarder movement of scientists and engineers, R&D service and investment, technology flows, etc.
- There has been no single optimum policy model which can be applicable to all member countries. A SIS policy for a certain country must be designed and formulated taking into account its cultural, economic and political environment as well as its resources. In this regard, the policy preparation work on SIS must be based on theoretical and factual analysis.
- When preparing a SIS policy framework, there is a need to consider a holistic approach taking into account both technical and non-technical elements as well as high-tech industry and low-tech industry. It is also necessary to list up whole policy issues and thus prepare a unique policy model according to each country's specific conditions, but a model must be flexible one.

- Establishing a SIS cannot be started from scratch and there may be a lot of successful SIS cases including cluster building, so not-yet-adopted countries should consider benchmarking from these cases. Awareness and advocacy at the administrative level is also very important and in the initial stage all stakeholders need to work together to initiate bottom-up approach.
- There is a need to clearly define the concept of SIS and to study correlation between NIS and SIS. Particularly, political leader's knowledge may be crucial. Firstly, we need to prepare a generic SIS framework based on bottom-up approach and then explore possibility to optimize it.
- Much emphasis needs to be put on the role of public sector to encourage other relevant actors as well as to create networking among public and private sectors. In this context, it may be necessary to make a combined approach of both bottom-up and top-down.
- Some elements to facilitate SME technology capacity-building of developing countries may include the following elements: mind-setting for SIS approach, technical platform for cluster building, R&D investment for SMEs, HRD, entrepreneurship, internet platform for SME innovation, and expert forum such as SME high-tech exhibition, etc.
- NIS may be interactive integration of SISs. There are a number of components putting in place in SIS and interaction among them is the most important factor. In efficiently practicing NIS or SIS, the most important element as well as the key constraint may be HRD. In the public sector, it is crucial to maintain a stable economic condition, prepare a right policy framework, and create an enable environment.
- A SIS is relatively a new concept and many developing countries have not yet adopted this approach. Therefore, it may be necessary to define a concept of SIS and prepare a basic policy guideline for setting up a SIS. In working on the preparation of a policy framework, practical issues relating to main components such as policy, system, actor, linkage and awareness must be considered.
- There was a consensus among participants that UNESCAP in cooperation with STEPI would develop a conceptual framework and policy guidelines on a SIS initiative in terms of issues, actors and system by forming and operating a working group among participants which might be working on the e-mail basis.

IV. CONCLUSIONS AND RECOMMENDATIONS

UNESCAP organized the Regional Consultative Meeting on Subnational Innovation Systems and Technology Capacity-Building Policies to Enhance Competitiveness of SMEs, in cooperation with the STEPI and Daedeok Innopolis in Soul, the Republic of Korea from 18 - 20 January 2006. Around 60 policymakers and experts from the public and private sectors participated in the Meeting and made significant contributions towards deliberations and formulations of a sound and efficient policy framework for promoting subnational innovation systems in the Asian and Pacific region.

The Meeting recognized the vital role of an innovation system in generating dynamic SMEs and in promoting sustainable growth in the global knowledge economy. Further, the Meeting noted that the setting up of a sound SIS is an important policy mechanism for local economic growth at the national and subnational level through contributing to the creation of a favourable environment enabling SMEs to become more competitive by enhancing technology and innovation capacity.

In particular, the Meeting underscored that the key for SMEs to be able to enhance or retain their technological capabilities and competitiveness in a globalizing knowledge economy is to develop a SIS along with the continuing efforts to strengthen a NIS. The Meeting also stressed the importance of the linkage to global innovation network and research and development collaboration to complement the limited technological resources and human capitals confronted by developing countries.

The Meeting also emphasized the increasingly important roles of SMEs in contributing to national economic growth and advancing innovation capacity taking into account their flexibility, creativity, special expertise and innovativeness to respond more quickly to today's world situation of rapid technological change and development. In order to strengthen those roles of SMEs in the current environment, the Meeting reaffirmed the pressing needs to reinforce competitiveness of SMEs through initiating such SIS related policy issues as:

- Building skills and technological capability and related infrastructural facilities
- Building up innovation capabilities for creating social and cultural capitals
- Developing more responsive clusters and networks through setting up of a SIS
- Establishing an appropriate policy framework and governance system for activating regional innovation
- Promoting entrepreneurship, technology incubation, and innovative and high technology venture companies
- Strengthening of the linkage with global innovation networks
- Fostering human resource and strengthening local universities' role in SIS
- Financing for technology innovation
- Identifying network players and developing a network orchestration model
- Improving innovative capacity and creativity kindling socio-cultural faculties

Based on the above-mentioned conclusions, the Meeting discussed and agreed to adopt the following recommendations to promote further development and implementation of a SIS policy framework for the SMEs' technology capacity-building.

A. Overall recommendations

(1) Member countries are requested to actively participate in implementing the on-going UNESCAP project on "Subnational Innovation Systems and Technology Capacity-Building Policies to Enhance Competitiveness of SMEs" to take full advantage of the potential benefits of the project.

(2) To successfully implement the project with the active engagement by participating countries, UNESCAP undertake the following steps in the implementation process:

- Provide information on the new development trends of SIS policy initiation across the world including efficient and effective models, elements, major policy instruments and real practices; and
- Best practices and benchmark policy frameworks.

(3) Through the close cooperation with the Regional Institutions of UNESCAP (e.g. APCTT and APCAEM) and other international organizations such as UNCTAD and UNIDO, UNESCAP develop specific technical programmes that could assist member countries in developing and establishing a SIS, including national training workshop for capacity-building, and technical advisory services necessary for the appropriate policy formulation and implementation.

(4) In the second phase of the project, UNESCAP organize sector-specific national workshops or consultative forum responding to the individual country's needs and priorities. These sector-specific themes could include:

- Public/private partnership for SME technology capacity-building
- Commercialization of public-supported R&D results
- Provincial S&T promotion strategies based on SIS approach
- Role of technology intermediaries (TBI, Techno-park, cluster, etc.)
- Sectoral systems of innovation for new and emerging technologies
- Intellectual property rights (IPRs) and IP exploitation
- R&D globalization and local SMEs' competitiveness
- Human resource development policies for SME innovation
- Strategic promotion of the access to technologies and innovative financing
- New technology exploitation and technology innovation

(5) Through the cooperation with APCTT, UNESCAP establish a regional innovation system network to share information, knowledge and best practices and engage in policy dialogue and private-public partnership for SIS and technology capacity-building of SMEs in the region.

(6) Member countries, under the technical support and advisory services of UNESCAP if necessary, need to develop and promote SIS-related policies and programmes, and organize national workshops on SIS to discuss those policies and strategies.

(7) UNESCAP would develop a conceptual framework and policy guidelines on a SIS initiative by forming and operating a working group among participants which might be working on the e-mail basis.

(8) UNESCAP would prepare, if necessary and appropriate, a policy reference publication with respect to SIS models and pertinent policy instruments, and disseminate them to member countries for their application and compile best practices in promoting SIS through the periodical survey of technology innovation activities in the region as well.

B. A subnational innovation system policy framework

(1) Since SIS-oriented SME policies are becoming more powerful tools to enhance the technological capacity at the long-term basis, not only central government but also provincial government (local authorities) and universities should play collective roles in establishing subnational innovation systems.

(2) There is a strong need to conduct country studies on SIS initiatives, comprehensive review of the SIS conditions of each participating country, to identify best practices.

(3) The SIS policy needs to be tailored to the industrial and cluster development stage. In general, the countries in the region have various development stages and varying socio-economic conditions. Thus, the policy should consider the characteristics and needs of the system and needs.

(4) Further studies need to be conducted to formulate detailed policy recommendations. Those country case studies should focus more on technological innovation of SMEs; relevant governance system; clustering trend and networking structure of SMEs; the development of management capabilities at both policy level and SME level in Asia and the Pacific context.

(5) It is necessary for UNESCAP and other international organizations to develop training programmes for the policymakers in the region, since many of them are not aware of the SIS-oriented SME policies and innovation cluster. Some of them are aware of subnational innovation system and national innovation system. However, this awareness is based on the perspective of science and technology policy rather than based on SME promotion.

(6) It is necessary to prepare a database and/or reference materials and diffuse them through internet. It is not that easy to organize the regional educational/ training meetings because large financial resource is necessary. Rather, the on-line reference and networking the experts would be a cost-effective way to develop a SIS for the region.

(7) It would be desirable to apply SIS-related concept and strategies to some selected countries in the region. The benefits of SIS-oriented SME policies and refining the application of such policies could be formulated as a pilot project.

C. Technology capacity-building strategies for SME competitiveness

Public sector context

(1) A coordinated policy framework, particularly those related to industry, trade & commerce, finance and technology or innovation systems, needs to be designed and formulated. One-spot business contact centres in the government for SMEs, preferably at national/state/regional/district levels, may be set up to facilitate implementation, to create better awareness, and to avoid inconvenience to entrepreneurs.

(2) Technology policies and incentives should differentiate between traditional SMEs (low-tech SMEs) and innovative SMEs (new high-tech SMEs), and also the class of entrepreneurs, depending upon the risks involved. Access to existing technologies and support systems, technology transfers within the country or abroad should be encouraged for traditional SMEs. SMEs may be encouraged to move up the value chain through the adoption of more advanced technologies and better production method.

(3) For innovative SMEs, start-ups, internationalized SMEs, export-oriented SMEs etc., new technology financing and innovative support mechanisms may be evolved. Academic entrepreneurship or start ups may be encouraged through allocating a part of government funds to national institutions.

(4) Technological aspects in world trade and investment including import duties/ tariffs, technical assistance and IPRs would be appropriately addressed responding to WTO guidelines and other globalizing needs in most economies. Therefore, the existing incentives need to be reviewed and new forms of incentives need to be developed.

(5) The setting up of 'technology services clinics' in the vicinity of SMEs, industrial estates, clusters and incubators is recommended as a sustainable business model.

(6) Both inward and outward FDI and other forms of foreign partnerships, under the appropriate domestic policy framework and indigenous capacity-building efforts are desired. Financial institutions need to reorient their approaches in supporting SMEs, and develop more innovative capacity. Venture capitalists and investment companies also need to offer a package services and provide easier access to financing at the early stage.

(7) Policies, mechanisms and incentives need to be evolved for innovations and application of new technologies in service sector.

Private sector context

(1) The SMEs would themselves have to take initiatives and change their mind set to compete globally. Large companies and TNCs also need to assist and network to develop technological and management capabilities of SMEs since they are now more active players in their supply chain management.

(2) E-learning methodologies, along with conventional modes of training would be useful for on-the-job training and skill development of entrepreneurs and employees.

(3) There are practically no formal courses for innovation management and management skills for SMEs. Private enterprises and governments may take initiatives towards upgrading technological and management skills.

(4) The private sector should increasingly spend more on innovation activities and R&D or technology-related capability-building. External capabilities may be utilized or tapped to compliment in-house capabilities.

(5) Private sector including SMEs should take full advantage of government incentives and institutional facilities for their technological capability-building. External capabilities may be utilized or tapped to compliment in-house capabilities.

SME support intermediary context

(1) Industrial associations including SME associations, promotional agencies, NGOs etc. are important for the promotion and development of technological capabilities and strengthening competitiveness of SMEs. Such organizations should assist SMEs through promotional programmes, besides representing their interests to the government. The programmes may include:

- Organizing training and skill development programmes
- Market promotion through organizing and participating in exhibitions, trade fairs, conferences, etc. within the country and overseas
- Setting up information systems and providing advisory services
- Forging partnerships in the country and abroad
- Evolve sustainable models and public-private partnerships for implementation of government policies, incentives and running or managing institutions
- Prepare case studies and data bases on SMEs technology capacity-building to help government in international negotiations or in policymaking
- Create awareness about government policies, global market trend, certification and standards in other countries, export requirements, technological trends
- Encourage exchange of experts and professionals

(2) Most of the activities can be undertaken with the support and cooperation of government agencies and international organizations such as INSME in Italy and APCTT at New Delhi. Public-private partnerships may be promoted for business development and technological capabilities of SMEs, especially in public funded projects and procurements.

International organizations context

(1) There is a need to review the existing policies, programmes and mechanisms set up at regional or subregional or international levels for the promotion and development of SMEs, including strengthening of technological capabilities. Awareness of contemporary technology capacity-building among SMEs needs to be increased.

(2) UNESCAP has taken several technology-related initiatives for SMEs. In this respect, the role of APCTT needs to be strengthened and the involvement of SME sector needs to be increased through implementing more practical and demand-oriented programmes.

(3) There is a need to prepare an atlas of SMEs related institutions in the UNESCAP region and widely disseminate it to SMEs through their associations and governments.

(4) Programmes to exchange expertise and experiences among member countries may be organized for various groups of beneficiaries. In this regard, information services and networking related to business needs and potential for SMEs may be set up as a sustainable business model.

(5) Conduct studies on the experiences and issues related to the WTO agreements and their implications on businesses of SMEs in the UNESCAP region. An action plan for preparing SMEs for WTO related challenges and opportunities need to be identified for groups of economies. The implications of regional and subregional trade agreements for SMEs also need to be studied.

PART TWO

BACKGROUND PAPER (I)

STUDY ON SUBNATIONAL INNOVATION SYSTEM POLICY TO ENHANCE LOCAL SMES COMPETITIVENESS

BY

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I. INTRODUCTION

The Asian and Pacific region is probably the most dynamic region in the world. Its fast economic growth is changing the whole picture of the global economy. But, there are also many countries in the region still falling into the category of least developed countries. Billions of people in this region are still under severe poverty and thus bringing the benefits of economic development to the people in the region is desperately required. In this sense, creating jobs and providing opportunities to work in the region are also desperately required. This can be possible when more companies, especially SMEs are created with close ties and integration being made in the region.

SMEs have been playing a vital role in national economic growth and equitable development in developing countries. SMEs provide many jobs and play critical roles in local development in many countries. As we can see from Table 2.1, the share of SMEs' production (or productivity) is lower than that of large companies.

Table 2.1 International comparison of SMEs

	Germany	Japan	Republic of Korea	United Kingdom
Share of employment in manufacturing (%)	44.9	69.1	86.8	54.7
Share of enterprises by SME in manufacturing (%)	97.8	98.6	99.8	97.7
Share of output by SME in manufacturing (%) (1)	30.1	47.3	-	40.5
Share of value-added by SME in manufacturing (%) (2)	34.9	53.8	-	45.9

Source: OECD SME and Entrepreneurship Outlook 2005
Note: (1) Turnover for Japan
(2) Value-added at producer prices for Japan
(3) SME means a business unit with less than 250 employees.

SMEs are becoming important not only in developing countries but also in the developed countries as many innovative SMEs grow and become the prime source of national economic growth. Promoting competitiveness of SMEs through innovation capacity-building is a crucial factor in achieving local economic development for employment creation, poverty reduction and balanced distribution of wealth.

However, most local SMEs are facing such difficulties as weak innovation capability and networking as well as lack of finance, technologies, marketing information and networks, managerial knowledge and skilled workforces. Moreover, a business environment surrounding SMEs is becoming competitive due to globalization, rapid technological changes and so on. A small number of SMEs can respond to such environmental changes and grow and usually these SMEs are very innovative and have global competitiveness by accumulating indigenous technological capabilities. On the other hand, most of the SMEs do not have such innovation capabilities and are left behind these global and technological changes.

In the knowledge-based economy, science and technology play the key role in developing the national economy as well as building core competency of an individual company. Not only multinational companies but also less developed countries are trying to invest more in science and technology to secure technological competitiveness. It may be therefore emphasized that technological capability is the real and sustainable source of competitiveness in this globalized market.

Traditional SME policies have focused on individual competitiveness factors such as marketing, skilled human resource development, access to financial resources, technological assistance and so on. It seems that traditional SME policies have worked well so far. However, it is also true that those policies are losing effectiveness in the changing environment. Today's changing environment is becoming more competitive than ever. SME policies should be more integrative and self-sustainable in order to upgrade competitiveness and/or technological capacity of SMEs. It seems that SMEs need to be provided with something more than traditional policy. Measures providing sustainable competitiveness are required by equipping the SMEs with innovation capabilities in terms of not only technology but also management know-how.

It is only recently that some governments in the region have started to look at their SMEs policies from a different perspective. They realized that SMEs need their own technological capacity, and government should promote technological capacity-building by providing a favourable innovation system. This is really a remarkable change in the policy paradigm because the new perspective is focused on the innovation system and technological capacity-building as the source of sustainable growth. In this regard, UNESCAP developed a conceptual subnational innovation system (SIS) framework.[1]

This report aims to provide developing countries with technical assistance in their development of policies, strategies and institutional frameworks relating to SME competitiveness based on the establishment of an efficient SIS. In order to assist developing countries, a study was conducted to identify policy needs of the SIS and SMEs for technological competitiveness and to develop enabling policy packages. This report suggests the guidelines for central and local governments in formulating and implementing SME-friendly SIS policies in their countries. Eventually, it is expected that these policy guidelines on SIS will contribute to managing globalization and poverty reduction through strengthening the innovation capacity of local economies in the Asian and Pacific region.

In the study, various methods were tried. Not only were a review of the literature on existing materials but also a fact-finding mission and interviews were carried out with experts on science and technology (S&T) policies and SME policies. In addition, the results of discussions through the e-forums and a regional consultative meeting are reflected in this final report.

The research is conducted as shown in Table 2.2. As mentioned before, the study used various methodologies, like literature review, fact-finding mission and hearings from the experts in the region. Since this report is the first one dealing with SIS-oriented SME policies in the region, further studies and elaboration would be needed.

[1] *The subnational innovation system can be confused with the sectoral innovation system (SIS) if the acronym is used as SIS. It may be necessary to use acronym like 'SnIS' to clearly show the concept of 'subnational' and differentiate the terminology with other similar possible acronyms. However, 'SIS' is still used in this report to express subnational innovation system. The right acronym will be chosen by the community of relevant researchers and experts in the future.*

Table 2.2 Research procedure

Research Sequence	Contents of Study	Remark
1	Literature Review	Sept. 2005
2	Draft Conceptual Framework	Sept. 2005
3	Fact-finding Mission	Oct. 2005
4	Draft Report and Policy Recommendations	Nov. 2005
5	Regional Consultative Meeting	Jan. 2006
6	Final Report and Recommendations	Mar. 2006

In this report, a subnational innovation system and related policies are reviewed in terms of concepts and today's SME policies. Chapter II is mainly focusing on a conceptual framework. In chapter II, there is discussion on similar and/or traditional concepts and those concepts are compared to clarify the concept of a subnational innovation systems. In chapter III, current policies of SIS are reviewed from the regional aspect. Through the fact-finding mission, current policies in the region are identified and analysed. In chapter IV, the policy framework to promote SIS in the context of an SME's technological capacity-building is described. For instance, some policy direction is discussed in terms of SME networking, SIS building, public-private partnership and so on. In chapter V, recommendations are presented reflecting the opinions and comments made at the UNESCAP Regional Consultative Meeting in Seoul, January 2006. Finally, the conclusion is drawn in the last chapter.

It has to be remembered that this is not an academic paper. Rather, this report intends to help policymakers in developing countries to make their own relevant policies and implement them. Therefore, the report is made to be pragmatic while it is based on internationally recognized literature, theories and practices.

II. SUBNATIONAL INNOVATION SYSTEM AND SME POLICY IMPLICATIONS

The subnational innovation system has emerged out of historical development of science and technology policy and other related social sciences, such as economic geography and industrial cluster theories. The SIS concept has powerful implications for SME policies because it deals with the subnational region and is closely related with local economic actors like SMEs. In this context, it is necessary to see the development of relevant concepts, including the national innovation system and innovation cluster.

A. Concept of subnational innovation system

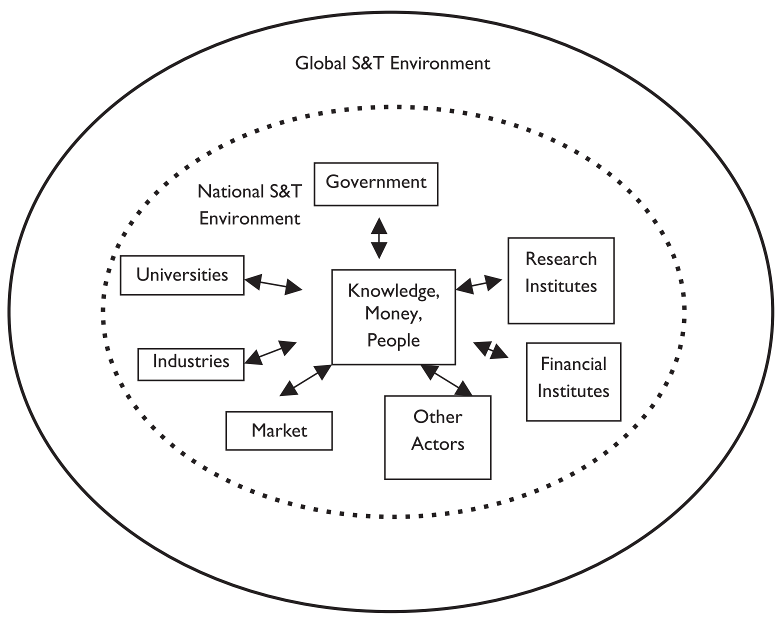
1. National innovation system

Science and technology policies have been evolving throughout time. In past days, policymakers directed their attention to such issues as the technology-push model, demand-pull model, university-industry cooperation, and so on. The theoretical perspectives of the old models are rather simple ones compared with recent theories, which emphasize the systemic characteristics of innovation, rapid technological change and globalization.

Nowadays, science and technology are understood in the context of the innovation system, which means that there are many related actors and the development and utilization of science and technology take place through complex processes. Research at an R&D laboratory does not automatically lead to marketing. To utilize the research results, more actors are needed, like a technology transfer centre, venture capital, a bank, a managerial consulting company, an entrepreneur, and so on.

Moreover, innovation has started to receive more attention than just science and technology. Still, science and technology remains the key to innovation. But, innovation is a results-oriented concept. It assumes that good science and technology automatically lead to good innovation. It also assumes that something more (like marketing, commercializing, financing) is needed to make good science and technology real innovation in the world.

Figure 2.1 National innovation system



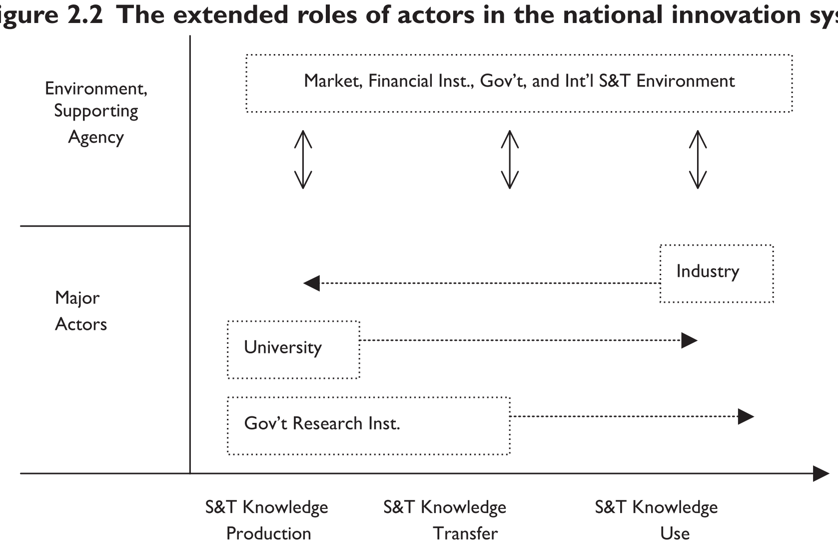
Among the various models and theories, the subnational innovation system has its background and roots in the national innovation system (NIS). In the 1990s, national innovation system theory attracted the attention of many policymakers. The NIS model started to focus more on relationships and processes between various innovation actors. In the meantime, globalization and regionalization of S&T have emerged as a key agenda item in S&T policies as well. In addition, many people from various backgrounds started to study the innovation cluster concept. Not only researchers in S&T policy but in economic geography, urban planning, and sociology adopted the perspective of the innovation cluster as well. For example, Saxenian (1994, 1999) compared the Silicon Valley with the Route 128 area and concluded that the culture and organizational network in the Silicon Valley are the most important factors attributed to its prosperity and successful development.

In the NIS and/or innovation cluster model, the main elements of interaction are Knowledge, Money, and People. The main activities are knowledge creation, transfer and utilization in the market. For this purpose, all of the innovation actors interact with each other and exchange knowledge, financial and human resources.

While the NIS model is a rather abstract concept, the innovation cluster model can provide practical guidelines. It is important to note that innovation takes place around a certain area as the result of the interaction between the market and innovation actors. In this sense, innovation cluster can be said to be a reduced NIS. Innovation cluster theory includes multidisciplinary perspectives from sociology, economic geography, network theory, and industrial organization theory, and it can be applied regardless of area. This systemic perspective implies that policymakers should emphasize not only the quantitative aspect of S&T policy, such as S&T investment and number of R&D personnel, but also the management of S&T resources.

In order to draw practical implications from theories on the national innovation system and innovation cluster, it is necessary to define innovation actors according to their generic roles in the system. In traditional S&T policy, the university is regarded as the actor that produces scientific knowledge only. However, there are many universities that do make some business too out of their research. We can see that industries and Government-support Research Institutes (GRIs) also extend their roles. In addition, financial institutes and consulting companies are becoming very critical agencies for the commercialization of R&D.

Figure 2.2 The extended roles of actors in the national innovation system



Source: Yim (2002)

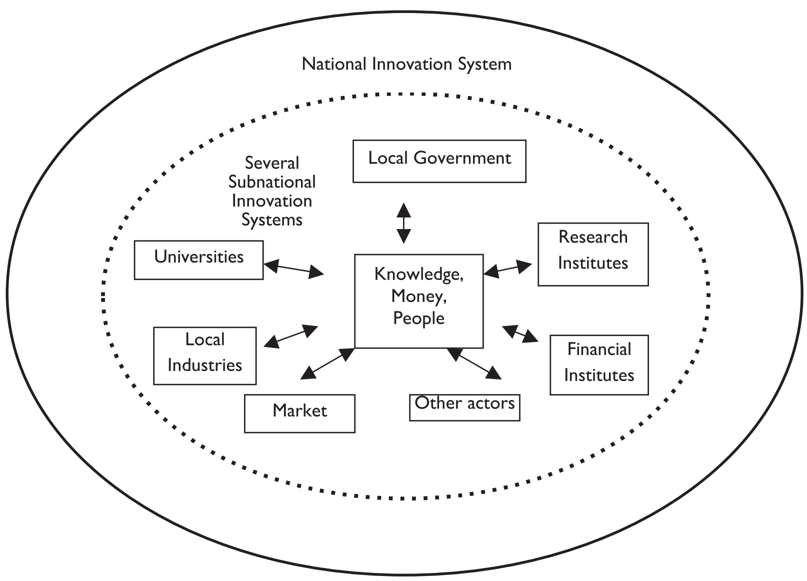
2 . Definition of the subnational innovation system

In order to gain a clear view of the subnational innovation system, it is necessary to review other related concepts, such as the national innovation system, global innovation system, and innovation cluster. In the following, the SIS concept will be firstly compared with the NIS and later with other concepts.

Innovation activities can be conceptualized at various levels: global, national, and subnational (or regional). The unit of the innovation system is important because it is the unit of policy target. Since SMEs are affected much by the subnational environment, it is necessary to lower the scale of the innovation system to the subnational (or regional) level.

In general, the subnational innovation system has similar characteristics as the upper level of innovation system, which is the country's national innovation system. It can be said that the SIS is a kind of reduced NIS and thus several SISs constitute the NIS. These relationships among the various actors and between NIS and SIS are shown in Figure 2.3. In addition, SIS has more local-specific characteristics due to its local geography, innovation culture, resources and so on. In this regard, a SIS policy should consider not only the NIS characteristics but its local specificities as well.

Figure 2.3 Subnational innovation system



Generally speaking, NIS level competitiveness is the result of SIS level competitiveness, which is the sum of individual industrial and/or corporate competitiveness. Since SIS is also a system concept, it has its own actors, structure (networks), and activities. Similar to the NIS concept, the activities in the SIS are knowledge production, transfer, utilization, and sharing or co-learning. In addition, there are secondary value activities, such as finance, information provision, and human resource development and supply. Table 2.3 compares SIS concept with other related theories and concepts.[2] The subnational innovation system shares similar characteristics with other concepts, as it is an innovation system. It has similar characteristics to NIS and similar in size to an innovation cluster. However, it also has its uniqueness in many aspects.

[2] *In addition, there are other innovation systems, such as a sectoral innovation system and industry-specific system. Some people even assert a corporate innovation system. Since SIS deals with all sectors and industry together, it is better to limit the objects of comparison as in Table 2.3.*

Table 2.3 Related concepts and policies

Category	Global Innovation System (GIS)	National Innovation System (NIS)	Subnational Innovation System (SIS)	Innovation Cluster
Focus	• Global innovation process • Multinational company	• National level innovation process	• Subnational level innovation process	• Clustering phenomena • Innovation process at specific area
Major Actors	• Multinational company, many national innovation systems	• National/local government, university, industry, public research institute	• Local government, local university, local industry (SME), public research institute	• Industry, university, public research institute
Network/ Structure	• Global network	National level network • Being connected to GIS	• Local network • Being connected to NIS and GIS	• Global/local network
Policy Objective	• Integration of NIS into GIS	• National competitiveness	• Subnational (Regional) competitiveness	• Competitiveness of cluster
Policy Direction	• Utilization of the global opportunities	• Promoting interaction among the actors • S&T culture promotion • R&D investment and management	• Involvement of local government • More local contents into S&T policy	• Cluster establishment, development

In the SIS concept, the network and interaction among actors are more important than a single actor's capability. The ecosystem for technological innovation is especially important. The main or major player can be varied according to its specific conditions. However, the university and local government are the driving forces for enhancing competitiveness of local SMEs. Large companies are also important as the driving source leading innovation in the NIS. However, SMEs receive special attention because of their local specificities in the SIS.

The innovation cluster concept also focuses more on the local, regional level innovation process. But, the regional level innovation cluster can be larger than its public administrative boundaries, whereas the SIS concept is based on public administrative boundaries.

Concluding all of the discussion, the subnational innovation system can be defined as a unit of the innovation system at the subnational level that is composed of local government, local university, and local industry – especially SMEs – within a certain public administrative boundary, and has formal/informal networks among the actors, and produces innovation results. These results occur by participating in value creation processes, like knowledge creation, knowledge transfer, and knowledge utilization through the sharing of knowledge, culture, and financial resources. Therefore, a SIS-based policy puts emphasis on local specificity, networking of actors and innovation competitiveness. As SIS is closely linked with NIS, it is necessary to design a policy in the context of the national innovation system.

3. Major factors for SIS development

It is necessary to identify the success factors of SIS development. However, the SIS concept and policies are very new and there is not enough research for SIS development. As we can see from the comparison of related concepts in Table 2.3, a SIS is a kind of small NIS and having characteristics similar to the innovation cluster, which is based on a small region. In this sense, it may be useful to briefly refer to the research on the innovation cluster. The success factors of the innovation cluster can be used later to identify factors of SIS development.

There are many factors that affect successful development of the innovation cluster. For instance, the initiatives of central/local government and role division and cooperation among related actors are important. Of course, the location itself is often the most important factor, which determines the performance of a SIS. In order to better understand, it is necessary to think over the clustering factors of an innovation (or industrial) cluster. Then, it can be applied to the SIS concept.

Why are clusters generally built around a particular area? And, what are the promotion factors influencing a cluster building? Many scholars have tried to answer these questions according to their scientific background. For example, in the traditional theory of trade, the reason a production cluster is built in a particular zone is the comparative advantage occurring from the differences of existing actors in each country. Where there are comparative advantages, production of certain products would be specialized and then, through trade, each one would benefit from profit. Nevertheless, this trade theory is insufficient to explain the phenomenon of the innovation cluster that innovative activity comprising more than production is accumulated in a particular area.

On the other hand, Porter (1998) gives the influencing factors of an industrial cluster as follows:

(1) Historical circumstance: A cluster's roots can often be traced to historical circumstances. In Massachusetts, for example, several clusters had their beginnings in research done at the Massachusetts Institute of Technology (MIT) or Harvard University. The Dutch transportation cluster owes much to Holland's central location in Europe, an extensive network of waterways, the efficiency of the port of Rotterdam, and the skills accumulated by the Dutch through Holland's long maritime history.

(2) Clusters may also arise from unusual, sophisticated, or stringent local demand. Israel's cluster in irrigation equipment and other advanced agricultural technologies reflect the nation's strong desire for self-sufficiency in food together with a scarcity of water and hot, arid growing conditions.

(3) Prior existence of supplier industries: Prior existence of supplier industries, related industries, or even entire related clusters provide yet another seed for new clusters. The golf equipment cluster near San Diego, for example, has its roots in Southern California's aerospace cluster. That cluster created a pool of suppliers for castings and advanced materials as well as engineers with the requisite experience in those technologies.

(4) Innovative companies: New clusters may also arise from one or two innovative companies that stimulate the growth of many others. MCI and America Online have been hubs for growing new businesses in the telecommunications cluster in the Washington D.C. metropolitan area.

Saxenian (1999) emphasizes the systematic network among organizations related to firms, research institutes and universities, culture to admit failures and lastly culture of exchanging information with each other as promotion factors of a cluster. Through these factors, she explains why Silicon Valley prospers relatively better than Route 128 in Boston. In order to identify key success factors of SIS development, world class innovation clusters are studied and eight factors are identified. A wide literature review on world innovation clusters was conducted to compare and identify the success factors of the innovation cluster. From the comparison and review of world innovation clusters, eight key success factors are identified.

(1) The first key factor is a high level of research capability. It is very obvious that the research capabilities of the universities of Silicon Valley have been the primary source of its success.

(2) The second factor is the abundance of high-qualified manpower. All of Silicon Valley (United States), Silicon Wadi (Israel) and Hsinchu (Taiwan Province of China) have strengthened research capability by putting together foreign and emigrant manpower for practical use. In the case of Taiwan Province of China, policy to attract foreign human resources, initiated by the government in the 1980s, decisively contributed to the transfer of technical knowledge and know-how of Silicon Valley to Hsinchu, and this facilitated early acquirement of developed technology. In addition, a large number of Jewish scientists and engineers who lived in Russian Federation moved to Israel after the collapse of the USSR, which bolstered Israel's science and technology human resources.

(3) Third, creation of infrastructures also results in a pleasant business climate. Silicon Valley provides specialized professional business infrastructure, thus enabling to start up new high technology enterprises, bank, jurist, headhunter, juridical accounts and consultant service systems are provided. French Sophia Antipolis concentrated its efforts on preserving at least a ninth green tract of its building site. Furthermore, in Hsinchu, English courses are provided to foreigners or children studying overseas, which largely attract researchers working overseas or foreigner researchers.

(4) The fourth factor is the retention of enough funds. In case of Oulu (Finland), the government concentrated 50 per cent of its R&D budget in the telecommunications sector. Therefore, it grew to a huge complex industrial town and has now become the driving force of Finland. The Government of Israel decided to set up a national venture capital, and then founded Yozma venture capital in 1992, while during the same period, built up about ten funds as Yozma's affiliated companies, which made possible direct investment in high technology enterprises.

(5) Fifth, diffusion of S&T and innovation culture is important in addition to having an open business climate. Firms in Silicon Valley not only compete but cooperate with each other too. Through competition and cooperation, they are getting to

know the rules of survival. In the case of leading companies in Kista (Sweden), Ericsson and Nokia maintain a balance among professional service firms, and through this, the culture of having respect for other firms is settled. In particular, cooperation among research institutes, universities, large enterprises and related industries has led to active interrelationships in Oulu (Finland).

(6) The sixth factor is management and vision. China, under its governmental reform and open policy in the beginning of 1980s, has overcome the restrictions of the planned economy structure in such fields as industry, science and technology, and education. Through this policy, China has introduced new management and vision.

(7) Seventh, inducement of multinational companies or research institutes has made globalization an important factor in the development of an innovation cluster. Research institutes of worldwide wireless mobile communications and wireless internet access companies, such as IBM, Telia, HP, Motorola, Nokia, Sisco, Oracle, Compac, and Siemens have already pushed into Kista (Sweden), Oulu (Finland) and Matam (Israel). In particular, Zhongguancun of China has changed from being a manufacturing-centred base to an R&D one, and it is now considered to be the most attractive place for R&D activities.

(8) Finally, the start-up of companies can be regarded to be one of the success factors for an innovation cluster. In Silicon Wadi of Israel, a cooperative industrial system is well formed among companies, universities, research institutes and private organizations so that new founders in the incubator share information and solve their problems in cooperation with universities and research institutes to make a business even more sophisticated. Therefore, these founders utilize universities and research institutes as technical consulting instruments.

B. SMEs and subnational innovation system

In any innovation system, the role of industry cannot be overemphasized. Industry is producing as well as using technologies. SME is usually the key player in the subnational innovation system because it is closely related with the local economy and development. The performance of SMEs is to a great extent affected by such local conditions as the availability of a good university, a public research institute, a leading company and so on. It is natural that SMEs are more related to SIS than NIS and have more interaction with local actors. In this context, it may be desirable for SME policy to be oriented at the subnational innovation system.

1. Changes in environment

It may be noted that today's SMEs are faced with a fast changing environment. Firstly, globalization is changing everything. Before, it was usual that SMEs used to be operated in local areas. Most of the input was secured from the local area; whereas, the market was also local and SMEs were competing in the local market. However, it is now obvious that SMEs are competing in the global market. Even the service industry is dependent on foreign customers who have diverse options to choose the service in the global market. So, it is necessary to monitor globalization trends and their effects on the subnational innovation system and SMEs.

Secondly, the local region often does not have the resources required for the establishment of a SIS and the promotion of SMEs. All available resources are usually clustered around a couple of cities in the developing countries. Therefore, it is hard to get the requried input from the local source. Sometimes, the central government puts some resources in the region, but the local government does not have the capabilitiy to utilize them.

Thirdly, technological capabilities are becoming the key competency factor not only for large companies but for small companies too. However, SMEs are not fully aware of this environmental change. Fourthly, the soft infrastructure is also lacking in the local area. For instance, the sociocultural infrastructure and legal/policy infrastructure are not so much favourable for the SME growth.

All these changes seem to be negative for the SME. However, there are many SMEs that use these environmental changes as the opportunities. Certainly, if some SMEs are ready to accommodate changes and grow, they can grow, as many example cases show.

2. Technological innovation in SMEs

SMEs have both advantages and disadvantages in technological innovation. SMEs have difficulties in mobilizing appropriate resources for R&D and new product development. With respect to micro-size companies, it is extremely difficult for them to put valuable resources into innovation activities. However, these difficulties can be offset by the flexibility of SMEs. In fact, many successful SMEs can succeed in innovation and compete with large companies because they are able to concentrate on niche innovation areas, which the large companies neglect. In addition, those successful SMEs can make quick decisions on innovation because the organization is slim. In this regard, SMEs have to be treated with positive perspective in technological innovation. Lack of human resources and capital would be barriers for SMEs to commercialise their technologies. Therefore, it is always necessary to be prepared for resource allocation.

Another important factor in technological innovation by SMEs is the right choice of technology based on their strategic goals. Which technologies do SMEs need for what purposes? It is often observed that new and advanced technologies are preferred in some developing countries. But, in many cases, SMEs do not need such technologies and do not have enough resources to utilize the technologies. Rather, there are many cases in which older and traditional technologies are more preferable for SMEs.

The managers or decision makers of SMEs seem to be not well aware of the importance of technological innovation. Often technologies and R&D are recognized as important issues and regarded as long-term agenda in corporate decision-making. But, as global competition becomes more stringent, technological competency has to be the primary agenda of SMEs.

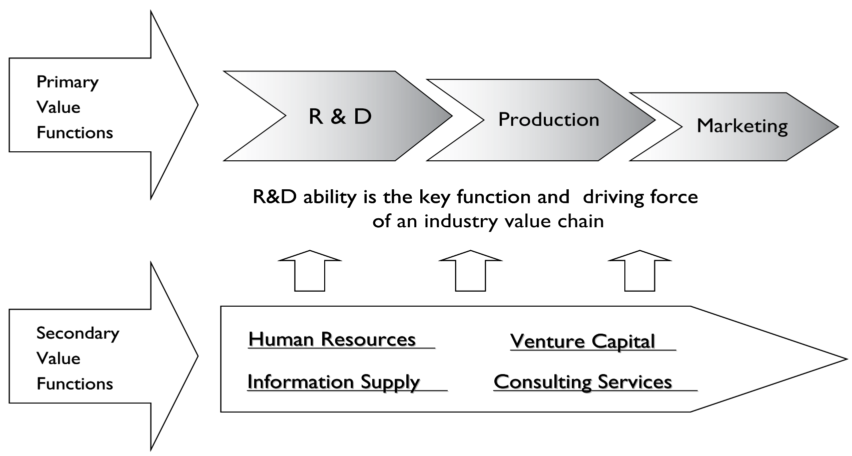
3. Value chain and networking

The value chain process in Figure 2.4 shows primary and secondary (supporting value chain) chain of value functions. The primary value chain refers to the primary value creating activities in the company. The secondary value function refers to activities that do not create the value directly but support primary value functions. There are various actors in each process of the value chain. The related elements are market, government, industry, university and society.

It is easy to understand that many actors are interacting to create values in each value chain process. As we have seen, the similar concept of interaction activities is about money, human resources, information, technology, and so on. As the actors interact they make some sort of network. And networked actors bring synergy effects to the competitiveness of SMEs. The network can be open or closed networks as well as local or global one. The network can be formed between users and producers.

In the globalized economy, the multinational companies are often leading the network. They allocate their production or even R&D units to the most favourable locations and to coordinate the global value chain process for their corporate objectives. Therefore, how to attract the MNCs and make them the leading part of network at a subnational innovation system is very important.

Figure 2.4 Value chain process in the innovation system



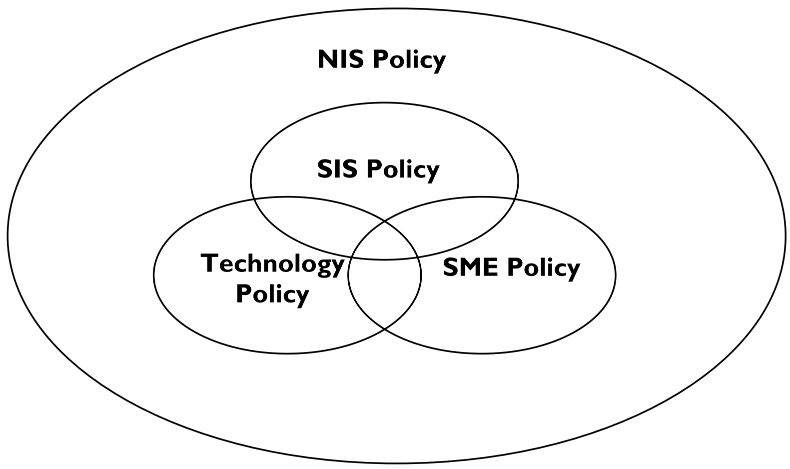
Source: Yim (2002)

4. Integration of SIS concept and SME policy

The subnational innovation system concept and SME policies are briefly reviewed in the previous sections. Since the goal of this report is to prepare a generic policy framework to enhance the competitiveness of SMEs in the context of the SIS, it is necessary to integrate the SIS concept with SME policy. NIS policy encompasses SIS policy as well as both SME policy and technology policy. This relationship can be shown as in Figure 2.5. SIS-based SME policies need to be designed in relation with technology and SIS elements.

As we can see from Figure 2.5, SME related policy may be better designed in context of the SIS and local development concept. In the globalized competitive market, technological capacity is the key to sustainable competitiveness of SMEs and their technological capacity-building could be made possible when the subnational innovation system is well established. However, the traditional SME policies are categorized according to the functions of marketing, financing, human resources, and technology. Those policies also can be categorized by the life cycle of SME as shown in Table 2.4. Whereas traditional SME policies fall on one of theses categories (marked with arrow), the SIS-based SME policies rather deal with all the life cycle of SME together in the context of an ecosystem.

Figure 2.5 Relationship among NIS, SIS, technology and SME policies



The SIS-based SME policies do not ignore the usefulness of traditional SME policies and need to be recognized that life cycle specific SME policies are still working. However, it is more important that more focus needs to be placed on the innovation friendly ecosystem of SMEs. This perspective emphasizes more of the qualitative characteristics, such as networking among the concerned actors. Therefore, the SIS-based SME policies should have longer-term time framework and system characteristics than traditional SME policies. For instance, they help SMEs to start and grow by providing creative culture and networking opportunity among the actors. They are also focused on the interactions of the system itself rather than targeting any one single actor.

Table 2.4 Conceptual framework for SIS-based SME policies

	Pre Start-up	Start-up	Growth Period	Declining Period
Marketing	→	→	→	→
Finance	→	→	→	→
Human Resource	→	→	→	→
Technology	→	→	→	→
Ecosystem	• University, industry, research institutes linkage • Creative culture • Mobility of human resources • Opening and globalization of the region			

III. STATUS AND POLICY ISSUES OF SIS AND SMES IN THE REGION

In order to review the policy issues of SIS and SMEs in the region, a host of literature was reviewed and the fact-finding mission was conducted. Four countries – Thailand, Singapore, Malaysia and Indonesia – were visited during 21 to 30 September 2005. In addition, UNESCAP organized the Regional Consultative Meeting on Subnational Innovation Systems and Technology Capacity-Building Policies to Enhance Competitiveness of SMEs, 18 to 20 January 2006, in Seoul, Republic of Korea. Many ideas were exchanged and future SIS-based SME policies discussed.

The policy issues identified through the literature review and the fact-finding mission are described in short, and integrated into the following chapters. In addition, the case of the Republic of Korea is discussed and summarized. It is believed that experience of the Republic of Korea will enrich the contents and reference of this report for other developing countries in the region.

A. Current status of SIS-based SME policies in the region

The current status can be described in the following categories: (1) recognition of SIS policy; (2) environmental trends of SMEs; (3) contents of SIS-based SME policies; and (4) administrative aspect of the policy.

First of all, most of the countries in the Asian and Pacific region are well aware of the importance of SMEs in the context of economic development. They understand that SMEs account for the lion's share of companies in their countries, and SMEs are especially important for local economic development. Therefore, they have been implementing SME policies as much as they can. But, most SME policies fall into traditional and individual policies.

Innovations and technological capabilities are recognized as being one of the most important factors in SME policy. Many countries admit that technological capabilities are the engine for sustainable competitiveness in the globalized competitive market. Many policymakers are also aware of the national innovation system and industrial/innovation clusters. In some countries like Malaysia, Indonesia and Thailand, science and technology policies are designed as part of the national/subnational innovation system policies. But, it seems that S&T policies are not fully integrated into SME policies. The foci of SME policies especially are not in technological capacity-building.

It is true that the establishment of an innovation system – regardless of national level or subnational level – and industrial cluster would take so much time and resources. The innovation system would take even more time to be established in developing countries. It is observed that some policymakers are trying to establish a SIS, but they are not sure of the result. Moreover, the globalizing innovation process would not give the developing countries enough time to establish their own national/subnational innovation system. The administrative SME and SIS policy system is also not coordinated very well. Many ministries and governmental agencies do have similar programmes and policies, but there is not so much coordination among them.

B. Meanings of SMEs in the region

It is necessary to have an exact definition of policy objective before formulating any policy. SME policy is no exception. The policy objective first has to be clearly set up. As it turns out to be, the definition of SME differs by country and even by time in same country. In many countries in the region, the definition of SME is not clear sometimes between concerned ministries. It is true that there are various definitions of SMEs over the world. In some countries, SMEs defined to include micro-companies or small businesses. In other countries, SMEs means small companies that operate under the modern management concept regardless of business sector. The definitions of SMEs differ by countries because of their specific economic and social conditions. The definition is important because government policies are normally focused on SMEs based on how the SME is defined.

1. Definition of SME: The Republic of Korea case

Here, the definition of SMEs in the Republic of Korea is given as a reference for the region. In general, the SME in the Republic of Korea is defined to be an enterprise with less than 300 employees. But, enterprises are classified into medium and small enterprises depending on the number of regular employees or the size of paid-in-capital/sales volume.

A specific criterion is as follows (based on Article 2 of the Framework Act on SMEs and Article 3 of its enforcement decree). There is also the following exclusion criterion: (1) More than 30 per cent of shares are owned by corporations listed pursuant to the Securities Trading Act, whose total assets exceed 500 billion won, shall be excluded from SME criteria and (2) Entrepreneurs of non-profit companies and those employing over 1,000 regular employees shall be excluded from SME criteria.

Table 2.5 Policymaking definition of SME in the Republic of Korea

Industry	SME		Micro-Enterprise
	No. of regular employees	Paid-in-capital or sales	No. of regular employees
Manufacturing	less than 300	8 billion won or less	less than 50
Mining, Construction, Transportation	less than 300	3 billion won or less	less than 50
Large-scale wholesaler, hotels, information processing	less than 300	30 billion won or less	less than 10
Seedling, broadcasting, fishery-related fuels or relevant products	less than 200	Sales of 20 billion won or less	less than 10
Wholesales, call sales, maintenance leasing, specialized S&T services, business assistance services, entertainment services, news provider	less than 100	Sales of 10 billion won or less	less than 10
Others		Sales of 10 billion won or less	less than 10

Source: Small and Medium Business Administration, the Republic of Korea (2005)
Note: 1,000 Korean won is about US$ 1 in 2006.

2. Status and role of SMEs

It is important to know exactly the contribution of an SME in one's economy. However, it was difficult to acquire all the relevant data and information during and through the fact-finding mission. Even the OECD publication does not provide relevant information for developing countries in the region. So, SME data in the Republic of Korea was used and analysed to understand the status and role of SMEs.

Since the Republic of Korea is a recently developed economy, it is able to provide dynamic characteristics of SME development. Common characteristics of their SMEs can be summarized as follows. First, they are small in size, but large in number. Second, they provide many job opportunities. Third, they can be the growth engines of the industry.

Small in size, but large in number

As of 2003, the number of SMEs in the Republic of Korea amounts to about 3 million, comprising some 18,828 medium enterprises (with 50-300 employees), 141,544 small enterprises (with 10-50 employees) and 2.84 million microenterprises (with less than 10 employees). As the backbone of the Korean economy, SMEs represent 99.8 per cent of the total enterprises (3 million SMEs) and 87.0 per cent of total employment (10.47 million employees).

Generally speaking, SMEs in the Asian and Pacific region have large number of business units, and employ many people. But, the share of manufacturing (or value-added in total industry) is less than the share in business units or employment.

Figure 2.6 Number of SMEs in the Republic of Korea

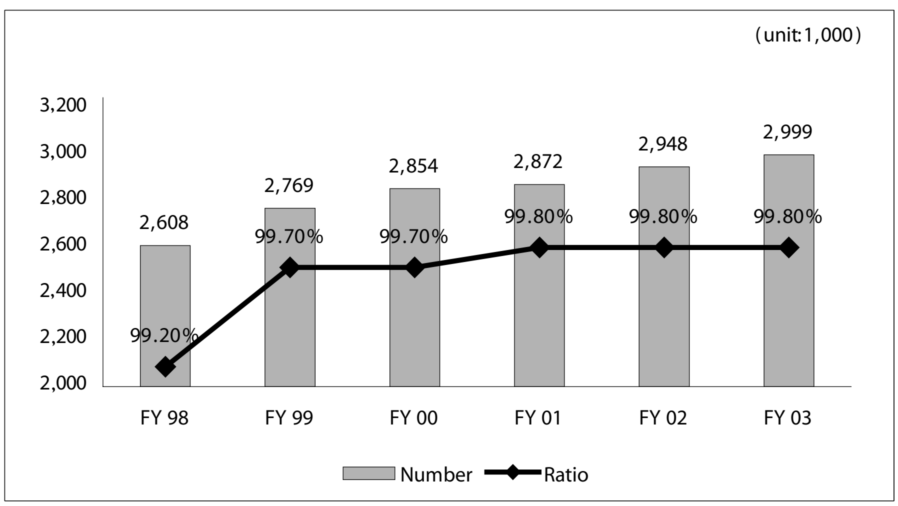
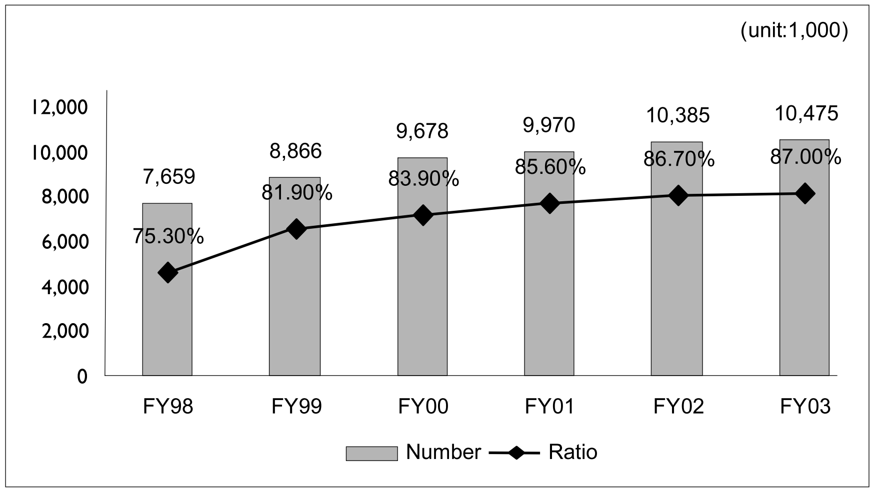
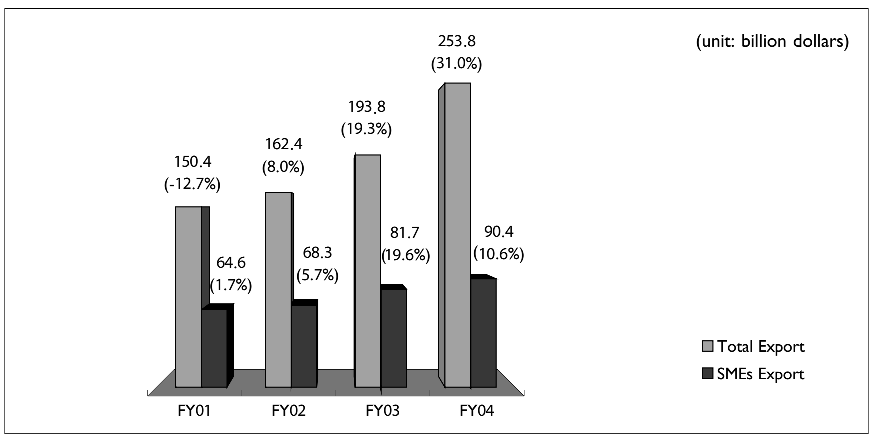


Figure 2.7 Number of SME employees in the Republic of Korea



Exports by SMEs have continued to grow, making up for the sluggish domestic consumption.

Figure 2.8 The Share of SMEs in export in the Republic of Korea



Note: Parentheses indicate an increasing rate compared to the previous year

Source of employment

During the period from 1998 till 2003, the number of those employed by large enterprises dropped by 950 thousand while that of SMEs increased by 2.81 million. As the source of innovation and new ideas, SMEs create a large number of jobs, helping ease unemployment problems.

Table 2.6 Number of SME employees – Annual trends

(Unit: 10,000, per cent)

	1998	1999	2000	2001	2002	2003
Total employee (A)	1,018	1,083	1,153	1,165	1,198	1,204
No. of SME employees (B)	66	887	968	997	1,039	1,047
Ratio (B/A)	75.3	81.9	83.9	85.6	86.7	87.0

Source: Small and Medium Business Administration, the Republic of Korea (2005)

Possible growth engine of industry

It is important to identify the contents and quality of SMEs. Are they really small in innovation capacity? Are they really flexible enough to compete with large companies in the global market? The Republic of Korea's case shows that SMEs can be as innovative as are large companies. According to the Global Entrepreneurship Monitor (GEM) report prepared by Bapson College in the United States and the London Business School to measure start-up activities of each nation, the Republic of Korea ranks 6th among 41 nations during the 2000 to 2003 period. This implies that there is a high degree of enthusiasm in the Republic of Korea for start-ups. Under this business climate, enthusiastic young people can realize their dreams by starting up their own enterprises. Moreover, this suggests that encouraging creativity and a spirit of risk-taking by SMEs is very important to the subnational innovation system and local economic development.

C. Policy environment

Generally speaking, the SME and SIS environment is not so much favourable for SMEs in developing and least developed countries due to the rapid changes in the global business environment and technology. With fast changes in technology, it becomes increasingly more difficult for less developed countries to catch up with the trends of technologies. One way to catch up with those trends is to become integrated into the global value chain. But, that requires a great deal of policy efforts, including changing socio-cultural settings in the region.

Policy environment can be classified as follows: legal and institutional framework, innovation infrastructure, policies, programmes and support measures.

Challenges and opportunities for SMEs

Until now, SMEs have steadily grown as subcontractors of large enterprises based on relatively low wages. However, such input factors that enabled SME growth in the past are increasingly disappearing with rapid changes in the global economic environment: global outsourcing strategy of large enterprises, emergence of China and other nations with higher cost competitiveness, shortening of technology life cycle, and fiercer competition brought about by market liberalization. Such changes in the economic environment are weakening growth potential and profitability of SMEs. The Study shows that facility investments of SMEs remain low. Although the present difficulties confronting SMEs are not easy to overcome, they provide opportunities to leap forward in the global marketplace. The Government of Republic of Korea places its policy priority on the enhancement of SME competitiveness. It also does its best to create the right environment for SMEs, in which anyone with creative ideas and strenuous efforts can start up a new enterprise. As many people regard SMEs as a means of self-achievement, the Small and Medium Business Administration (SMBA) in the Republic of Korea make its utmost efforts to promote entrepreneurship and create the best business environment for SMEs.

D. Best practices and lessons

1. SIS-oriented policies in the region

SIS-oriented SME policies target upgrading the competitiveness of SMEs, especially in the field of technological capacity-building, through the establishment of a strong and competitive subnational innovation system. Therefore, the technological competency of SMEs is really the ultimate policy goal. In order to design an enabling policy, it may be necessary to (1) identify the success and failure factors in implementing those SIS-related initiatives and (2) find many good examples and benchmarking cases.

Some policy needs and strategic issues are identified by the results of investigating circumstances of the selected countries and the e-forum among experts and stakeholders. For benchmarking cases, it seems that the Republic of Korea, Singapore, Taiwan Province of China, Thailand, and Malaysia could provide some examples. However, it is difficult to identify any real SIS-focused SME policies in the region in the following reasons.

Firstly, many of the policies investigated were regarded as just being traditional SME policies while some individual policies aimed at affecting only part of the whole SIS system. For example, there are just some financial programmes that SMEs can rely on for help.

Secondly, those policies, which could be identified, are not really SIS-oriented policies. They attempt to assist SMEs in the traditional and partial way. They are not really system-oriented, even though some countries are trying to introduce such system-oriented policies.

Policy practices in the region can be classified by the development stage – less developed countries, developing countries, and newly industrialized countries. Moreover, their policy contents can be described as such entailing items as policy system, policy contents, policy implementation management and policy people.

2. Major SME policies in the Republic of Korea

SME policies in the Republic of Korea have changed over the time. Before the 1990s, there were traditional policies that focused on individual corporate functions. The government provided financial resources through the Korea Credit Guarantee Fund (KCGF) and protected SMEs from the competition of large companies in certain business areas. In addition, public sectors were required to purchase SME products on a preferential basis. However, these policies could not really support SMEs in the fast changing global environment. As labour cost increases, the government allowed large firms to enter into SME business sectors by deregulating anti-competitive economic policies.

At the same time, the government started to promote technology-oriented SMEs by providing credit guarantees through the Korea Technology Credit Guarantee Fund (KOTEC) in 1989. In the late 1990s, the promotion of venture companies and technological capacity of SMEs became major policy issues. However, there was some evidence that the existing SME policies were not efficiently implemented. In order to introduce new effective polices, the Presidential Commission on Small and Medium

Enterprises (PCSME) was created to coordinate overall SME support policies and programmes of various agencies so that all of the separate and functional programmes have been well coordinated and integrated effects.

As a result of these changes of policy mechanism, a great deal of effort has been made to improve the technological capacity of SMEs by providing regional technology services and more R&D funding to SMEs, and facilitating cooperative R&D and technology transfer among SMEs, universities and public R&D institutes. Another important point is that SMEs now can receive money, technology, and professional human resources support as a package as the result of new SME polices. Recently, there has been a major shift in policy direction. Firstly, the government reviewed all SME polices and started to think over them in the context of the regional base. The second change is that each SME policy is to work as one element of all of the integrated SME policies. The third point is that SME innovation policy has to be designed along with regional innovation policy. Major policy initiatives for SME technology capacity-building taken by the government of the Republic of Korea are briefly described in the following.

(a) Facilitating start-up and enhancing entrepreneurship

The Start-up is an important economic activity that can generate national economic dynamism as a source of new ideas and innovation. Various programmes for promoting business start-ups are as follows: to foster young entrepreneurs and create the entrepreneurial business climate. The SMBA has been implementing various programmes: start-up courses, start-up clubs, the Bizcool programme for young people, and Graduate School for Business Start-ups.

The Administration is promoting the business environment that is favourable for start-ups by removing or streamlining regulations and procedures that are used to hinder start-up activities and providing start-up agency services – conducting start-up activities on behalf of the company. The SMBA also offers the necessary land for start-ups by supporting setting-up of business incubators belonging to universities and public research institutes across the nation, and provides funds for business founders through start-up funds.

(b) Providing effective financial service

People intending to start up an enterprise, or expand/restructure an existing business, will face the most common difficulties with financing. This is mainly because banks require collateral before agreeing to extend a loan to an SME, and their technology and corporate value cannot be correctly assessed for underwriting. In this respect, the SMBA provides direct and indirect financing support for SMEs to ensure that creative and innovative SMEs will not fail because of difficulties with financing. As indirect financing services, the administration provides a security assurance service for SMEs ineligible for bank loans due to lack of collateral and technology. These services allow them to borrow needed funds from the KCGF, the KOTEC, and local KCGF offices. The SMBA plans to utilize venture capital and the KOSDAQ market through directing its effort to supporting SMEs with direct financing from the market.

(c) Ensuring a stable supply of human resources for SMEs

The SMBA is well aware that "Developing and Securing Competent Human Resources" is the key solution to enhancing the competitiveness of SMEs. In this regard, the Administration is formulating a policy towards raising the capabilities of both SME employees and managers, and at the same time, creating the social and business environment wherein SMEs are able to employ competent human resources. To lure an increasing number of young people into SMEs, the Administration has been implementing the "On-site Work Conditions Improvement Programme" and providing tax benefits and other preferential treatment for SME employees. In order to change the way that young people perceive SMEs and sustain friendly ties between college students and SMEs, the SMBA initiated the "Collegian SMEs Experience Programme" and the "Youth Employment Package Programme." The "SME Training Centre" implements various programmes to educate SME managers and employees on new management methods and on-site work skills. The "Foreign Workforce's Industrial Training System" and the "Industrial Technician Certification System" have been put in place to ensure the availability of human resources at production sites and mid-level, qualified technicians, respectively.

(d) Enhancing the market access of SMEs

As consumer demands become more diversified and change constantly in the 21st century, marketing capabilities of enterprises have become more important than ever in the global market as well as in the domestic market. Accordingly, only companies capable of opening new markets with aggressive marketing strategies will be able to survive the fierce competition of this century. Nevertheless, export enterprises represent only 30 per cent of the total amount of small and medium-sized manufacturers as of now. Furthermore, export destinations and products are limited to just a few nations that include China and the United States, and a small number of items like IT and automobile products. Some of support measures for the successful entrance of SMEs into overseas markets are as follows:

- Support for SMEs' participation in overseas exhibitions
- Nurturing talented employees into becoming trade professionals
- Supporting SMEs with opening up new overseas markets
- Support through export management companies (EMCs)
- Providing information on the international procurement market

(e) Building technological innovation capacity of SMEs

To strengthen innovation capabilities of SMEs, the Government is pushing various policies with focus on: fostering innovative SMEs that will lead the technology innovation of SMEs down the road; reinforcing networking among industry, academia and institutes; promoting commercialization of developed technologies; and establishing the digitalization infrastructure.

Along with these, various policy measures are being implemented to accelerate technology development of SMEs. For example, the Government seeks to develop up to a 10 per cent segment of the entire manufacturing SMEs that are equipped with technology development and innovation capabilities through selection and fostering programme of Inno-Biz. The relevant Government ministries and institutions are also required to allot a certain percentage of their R&D budget to support SME technology development (KOSBIR: Korea Small Business Innovation Research), and provide support for R&D expenses of SMEs that are capable of developing their own technology. Additionally, the national defense and electricity companies and others in the public sector guarantee their purchase of SME products as internal procurement.

In an effort to prevent superior technologies from remaining unused, the New Technology Commercialization Funds have been mobilized to fund the cost of facility investment and raw materials required for commercialization of new technologies. Various policy measures have been taken to reinforce networking among enterprises or among industry, academia and research institutes. The networking measures include training programmes held at the SME R&D Institute; activities of the Industry, Education and Research Consortium Project; SME Technology Training Programme; and training programmes of SME employees that involves universities and research institutes.

(f) Promoting venture businesses

Venture businesses are expected to lead the Korean economy as strong growth engines in the future. The Government will continue to keep its policy stance to foster them, while policies will be focused on improving quality and competitiveness of SMEs rather than quantitative growth only. The Government ensures that funds, human resources, land or other necessary production resources will stably flow into SMEs. To that end, efforts are under way to create the business environment that will facilitate start-ups of innovative SMEs by easing or even removing regulations that have been mistakenly used to hinder venture businesses within the framework of special law on venture business promotion. Policy efforts are also being made to facilitate active merge and acquisition (M&A) of venture companies with the expectation that M&A will bring about beneficial effects: facilitated strategic alliances among enterprises, added venture investment, and enabled freer movement of technicians. In addition, the Government is promoting globalization of venture businesses through the establishment of overseas support centres and global star funds.

E. Policy needs and strategic issues

As stated in previous chapters, many countries in the region are trying to introduce SIS-oriented SMEs policies, although they are still at the initial stage and in a policy environment that is not so much favourable. Therefore, in order to successfully meet the challenges of designing and implementing SIS-oriented SME policies, there is a need to take into account the strategic approach as follows.

Firstly, there should be a kind of top-down approach that starts at the central government and works down to local government and related actors in the local area. Through the education or training programme, the mind-set of policymakers needs to be changed to understand the importance of SIS and way of applying the SIS concept to SME technology capacity-building.

Secondly, there is a need for setting up policy networking. Since this is a new initiative in SME policies and it requires a longer time frame than traditional policy approaches, policymakers and related resource persons should be well informed. In addition, policymakers and a government may have to be patient. In this sense, international policy networking is a good idea to work with.

IV. A FRAMEWORK OF SIS-RELATED SME POLICIES

Since the SIS concept is a system concept, which involves various actors and interrelated activities, the nature of recommended policies is normally systematic, long-term and environment creation-oriented.

A. New and emerging policy issues

There are very important changes in policy environments such as globalization, regionalization and rapid technological change. These changes require that a policy be changed and designed within a new framework. A policy should be quick and flexible enough because it deals with the innovation system, which has various related actors and a fast changing environment. Policymakers need to be prepared for the coming threats while seizing opportunities that globalization and regionalization processes bring into the region. Moreover, policymakers should encourage SMEs to take advantage of global production networking. As the globalization process deepens, it may be difficult to compete in the global market without being integrated into the global value chain. Of course, this does not necessarily mean that SMEs have to give up their locality and own decision process. Rather, it means leveraging the global opportunities based on local, specific competency.

B. Innovation cluster building and networking of business firms

There are many policies to support SMEs in the rapidly changing environment. As we have discussed in previous chapters, SIS-oriented SME policies should be something to encourage innovation cluster building and networking among SMEs, universities, research institutes, and a government. Innovation cluster building means various things. First, it means that the innovation actors in a cluster must be competitive enough individually. For the upstream innovation value process, universities and research institutes have to bring good R&D results; whereas, private companies have to commercialize R&D results well. Actors rely on collective success rather than an individual actor's success, and collaborate for the common purpose.

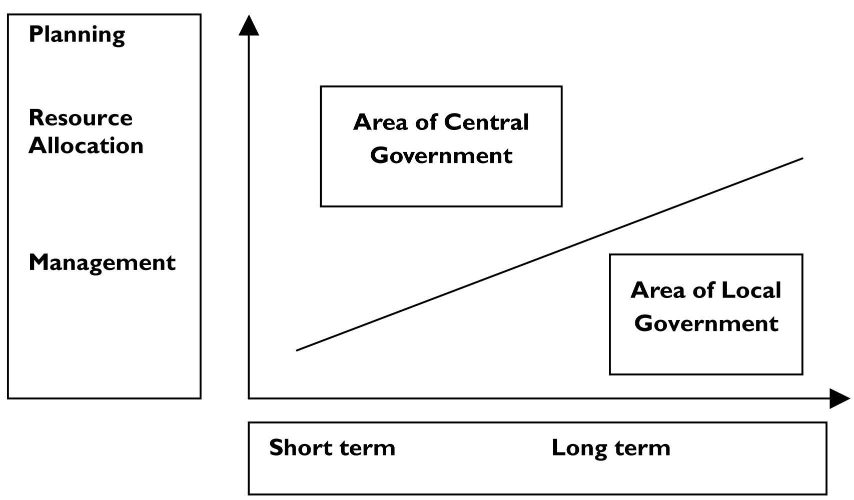
The second point is networking among firms, universities, and public agencies. It is true that the networked system can perform well. Not only institutional actors but also employees, and local citizens are all networked in some way. The networks could be cultural or sport meetings. A policy has to encourage networking by providing various opportunities for the actors, employees and citizens to come together. Those cultural, business, and R&D networks make it possible to share knowledge and information through facilitating interaction among actors. It should be also kept in mind that there has to be competition as well as cooperation among the actors. Even though the policy encourages the actors to cooperate and be networked, that alone is not enough without competition. In fact, the actors are encouraged to compete collectively with global competitors.

C. Role division between central/local governments and public/private sectors

As mentioned above, a SIS has various actors and cooperation among them is the key to successful development of the SIS. In order to cooperate, it is necessary to understand the interaction mechanism of related actors and the effects on the development of the SIS.

The subnational innovation system has three components. Firstly, it has a public governance system. The second component is the knowledge innovation system where R&D activities are carried out. The third component is the business innovation system (UNIDO, 2005). In developing countries, the role of public governance is very important because the government has most of the resources and policy tools. In most of the developing countries, policies tend to come from the central government and often the public sector is the only source for R&D investment. In today's policy environment, there has to be more coordination between the central and local governments. First of all, local-specific matters are required to be put into policy contents. Therefore, the role of local government is more important than before. In this sense, central and local governments should cooperate. The central government can provide the vision and direction; whereas, local governments add locality to the policy and implement it.

Figure 2.9 Role division between central and local governments



This relationship applies to the public and private sectors. Private sectors used to be the recipient of public policy. However, there are many important innovation actors in the private sector. Without the private sector's active participation, the subnational innovation system cannot be established. Therefore, it is necessary to include private sector initiative at the outset of designing policy. The relationship can be drawn as in the figure below. As time passes, the role and involvement of local government and the private sector increase. The central government and public sector provide initial policy design and financial support. But, as the SIS is established there are more requirements from the private sector and local government.

D. Linkage among the actors and the GIS-NIS-SIS relationship

It is more important than ever to have strong linkages between the public and private sectors in the national innovation system. Traditionally, it was believed that public S&T investment produces basic and generic scientific knowledge and then the private sector utilizes the output of that public R&D investment. That there is a sequential innovation process and a division of functions between the public and private sectors is known. However, today's innovation process requires a strong public and private partnership (PPP) at the outset of the innovation process.

Since a government invests a large amount of money for national S&T development and the public sector maintains large research groups and has accumulated S&T knowledge, the private sector can earn much benefit from collaborating with the public sector. A strong PPP can be achieved from the initial innovation process, like R&D investment at various levels among R&D centres, universities, governmental agencies and business units. However, building a strong partnership between them is not easy because of the inherent, generic gaps in their missions, organizational structures, activities and financial capabilities.

Since the SIS is a complex innovation system, it is necessary to have a close network among the related industry, academy, and government. Especially, the universities and public research institutes are somewhat isolated when it comes to starting the innovation process in the local industry: a typical phenomenon that can be observed in many developing countries in the region. In this situation, the R&D investment in public sector and educational institutes would not bring about the desired results. The local government has to make sure that R&D investment is closely related with local (sometimes traditional) industries. Otherwise, local industries would not have the competence required for the global market. It should be kept in mind that multinational companies also invest in the region where the public-private partnership is active.

Because of the globalization process and increasing role of multinational companies, the global innovation system emerges. Multinational companies are changing the global innovation system (GIS) by locating and outsourcing their R&D activities to the best locations in the world. Since the role of multinational corporations (MNCs) became increasingly important in the global economy, individual countries – especially small and less developed countries – are heavily affected by the changing global innovation system. There are many cases in which certain local industries grew or disappeared because certain MNCs invested or pulled out their investment. MNCs are always ready to change their global outsourcing locations as competitive factors change in the region. Not only local industries but also the national innovation system can be affected heavily by MNC strategy.

In the globalized market, MNCs investment cannot be denied. Absolute denial would make an individual country be at the risk of being left out of world competition. Rather, the individual countries have to be prepared to attract MNCs investments and utilize them. In order to attract MNCs, the following favourable conditions are needed: low-cost but reliable labor, good S&T knowledge stock, good infrastructure and so on. This does not equate to absolutely good conditions. It means comparatively favourable conditions. Fitness is the most important concept in GIS-NIS-SIS interface.

E. Major policy measures to promote innovation process within the SIS

Policy measures can be classified in several categories, including the major target of the policy and system characteristics of the policy, etc. For example, policy can target R&D, financial support, marketing, human resources supply and so on. Some policies target a group of the actors; whereas, other policy may support only one actor. In reality, it is somewhat hard to clearly distinguish policies with these categories.

As has been discussed before, the SIS-based SME policies are targeting the subnational area as an innovation system. Therefore, the policies are rather oriented to mid/long-term systematic SIS improvement by networking the concerned actors and encouraging SIS synergy in technological capacity-building. Below are examples of the Republic of Korea's SIS-oriented policies, which mainly target promoting SMEs and innovative venture start-ups. These examples could provide policy directions and benchmarking cases to other countries.

1. Techno-Park (TP) Policy

Policy background

The Techno-Park policy was initiated in recognition of environmental changes, such as the information revolution and emergence of the new globalized economy. Firstly, the advent of the information society has created a virtual reality whereby information and knowledge is exchanged online, and existing high-technology products and technology become obsolete faster than ever. Moreover, the prime factor that determines a nation's competitiveness increasingly shifts from "price" to "technology," which transforms the source of wealth from "capital and labour" to "information and knowledge."

With a greatly shortened life circle of production and technology as well as the emergence of e-commerce, it has become increasingly important to form a cooperative network and interaction between industry, business and the government in order to keep up with an ever-changing global economy. The second change is the emergence of the new global economic order, a Paradigm Change in International Politics and Economy. The development of local economy as well as economies of many other countries during the last decades was initiated and managed by a central government, with regional development policies being legislated and implemented at the top.

Although this centralized economic development made tremendous contributions to considerable economic growth and expansion in quantitative terms for the past years, it has resulted in negative impacts on society as a whole by creating an unbalanced regional development. Consequently, this disproportionate economic development deepened regional tensions and endangered national cohesion. It is now widely recognized that the centralized, top-down approach, was no longer relevant in the era of globalization as the global economy was opening up every region to fierce global competition and a great deal of flexibility would be required to attain economic success.

In the face of the new technology revolution and the new public demands for social and economic justice, three main contributions made by the local economy consisting of "regional governments," "research centres of universities" and "businesses" alike, recognized the need to cooperate with one another under the common goal of economic development and regional prosperity. In the context of ongoing technological and political transformations, the Techno-Park Project was finally born in the late 1990s in the Republic of Korea to achieve "Balanced National Economic Development" and an "Autonomous and Self-Reliant Regional Economy."

Definition of Techno-Park

Techno-Park refers to an industrial and technological cluster operated to enhance the regional economy and maximize the competitiveness of regional, specialized industries. It is the site where a network is formed of local governments, academia and industry, and where comprehensive business activities are performed. The greatest benefit of the Techno-Park is that R&D, business incubation, education, business support and production functions can be activated under one roof. The start-up of an enterprise's new technology can be supported through circulation of information about industry and technology through incubation facilities. Furthermore, test-production can be carried out through joint utilization of research and development facilities so that technical innovation of regional enterprises and up-to-date industrial development can be guided. The prime objective of the Techno-Park policy is to foster knowledge-based industries in the local economy, heighten local competitiveness, and contribute to the development and prosperity of the local economy.

Main activities

The two major activities of the Techno-Park are categorized into "Assistance to Companies" and the "Regional Innovation System (RIS) Project." While the former consists of programmes of "Business Creation and Incubation," "R&D Promotion," "Education," "Business Support and International Marketing," the latter embraces "Construction of New Industrial Infrastructure," "Promotion of Regional Innovation," "Recruitment of Innovation Manpower," "Industry-University Networking," and "Cluster Networking."

(i) Assistance to companies

a. Business creation & incubation

Being a venture start-up evaluator and business creator, the Techno-Park is on the forefront of discovering and nurturing venture companies based on high technology. The Techno-Park promotes new businesses with a high degree of potential for innovation and viability by attracting fresh business ideas and projects, and by motivating, training and advising start-up high-technology businesses. Being a business incubator, it provides start-up businesses with facilities and equipment necessary for promoting business activities.

b. R&D promotion

The Techno-Park strives to foster the global competitiveness of local industries by utilizing the research potential of industries and universities to the fullest extent. It activity promotes research activities for business creation based on new technology development and commercialization. It implements various R&D projects where research proposals are assessed and selected according to industrial needs, and those that are selected are funded and nurtured.

c. Education

The Techno-Park offers various educational programmes aiming to recruit qualified venture human resources of which many start-up venture companies are short. They are intended to spur on entrepreneurship, encourage setting-up of companies based on new technology, and upgrade management and marketing skills of venture employees. Education projects organized by the Techno-Park cover a broad range of training programmes, which specifically target enterprises, students, graduates, marketers and managers.

d. Business support and international marketing

In an effort to provide software type services to venture firms that might lack administrative and marketing strategies, the Techno-Park promotes a system in which tenant companies are offered a wide range of business services from consulting and funding to marketing. While trying to implant an outward global mind-set, tenant companies are introduced to experts in international marketing and invited to product exhibitions, workshops and seminars on international business and marketing.

(ii) The Regional Innovation System (RIS) Project

a. Construction of a new industrial infrastructure

To build and consolidate a new industrial infrastructure that lives up to the 21st century knowledge-oriented economy, the importance of R&D cannot be overemphasized. Aware of this, the Techno-Park houses and supports R&D centres of regionally specialized industries. All of these R&D centres endeavour to advance their respective research field and help related industries to absorb and share research outcomes by networking among industries, research institutions and universities.

b. Recruitment of innovative human resources

Since qualified people are a determinant of the future economy, the recruitment of a capable and competent workforce has become important. In collaboration with the Korea Industrial Technology Foundation, the Techno-Park sponsors businesses in conducting research aimed at advancing regional strategic industries, as well as Industry-University joint research activities. This is to let researchers grasp an understanding of industry at the ground level and form a Business-University Network.

c. Industry-university networking

Techno-Parks host conferences, workshops and seminars at which invited members of university research centres, incubating agencies, enterprises, industry sponsors, and other important players in the local economy are able to share mutual concerns and exchange information. By so doing, not only do they promote transfer of technology, they also reinforce partnership between industry and university.

d. Cluster networking

In addition to the networking formed at the regional level, Techno-Park information exchange occurs within the cluster and Park. If Industry-University Networking is relying on off-line face-to-face contacts, cluster networking is being carried about on an online basis. News of the cluster is consolidated and circulated online on a weekly basis with an online community in operation.

Present status

Currently, thirteen Techno-parks have been operating nationwide since 1997, and one more will be built in the near future. The Ministry of Commerce, Industry and Energy is the main authority for this policy, and it supports Techno-parks in the region under the matching funds concept. So, the regional government (or concerned university) has to expend its money to make the policy work. By 2004, some US$ 25.0 million was invested in establishing thirteen Techno-parks. It seems to be too early to make any judgment about the output of Techno-parks. However, they produced 1,510 companies, did 726 R&D projects, educated 15,346 people, installed 993 pieces of equipment and used the equipment 744,411 hours. In any case, Techno-parks are expected to bring forth the following results. Firstly, local industrial structure will be rearranged. Secondly, local industrial competitiveness will be enhanced. Thirdly, they will help advance effectiveness between new technologies and supporting enterprises for ventures. Fourthly, they will create new industries and jobs. The central government has limited the initial donation period to five years, and the Techno-parks were to be self-sustainable. As official support to the first five Techno-parks, which started in 1998, is now finished, they now have to survive on their own. However, it is difficult for them to operate on their own and some support still continues to be provided by the Ministry. The government guides survival of Techno-parks through their participation in public R&D programmes.

2. Technology Innovation Centre (TIC) Policy

Definition of TIC

The Technology Innovation Centre is a not-for-profit business incubator dedicated to supporting the growth of very early stage technology-based businesses. It is an extremely entrepreneurial business environment that fosters collaboration and information sharing among young companies, while respecting the independence and self-reliance that motivates entrepreneurs. It is a community with a culture that supports risk taking, invention and the creation of wealth. The goal of Technology Innovation Centre is to promote the establishment of the blue chip venture companies, technology innovation of SMEs and the enterprise of middle standing firms through concentrating technology resources of regional industry-academic-institution.

Main activities

Technology Innovation Centre (TIC) has following businesses:

- Utilization of equipment: managing high-priced equipment for experiments and measurement
- Collaboration: encouraging collaboration among industry-academic-institution and supporting R&D of enterprises
- Education and training: re-educating people in industries and developing high quality human resources
- Information distribution: introducing world high technology trends and providing technological information to industries
- Start-up support: providing space, technologies and business skills to founders

Present Status

As of February 2005, there are 44 TICs in operation in universities and research institutes.

Table 2.7 List of technology innovation centres

Technology Sector	Name of TIC
Mechanic Sector (11)	Chosun Univ., Kyungbuk National Univ., Univ. of Incheon, Chugnam Advance-fabrication Technology Innovation Centre (Hanseo Univ, Soonchunhyang Univ, Hongik Univ., Shinsung College, Sunmoon Univ.), Univ. of Ulsan, Korea Polytechnic Univ., Jeonju Univ., Wonkwang Univ., Korea Institute of Machinery & Materials*, Kyungnam Special region (Kyungnam Univ., Gyeongsang National Univ., Inje Univ., Changwon National Univ., Daebul Univ.)
Auto Sector (5)	Chonbuk National Univ., Kunsan National Univ., Pusan National Univ., Catholic University of Daegu., Korea Automotive Technology Institute*
Metal and Material Sector (4)	Postech, Inha Univ., Korea Univ., Yonsei Univ. (Seoul), Research Institute of Industrial Science & Technology*
Electronic Electric Sector (12)	University of Suwon, Sungkyunkwan Univ., Yonsei Univ.(Wonju), Juseong College, Dongshin Univ., Dankook Univ., Dong eui Univ., Honam Univ., Konyang Univ., Kyunghee Univ., Yeungnam Univ., Korea Electronics Technology Institute*
Chemistry Sector (7)	Soongsil Univ., Kangnung National Univ., Ulsan College, Sunchon National Univ., Kyungwon Univ., Hanbat National Univ., Korea Research Institute of Chemical Technology*
Biology Sector (5)	Korea Research Institute of Bioscience and Biotechnology*, Youngdong Univ., Cheju national Univ., Sangju National Univ., Hallym University,

*Note: * government-supported research institute (GRI).*

3. Technology Business Incubator (TBI) Policy

Definition of TBI

Technology Business Incubator is a not-for-profit centre, which provides start-ups with low-cost space, and efficient business environment to build and growth venture business.

Its goals are as follows: (1) to provide office space, facilities, and other environments for start-ups, which only deal in ideas and technologies; (2) to focus on the venture cluster and specialization, enhanced entrepreneurship and synergy among cluster venture; (3) to develop the venture Mecca in the field of information and telecommunications industries in the Republic of Korea; and provide technical assistance to develop the specialized venture enterprises to enhance global core competition.

Main activities

The activities of the technology business incubator are as follows:

- Financial support: Supporting for the cost of commercialization of new technologies within the limit of 0.1 billion won (about US$ 100,000) per person.
- Space support: Providing space for business, basic equipment and office machines through universities and institutions.
- Business support: Offering technological and business information and connecting services to financial and investment companies.

The MOCIE is the main authority for the policy and supported about 8 billion Korean won (about US$ 8 million) in 2005. Like other policies, some sort of matching fund is required and the supporting period is limited to one year. The eligible person for this support is the founder within 3 years or preliminary founder with new technologies.

Present status

As of March 2005, 291 TBIs including private enterprises are operating.

Table 2.8 Status of technology business incubators

Areas	No. of TBIs	No. of resident enterprises	No. of graduate enterprises
Seoul	35	546	733
Busan	21	323	280
Daegu	9	149	135
Incheon	7	123	149
Gwangju	16	297	254
Daejon	18	244	249
Ulsan	5	96	35
Kyeonggi	48	684	623
Kagnwon	20	244	135
Chungbuk	15	199	115
Chungnam	20	316	325
Jeonbuk	16	187	160
Jeonnam	11	132	100
Kyeongbuk	27	348	208
Kyeongnam	19	305	317
Cheju	4	56	51
Total	**291**	**4,249**	**3,869**

4. Establishment of the innovation cluster

Establishment of the innovation cluster in the Republic of Korea is an important policy. The innovation cluster policy is combined with technology, industry and regional development policies. In this policy technology-intensive SMEs receive a great amount of support. The government is well aware that copying and transplanting a successive cluster to a different environment (even in the same country) would surely be futile. In addition, building a new cluster from the scratch is extremely difficult. The government is therefore trying to upgrade existing clusters to innovative clusters rather than making new ones. And the core strategy is to build and strengthen networks among industry, research institutes and universities.

Currently, there is one big national innovation cluster (Daedeok Innovation Cluster: DD Innopolis) and seven industrial complexes, which are the target of innovation cluster policies. DD Innopolis is now designated as a new special R&D zone by the special law and various policies are being introduced to make DD Innopolis a more innovation friendly place. Seven industrial complexes are now conducting more R&D functions to create innovation within their existing production capacities. In addition to them, there is the planned Bio-Technopolis in Osong, Chungbuk Province, which will be built by 2010. An IT Complex is also being built in Seoul metropolitan city and another one in Incheon metropolitan city. Other than that, cultural clusters, innovation city, and agricultural clusters are being tried at several different locations based on the innovation cluster concept.

V. RECOMMENDATIONS

In the previous chapters, a conceptual framework of SME promotion policies in the context of the subnational innovation system and technological capacity-building is discussed. After that, current policy status and policy issues are discussed. Through the discussion, it is identified that the SIS-oriented SME policies are powerful tools to enhance the technological capacity in the long term, and not only central government, but also local government and universities should play important roles in establishing a subnational innovation system.

Since the primary objective of this report is to draw up a conceptual framework for the SIS-oriented SME policies, to review the current policy status in the region and give guidelines to policymakers, the following recommendations are offered. Those actions could be undertaken by UNESCAP and participating countries in promoting SME initiatives and programmes.

First of all, more country cases need to be studied. Even though there were many discussions during the Regional Consultative Meeting in January 2006, the need still exists to clearly identify best practices and set philosophy of policies. Here, many of the benchmarking cases are identified through the Republic of Korea and Thailand cases. However, there is a need to investigate and compile more specific cases, which can be found in other countries with different development stages.

Policy needs to be customized according to the cluster development stage, country, industrial development, and so on. Since a SIS policy is a systematic policy, it has to fit the system which it targets to improve. Therefore, a policy should be designed by considering the characteristics of the system. In general, it should be noted that countries in the region are at various development stages, which are associated with their socio-economic conditions. In order to elaborate the policy recommendations, further studies are needed. Case studies by country should place more focus on technological innovation of SMEs, clustering trends, networking structure, and development of management capabilities at both the policy and SME levels in the specific Asia and the Pacific context.

Secondly, there is a need to devise educational and/or training programmes for policymakers in the region. As it turns out, many of the policymakers in the region are not aware of SIS-oriented SME policies or other related concepts like innovation cluster. Some of them are aware of the regional innovation system and national innovation system. But, this awareness is made only from the perspective of science and technology policy. There are few policymakers who attempt to adopt those concepts from the perspective of SME promotion. This enforces the need for further studies. The development of benchmarking cases and educational/training materials will be really helpful to diffuse SIS-oriented SME policies.

Thirdly, it is necessary to develop a database and/or reference materials and diffuse them through the internet. It is not so much easy to organize regional educational/ training meetings because large financial resources are necessary. Rather, on-line references and networking of experts would be a cost-effective way to help policymakers get awareness on the SIS approach. However, it is possible to have a small programme to share expert knowledge and experiences among member countries.

Fourthly, it is desirable that the SIS-related concept and strategies be applied to some selected countries in the region. A pilot project for the benefits of the SIS-oriented SME policies to member countries and refining the application of such policies could be formulated. As an example project, a technical advice programme for assisting a policy formulation could be initiated by UNESCAP.

As discussed at the Seoul Regional Consultative Meeting, UNESCAP and member countries need to focus their policies and studies on following themes:

- Subnational innovation system and its impact on regional economic growth
- Human resource development policies for SME innovation
- Strategic promotion of the access to technology innovation financing
- SME cluster building and networking
- Promotion of technology business incubation and high-technology ventures
- New technology exploitation for global competitiveness of SMEs
- Intellectual property rights (IPRs) regime, patent protection and utilization
- R&D globalization and its impact on local SME competitiveness.

VI. CONCLUSIONS

In order to build a SIS policy framework and make recommendations to countries in the Asian and Pacific region, various activities were carried out. Literature was reviewed to conceptualize the subnational innovation system and the fact-finding mission was conducted to identify the policy status and needs of selected countries. In addition, the e-discussion forum was organized to bring up more ideas from all over the world and find benchmarking practices.

From the national innovation system to innovation cluster concepts, related concepts and theories are reviewed. The review confirms that the subnational innovation system is an important concept for facilitating the innovation activities of small and medium companies. In this report, the subnational innovation system is defined as a unit of innovation system at the subnational level that is composed of local government, local university, local industry – especially SMEs – within a certain public administrative boundary, has formal/informal networks among the actors, and produces innovation results by participating in value creation processes, like knowledge creation, knowledge transfer, and knowledge utilization through the sharing of S&T knowledge, culture, and financial resources.

A SME policy has to be changed to incorporate the SIS approach and to provide an enabling environment conducive for upgrading their technological capacities of local SMEs. Countries in the region are also compared from the perspective of SIS-oriented SME policies and a generic policy framework for initiating SIS approach is conceptualized. Recommendations are drawn for the implantation of SIS-oriented SME policies. As the SIS policy is focused on system, it is necessary to design a SIS policy in the longer time frame and the related actors should cooperate in making the policy work.

To build a SME-friendly subnational innovation system, diverse elements need to be prepared and lots of inputs must be mobilized. Since system building requires a long time and a considerable financial resource, it seems that many developing countries are not able to really afford such policies. However, it must be taken into account that there are still many resources, which are not utilized properly. For instance, one of the most neglected resource sectors is a local university. In the developing countries, the university has enough human resources and technological background to support local industry. However, strong networking is lacking between university and industry, and adequate mechanisms to support local industries are missing. If proper policies are introduced, a local university-centred SIS could be established.

On the other hand, policymakers in the region should understand the SIS policy concept and related policies. Still, most of them are not well aware of the SIS policy concept and do not have sufficient capacity to initiate those policies properly. Considering the regional specificity of innovation systems - both at national and subnational levels - one of the top priorities could be to provide proper education or training programmes to concerned government officials, policy researchers, and technology practitioners.

It is the right time for UNESCAP to make a strong initiative on SIS approach by identifying the best benchmarking policies and diffusing them to member countries. Countries in the region also have to allocate their budgets to collaborative projects to develop and implement SIS-oriented SME policies in the region.

REFERENCES

Bengt-Ake Lundvall, eds., *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning,* Pinter Publishers, 1992.

OECD, *Reviews of National Science and Technology Policy: Republic of Korea,* 1996.

Richard R. Nelson, eds., *National Innovation Systems: A Comparative Analysis*, Oxford University Press, 1993.

Saxenian, A., *Regional Advantage: Culture and Competition in Silicon Valley and Route 128,* Harvard University Press, 1994.

_______, "Comment on Kenney and Von Burg, 'Technology, Entrepreneurship and Path Dependence: Industrial Clustering in Silicon Valley and Route 128'", *Industrial and Corporate Change,* Vol. 8, No. 1, 1999.

Raphalel Kaplinksy and Jeff Readman, "*Integrating SMEs in Global Value Chains: Towards Partnership for Development*", *UNIDO, 2001*

John Humphrey & Hubert Schmitz, *Principles for Promoting Clusters and Networks of SMEs*, UNIDO, 1995

Kai Bethke, *Involvement of SMEs in the Global Compact*, UNIDO, 2003.

UNIDO, *Industrial Development Report 2005*

Porter, M. (1998), "*Clusters and the New Economics of Competition*", Harvard Business Review, November-December, 77-90.

Yim, Deok Soon, "*The Organizational Format of Technological Research Institutes for Innovation Promotion: Korean Experience,*" Congress ABIPTI 2002, The Brazilian Association of the Technological Research Institutions, Curitiba, Brazil, May, 2002.

Chung, Sunyang, Yim, Deok Soon et al., *The role of Government-Sponsored Research Institute and Way to Improve the Operation of Research Council,* PACST, 2001.

Kim, Young Sil, Yim, Deok Soon, and Jang, Seung-kwon, *Knowledge Management: Theory and Practice,* Samsung Economic Research Institute, 1998.

Lee, Chul Won, "*The Management Direction of Government-Sponsored Research Institute in Korea,*" STEPI Forum, 2001.

Lee, Kong-Rae, et al., *A Study on the Korean National Innovation System,* STEPI, 1998.

Yim, Deok S and et al., *The Master Plan for Daedeok Special R&D Zone,* Daejeon Metropolitan City, 2005.

Yim Deok S, Kim Wang D., Yu Jung H., "*The Evaluation of Daedeok Science Town and its Implication for the National Innovation Policy – in the Perspective of Innovation Cluster,*" PICMET 2004 Symposium, Seoul, Republic of Korea, July 2004.

PART TWO

BACKGROUND PAPER (II)

STUDY ON STRATEGY FOR ENHANCING COMPETITIVENESS OF SMES BASED ON TECHNOLOGY CAPACITY-BUILDING

BY

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I. INTRODUCTION

A. Objective and scope

National Innovation Systems and Subnational Innovation Systems (NIS/SIS) are being increasingly recognized as important policy mechanisms for local and overall national economic growth, and several approaches are being evolved to support technology-driven innovations through technological capacity-building at the enterprise level. SMEs are making significant contributions to development of local economies, and have to be competitive and co-exist with large companies and transnational corporations (TNCs) in globalizing and liberalizing economies. Therefore, there is a close relationship between NIS & SIS and technological capability-building of SMEs for strengthening their competitiveness and revitalization. However, the innovation and technological capabilities, as well as the objectives and development or competitiveness of SMEs widely vary in the Asian and Pacific region. Even the definitions of SMEs vary from country to country.

With the above in view, UNESCAP initiated a project on "Subnational Innovation Systems and Technology Capacity-Building Policies to Enhance Competitiveness of SMEs". This project aims to help member countries in developing their SIS policies including technological capability-building strategies for development of SMEs. The project is thus intended to help them in making a swift transition into innovation-led sustainable economic growth responding effectively to increased global competition and rapid technological changes.

UNESCAP engaged two consultants for carrying out the above study, since the subject is so wide and complex. It was decided, based on a series of discussions and consultations among UNESCAP and two consultants that there could be two reports relating to: (1) Subnational innovation systems policy to enhance local SMEs competitiveness; and (2) Strategy for enhancing competitiveness of SMEs based on technology capacity-building.

The two reports then can be synthesized at UNESCAP to prepare a single comprehensive report. This report relates to technology capacity-building strategies to enhance competitiveness of SMEs in the UNESCAP region. It is essentially based on the premise that technology capacity-building is a complex and multidimensional process and the technology strategies need to be woven into the corporate or enterprise strategies for growth and development, and also be coordinated or be in synchronization with other developmental and regulatory policies. Technology policies and strategies should not be evolved in isolation for effective benefits to the enterprises or the society at large.

B. Methodology

The methodology adopted for carrying out the study and preparation of the report included in the following:

(i) Desk study involving literature survey from electronic and physical media.

(ii) Discussions with various groups representing policymakers, R&D and innovation experts, industrial associations, enterprises, consultants, academics, etc.

(iii) Inception meeting held at UNESCAP, Bangkok, on 21 September 2005 to discuss overall strategies for the successful implementation of the project.

(iv) The fact-finding mission to Thailand, Singapore, Malaysia, and Indonesia, during 20 to 30 September 2005 through which a lot of information and data were collected. More importantly, their perceptions and views about the subject were available, which may not be possible otherwise.

(v) The e-Discussion Forum piloted by UNESCAP and Science and Technology Policy Institute in the Republic of Korea, where the two consultants were moderators, during the period of 7 to 29 November 2005.

(vi) Compilation and analysis of information and data gathered as above and preparation of the draft report.

(vii) A questionnaire was also prepared by UNESCAP, with inputs from the two consultants, to collect data and information from select member countries.

(viii) The draft report was discussed in the Regional Consultative Meeting held by UNESCAP and hosted by STEPI during 18 to 20 January 2006 in Seoul, the Republic of Korea. This is the revised report taking into account the discussions and recommendations of the Regional Meeting.

C. Structure of the report

The present report is structured as follows:

- Introduction
- Review of policies and measures in various countries
- Globalization, technology and competition
- Policies and measures in selected countries in ESCAP region
- Key issues and best practices
- Strategies, recommendations and conclusions

The above structure of the report has been adopted based on the discussions among the UNESCAP mission team members and with a view to have a wider coverage of the issues and to avoid overlapping of contents in the reports. It is hoped that the report would be useful to the policymakers, SMEs and others directly or indirectly connected with the subject. The views in this report are those of the consultant and not of the organization he belongs to.

II. POLICIES, INCENTIVES AND MECHANISMS: A REVIEW

A. Preamble

A large number of researches and studies have been made at the international, regional and national levels in various developed and developing economies as well as by international organizations, related to the policies, incentives and institutional mechanisms for the promotion and development of SMEs. These studies have also identified issues and concerns of SMEs in various economies, and also suggested policy measures to improve their sustainability and competitiveness in the globalizing world. However, there is very limited literature dealing with technological capacity-building of SMEs for enhancing their competitiveness.

SMEs seem to be deeply affected and are being generally marginalized in increasingly competitive global marketplace under the emerging world trade rules and knowledge economy though they continue to be significant in local and national economic development, providing employment, and dispersal of growth. In fact, it appears that SMEs received much more attention in terms of policies and incentives during and after the financial crisis in some of the East Asian countries, and the economies started recovering from the crises through revitalization. A brief review is presented in this Chapter of the policies, incentives and mechanisms for the promotion and growth of SMEs in various countries and international initiatives, with special reference to technological capacity-building to enhance their competitiveness. It may be mentioned here that the definitions of SMEs vary from country to country and a direct comparison may not be fare. Therefore, the findings are often of generic nature, which need to be appropriately modified as per national or regional requirements.

B. Organization for Economic Cooperation and Development

In the Organization for Economic Co-operation and Development (OECD) countries(1, 2), SMEs generally represent over 95 per cent of enterprises and generate over half of private sector employment. Most of OECD countries promote entrepreneurship and develop SMEs with a myriad of policies and programmes. In the United Kingdom, difficulties related to financing, technology and innovation, e-commerce, management and internationalization are being addressed through SMEs policy measures. In the Republic of Korea, policy measures for SME promotion include tax breaks and reduced interest loans, and the total SME-related funding from the public sector in 1996 was estimated at 1.5 trillion won. (2)

Istanbul Ministerial Declaration, June 2004 (3)

Several recommendations have been made and actions taken by OECD for promoting various levels of SMEs including innovative SMEs, in various economies, including disadvantaged groups and women entrepreneurs. It has emphasized on promoting cooperation and linkages, and exchange of experiences among the economies at different development stages, besides strengthening capabilities and evaluating policy measures and incentives for SMEs. One of the initiatives relates to setting up of International Network for SMEs (INSME) which was officially established in 2004 in Italy. Improving transnational cooperation and public-private partnership in the field of innovation and technology transfer to SMEs, is an objective of INSME(4). OECD Centre for Entrepreneurship, SMEs and Local Development promotes small enterprises for local and regional development.

The Declaration reaffirmed the need to support the development of the best set of public policies that could foster the creation and rapid growth of innovative SMEs. This requires laws and systems of governance, among others, that support the development and diffusion of new technologies in ways that enable and encourage SMEs to take full advantage of them, notably by strengthening the science-innovation interface; ensuring that intellectual property right systems be coherent, easy to understand and used effectively, and promoting access to and use of quality information and communication infrastructure. Policies and an institutional framework that contribute to a conducive environment for promoting entrepreneurship, SME assistance and development, and policies that contribute to mobilizing human resources to promote entrepreneurship, etc. are some of the suggested action points in the Declaration.

SME policies should aim at reducing barriers to SME access to global markets. The need to improve access to financing for SMEs on reasonable terms, including structured risk capital at all stages of development; increasing managerial and technical expertise of intermediaries; developing a strong evaluation culture in government ministries and agencies responsible for SME policies and programmes; and strengthening the factual and analytical basis for policy-making so that policymakers are able to make decisions in an informed manner based on empirical evidences are some of the identified actions. Regional Emerging Markets Technology Transfer Network (REMTECH), initiated by Turkey, may be supported with the goal of developing technology transfers among clusters of specialized innovative SMEs at the global and subregional levels. OECD is committed to assessing the effects of globalization on SMEs, specially access to financing and support for innovation, among other issues. Recommended OECD action plan included:

- Enabling a better understanding of international value chains and the role for SMEs,
- Identify ways to remove unnecessary barriers to SMEs access to international markets,
- Best practices for the evaluation of SME policies and programmes,
- Financing SMEs at all stages of development, with emphasis on innovative SMEs,
- Development of women entrepreneurship and disadvantaged groups.

OECD Business Symposium, June 2004 (5)

The recommendations of the Symposium included:

- Specific financial and other incentives should be applied to encourage enterprises to invest in training,
- Knowledge-based technology SMEs should be encouraged for e-businesses,
- Regional clustering and networking, incubation, intellectual property development and knowledge transfer, creation of new start-ups, e-applications, and innovation capacity be encouraged, in the context of regional innovation systems,
- A global Trust Centre and valuation standards for knowledge capital be established.

The United States

In the United States, small businesses benefited from a grant/fund of about US$ 2 billion in 2003 and procurement policy favours small businesses. SMEs are defined as those having 500 employees in manufacturing, and sales of US$ 5 million for non-manufacturing. The SMEs constitute 96 per cent of total business establishments and represented 69 per cent of total employment. In 1994, the SMEs value-added accounted for about half of GDP and generated half of the national total sales, and contributed a third of the merchandise on exports. Problems encountered by the SMEs included lack of export financing; limited R&D investment; increase in raw material prices; and lack of knowledge on foreign markets.

The Small Business Administration (SBA) is responsible for SMEs promotion in the United States and is implementing programmes such as those related to technical assistance, financing, training, market information etc. Special export assistance programmes including training, have been mounted. The vision of SBA revolves around customer-driven outreach and quality-focused management.

The Best Practice Programme includes Small Business Institute; Service Corporations of Retired Executives Association; Small Business Innovation Research; Small Business Development Centre; and Small Business Investment Companies. The government welcomes FDI and maintains very limited restrictions, mainly related to national security, on such investments. Tax and non-tax incentives vary among states. [5, 38]

An analysis of SMEs in the United States regarding their training and development needs has indicated that 55 per cent of the reporting companies had a shortage of skilled workers and 64 per cent of manufacturers believed entry level workers lacked the necessary skills to positively impact their companies. Employees need training in a variety of areas and the most useful training methods relate to on the job training followed by conferences and training manuals. Accounting, finance and marketing were some of the identified areas for training. [7]

Canada [8]

According to a recent report of 2004, Canada's future prosperity is linked to the ability of the next generation of SMEs to grow faster and be more productive. Canada's entrepreneurs need to think about productivity and profitability, as in the United States, for competitiveness. They need to invest in physical and human capital, be more proactive in adapting to new technologies, and to think beyond borders. Canada's small business sector is responsible for nearly half of Canada's economic activity, and comprises lion's share in total employer business establishments at a whopping 99.7 per cent. Furthermore, 65 per cent of 10 million private sector employees are on SME payrolls and added roughly 43 per cent to Canada's private sector GDP in 2000. SMEs are identified as firms with fewer than 500 employees, small firms with less than 100, and medium firms with 100-500.

Demographics, educated entrepreneurs and education, female labour force participation, and a more simulative regulatory environment are to be the drivers of growth for SMEs in Canada. A variety of initiatives, including new grants, low interest loans, tax refunds and insurance deducts, tax credits for scientific research, experimental developments and other R&D activities, are offered. In addition, there are a number of government organizations to help SMEs, including the Canadian Business Service Centres, the Business Development Bank of Canada (which is offering consulting services, with special emphasis on knowledge consulting services, and knowledge/export-based industries), and the Canadian Small Business Financing Programme.

R&D spending – The large majority of firms allocate no money at all for R&D. SMEs also score lower than larger firms in training, collaboration, copyright and patents. Investment has focused on productive capacity – machinery, equipment, software. Export-oriented SMEs are less equipped and financially unable to handle the multitude of new requirements compared to large firms, and are less likely to absorb the higher costs. One of challenges facing SMEs is slower growth in supply of labour. The strategy for growth-oriented firms should be that business, labour, governments and financial institutions all need to work more closely together to encourage faster growth in output and productivity at SMEs. This will come through a greater focus upon research and development, export markets, and investment in productive capital, to encourage growth-oriented firms.

C. European Union

UNECE: Entrepreneurship and SME development [9, 40]

The European Union has strongly acknowledged the value for entrepreneurship in terms of raising its global competitiveness, job creation and economic growth, social cohesion and environment, and other social and societal goods.

The above vision is being infused in the newly adopted the Central European Initiative (CEI) countries. For example, Slovenia has taken several measures to strengthen the capabilities and competitiveness of SMEs through improvement of skills, technology development in collaboration through such mechanisms as technology parks, spin-off incubators, SMEs networking and clustering, and by encouraging collaboration of SMEs with large companies. Over 90 EU programmes and funds are available to private sector, particularly for SMEs since the participation of SMEs in joint R&D efforts, and European networks of excellence etc, may be important. However, there is a need to develop an institutional framework to support knowledge transfer and facilitate innovation for SMEs, among other factors, while paying attention to role of higher educational institutions, and linking clusters to concepts of innovation. Consulting services to SMEs, promotion of entrepreneurship, and interregional cooperation are other areas for paying a keen attention for the new member countries of the European Union.

SMEs in the United Kingdom

A small company is defined on the basis that at least any two criterion of the following are satisfied:

- A turnover of not more than £2.8 million
- A balance sheet total of not more than £1.4 million
- Not more than 50 employees

A medium company satisfies & any of the following two criteria:

- Turnover not more than £ 11.2 million
- Balance sheet total of not more than £ 5.6 million
- Not more than 250 employees

In 2001, 99 per cent of 3.9 million businesses in the United Kingdom were either sole proprietor/partnership or had fewer than 50 employees. The SMEs in industry sector as a whole provides 37 per cent of all employment. SMEs accounted for more than half of the business turnover and more than half of the employment. In order to promote R&D and technological capabilities of SMEs, cooperative and collective R&D programmes among academy, industry and research institutes need to be implemented in order to induce more SMEs and Associations, in which they could retain the ownership of the results. Further, government departments are required to spend 15 per cent of their R&D funds for SMEs technology capacity-building. Clearly research-oriented SMEs could be involved in targeted research projects and possibly in integrated projects. Similarly the Procurement of Innovative Technologies and Research Bill, enacted based on existing legislation in the United States, is in pipeline.

A grant of £ 2.3 billion of cash is available for small firms under its Sixth Framework Programme (2002-06) [10, 11]. The European Union has taken a number of programmes to strengthen technological capabilities and competitiveness of SMEs through providing funds for cooperation with other countries including Asia, especially in ICT and other technology intensive areas. EU is inviting foreign specialists and entrepreneurs to work and set up enterprises in the United Kingdom and other countries. Networking of SMEs with academics and R&D institutes abroad is encouraged.

One of the initiatives of EU relates to their EDECAD project being implemented by the University of Central England at Birmingham in partnership with academic institutions including the Indian Institute of Foreign Trade (IIFT) in India, Dalian Maritime University in China and Espon Foundation in Spain. Under this Project extensive studies have been carried out related to technology financing of SMEs including Foreign Direct Investment (FDI), knowledge management in SMEs and e-status and needs of SMEs. The studies by IIFT have indicated that there are no formal knowledge management systems in SMEs in India or other developing countries, though informal systems are followed in some SMEs. Also, there are no data or studies available regarding role of FDI in SMEs in developing countries though United Nations Conference for Technology and Development (UNCTAD) report and some other studies are available. Most of the SMEs do not have internet facilities or their own websites, although export-oriented SMEs do have better facilities and awareness about e-technologies than domestic SMEs. E-infrastructural facilities are reported to have a positive impact on the operational efficiencies and competitiveness of SMEs.[10]

Central European Initiative (CEI) [13]

CEI is an activity of United Nations Economic Commission for Europe (UNECE) and its projects and activities are as follows:

- Development of CEI SME Internet Portal, Bulgaria – for connecting and promoting existing web resources.

- Promoting investments in innovative SMEs and exchange of best practices among CEI countries in the field of availability and access to finance. Croatia is the project leader.

- Incorporation of subsidized advisory services in the extension of CEI Business Advisory Service Programme (BAS). The objective is to assist the growth and competitiveness of SMEs by providing financially supporting business advice and consulting activities while developing and strengthening the skills and quality of local consultants.

CEI Clusters – Slovenia

The basic objective is to collect data on existing clusters and promote networking to facilitate information exchanges among them in various countries. Italian experience indicates that it is very difficult to promote the development of clusters as in Italy. It was not the result of a political decision but of a special historical and economic environment. Italian clusters are presently facing problems linked to the globalization as it has changed the economic factors. Cluster models or policies to improve clusters may be different from country to country.

D. China [12]

Enterprises with annual turnover and total capital with more than RMB 50 million are categorized as medium-sized firms, and those with lower turnover and total capital are called small firms. SMEs account for 99 per cent of all enterprises in China. The eight million SMEs in the country represent 60 per cent of the total value of all enterprises and are responsible for 75 per cent of urban employment and 76 per cent of industrial value-added outputs. SMEs account for 60 per cent of exports. SMEs are often credited as agents of innovation and economic development.

China has taken several initiatives to promote SMEs and strengthen their technological capabilities. These include technology incubators, clusters, soft loans and financial incentives, promoting FDI liberally, encouraging Chinese to return from abroad to set up enterprises, encouraging technology acquisition and training abroad, technology exchanges, R&D incentives, technical consultancy services and so on. Transfer of technologies from local institutions and abroad are encouraged. Special industrial or economic zones with several incentives encouraged large companies and foreign companies to develop SMEs or link with SMEs. However, SMEs also continue to face the problems such as access to finance, marketing, etc. There is increased emphasis on IPR and to promote outward looking or export-oriented SMEs.

Setting up an effective incubation system for SMEs is one of the outstanding public services, facilitating the development of technology-based SMEs in China. Currently there are about 500 technology business incubators (TBIs) in China, with 31,385 tenant enterprises of which 9,565 enterprises have graduated. The total seed funds exceed RMB 3 billion. These TBIs are meeting many needs of technology start-up companies. Further, due to the diversification on regional economic and social development levels, it is necessary for technology-based SMEs to select TBIs carefully.[14]

E. Asia-Pacific Economic Cooperation

APEC was established in 1989 and it has membership of 18 countries. APEC has taken several SME related initiatives such as establishing the Asia Pacific Business Network (APBNET), a training centre and technology centre, promoting cooperation of SMEs in post harvest sector of fisheries industries, business volunteers, trade financing, and FDI.

There are over 10 million non-agricultural SMEs in the APEC economies, and well over a million non-agricultural SMEs in the Asian region alone, of which 75 per cent are domestic. There are about 250,000 SMEs that are internationally active and less than 50,000 SMEs which have activities across borders. SME research network; trial common electronic protocols for APEC documents; common reference, registration system for documents and publications; identification of key indicators for SMEs activity; SME information package, best practices, APEC Business Angels programme; etc. are some of the agenda action items. Other issues to be addressed are providing a forum to policymakers and bureaucrats to exchange views and knowledge, providing a coordinated independent regional viewpoint, identifying the impediments to the progress of open regionalism, etc.

SMEs have been recognized as a priority item since 1993 Leaders' meeting in Seattle. SMEs make up about 99 per cent of enterprises, and contribute between 30 to 60 per cent to GDP. They employ between 40 per cent and 80 per cent of workforce. In Asia, SMEs contribute as much as 35 per cent of direct exports, the weighted contribution of SME exports to GDP is about 12 per cent, almost double the contribution in OECD economies.(15)

There are many issues facing SMEs in the region; technology transfer, human resource development, finance, regulatory red tape, access to markets, etc. The SMEs are broadly categorized as:

- Those SMEs which are internationally competitive or able to become internationally competitive; 25 per cent in China, the United States, Canada, Australia, and Singapore.
- Those SMEs less likely to be able to adapt and thus at risk; 20 to 30 per cent in Japan.
- Those SMEs which are insulated from the effects of globalization 40 to 50 per cent.
- Technological and regulatory changes are reducing both the natural and artificial barriers that protect them in many developing or least developed economies.

The main challenges to policymakers are to ensure that international SMEs remain competitive; SMEs at risk are assisted to become internationally competitive and active; and they resist pressure from insulated SMEs for protection.

OECD and APEC have identified four broad areas where governments have the potential to assist domestic SMEs to become more competitive.

(i) Low growth domestic SMEs
   - Access to information and markets
   - Finance
   - Business environment
   - Capability and HRD

(ii) Entrepreneurial fast growth SMEs

- Access to markets
- Registration and legal incorporation
- Identification of partners
- Protection of IP
- Skills for management and staff
- Start-up assistance
- Exit and bankruptcy arrangements
- Cultural awareness and support for entrepreneurship
- Credit guarantee, start-up, venture, and mezzanine capital
- Telecommunications

(iii) Internationalized subcontracting or supply industry SMEs

- EDI standardization
- Quality improvement and accreditation
- Technology transfer
- HRD and skilled local staff
- Competition policy and contractual relations
- Access to foreign contractor firms
- FDI
- Data bases for matching SMEs and contractors
- Intrafirm trade and taxation
- Industrial planning

(iv) Trading SMEs

- Access to markets
- Simplified standardized customs procedures
- HRD
- Swift resolution of disputes
- Trade finance and credit guarantee
- Trade facilitators
- Export promotion and assistance

Best practices [16]

SME development has been included as part of the economic development plans and most economies adopted some specific policies and implementation measures relevant to SMEs. These include finance, taxation, market promotion, R&D, export strategies, technology transfer, etc. Most economies have financial assistance policies for export loans, financial instruments, reinsurance, and lending instruments. For instance, Taiwan Province of China has established a comprehensive assistance system encompassing financing, management, production technology, R&D information management, industrial safety, pollution prevention, market guidance, a credit guarantee fund, specialized export-processing zones, central-satellite plants, an SME development company and an SME development fund.

Most economies have designed a number of private agencies or organizations to improve and support the government policies. These organizations provide various services to SMEs which include consulting, market or technology information, training courses, etc.

Removal of tariff and non-tariff barriers is favoured by several countries, specially advanced countries such as Hong Kong, China, Singapore, Canada, etc. HRD, technology transfer and business networking are the three main topics of experience exchange conferences. Other cooperative activities include harmonizing standard system, apprentice and study visit programme, designing an institutional mechanism, and expertise exchange & joint venture in support industries. Establishing a regional R&D organization within APEC region is another suggestion for APEC.

Overall suggestions

Based on a survey, following suggestions were made: There is a need to make more efforts for data collection in areas of trade, investment, finance, and R&D activities; Difficulties encountered by SMEs are different from economy to economy, so are the assistance policies and implementation measures for SMEs. There is a need to enhance the SME policy dialogue among APEC members.

F. Association for South-East Asian Nations

ASEAN has evolved a policy blueprint for SME development (APBSD) for the period 2004-2014.(17) APBSD 2004-2014 was approved by ASEAN Economic Ministers at the Thirty-Sixth Meeting in September 2004 in Indonesia. The objectives of this blueprint included: enhancement of competitiveness and dynamism of ASEAN SMEs by facilitating their access to information, market, human resource development and skills, finance as well as technology.

Focus programmes and activities

(i) Human resource development and capacity-building

- Entrepreneurship development programme
- Enhancing SME-sector skills in management and organization on a self-reliant basis
- Fostering SME capabilities for inter-firm networking and linkages
- Tracing and benchmarking SMEs capabilities, dynamism and competitiveness

(ii) Enhancing SME marketing capabilities

(iii) Access to financing

(iv) Access to technology

- SME technology upgrading and transfers of innovative technologies

(v) Creating conducive policy environment

- Simplification, streamlining and rationalization of procedures and support services
- Fine tune policy and regulatory framework for SME development
- Promotion of public-private synergies and partnership for SME development and integration.

Policy blueprint for SMEs for the ASEAN Development Decade 2002-2012 aims at accelerating the pace of SME development, and elevating SME's cooperation and integration efforts in the region. Entrepreneurship culture, innovation, networking, capacity-building, benchmarking of capabilities and competitiveness of SMEs, improving access to e-commerce and finance, enhancing policy environment and partnerships etc. are some of the identified actions. ASEAN has carried out a number of activities during 2002-2003, such as promoting joint ventures between large firms and SMEs, training programmes etc. Matters relating to intellectual property have to be the fore, both in form and substance, ASEAN IPR road maps and identity, and creating awareness. The expert group on patents is exploring the possibilities of establishing an ASEAN design system. ASEAN-EC and WIPO cooperation has helped in training etc. in IPR for SMEs. ASEAN Intellectual Property Association has also helped in IPR education.(18)

G. Other countries

Latin America has now realized that SMEs are the true job creators, as well as important players in technology supply chain. The vast majority (80 to 90 per cent) of companies are microenterprises.(2) It has been recognized that some of the best performing economies, notably Taiwan Province of China and Hong Kong, China, are very heavily biased on small enterprises. 81 per cent of all employment in Japan is in SMEs where the average enterprise employs nine staff as opposed to four in EU. In South Africa, the share of employment is located in the micro- enterprises and SME sector is at 60 per cent while the sector generated about 40 per cent of output in 1999.

As a whole, in developing world, the private economy is almost entirely comprised of SMEs and they are the only realistic employment opportunity for millions of poor people throughout the world. SMEs in developing countries mostly remain in traditional sectors generally with low level of productivity, poor quality products, serving small localized markets. There is little or no technological dynamism in this group, and a 'few' graduate into large size or modern technologies. (2)

H. United Nations Conference for Technology and Development (19)

UNCTAD has been studying and preparing a number of studies related to various aspects of development of SMEs including policy options for strengthening SMEs competitiveness. The export competitiveness of firms depends on ability to sustain or expand their position in international markets – directly or indirectly by supplying quality products on time and at the competitive prices. This requires flexibility to respond quickly to changes and skills to successfully manage product differentiation by building up innovative capacity and effective marketing channels. SMEs contribute over 55 per cent of GDP and over 65 per cent of total employment in high income counties, and most of employment and income generating opportunities in developing countries. For example, SMEs contribute a substantial share of the East Asian manufactured exports (56 per cent in Taiwan Province of China, over 40 per cent in China and the Republic of Korea, more than 31 per cent in India) while their role is marginal in least developing countries (LDCs), especially in Africa.

Competitiveness is embodied in:

- The current efficiency and effectiveness of use of resources;
- The willingness and the ability to relate profitability to growth of capacity through continued investment; and
- The ability to innovate in technology and organization and thus improve efficiency and effectiveness of production.

A firm benefits from externalities derived from the existence of technological capability and export competitiveness at national level. National technological capability is more than a sum of capabilities of individual firms in a country. It is an innovation system which includes the externalities and synergy generated by the learning process, and the knowledge and skills residing in related institutions.

The UNCTAD study discusses various aspects of linkages and spillovers of transnational corporations (TNCs) to SMEs in host countries, and the role of inward and outward FDI to enhance export competitiveness of SMEs. Clustering and networking may facilitate SMEs ability to access external markets. The Republic of Korea and Taiwan Province of China are the examples of internationalization of SMEs. These linkages could facilitate access to international markets, finance, technology and managerial skills. At the same time, strong linkages with local SMEs can also enhance the corporate image of TNCs.

Business linkages may happen to be more feasible in some high-technology industries than in other sectors; automotive and electronics are the examples. The study has made several recommendations for the governments, private sector and international community. Technology capability-building and technology transfer facilitation for SMEs, and conducive relevant policies are centric, among other issues, for enhancing export competitiveness of SMEs. These may include training facilities, technology upgrading centres, research and testing laboratories, scientific hubs, investment funds, start-ups, incubators, and so on. Independent specialized SMEs, SMEs that link up with TNCs or large domestic exporting firms and SMEs that are part of clusters and networks are better equipped and competitive in exports.

I. World Intellectual Property Organization[20]

WIPO is focusing, as one of its activities, on the intellectual property needs of SMEs since there is need to promote use of the IP system to improve their competitiveness. SMEs in Asia and the Pacific constitute over 95 per cent of the total number of enterprises employing between 40 to 80 per cent of the workforce, contribution to national GDP vary between 30 to 60 per cent and accounting for about 35 per cent of direct exports. Use of IP system by SMEs worldwide is largely limited to the use of patent system and only minority of European SMEs file patent applications. According to a survey, patents are not considered relevant to the line of business of the company, and patent system is too costly and complex.

In the Republic of Korea, it is estimated that 25.3 per cent of applications for IP rights are from SMEs. The use of IP system by SMEs is generally highly related to their level of innovative and technological capacity. SMEs in the European Union are divided into three broad groups: (1) technology developers (1~3 per cent); (2) leading technology users (10~15 per cent); and (3) technology followers (80~85 per cent)

The use and awareness of IP system depends upon the level of SMEs as above. WIPO's strategies focus on:

- Targeting a new audience through building IP component in innovation promotion programmes, for SMEs and training programmes, etc.
- Creating simple SME friendly material on IP
- Focusing on new areas
- Establishing new partnerships
- Strengthening outreach activities of IP offices.

WIPO has developed an SME website for information and education of SMEs on IP related issues including best practices and case studies. An IP survey of the SMEs indicated that the desired action areas included: need for awareness raising and training programmes, technological information services, financial assistance, customized advisory services on IP, assistance for technology transfer, and partnership between institutions. Areas of discussion for further cooperation were: national plan of action, research studies on IP and SMEs, development of sector specific packages, cooperation with regional institutions such as Asian Development Bank (ADB), UNESCAP, UNIDO, UNDP and World Bank; strengthening university – industry links through technology incubators and university spin-offs and collection of best practices.

J. International Organization for Knowledge Economy and Enterprise Development [21, 39]

IKED is an independent, non-profit association and international organization focusing on the emerging issues of the knowledge-based economy in Sweden. One of their studies relates to strengthening innovation and technology policies for SME Development in Turkey. SMEs form the backbone of the private sector – representing the largest percentage of companies and employment in Turkey. However, despite this, unfavourable framework conditions prevent SMEs from developing sufficiently. Official start-up rates of new businesses are very low. Inadequate access to finance for entrepreneurial companies and weak international profile among SMEs are identified as two of the main obstacles.

Key challenges to innovation and SMEs development include:

- Improving innovation policy governance
- Improving national ICT infrastructure
- Developing local and regional plans for innovation
- Facilitating FDI and strengthening absorptive capacity of the domestic economy from spill over effects
- Encouraging cross border knowledge flows.

Entrepreneurship training/education programmes, public awareness on importance of innovation, growing regional clusters, and international linkages are some of the areas for action.

K. Asian and Pacific Centre for Transfer of Technology [22]

APCTT has been set up by UNESCAP at New Delhi for which host facilities are being provided by the Government of India since 1987. The Centre emphasizes promotion of environmentally sound technologies especially for SMEs. The technology transfer services to SMEs include information on technology, matching and pre-selection of business partners, support services including technology valuation and contract negotiation, finance syndication and product marketing etc. It has developed partnerships with intermediaries offering complimentary technology transfer services, international networks of technology brokers, technology transfer data bank, technology transfer periodical and organizing business meetings, workshops and training programmes. The total value of technology transfer contracts among SMEs facilitated by APCTT in 1996 was more than US$ 60 million. The Technology Bureau for Small Enterprises (TBSE) has been set up at APCTT in collaboration with Small Industries Bank of India.

L. Other studies

Knowledge integration and network expertise in SMEs

This study relates to surveys carried out for SMEs in OECD countries and European Union to assess the status of innovations in SMEs, government measures and policies, utilization and effectiveness of incentives on R&D and innovation, competitiveness etc. and to suggest measures to promote knowledge integration, technological capacities, etc.[19, 23]

The Inno-barometer 2004 shows that the usage of support measures by innovative SMEs in the European Union is very limited. Only 15 per cent of SMEs received public assistance or subsidy for R&D, Spain leading with 27 per cent followed by the Netherlands with 26 per cent. Collaborative R&D intake in the European Union is only 7 per cent. Only 25 per cent of manufacturing SMEs are internationally competitive. SMEs have to innovate and to integrate technology, market and customer knowledge on a global scale in order to stay competitive. Technology transfer, inter-company contacts, clusters, cooperation, and mobility of human resources are the areas in the 2004 report of European charter for SMEs. Knowledge management activities are embedded in product innovation processes. The aim is to develop ideas for new products from inception to commercialization. Knowledge management and knowledge industries stimulate product innovation.

Innovation policy and transfer of technology [23]

This study makes a comparison of the evolution in technology transfer policy in Japan and some European countries having an important role in the global marketing economy, with special reference to innovative SMEs. The study makes a comparison and data analysis for innovation policy frameworks, incentives, national R&D expenditure, and the outputs from these investments, especially in the form of innovative firms in different countries, including start-ups.

Innovative firms and incubators

One of the key results of research is the creation of start-ups innovation firms, based on the transfer of technology. Incubators for start-ups innovative firms in the United States, France, Germany and the United Kingdom are classified into four groups:

- Local economic development incubators
- Academic and scientific incubators
- Corporate incubators
- Private investors incubators

In France, innovative companies can benefit from direct investment from individuals and also from investment funds in innovation, dedicated to SMEs. In total 1,042 enterprises are qualified as of July 2003. Tax deduction for investment of companies in R&D was expanded. For innovative companies, a legal status of simplified joint stock company was proposed for more flexibility and freedom from regulations, besides several other incentives. The universities and national research agencies and/or institutes were innovative companies. In 2003, an Innovation Plan was launched aimed at increasing the private sector share of investment in R&D and to improve the exploitation of public research results.

Business angel

There are about 300~400 business angles in France, a tenth of what it is in the United Kingdom, with an average annual investment of 70,000 euro. Young high technology SMEs, less than eight years old, with heavy R&D expenditure during early years are supported.

Intellectual cluster

In Japan, several new initiatives have been taken in recent years to promote innovations, R&D, commercialization and transfer of technologies, besides setting up of the Council for S&T Policy (CSTP) and Technology Licensing Office (TLO) and other institutional mechanisms. In total presently there are 23 incubating facilities on the premises of national universities. "Intellectual clusters" were conceptualized in the second S&T Plan (2001) to use the regional R&D resources to upgrade and vary S&T in the country as well as to revitalize the Japanese economy through regional technical innovation and creation of new industries.

An intellectual cluster is a regional system of technological innovations in which a public research organization uses its R&D potential and other unique abilities to lead companies in and around a peculiar region. Another concept of the 'City Area" Programme was launched for supporting cooperation for innovative technology for industrial companies. Industrial clusters are also promoted to support SMEs, universities, etc. Their main participants are 5,000 SMEs and 200 universities, besides others. There are more and more joint actions between intellectual clusters and industrial clusters. Special policy measures have been framed to encourage start-ups (1,000) deriving from universities and for acceleration of creating new businesses. As a result of these new initiatives, the start-ups have increased from 104 in 1998 to 600 in 2003. About 20 per cent of start-ups plan to offer their stocks on the market.

The study indicated that France and Japan are moving in the same direction to improve their innovation policy and technology transfer, particularly for innovative start-ups.

Strategic alliances for SMEs [24]

SMEs in technology industry are characterized by their capabilities in proprietary technologies and talented human resources. Since management resources are limited in SMEs, strategic alliances are one of the effective ways in which they can make up for these limitations by effectively utilizing resources owned by large companies. These alliances could be in areas of manufacturing, technology licensing, joint development and equity investment.

Another study on the strategic requirements for advanced manufacturing technologies (AMT) in SMEs in Malaysia showed that the companies were more concerned with short term gains, rather than the strategic benefits offered by AMTs. The lack of organic structure, the lack of understanding of technologies, inadequate levels of skilled-workers and engineers and culture of industries are the factors that hinder SMEs from achieving the strategic benefits of AMT and adopting innovative management practices.[25] The government agencies and academic institutions also have to re-assess their policy and support systems for SMEs.

M. Learning from review

A summary of the above-mentioned literature review and lessons learnt from this review related to technology capacity-building towards enhancing competitiveness of SMEs in various economies are briefly given below.

(i) It has been widely recognized that growth and competitiveness of SMEs is crucial for national economies including employment and job creation, regional and local economic developments, reducing poverty, increasing exports etc. and technological capability-building efforts of SMEs are closely linked to overall policies, mechanisms, incentives, national and subnational innovation systems, human resources and skills, financing systems etc. Technology & innovation policies, trade and industrial policies are of particular importance for development and promotion of SMEs. Work culture and mind-sets of policymakers, entrepreneurs, intermediaries, R&D and academic institutions etc. are also of critical importance, given the changing needs of SMEs in the era of globalization and liberalization and faster rate of technological developments as well as new world trade rules. SMEs are facing the threat of being marginalized if they do not recognize the challenges and opportunities, and policymakers and intermediaries do not review and adjust the existing policies and mechanisms as well as incentives appropriate to support the growth and competitiveness of SMEs. Entrepreneurship is critical for success. National technological capabilities and competitiveness are more than the sum of those at individual or enterprise levels.

(ii) Several international, regional and subregional agencies/groups are active in promoting and strengthening the technological capabilities for enhancing the growth and competitiveness of SMEs. A number of initiatives, support systems and institutional mechanisms have been set up. Examples include: OECD, EU, APEC, ASEAN, UNCTAD, UNIDO, UNESCAP etc. However, there appears to be considerable overlapping of activities, and the existing mechanisms need to be reviewed from a holistic point of view. SMEs do not seem to be really benefited to the extent as could be expected. Basically, it is the countries and the enterprises themselves who should take initiatives to take advantage of these facilities as per their requirements. Nevertheless, the awareness about the programmes and facilities need to be made. International agencies will continue to be playing an important role towards promotion of technological capability-building of SMEs.

(iii) There are perceptible differences in technological capabilities of SMEs in North America, Europe, Asia and Africa. SMEs in the United Nations are most advanced and innovative while SMEs in Africa and least developed economies are at very low technology level. Among EU members, SMEs in most of newly admitted members are of relatively lower technological capabilities than West Europe. SMEs in Singapore, Taiwan Province of China and the Republic of Korea, are comparatively at higher levels and more competitive than other developing countries in the Asian and Pacific region.

(iv) Basically, the policies, mechanisms and incentives for promotion of technology capability-building and innovations in SMEs are similar in nature in most of economies. These include tax concessions and grants for R&D, liberalized duty structure on imports, domestic regulations, support for commercialization and patenting as well as technology acquisition domestically, subsidies for training and expert services, modernization of plant & machinery, etc. However, there are no specific technology policies for SMEs in most countries, and there is lack of clarity and coordination among concerned ministries.

(v) The implementation systems and the available resources vary from country to country, and so the innovation and technological capabilities. The limited resources in developing countries and least developed countries are often thinly distributed over a large number of activities. As such these resources do not have desired impact on technological capability-building of SMEs, and consequently their competitiveness. Clearly there are differences in the technological capabilities and competitiveness of SMEs in various countries.

(vi) SMEs in the United States are supposed to be highly innovative and technologically leading the pack. The main future strategies seem to be related to customer-driven outreach and quality-focused management. While in Canada, the emphasis is put on productivity and profitability. SMEs in the Republic of Korea, Taiwan Province of China, and Singapore are the next in the technological competitiveness of SMEs. EU and Japan seem to be catching up and have devised a number of new programmes and incentives for encouraging R&D activities and technology innovation in SMEs. The basic objective of SMEs in those countries is considered as national development while in least developed countries, SMEs are viewed more for poverty reduction, natural resources utilization and local development. The other countries are in between.

(vii) Technological capabilities in SMEs also have a bearing on national R&D expenditures, and the contributions of private sector to R&D. There is an urgent need to review the existing policies and mechanisms for SMEs in developing countries, and evolve appropriate coordination/linkages among various agencies concerned with technology, industry, education and financial policies, etc. Capabilities of policymakers and intermediaries also need to be increased from time to time. Availability of right people at right places is the most important element for implementing SME technological competitiveness initiatives.

(viii) R&D activities are practically non-existent or R&D expenditure are low in SME in most of the developing countries or even in some of the advanced countries such as new members of EU or countries in transition. The IP and patent related activities and awareness about patent laws etc. are also at low level. WIPO has taken several initiatives to create awareness and education about IPR for SMEs. However, in some countries such as China and the United States, SMEs significantly contribute to patents and innovations.

(ix) SMEs generally do not innovate or develop technologies but often use the existing technologies with modifications and improvements. They are generally short sighted or do not have adequate resources or vision for future. Hence, SMEs often look for quick and efficient ways of technology transfer through plant & machinery, designs & drawings or purchase of know-how, or even copying. Finance and marketing seem to be their main concern.

(x) Awareness about government policies and incentives for technology development and capability-building is very limited among SMEs. Countries such as Singapore and the Republic of Korea have evolved a number of initiatives and innovative financing mechanisms which are easily accessible, affordable and efficient for SMEs. For example, one-spot facility for SMEs for their requirements, encouraging sharing of expenses for technical and consulting services of public institutions and experts, purchase of technology from abroad, training abroad, venture capital, encouragement of start-ups, etc. are some of the facilities to encourage technology capability-building.

(xi) Encouragement and support for promoting start-ups, clusters, incubators, networking and partnerships are general features to build technological capacity of SMEs. However, the objectives and models of these mechanisms vary widely. In many countries, these are looked upon merely as activities for industrial development while they are also seen to provide technological and intellectual support including linkages with R&D and academics, and encourage high technology based SMEs. In Japan, the "Intellectual Clusters" concept is evolved and there is close linkage between intellectual and industrial clusters.

(xii) Start-ups in high technology areas are encouraged in advanced or newly industrialized countries such as the United States, Republic of Korea, Singapore and China, since there are enabling policies, entrepreneurship talents and institutions of intellectual capital. Intellectual capital is encouraged to be commercialized, while in many other countries both capabilities are limited. Some of the successful start-ups grow to large companies and acquire the status of multinational corporations in advanced countries while there are very few such cases in developing countries. Networking of academics and R&D institutions with SMEs is encouraged, especially for promoting innovation and start-ups. Reorientation of courses is also needed.

(xiii) There is preference in government procurement for SMEs in some countries such as the United States and the United Kingdom and also in R&D funds, to encourage technology capability-building and innovation activities in SMEs.

(xiv) In some developed countries such as the United States, the United Kingdom, Canada and the Republic of Korea, retired executives/experts are supported to give services to SMEs.

(xv) FDI is considered as an important mechanism to promote technology transfer, skilled work forces, R&D activities and innovation, access to foreign markets, and management capabilities. There are very limited studies related to FDI in and from SMEs to SMEs. FDI is also advocated to enhance export competitiveness of SMEs.

(xvi) SMEs are categorized as high technology based sector, medium technology sector and low technology areas. Also, there are SMEs which are internationalized and some are capable of being internationalized and there are SMEs mainly catering to domestic markets. The majority of the last category of SMEs is likely to vanish in future. SMEs will have to internationalize for sustainable growth. Technology capability and innovation are almost pre requisites. World trade is moving towards technology intensive products and services. Technological and regulatory changes are reducing protection for SMEs. SMEs will have to move up in global value chain.

(xvii) Information and communication technology (ICT) is increasingly playing an important role in business operations. Increasing need of SMEs would be to link in the global supply chain (GSM) management which would necessitate greater adoption of ICT facilities by them. Many governments are encouraging and supporting SMEs in this respect. However, ICT use remains limited in SMEs in most of the countries.

(xviii) Knowledge management, knowledge integration and knowledge networking, valuation of intangibles, etc. are some of the issues being addressed for SMEs. OECD has proposed to set up a Global Trust Centre for SMEs.

(xix) Technology financing is more risky and need patience of the financing, institutions and SMEs as well. Venture capitalism, angel investors, patent stock markets/ auctioning, small business investment companies etc. are being encouraged in advanced countries

(xx) Some of the advanced countries such as the United States have set up Small Business Innovation Research Centres, for research on SMEs in the changing scenario.

(xxi) International cooperation and support in developing technology innovation systems, industrial policies initiatives, and institutional mechanisms, and also exchange of experiences, expertise and information among various levels of economies, has helped SMEs in the developing and least developed economies, while the flow of investment, goods, technologies and services is also accelerated among various groups of countries.

(xxii) Reorientation of courses in academic institutions and human resource development are needed for SMEs. Science and mathematics courses need to be encouraged at school level, and parity of R&D personnel with administrative or other professions.

Box 2.1 Issues for SMEs

Issues for development and growth of SMEs through technological capability-building would differ from country to country, and also the sectors of manufacturing and the level of technology and innovation capabilities. However, some generic issues facing most of SMEs in developing and least developing countries are in the following:

- Incoherent, unstable and ineffective policies on promotion of SMEs and lack of responsiveness on the part of policymakers.
- Limited R&D investments.
- Lack of knowledge of foreign markets, and information about world trade rules, technologies and sources of technologies, and also marketing.
- Technical assistance and training including access to national innovation system and R&D, academics and specialized institutions, clusters, technology incubators, IPR awareness, etc.
- Viable export assistance programmes, easy finance, risk sharing capital, liberalized FDI, etc.
- Human resource and entrepreneurship development.
- Awareness and complicated procedures for government policies and incentives, including loans, grants, tax concessions etc.
- Networking and partnerships and management capabilities.
- Low technology, productivity, quality, and technology dynamism.
- Lack of sustainability and sub-criticality in most of government schemes.

III. GLOBALIZATION, TECHNOLOGY, AND COMPETITIVENESS

A. Preamble

In the era of globalization and liberalization, competitiveness and technology are two main drivers, among others, for the success and growth of enterprises including SMEs. A large amount of literature is available on SMEs but studies and researches carried out at the technological perspectives for SMEs seem to be limited. We have seen in the previous chapter that some of SMEs in developed countries and in advanced developing countries have adopted strategies for promoting technology capacity-building and globalization of SMEs. For example, SMEs in the United States and the United Kingdom (1 per cent) are reported to have globalizing strategies, while the Republic of Korea and Taiwan Province of China are examples in developing countries, for encouraging globalization of SMEs. It may be noted that larger number of SMEs in developing countries adopt globalizing strategies – taking advantages of strengthening innovation and technological capabilities, besides marketing etc. as a medium for competitiveness. Least developed economies may first strengthen the production and technological capabilities in domestic markets and take advantage of the foreign collaboration arrangements and international assistance to prepare SMEs for globalization on selective basis. Such an approach would catalyse the growth of other SMEs in domestic markets and SMEs would ride the international value chain, including strengthening of linkages with TNCs. Globalization of production and services facilities by TNCs is order of the day for maximizing profits and withstanding competition due to globalization and internationalization, which have direct and indirect effect on SMEs.

B. Globalization

Globalization in its economic aspect refers to the increasing integration of economies around the world, particularly through trade and financial flows. The term sometimes also refers to the movement of people (labour) and knowledge (technology) across international borders. [26] Globalization and internationalization are frequently used interchangeably. Some studies have shown that globalization need not be limited only to large companies and TNCs but globalization and SMEs are compatible notions despite resources constraints. Global strategies may include:

- Competitive moves into international marketplace
- Value-added activities, sales, R&D and production are established in different places.
- Target countries are chosen based on anticipated gains from a world wide presence
- A standardized product and homogenous marketing mix are offered to all countries.

SMEs competencies and strategies may include global mind-set and forward looking management, proprietary technological know-how, innovativeness, marketing mix factors, partnerships & collaborations, exports etc. The possession of products with significant technological competitive advantage is considered as main advantage. The studies have also indicated that the higher the level of innovation in a sector, the greater the probability that more firms in the sector with exports, whether innovative or not, but more successful new high technology products are generally launched in overseas markets. In some countries, it is observed that 33 per cent of the innovative firms generate more turn over from the international markets than the domestic market. It is not necessary for all the resources and competencies required for globalization success to be available within the firm itself – some can be accessed or leveraged through meaningful links with network partners. Internet usage is another factor for increasing exports and competencies. 'Born global' and 'global exporting' are discussed as globalizing SMEs in the literature.[26] Value-added activities in different countries including R&D and production facilities, and acquisition of foreign market knowledge are important for achieving economy of scale and scope of products for global markets. Advances in information technology and other technological developments, plus an increasing trend towards collaborative arrangements, have made presence by SMEs in other markets more feasible than in the past.

According to Hazley[27], there are a wide range of policy initiatives currently in operational, most of them are supply side oriented and lack reference to the demand side or customer focus. These initiatives on their own cannot create competitive industries, only companies can do. One of the most persuasive phenomena is the cluster concept of economic growth and competitiveness. Fostering entrepreneurship is another factor for encouraging globalization and competitiveness of SMEs. The present trend is to go beyond solving current technical problems by stimulating firms to develop and implement a more strategic upgrade. Some of the technology development and diffusion programmes for SMEs in OECD countries are indicated in Table 2.12. Many economies assign SMEs to seek international markets and seek to help them through enhancing their human skills and technology capacity-building. Venture capital helps innovative SMEs to internationalize. Apple, Compaque, Digital Equipment Corporation, Intel, Microsoft, and Sun Microsystems are the examples. There are also examples in biotechnology, pharmacy, engineering, auto components etc. also. The United Nations and Canadian venture capital investments have tended to have a high concentration in technology, while it is not so in most of the developing countries. The study suggests that there is a strong negative relationship between barriers to entrepreneurship and venture capital investments in early stages and expansion.

United Nations Economic Cooperation for Europe [15]

UNECE approach to internationalization of SMEs is essentially based on:

"Globalization is an ongoing process that presents opportunities; as well as risks and challenges. It has expanded the prospect for technological advances and for effective integration into international economy........"

Numerous international strategies for the SMEs have been analysed and advanced in recent years by OECD countries, but there exists a notable divergence as to the importance and utilization. Several CEI countries are worried that "there will be an effect of exclusion of SMEs, which will be pushed to the margin of this process to the advantage of better financed and more internationalized giant corporation......." The role of international institutions in fostering the development of SMEs has therefore been recommended to further multilateral exchange of experience and good practices. International strategies differentiate between exportation, licensing, joint-venture and the establishment of foreign subsidiaries. Of these activities, exportation is the most common.

Uppasala internationalization model enterprises when faced with unknown markets, incomplete information, and being in the state of constant uncertainty, they develop in foreign markets by adopting a process, which evolves by increments. The internationalization process also evolves between the development of enterprises' foreign market knowledge and growing commitment of its resources in the market. R&D and management also make an impact on the internationalization process as evidenced by an empirical analysis of about 4,000 Italian companies.

Characteristics of SMEs

UNECE believes that the integral approach to SMEs development is appropriate and is being employed more and more in counties in transition. The main constraints faced by SMEs are lack of entrepreneurial, management and marketing skills, especially "start-ups". Management of innovation, commitment to quality and knowledge of quality systems, information technology, etc. are all critical elements. A selected list of barriers to internationalization of SMEs is in Table 2.11. Innovation and technology transfer, creation of quality management systems, use of internet-based e-commerce, etc. are some of the specific issues for attention.

UNECE instruments for SME internationalization include: team of specialists on business incubation, specialists on quality management systems, management skills, appropriate foreign strategic liaisons/partners, technical capability and knowledge, quick adaptability and response, specialists on internet enterprise development, etc.

About 25 per cent of manufacturing SMEs in OECD countries are now internationally competitive, and SMEs contribute between 25 per cent and 35 per cent of world manufactured exports, but account for a small share of FDI. Three major tasks of primary importance relate to:

(i) Information centre for SMEs

(ii) Training programme in the field of internationalization

(iii) Promotion of FDI.

Partnerships between large international banks and SMEs [1]

Conn has pointed out that some international banks have taken the initiative to establish new kinds of partnerships with SMEs, changing business practices, management and communication, and access to information. Bank of Montreal (BMO), the Canada's oldest bank, is an example. BMO has decided to expand its SME business, and build strategic partnerships with SMEs, among other factors. It considered issues such as kind of services useful to SMEs, required information, and how they could be strengthened.

World Assembly for Small and Medium Enterprises

WASME has been actively engaged in the promotion of internationalization and development of SMEs, and their cooperation among various countries. Abuja Declaration is its main mechanism for improving the business environment for SMEs. Role of SMEs in global economy is not clear in DDA of WTO. Finance appears to be the main concern for SMEs. WASME's electronic portal helps SMEs to exchange information among SMEs all over the world. Technology incubators, clusters, inter-firm cooperation and networking can facilitate both SMEs internationalization and the transition to the knowledge-based economy. [28]

Foreign direct investment

UNCTAD [29] defines an SME generally as a firm with fewer than 500 employees. FDI by SMEs refers to FDI involving SMEs, as foreign investors and/or as affiliates or recipients. UNCTAD conducted a study based on a survey; related to FDI in SMEs in Asia in 1998. A large number of studies and research are available on FDI, mainly at national or TNCs or large companies, but very few studies or data are available for SMEs. This study of UNCTAD considers FDI as an important tool for globalization and competitiveness of SMEs, besides enhancing technological capabilities, and exports or export competitiveness, as discussed earlier in this report. There is skewed distribution of FDI in SMEs and their performances as well as status in various developing economies in Asia.

In Indonesia and the Philippines, over 65 per cent of output is produced by large firms, and small firms (fewer than 100 firms) account for less than 1 per cent of output in Indonesia and some 13 per cent in the Philippines. In Singapore and Taiwan Province of China, large firms produce 59 per cent and 39 per cent of output respectively while small firms account for 15 per cent and 41 per cent of output respectively. Thus, in Indonesia and the Philippines, the local small firms would have to develop ability to grow and act as clients for, or subcontractors to large domestic or foreign firms.

As mentioned earlier in other studies, internationalization has both positive and negative dimension. Although it poses competitive threats and creates social and economic disruptions, it also opens up new opportunities, especially via the transfer of capital, technology and training. As such, SMEs FDI can be an attractive option for governments seeking to develop a vibrant and internationally competitive sector. Table 2.13 indicates that in general, a large firm putting equity into on SMEs will bring technology and/or training with it but this is less likely for small investors than for larger ones.

The factors considered important by SMEs for strategic business development, include improving the quality of products/services, training of local managers, good relations with governments, and training of local unskilled staffs. According to the UNCTAD survey, in case of SME-SME FDI, firms are:

- Three times more likely to regard training of unskilled staff as very important.
- More than twice as likely to regard the introduction or improvement of products or services as very important.
- More than 50 per cent more likely to regard training of local managers and foreign exchange earnings as very important.

Use of FDI approvals of less than US$ 1 million as a proxy for SME FDI reveals that

- In terms of cases, small package FDI accounts for noticeable proportion of all FDI projects, ranging from about 15 to 20 per cent in Myanmar and Viet Nam to over 60 per cent in the Philippines.
- In terms of value, it makes up as little as 1 per cent of total FDI in Viet Nam to about 2 to 10 per cent by value in the Philippines. In the Republic of Korea and Japan, FDI by SMEs accounts for more than half of the cases but only about 10 per cent of the value of outward FDI. The Republic of Korea have used SMEs as a well integrated part of their development strategies, but have not relied much on inward FDI. Singapore and Taiwan Province of China have successfully used FDI for competitiveness of SMEs. The studies have made the following recommendations on a favourable business climate for various groups of organizations concerned with SMEs: a clear and transparent commitment to SMEs, sustained economic growth with a degree of certainty about the future, definable and transferable property rights, transparent legal and regulatory systems, and appropriate tangible and intangible infrastructure. Table 2.9 gives the best practices for home countries and international organizations to encourage SME FDI.

Table 2.9 Best practice policies for home countries and international organizations to encourage SME FDI

Challenges	Best practice solutions
How to encourage SMEs to invest abroad	National: adapt support programmes (human resource development, finance, technology transfer etc.) to encourage SME FDI. International: greater international cooperation on a range of policies and programmes designed to encourage export, investment, technology transfer, recognition of quality standards, credit guarantees etc.
How to provide accurate information	National: make information services more accessible and useful to SMEs seeking to invest abroad. International: cooperation and sharing of information among providers
How to encourage linkages between SMEs	National: use of mix of channels to introduce potential partners International: joint initiatives on networking and business partnering
How to provide appropriate incentives	National: subject incentives to specific guidelines to make them as effective as possible International: cooperation possibilities to deal with excessive incentives competition
How to encourage the development of appropriate infrastructure in host countries	National: encourage large firms and invest directly in physical infrastructure and assist developing countries with technical and other advice on intangible infrastructure for SMEs. International: develop best practice models for infrastructure development.
How to identify and reduce impediments to SME seeking to invest or internationalize and	National: identify and act on impediments in home country; bilateral liaison with host countries in cooperation with chambers of commerce, etc. International: cooperation in setting up mechanisms to address impediment and cooperation on means of monitoring the competitiveness of countries seeking to attract SME FDI

Source: Szabo Antal; Internationalization of SMEs; www.unece.org/indust/sme

Studies related to FDI in SMEs in India for the past three years (2001-2004) have also indicated a pattern that number of FDI cases approved were about 50 to 60 per cent while FDI amounts approved were in the range of 1.5 to 2 per cent, and varied sector wise. The FDI approvals were more in technology intensive manufacturing and export oriented SMEs, though the analysis was related to FDI up to 10 million rupees since small enterprises are those having investment up to Rupees 10 million in general, and up to 50 million rupees in some areas, and the FDI policy limits investments up to 24 per cent only. [35] SMEs are much more active in FDI in China and FDI policy is more liberalized for SMEs.

C. Competitiveness

Competitiveness has emerged as a critical factor for the growth and development of SMEs in the times of globalization and liberalization, coupled with internationalization of production and services as observed in the above paragraphs. The protection measures for SMEs are being replaced by promotional policies and mechanisms in most of the developing countries. Technology and innovation capabilities have therefore become of growing importance for enhancing competitiveness of SMEs, besides other areas of attention such as financing, marketing, skills, and policy environment.

Firm competencies and strategies

A large number of theoretical and empirical studies are available on competencies at firm level, but very limited information or studies for SMEs in developing countries. Various studies have highlighted the importance of organizational competencies, including proprietary technological know-how; market research and web usage, innovativeness including product innovation, and marketing mix factors, etc. Manufacturing firms with higher exporting levels have a better understanding of the important variables driving the import decision of overseas distributors. Exporting firms pursue efficiency gains through conscious management of their supply links. The influence of inter-relations in network on the market selection decisions of the United Kingdom high technology firms, and alliances to exploit R&D technology, are also mentioned in the literature. Resources and competencies are the major two factors for determining the export behavior of firms.

Competencies and strategies would vary with the objectives, resources, technology and management levels, mind-set, human skills, etc. of SMEs, and also with the sectors and markets in which they operate. However, the need for higher competencies or competitiveness would increase with the levels of technologies – high technology, medium technology and low technology based products and services. It appears from the literature that there are limited studies for these aspects. Technology information, capabilities to identify and access to appropriate and competitive technologies, procurement of cost effective and efficient machinery and equipment, knowledge about policies and international trade rules, procedures and technical approvals, networking, financing, management, etc. are some of the main factors for driving the competitiveness of the firms.

High-technology firms may also like to use incubators, clusters, venture capital, public R&D facilities, FDI etc., and put particular emphasis on innovations and quality management system. Use of external expertise on a case to case basis, is frequently benefited among SMEs. The policies and incentives also favour building competitiveness at a firm level in many developing countries. Export appears to be a basic activity for enhancing competitiveness. The degree of value addition and levels of technologies used in exports differentiate firm level competencies, among other factors. Strategies for service sector and manufacturing SMEs would also be different.

European Competitiveness Report [36]

European Competitiveness Report 2001 highlighted the role of R&D and also of investment, particularly in ICT, in output and productivity performance. The report for 2002 directly correlates competitiveness and productivity. Productivity growth in business sector services in the United States accelerated from an average of 1.3 per cent during 1990-1995 to an average of 3.1 per cent in the period of 1995-1999. In contrast, in EU, service sector productivity growth declined during the second half of 1990s. The important determinants of productivity include innovation, introduction of new products, applying a new technology, etc. Typically innovations in service sector are introduced through acquired technology – ICT, organizational changes and human capital, rather than through direct R&D spending by service firms themselves.

Competition and enterprise policies compliment each other. Government's enterprise policy aims at increasing competitiveness of firms and entire industries. It emphasizes the need to faster innovation by creating widespread and closely enter-twined knowledge pools, which in particular help to raise the R&D potential of SMEs. Technology development and innovation, the drivers of increased productivity, are by their nature uncertain, and therefore need to be accounted in the enterprise policy. Subsidies in the fields of SMEs and venture capital, R&D in strategic sectors, appear to have been more generous and targeted in United Nations than in the European Union.

Energy and environment are being considered important for competitiveness of manufacturing sector in EU, including for SMEs. It seems that the eco-efficiency of EU industry has increased almost twice as quickly as in the United States. The environmental protection expenditures now stand at 2 per cent of the value-added of the manufacturing and energy sectors. However, enterprise and industry competitiveness has to be kept in mind and those additional investments should result in better competitiveness rather than meeting simply social objectives.

Global Competitiveness Report 2005 [37]

The World Economic Forum's (WEF) definition of competitiveness also links to concept of productivity and largely relates to national level competitiveness, comprising of micro and macro level determinants. Competitiveness is defined as the collection of factors, policies and institutions which determine the level of productivity of a country, and is also the key driver of the rates of return on investment. One of the determining factors for competitiveness is how efficiently new technological innovations are absorbed and the educational system is upgraded. The factors and policies governing the competitiveness vary from county to country. The rankings of Growth Competitiveness Index (GCI) and Business Competitiveness Index (BCI) of select countries, among the 117 countries included in the WEF report 2005 are indicated in the Table 2.10.

Education and the extent to which countries are able to upgrade the skills and training of the labour force have gained growing importance as indicators of country's future growth potential. A country's ability to absorb new technologies, to produce goods and services that can reach standards of quality and performance acceptable in international markets, to engage with the rest of the world in ways that are value-creating, is intimately linked to the quality of education, accessibility of specialized research and training centres. The global competitive index separates countries into three specific stages called factor-driven, efficiency-driven and innovation-driven. Among the top performers in mini pillars of GCI, Singapore is ranked as the first in technological readiness while the United States as fifth and Japan as 17th. In business sophistication, Japan is ranked as the first, while the United States as third and Singapore as 20th.

The ranking in the Table 2.10 indirectly incorporates the performances and contributions of SMEs to national competitiveness since SMEs have significant share in the industrial and economic developments. There are variations in GCI and BCI for some of the countries such as Republic of Korea, India, and Indonesia. Technological readiness index also does not directly reflect its relationship with the above indexes. These variations suggest that technological capabilities do not automatically get translated into growth or business performance in a country, and more research is needed. Perhaps, a coordinated approach, with proper weightiness to different parameters is needed.

Table 2.10 Global competitiveness rankings

Country	GCI	BCI	Company Operations and Strategies
● Finland	1	2	9
● United States	2	1	1
● Taiwan Province of China	5	14	13
● Singapore	6	5	14
● Japan	12	8	3
● United Kingdom	13	6	6
● Republic of Korea	17	24	17
● Malaysia	24	23	24
● Thailand	36	37	25
● China	49	57	53
● India	50	31	30
● Indonesia	74	59	50
● Bangladesh	110	100	99

Source: Global Competitive Report 2002

D. Technology

We have seen above that technology is a crucial element at enterprise and national levels, in globalization and competitiveness. The competitiveness of SMEs would be largely dependent on their technological capabilities, with a judicious mix of policies and institutional mechanisms, especially in high value-added or higher technology content manufacturing. International competitiveness is considered to be intimately connected with productivity. There are lots of studies and models for productivity enhancement in SMEs. Singapore, Republic of Korea and Taiwan Province of China clearly stand out in approaches to the promotion of SMEs' technology capacity-building for their economic growth among the developing countries. It is worth studying in detail the technological approaches for SMEs in these countries though the local conditions in other countries need to be considered and the models in one country may not be applicable as such, in another country.

World Trade Organization

The main objective of WTO is to facilitate world trade and enhance the capacities and share of developing countries in world trade. However, the opinions and experiences of WTO member countries, especially developing countries and least developed economies based on the implementation and negotiations for various agreements are widely differing. It is being expressed in several quarters that impact of WTO on the building of capacities of developing countries is debatable. As mentioned earlier, WASME has also expressed that the strategies or implication for SMEs are not clear in the WTO Agreements. Notwithstanding this debate, WTO is a reality, and the process of globalization and liberalization is going on. SMEs have to equip or prepare themselves for the challenges and opportunities arising from the implementation of various WTO agreements. At the same time, governments have to continue their dialogues, develop strategies and go for negotiations at WTO, based on their experiences and needs.

The main agreements of WTO relate to investment (TRIM), intellectual property (TRIP), services (GATS), technical barriers (TBT), agriculture, IT, textiles, etc. The primary concerns of developing countries have been largely related to reducing import duties, market access, subsidies, transparency, and bringing domestic policies and rules including patent laws in line with other countries or as per agreements. It is also recognized that there are wide disparities in the technological and production capabilities, besides various other factors, among developing and developed or least developed economies. The developed economies and large companies are at distinct advantageous positions compared to developing countries, and are evolving several non-tariff barriers or non-transparent systems to discourage the inflow of goods and services from developing countries, besides not sincerely following the agreements themselves. Nevertheless, some of the advanced developing countries are able to restructure their policies, production systems and institutional mechanisms etc. better to take advantage of the business opportunities in the world trade. Development of SMEs, especially innovative and high technology SMEs, through various incentives and tools, has been one of their strategies. Republic of Korea, China, Malaysia, India, Thailand, Singapore and Taiwan Province of China are the examples, though with varying degree of success.

The need for compliance of stricter technical specifications, quality systems, environment and pollution control related regulations, safety requirements, testing and approvals, liberalized foreign investments, movement of personnel, subsidiaries on exports and agriculture, child labour, access to markets, recognition of qualifications, etc. are some of the concerns for SMEs and large manufacturing companies. These requirements are adding to needs for technology capacity-building, more efficient modes of technology transfer, increased productivity and efficiency, more effective utilization of resources, up gradation and training of skills in new areas, international networking and collaborative arrangements etc., and increasing applications of ICT are adding to the complexities for competitiveness of SMEs.

For example, re-engineering and production of products based on existing patented technologies elsewhere, is becoming difficult now for SMEs since the national patent laws are being modified in tune with TRIP Agreement of WTO in many countries. Similarly, additional technological capabilities and resources are required to meet the import requirements of advanced countries as per the notifications under TBT Agreement. The reduction of import tariffs in line with those of other countries and increasing imports in their countries are further necessitating the competence building in SMEs, and also the revision of R&D objectives in some cases where indigenization or import substitution, even at higher costs, was the main objective. SMEs therefore, have to prepare themselves to meet the challenges of WTO and also take advantage of the businesses opportunities arising from it.

Box 2.2 Competitiveness and Technology

Globalization, internationalization, liberalization and emerging world trade rules coupled with faster technological developments and ICT applications in businesses, have necessitated the SMEs to enhance their competitiveness through technological capabilities and other measures including management and market strategies. Competitiveness and productivity are closely linked. National policies including innovation policies and technology intermediaries are to be reoriented or redesigned for SMEs in many countries in the UNESCAP region, though the extent of redesigning or implementation greatly depends upon the levels of national developments. For example, preparing SMEs to attract higher investments from abroad or taking advantage of the spill over effects of FDI or linking to the large and international companies is greatly affected by the national policies, and capabilities of intermediaries, among other factors. R&D and educational institutions can facilitate the technological capability-building in SMEs, through restructuring their courses and evolving new programmes. Development of innovative SMEs and start-ups very much depends upon intellectual capabilities coupled with entrepreneurship, among the academic and R&D institutions. International agencies such as UNESCAP can assist the SMEs and institutions through various promotional programmes towards their technology capacity-building and competitiveness. Organization of training programmes and easier access to information, as in case of WIPO, are the examples. Awareness in R&D and academic institutions about the latest developments, trends, and WTO etc. and technological needs of SMEs, is also essential.

Source: The OECD Small and Medium Enterprise Outlook, 2000
Colin J. Hazley, Accelerating Growth of SMEs via Internationalization; 2001 (p.19)

Table 2.11 Barriers to internationalization of SMEs

Sr. No.	Barriers	
1	Lack of entrepreneurial, managerial and marketing skills	Most important
2	Bureaucracy and red tape	↓
3	Lack of accessibility to information and knowledge	↓
4	Difficulties to access financial resources/Lack of capital	↓
5	Lack of accessibility to investment (technology equipment and know-how)	↓
6	Non-conformity of standardization, lack of quality awareness and lack of mutual recognition schemes	↓
7	Product and service range and usage differences	↓
8	Language barriers and cultural differences	↓
9	Risks in selling abroad	↓
10	Competition of indigenous SMEs in foreign markets	↓
11	Inadequate behaviors of multinational companies against domestic SMEs/Lack of government supply supporting programmes	Least important
12	Complexity of trade documentation including packaging and labeling	
13	Lack of government incentives for internationalization of SMEs	
14	Inadequate intellectual property protection	

Source: Small and Medium-Sized Enterprises (SMEs) in EU Research; EU Initiatives within IS. Centre of International Technology, http://www.cit.org.by/fp

Table 2.12 SME technology development and diffusion programmes

Type	Purpose
Financial assistance	To provide loans and grants to firms for R&D and commercialization of innovations
Technology incubators	To provide a range of services to small technology based start-ups (premises and facilities)
Technical assistance	To assist firms in diagnosing technology needs and in problem-solving
Technology networking	To enhance research/technology linkages between firms and university laboratories
Demonstration programmes	To demonstrate the practical implementation of technologies
Training	Top train workers/managers in the use of new technology and adopting innovative approaches
Organizational change	To assist firms in developing innovation-orientated management

Source: The OECD Small and Medium Enterprise Outlook, 2000
Colin J. Hazley; Accelerating Growth of SMEs via Internationalization, 2001 (p.19)

Table 2.13 Combinations of resource flows received by SMEs in host developing countries in Asia, 1995 (Percentage)

Item	FDI and loans from unrelated organizations	FDI and training	FDI and technology	DI, training and technology
Total	36	47	42	31
SME-SME	26	44	29	24
LE-SME	55	59	68	50

Source: UNCTAD Handbook on FDI by SMEs, 1998 (p.16)

IV. POLICIES AND MECHANISMS IN SELECTED COUNTRIES

A. Preamble

This chapter discusses the policies and measures for technological capacity-building of SMEs towards enhancing their competitiveness in selected countries, essentially based on the information and findings of the fact-finding mission of UNESCAP which visited selected organizations in four countries viz. Thailand, Singapore, Malaysia and Indonesia during 21 to 30 September 2005. The mission report, mainly dealing with technology capability-building of SMEs, was submitted to UNESCAP by Mr. S. P. Agarwal in October 2005. Therefore, only salient features of the report or the main findings are reported here. The details can be seen in the Mission Report 2005.[36]

General observations

Most of the countries have recognized the importance of SMEs in economic development, and have evolved specific industrial and financing policies for them. It is also recognized that innovations and technological capabilities are crucial for enhancing the competitiveness and sustainable growth in the globalizing world and liberalizing economies. Further, the innovative and technological capabilities of SMEs are highly dependent on and related to the national and subnational innovation systems and technology policy environment including incentives and institutional facilities for encouraging R&D activities, technology policy environment including incentives and institutional facilities for encouraging R&D, technology transfer, technology information, etc. Therefore, many developing countries and countries with economies in-transition (CISs) have taken a variety of initiatives to promote SMEs within the national technology policies and technology related systems. In some countries, such technology-related policies have been initiated or are being implemented at state levels or subnational levels also, based on their specific objectives and needs as well as resources available. Of course, there are variations in depth and spreads of implementation of these policies which also take into account the sectors, locations, and technological needs of SMEs in the region.

Box 2.3 Some policy features for SMEs

- There are no specific technology policies spelt out for SMEs in most countries as in case of industrial or financial policies. Technology policies for SMEs are integrated in the overall policies for all sectors and levels of enterprises or organizations.
- Innovation systems or subnational innovation systems are yet to be understood and well appreciated in many developing countries or least developed countries. Innovation systems and technology systems are usually not distinguished.
- There is often overlapping of programmes and activities for technology related capability-building of SMEs, which have been initiated by the various organizations, particularly ministries concerned with industry and technology.
- International organizations concerned with the promotion and development of SMEs also do not seem to have recognized necessity for specific technology and innovation policies for SMEs, and tend to incorporate the same in overall industrial and financial policies. In some advanced developing countries, industrial and technology related activities are dealt by ministry of industry only, for the convenience of SMEs and to avoid overlapping of similar activities though there are separate ministries for industry and technology.

B. R&D and innovation

As mentioned earlier, national R&D and innovation capabilities have a close bearing on the technological capability-building of SMEs, or for that matter for all enterprises. It is therefore worthwhile to have some information about the R&D expenditure etc. at national level. Data related to R&D activities by SMEs is not readily available, but the potential for R&D and technology capabilities in SMEs can be assessed from national level data.

Total R&D and business R&D spending for some leading economies are given below.[37]

Table 2.14 R&D Expenditure in 2002 (US$ billion)

Country Total	R&D expenditure	Business R&D spending
1. World (total)	676.5	449.8
2. United States	276.2	194.3
3. Japan	133.0	92.3
4. United Kingdom	29.3	19.6
5. China	15.6	9.5
6. Republic of Korea	13.8	10.4
7. Taiwan Province of China	6.5	4.0
8. Russian Federation	4.3	3.0
9. India	3.7	
10. Singapore	1.3	1.2

Source: Global Competitiveness Report 2005, World Economic Forum (WEF)

UNCTAD innovation capability index comprises of technological activity and human capital activity for a country, and is a relative innovation standing of a country among 117 countries studied. This innovation capability index for a few select countries is given below.

UNCTAD Innovation Capability Index as of 2001 (WEF, 2005)

1.	Sweden	0.979
2.	United States	0.926
3.	United Kingdom	0.906
4.	Taiwan Province of China	0.852
5.	Republic of Korea	0.819
6.	Russian Federation	0.801
7.	Singapore	0.719
8.	Thailand	0.488
9.	Malaysia	0.467
10.	Philippines	0.423
11.	China	0.358
12.	Sri Lanka	0.317
13.	India	0.285
14.	Indonesia	0.261

Internationalization of R&D

We have discussed in the previous chapters about the internationalization of SMEs and their technological capabilities for competitiveness. Internationalization of R&D activities is now increasing by the TNCs from both developing and developed countries, with the main objective of taking relative advantages of locations abroad including reduction in R&D costs. Availability of infrastructure, IPR policies and skilled professionals appear to be the main guiding factors. Such trends are opening up a lot of business opportunities for SMEs also, by way of contract research, outsourcing of R&D services, design and engineering, etc. However, these businesses need strong technological capabilities and entrepreneurship among SMEs. It is estimated that R&D outsourcing services may have a potential business for over US$ 20 billion per year. There could be many more spill over effects of internationalization of R&D, such as access to new technologies, emergence of a larger number of techno-entrepreneurs, linkages of foreign R&D centres with incubators, clusters, national R&D laboratories and academic institutions, etc.

It is not only TNCs from developed countries opening their R&D centres in other countries such as Republic of Korea, China, Singapore and India, but TNCs from developing countries are also setting up R&D centres elsewhere outside their countries. For example, a number of firms from Malaysia, the Republic of Korea, Singapore and Thailand have set up R&D activities in India, especially in IT sector. In 2003, Samsung announced plans to open R&D centres in China, India and Russian Federation. China, India and the United States have been being considered as most attractive locations by experts and TNCs for foreign R&D investments.

In all the developing economies that have been successful in improving their innovation capabilities and in attracting R&D by foreign companies, the government has played a key role. Human resource and institutional framework have been the main areas for strengthening the attraction of R&D investments from TNCs. The ability of a country to benefit from R&D internationalization depends first and foremost on the strength of its national innovation system.

C. Service companies

Service sector is increasingly contributing to GDP in most of the economies. For example, the service sector in India contributes to more than 50 per cent now as compared to about 35 to 40 per cent a few years back. In developed countries, it accounts even to the extent of 60 to 70 per cent. It is also being realized that service companies are also being driven by newer technologies, though development of new technologies in this sector seems to be rather limited compared to manufacturing companies. In established service sector companies such as banking, insurance, shipping, hotels and airlines, large companies mainly operate, but they network and develop small companies which supply them software and hardware, maintenance, logistics, training, etc. Further, there are several technology intensive services such as R&D services, publishing and printing, space-mapping, technology transfer, standardization and quality management, project management, consulting, repair and maintenance, transportation, travel and hospitability, organizing events including exhibitions & seminars etc. In the area of medical sciences, clinical research and trials, contract research and testing, etc. are reported to have vast potential of business for SMEs.

The World Investment Report 2004 has emphasized the increasing role of FDI and internationalization of services by TNCs. According to the UNCTAD study, the FDI flows have considerably increased during last about ten years, specially in developing economies, even to the extent of almost three times. Services sector is also an area of serious concern under the GATS of WTO.

In spite of above trends, it appears that most of the developing countries are yet to appreciate the role of SMEs in service sector, and a set of policies and incentives need to be evolved to encourage SMEs in at least technology intensive services. The technological and management needs, as well as the financing mechanisms would be different for service SMEs than manufacturing SMEs. It may however be noted that manufacturing and service sectors both need to grow together. One sector should not be developed at the expense of the other. Further, service sector is usually more knowledge intensive, and is equipped with more of intellectual capital or trained skills than physical capital and infrastructure. This sector would require special training programmes and skills development activities in a country.

Service companies are also characterized by the economic and educational standards, local culture, languages, and knowledge of society needs etc. ICT need to be encouraged in service companies for efficiency and competitiveness. Establishment of efficient service companies in industrial clusters, technology incubators, R&D laboratories and academic institutions etc. could facilitate the growth and competitiveness of manufacturing SMEs. There could even be special economic or industrial zones for the growth and development of service SMEs, with common infrastructural facilities and access to technologies. Some of the venture capital companies have supported the start-ups and new SMEs in service sector, in some countries such as India. The success rate of service SMEs seem to be better than that of manufacturing SMEs. There is a vast scope of service SMEs in rural areas where large companies or TNCs have not been able to reach so far so effectively.

D. Indonesia

SMEs are crucial for the industrial and economic developments in Indonesia and various policies have been woven into the national economic development plans. There are a large number of agencies and initiatives to promote and support SMEs. The needs and constraints of SMEs seem to have been well recognized but policies and actions are not commensurate with these needs. SMEs in Indonesia appear to have weathered the economic crises better than larger industrial units. Employment creation and development of broad based industrial sector are main objectives. The main ministries conceming SMEs with specific reference to technology and industrial policies are Ministry of Industry, State Ministry of Cooperatives and SMEs, and Ministry of Research and Technology.

These ministries and other departments have set up a number of institutional mechanisms and support systems such as Directorate General of Small Scale Industry, Agency for Research and Development for Industry, National Industrial Centre, Technology Business Centre, etc.

Agency for Research and Development of Industry

There are basic policies, institutional mechanisms, and incentives for development and promotion of S&T and SMEs, as in case of most of other developing countries in South Asia, though the contents and extents or effectiveness of implementation may vary. The Agency for Industrial Research and Technology (AIRD) in the Ministry of Industry provides support to SMEs through development and application of national standards, establishing R&D policies, etc. The major issue for AIRD is how to raise the R&D capacity of local companies, especially SMEs, to compete in the global economy. There are nine national industrial centres for different sectors such as machinery, chemicals and packaging, ceramics, textiles, handicrafts, rubber, leather, etc. In addition, there are thirteen regional centres to provide technological and related services in various sectors of manufacturing. These centres provide R&D service, testing services, training and consulting service etc.

SMEs are dispersed all over the country and there is large supply of workers. However, the major weaknesses of SMEs include lack of high skilled workers, limited R&D infrastructure, poor incentive system and low technology innovation. The major issues identified by AIRD relate to linking domestic strengthens to global opportunities and upgrading human resources. According to AIRD, an action plan should therefore aim at managing network together with other R&D institutions and other ministries related to industry inside and outside Indonesia including universities; and to develop competitiveness based on the core of business of AIRD. Policy analysis, coordination, management of R&D in industries and utilizing indigenous resources, tight disciplines and financial transparency are other identified areas for action.

Industrial revitalization programme in Indonesia is focused on the labour intensive and export industries, with the main objective of job creation, generating foreign exchange etc. A business solution centre has been established in 2002 to handle complaints related to human resources, security, illegal levy etc. Empowering SMEs as a supporting industry, is another objective of the revitalization programme. Besides identifying sectors for development, the programme is to address competition, productivity and technology related issues.

The State Ministry of Cooperatives and SMEs

The State Ministry of cooperatives and SMEs is the administrative ministry for development and promotion of SMEs in Indonesia. GDP (without oil and gas) contribution of small units is 46 per cent while of them 17.27 per cent is by medium and 36.73 per cent by large units. Small enterprises are mainly in agriculture (86 per cent), trading (76 per cent), building (44 per cent), transportation (35 per cent) and services (76 per cent); while medium units are in finance (46 per cent), and large units are in mining (89 per cent), processing (32 per cent), electricity (46 per cent), gas and water (92 per cent), services (57 per cent), transportation (38 per cent), and finance (37 per cent). The support system for SMEs promotion may include:

- Easier finance
- Cooperative empowerment
- Incentives and facilities for IPR
- Development of accreditation and certification of BDS
- Entrepreneurship and competitiveness development
- Development of clusters
- Promote infrastructure and technical guidance
- Quality enhancement of cooperative institutions
- Preparation of proposals banks

There are 400 districts in Indonesia, and more than 95 per cent enterprises are microenterprises. The R&D expenditures are very small. There are 40 incubators, promoted by universities. MNCs need to collaborate with SMEs, and technology-based SMEs need to be promoted in future, the emphasis to be changed from marketing to technology. Manufacturing SMEs are small percentage.

Ministry of Research and Technology

There is an elaborate ministerial and administrative approach for promotion of S&T in Indonesia. The Ministry for Research and Technology has a minister and five deputy ministers, and a secretary, besides five advisors in economy and technology, industry and trade, education, food, and TRIPS and IT. The areas of deputy ministers relate to research and technology development; community dynamics; research, science and technology programmes; national science and technology systems; and the empowerment and socialization of S&T. There are seven national research institutions in the Ministry of R&T, besides research agencies and institutions under other departmental ministries such as agriculture & communication, energy, forestry, health, and industry and trade, etc.

Assessment and application of technology programme includes monitoring, technology servicing of government institutions and private sector related to innovation, diffusion, capacity-building, and technology transfers. Access and application research fields include natural resources, energy, bio-technology, agro-technology, pharmaceutical, IT, electronics, etc. The Agency for Industrial and Trade Research and Development of the Ministry of Industry and Trade conducts research and development of technology in the utilization of new materials, product and equipment, industrial environment and pollution control etc. It provides technical assistance to increase and control quality as well as the utilization of raw materials, etc. Quality control and standardization are some other areas. As mentioned earlier, there are new sectoral R&D centres and 13 regional R&D centres.

In the National S&T Policy 2005-2009, innovation is addressed as one of the key thrusts. Easy financing of technology for industry is an issue of concern. It was informed that there were 36 million SMEs in early 1990s, in which manufacturing units were less than 13 per cent. Some research incentives are available to industry, and about 4 per cent research results are adopted against expectation of 13 per cent. Majority of SMEs have little knowledge about technology and are at low end. Access to technology, interpretation/internationalization of technology, how to run technology transactions, weak national innovation system, absence of operational regulations, S&T infrastructure, and management of S&T, are some of the issues of concern. R&D budget is as low as 0.05 per cent of GDP. Lack of data base, tax policy, R&D training, commercialization and promoting new companies, incubators and start-ups, information networks, etc., are some other issues. Priority areas are included food, energy, transport, ICT, defense and health. FDI would be preferred for technology transfer and capability-building.

It seems that technological capabilities and necessary instruments for SMEs are highly inadequate. There is overlapping of activities, and scarce resources are very thinly spread. A detailed study is needed to identify the technological needs and constraints of SMEs, as well as a review of existing policies.

Business Technology Centre (BTC)

The BTC was set up in 2003 as a cooperative effort of government under the Agency for Assessment and Application of Technology (BTC-BPPT), banks, venture capitalists, etc. to develop and support technology-based SMEs, through business services including office and logistics facilities. Consultation and assistance include technology and capital financing, technology commercialization capacity-building, IPR management, training etc. Technology and financial needs are met through networking with banks, experts, universities, R&D centres, etc. SMEs, R&D centre, and banks are BTC members. The business areas of BTC include manufacturing/process, agriculture/fisheries, services, ICT etc.

There are 2,000 members including 180 SMEs. Interest rate for loans for SMEs is 10 per cent and a service fee is charged by BTC. Support is for marketing, technology and arranging capital for SMEs. About 6 to 8 months is needed for processing applications for bank loans of US$ 50,000 to 200,000. So far only three companies have secured loans during last two years through BTC, and 12 applications were under process. There is no support for utilizing foreign patents. Currently another 6 BTCs are in pipe line under different agencies. There is one science park. BTC employs 19 people including five technical and 20 SMEs have been helped so far. The concept of BTC appears to be good but need to be more efficiently operational and a model for supporting a larger member of SMEs for a national impact need to be evolved.

The other initiatives include setting up of industrial clusters, technology business incubators around academic institutions, training and vocational programmes, easy and subsidized loans, grants and fiscal incentives to promote R&D and technology capabilities of SMEs. The weaknesses include lack of export orientation and internationalization of SMEs including linkages with TNCs or large companies, inadequate incentives for undertaking R&D or using modern technologies, limited resources and weak financing mechanisms for technology, rules and procedures for implementing the existing policies, etc. Even the models adopted for industrial clusters and technology business incubators etc. are not very modern and dynamic to promote technological capabilities and innovation capacity. Intellectual outputs and linkages of SMEs with academic and R&D institutions are also very weak. An overall review of policies and mechanisms, including effective coordination among various ministries and organizations is needed. Microenterprises are significant in Indonesian economy.

E. India

Industrial promotion & financing policies and mechanisms

SMEs as in many other countries, have been receiving special attention from the Government, and SMEs related policies have been well reflected or integrated in various national development plans including the National Social and Economic Development Plans. A special ministry for development of small-scale industries has been set up, with a wide network of technical and support institutions all over the country. These include testing and development centres, prototype centres, tool rooms, small-scale services institutes, design and engineering facilities, entrepreneurship development institutes and training programmes. Some of these facilities have been set up with the support of international organizations such as UNDP and UNIDO. A variety of financial incentives are being provided, such as soft loans at low interest rate, grants and tax incentives or concessions for small industries. Special financial encouragement is given for technology upgrading in selected sectors such as textiles, hand loom, food processing etc. National Small-Scale Industries Corporation (NSIC), a public sector company, provides technical, financial and business services.

Small-scale industries are widely dispersed all over the country in almost all areas of manufacturing and services including technology intensive areas such as engineering, pharmaceutical, ICT, electronics, etc. and contribute to almost 40 to 50 per cent of total industrial output, 40 per cent to exports, and employment. A specialized bank known as Small Industries Development Bank of India (SIDBI) has been set up for SMEs and some of the financial schemes of the Government of India are being implemented through SIDBI. A number of institutional mechanisms and incentives are being made available by the state governments at regional or subregional levels. Small industries development corporations, training institutions and infrastructural development agencies, etc. have been promoted by the state government. Current small industries development plans include dispersal and development of small industries growth centres in various sectors, technology business incubators, and industrial clusters, etc. all over the country. The emphasis is put on value creation, production and technology capability-building, and internationalization of SMEs.

Liberalized FDI policies are being implemented to encourage FDI in almost all sectors, without any major restrictions. However, FDI in small-scale sector is limited to 24 per cent in general, though this limit may be relaxed to exporting SMEs. Linkages of SMEs with TNCs and large companies are strongly encouraged.

Some of the new initiatives to promote SMEs include:

- SME development fund
- Specialized stock exchange for SMEs
- Encouragement for patenting and ISO certification
- SME venture capital fund
- National Commission for Small Industries (informal sector)
- Preparation of a new bill for promotion and development of small-scale sector, which seeks to raise the investment limit in plant and machinery, from present value of 10 million to 50 million rupees, and define officially medium sector having investments in the range of 50 to 100 million rupees, besides other liberalized laws and regulations for SMEs.
- Wider reach of SIDBI and other banks or financial institutions to SMEs in more efficient and responsive manner
- Setting up of credit rating agency for SMEs
- Promote special venture capital companies and risk financing or investment companies for SMEs
- Improve the working of credit guarantee and export promotion institutions
- Progressively reduce protection measures including reservation of items for exclusive production by small-scale sector, and simplify the implementation of policies and control mechanisms
- SME Development centres at SIDBI and IIFT

Technology promotion policies

The Ministry of Science and Technology is mainly responsible for the promotion and development of S&T in the country, though there are other specialized departments/ ministries for areas like electronics and ICT, space, atomic energy, defence, non-conventional energy, etc. Also, economic ministries have a S&T components in their budget and programmes for development of sector S&T capabilities. National S&T Policy of 2003 provides guidelines and strategies for development of S&T in the country. National R&D expenditure is targeted to be increased to 2 per cent of GDP in next few years, from the present level of about 1 per cent. There are a number of technology promotion programmes for promoting R&D and technological capability-building in the industrial sector, including for SMEs. There are practically no specific technology or innovation policies for the SMEs, but SMEs do take advantage of these schemes which include:

(i) S&T entrepreneurship development board

(ii) Technopreneur promotion programme

(iii) Consultancy development programme

(iv) Programme for advancement of technology and research

(v) In-house R&D recognition scheme for industry

(vi) Promotion of scientific and industrial research organizations

(vii) Science & Engineering Research Council

(viii) National Innovation Foundation

(ix) Technology Development Board

(x) Technology, Information and Forecasting Assessment Council

Some of the activities under the above programmes include promotion of technology incubators and S&T parks, interaction and networking of SMEs with R&D and academics, grants and loans for R&D and technology development and commercialization of technologies, transfer of technology from national R&D institutions to industry, technology data base and information services, export of technologies and technology intensive products and services, grants for grass-roots inventors etc. A variety of fiscal incentives and tax concessions are also available for promoting R&D in industry. Human resource development and technology skills for SMEs are also important areas for almost all ministries and special programmes have been developed. Recognizing the need for science-based development and qualitative education, the government has recently upgraded some of the colleges to National Institutes of Technologies (IITs), and planned to strengthen the leading institutions besides creating two more science institutes similar to IITs. National manufacturing competitiveness council has however recently emphasized on technology support to SMEs, and a national fund for manufacturing technology, including for SMEs, is proposed, in mission mode projects.

Private sector initiatives

There are a few national level associations of SMEs for the promotion of SMEs. Federation of Small and Medium Enterprises (FISME), Confederation of Indian Industry (CII), World Assembly of Small and Medium Enterprises (WASME), PHD Chamber of Commerce and Industry, etc. are some of the examples. There are sector- as well as state-level SME associations also. All these associations are primarily engaged in taking care of the day-to-day difficulties faced by SMEs, including those from distortions arising from policy implementation or financing or trade rules etc. There are limited initiatives for long-term development and technology capability-building of SMEs or promotion of innovations. The networking of SMEs with intellectual resources and technological facilities are also very limited. There are limited capabilities and vision in associations.

Public-private partnerships

Recently, a number of initiatives for the promotion of development and capabilities of SMEs are being undertaken by both the government and the private sector including SME associations. These include setting up of industrial parks, S&T parks, conducting training and skill upgrading programmes, development of clusters, export market promotion, organization of seminars/exhibitions in India and abroad, etc. Export promotion agencies are also active in promotion of export through world market information, world trade rules, import-export procedures, market development activities, coordination and interactions with international agencies, etc. Development of sustainable models for promotion of SMEs also seems to be in the pipe line in some cases. Technology related initiatives of DPP mode was announced by the government for food processing and handicrafts, etc.

Box 2.4 Brief about SMEs in India

There are a large number of policies and mechanisms to promote and support SMEs including technology capability-building for competitiveness but SMEs are not adequately aware or fully aware about them. Also, SMEs often have expressed their concerns in the cumbersome and time consuming procedures and systems. There is lack of coordination among various ministries and agencies, and also evaluation of the effectiveness of the policies and institutions, since some of the incentives and policies have become irrelevant in the newly globalizing economy and new policy instruments are needed, specially related to technology, innovation and financing.

Policies and incentives related to acquisition and access to foreign technologies and efficient technology transfers, as well as commercialization of technologies from indigenous sources, need to be strongly evolved. R&D and innovation, in general, is at low level or considered insignificant in most of the SMEs, and technological activities are usually limited to incremental modifications, adaptations and upgrading of existing technologies, testing and quality control, etc.

Encouragement to start-ups and interactions with academics and R&D institutes are also practically non-existent. Universities are not generally equipped to generate intellectual property or techno-entrepreneurs, though some of the institutes such as IITs have taken initiatives to promote entrepreneurs. Clusters and technology incubators or S&T parks are usually providing physical support and facilities, and not really innovative. The models need to be examined, and the depth and spread also need to be much deepened. Technology financing is a major

Box 2.4 Brief about SMEs in India (continued)

concern for SMEs. The technological capabilities of SMEs do not seem to be commensurate with the national technological and entrepreneurial capabilities. SMEs need to be prepared for the challenges from WTO and other world trade rules including technological requirements of the importing countries. It would be desirable to have a thorough review and evaluation of the existing policies and institutions related to SMEs, and carry out a study on the practices in advanced countries such as the United States, Republic of Korea, Singapore, and Taiwan Province of China.

F. Malaysia

Policy framework

As in other countries, SMEs are very important in the industrial and economic developments in Malaysia, and contribute significantly to the total production, exports, employment and GDP. Several new measures and policies have been developed to accelerate the growth of SMEs and to enhance their competitiveness. Technology capacity-building and support facilities for SMEs are important agenda item in Malaysian national development plans. There are a number of ministries and agencies concerned with the development of SMEs, including Ministry of International Trade and Industry, and Ministry of S&T. Some of the major institutional mechanisms include Technology Park Malaysia Academy, Malaysian S&T Centre, Third World Network, Federation of Malaysian Manufacturers, World Association of Industrial and Technological Research Organization, Malaysian Technology Development Corporation, Small and Medium Industries Development Corporation (SMIDEC), SIRIM Berhad, etc. Technology policies and incentives include tax concessions and fiscal incentives, soft loans and grants, incentives for training and technology transfer from abroad or within the country. Technology incubators around academic institutions or stand alone, industrial clusters, testing and standardization, venture capital, promotion of FDI, etc. are some of the initiatives for SMEs. ICT and some of the high technology sectors as well as internationalization of SMEs are some of the areas identified for future.

SMEs in Malaysia

SMEs practically operate in all industrial sectors and are spread all over the country. However, these are mostly in low technology sector and resource based activities. About 30 per cent of SMEs in manufacturing sector relate to electric and electrical products, 6.5 per cent to wood and wood based products, 9 per cent non-metallic products, 11 per cent to fabricated metal and machinery, 3.8 per cent to transport and 3.6 per cent to food products.(38) This distribution clearly shows that SMEs are generally not operating in technology intensive sector or do not have built in technological capabilities or innovativeness. It is also noted that a few start-ups have succeeded to become publicly listed companies, during last about fifty years. The areas include plastic products, garments, electrical products, wood products, consumer products etc. It is pointed out however that recent initiatives such as Technology Park Malaysia (TPM) have catalysed the speeding up of growth of new business, and about ten of them have come up with IPO in recent years.

Currently, many SMEs are quite inefficient and still rely on traditional organization and techniques of production. R&D expenditures are very low though national R&D expenditure is rising. We have seen in the earlier chapter that Malaysia is quite good in competitiveness index as well as technology and business indexes as per Global Competitiveness Report 2005. Thus there is a clear need to modernize, change or modify their product lines, and update their production technology. Enhancement of competitiveness through technology capacity-building is need of the day for SMEs. On the whole SMEs in Malaysia have plenty of scope and there is ample evidence that they can substantially increase their productivity and rate of growth.

Technology capability-building

The second national S&T Policy aims at accelerating the development of S&T capability for national competitiveness through increasing R&D spending to at least 1.5 per cent of GDP by 2010 and achieves a competent work force of at least 60 per cent 10,000 labour forces. Lack of skills is identified as a major constraint for SMEs. The policy also aims at encouraging partnerships between public funded organizations and industry as well as between local and foreign companies with a view to increase their indigenous technology capability-building. SME and technology perspectives are integrated in the following documents: (1) Vision 2020; (2) Industrial Technology Development – a National Plan of Action; (3) Industrial Master Plan 2; (4) National Agriculture Policy 3; and (5) the Third Outline Perspective Plan.

Specific initiatives related to technology capability-building of enterprises include:

- Public-industry partnership for technical assistance of researchers to industry
- Procurement policies to support innovation and technology
- Encourage technology transfer through teachers and students
- Skills development fund creation
- Effective role of academic institutions in technology parks and innovation centres
- Technology credit guarantee scheme to support technology-based firms
- Facilitate interactions between R&D and vendors
- Encourage new technology-based firms for commercialization of technologies
- Technology Acquisitions Fund

Current issues and concerns for SMEs are as follows:

- Lack of participation in R&D and innovation by private sector including SMEs
- Weak implementation of policies, overlapping, and inadequate awareness
- Entrepreneurship need to be encouraged
- Human resources development and training
- FDI policies
- Innovative technology financing
- World market and technology-related information
- Encourage public-private partnership
- Venture capitalism need to be encouraged

Box 2.5 Brief about SMEs in Malaysia

The limited financial resources need to be utilized for specific activities aimed at enhancing competitiveness through technological capability-building in industries, including SMEs, in selected sectors. Partnerships and networking of TNCs and large companies with SMEs, and to maximize the benefits of FDI including spill over effect need to be encouraged. FDI in SMEs and from SMEs would accelerate the development and transfer of technologies. There should be a coherency between the areas identified for S&T and industrial development as well as exports so that concentrated efforts are made. Unnecessary competition with TNCs and large companies should generally be avoided, and rather a complementary approach is needed. Policies and incentives should also take into account the technology levels, local needs, natural resources, employment potential, and other local advantages for SMEs. Increasing internationalization of SMEs through strengthening technological capabilities would be necessary for long term sustainable growth. National and subnational innovation systems need to be developed and linked to SMEs. There is a need to review the approaches for incubators and clusters, etc. Public-private partnerships, and SME related associations need to be encouraged to evolve sustainable models for strengthening technological capabilities and R&D in SMEs. IPR does not seem to be a major issue at this stage but would assume importance as SMEs become more innovative.

G. Singapore

Policy framework

Singapore has traditionally relied heavily on its position as a trading centre for its economic survival, with economic strategy focusing on building infrastructure, attracting FDI and pursuing export-led growth. This in conjunction with political commitment to openness in trade, capital, and more recently, labour, has resulted in remarkable economic outcomes. Until recently, however, the role of SMEs in this strategy has been secondary. In the new knowledge based economy based on skills and infrastructure, the fundamental change has been driven by two main forces: globalization and technology. Technology-based entrepreneurs and enterprises are to be nurtured for the 21st century, basically to develop local industrial base and attract higher and quality investments in emerging areas of technology such as biotechnology, material sciences, electronics and ICT, pharmaceutical etc. In recent years, entrepreneurial culture is considered as a pre-requisite. The Global Competitiveness Report 2005 has rated Singapore as one of the most competitive economies in the world. The growth index, technology index and business index are all rated very high. The SME Master Plan reflects the government's recognition of the central role of SMEs as a source of entrepreneurship and innovation. Government policy is now focused on encouraging and nurturing successful indigenous companies with the potential to grow into companies of global nature.

Technology capability-building programmes

A comprehensive network of government agencies charged with various aspects of SME policy framework and assistance programmes has been put together. The leading agency for administering the SME policy is the Singapore Standards Productivity and Innovation Board (SPRING). There are close to 100 assistance programmes that address the needs of SMEs, addressing problems such areas as access to technology, access to manpower, access to finance and access to markets.

Access to technology issues mainly relate to areas of weakness of the need for new technology, identification, evaluation of the technical and commercial feasibility of new technology and prototyping.

Encouraging and accelerating the diffusion of technologies to SMEs is another area of importance. Technology Network Programme facilitates connections to researchers, experts and venture capital funds, while Business Fusion Programme refers to a process whereby a group of related companies come together to share knowledge, experience and ideas, mainly to provide access to top internally developed technologies, and interactions with trade chambers and industry associations. The other programems include GET-UP (Growing technology with technology upgrade) and comprises of components of activities to provide technical specialists, facilitators and R&D centres which will test the viability of the participants' ideas and innovations, and be funded by the government. SMEs are encouraged to go out, and a fund is created for brand management for overseas markets.

Singapore is one of the few countries in the world pushing for national standards for the service sector. Accreditation is crucial for Singapore's economic development. Capability and credibility are important for growth of SMEs. The National Continuing Education and Training Framework (NCET) provides companies with a system to train their staffs on service companies, and up to 90 per cent funding assistance is available.

Upgrading of S&T-based educational facilities and networking with SMEs is a priority area in Singapore. Science-based industrial development is being aimed at for long-term success. Agency for Science, Technology and Research (A* STAR) has a number of programmes for technology capability-building of SMEs, including a special company recently set up to promote commercialization of technologies (ETPL). Key tasks include integration of public research with industry clusters, to training human capital for public research and industry, and own and exploit intellectual capital. Local manufacturing companies now have a single contact point for SMEs.

Economic Development Board (EDB) is largely responsible for development of industries including SMEs, and operates a large number of schemes for SMEs, including those aimed at building technological capabilities of SMEs. There are several new financing schemes and technology capacity-building programmes for SMEs, including enterprise development centres operation and technology road mapping (OTR), etc.

There are about 120,000 SMEs including 4,000 in manufacturing in Singapore. Singapore wants to move from labour intensive to capital intensive to knowledge intensive SMEs. There are about 20 per cent MNCs and 70 per cent SMEs of total enterprises in Singapore. Globalization of R&D and internationalization of SMEs are the objectives in future, for competitive strength building. Increasing share of e-learning, e-commerce, etc. in SMEs is to facilitate their competitiveness and efficiency. The government is putting together the next blueprint, the ICT 21 Master Plan, within the express aim of transforming the country into a full-fledged New Economy by 2010. "SME 21" is a strategic ten-year plan aimed at SME capability-building for global competition and knowledge economy. "Technopreneurship 21 or T 21" is another plan to prepare and lay the foundation for successful development of a technopreneurship sector in Singapore. Education, facilities, regulations and financing are the four elements of T-21. A technopreneurship investment fund of US$ 1 billion is committed to attract venture companies.

Promotion of excellent infrastructure along with integrated services including residential, education, and commercial facilities for TNCs and foreign nationals, promoting Science Parks, technology incubators, innovation centres, industrial parks and industrial zones, are major initiatives towards building S&T infrastructure and technological capabilities in the country. In Singapore, the concept of National Innovation System and its importance for technology capability-building of SMEs seems to have been well understood. New policies are focused in this direction. The success of Science Parks in Singapore is greatly appreciated worldwide.

Box 2.6 Brief about SMEs in Singapore

Singapore is a small country and a vibrant economy. Very comprehensive, well coordinated and focused approach in the form of polices, mechanisms and incentives is being evolved and honestly implemented for the promotion of innovative SMEs, as well as for strengthening domestic industrial base and competitiveness in the long term and short term. The objective is also to encourage the emergence of global large companies, out of these SMEs, over a period of time. The basic problems and issues facing SMEs are recognized and the same are being addressed to facilitate the operation and technological capability-building of SMEs. It is also recognized that SMEs themselves may not be able to invest resources in R&D at their initial growing stage; hence more emphasis is put on acquisition, commercialization and technology transfer, along with networking and partnerships with private and public sectors including universities and R&D centres. Development of ICT infrastructure and promoting its usage at the lowest level is another important activity.

Another feature of SME development is that a few areas such as biotechnology and life science have been identified for focused development, rather than spreading resources on a large number of areas. Entrepreneurship, financing and skill development are the main pillars for innovation and technology capacity-building of SMEs. Singapore is characterized by highly disciplined work force and dedicated professionals in both public and private sector. Avoiding harassment or inconvenience to entrepreneurs is best kept in mind. Quality and standardization is important activity for SMEs. Recognition and development of service sector SMEs is a unique initiative in Singapore.

The main limitation for the development of SMEs is limited domestic markets and lack of manpower and skills as well as weak R&D and science based technology generation institutions. A careful FDI, S&T and industrial policy will need to be evolved so that SMEs are maximally benefited by TNCs or developments elsewhere, and the country is able to promote internationalization of SMEs.

H. Thailand

SME policies

The neglect of SMEs in Thailand for long has led to their SMEs being inefficient; lacking innovation; inadequately financed, and poorly integrated into domestic and international supply chains. However, in recent years, The Government of Thailand has recognized the importance of SMEs in economic development, and evolved a planned approach involving several policies and programmes. SMEs suffer from multiple government departments handling their registration and assistance programmes, using different classification methods. Thailand's industrialization has been centred in and around Bangkok, with the result that SMEs are concentrated in the capital and its five surroundings provinces. Around 45 per cent of all manufacturing SMEs are situated in the Bangkok Metropolitan Area. (38)

The White paper on SMEs in Thailand (2002) has laid down promotion policy for SMEs. The Office of SME Promotion, Bangkok, under the Ministry of Industry is responsible mainly for implementation of the policies; while Department of Industrial Promotion (DIP) is the lead agency for the SMEs promotion and development and follows the guidelines set by Ministry of Industry and National Plan.

The SME Master Plan

There are seven strategies of the SME Master Plan:

(i) Upgrade technological and management capabilities of SMEs

(ii) Develop entrepreneurs and the human resources of SMEs

(iii) Enhance SMEs access to markets

(iv) Strengthen financial support system for SMEs

(v) Provide a conducive business environment

(vi) Develop microenterprises and community enterprises

(vii) Develop networking of SMEs and clusters

A special cabinet committee has been established to oversee the development of SMEs. The SME Promotion Act 2000 contains three main features; new government agencies explicitly for SMEs, an SME Promotion Fund, and an SME Action Plan.

SME support programme

Board of Investment (BoI) is responsible for promoting investments in industry including SMEs. The BOI unit for Industrial Linkage Development (BUILD) Programme aims at promoting the growth of supporting industries. Another programme – National Supplier Development Programme (NSDP) is a subcontracting development programme to foster linkages with large companies. Institutional mechanisms under the Ministry of Industry include: Thailand Productivity Institute; Thai German Institute (transfer of technology); National Food Institute; Thailand Textile Institute; Management System Certification Institute; and Institute for Small and Medium Enterprise Development (ISMED).

A few financial support institutions and programmes have been established including EXIM Bank of Thailand and Miyazawa Fund of Japan in 1999. Some of these programmes are for all industries while a few are for SMEs.

Thailand labour costs have risen sharply and its labour supply is no longer competitive in the region with the likes of Indonesia, Viet Nam, Bangladesh, etc, Thai firms in general fail to employ greater use of technology, and have become less competitive.

Clusters and their accompanying linkages and networks are emerging in several sectors in Thailand, most notably in automotive industry. Thai companies have not been able to take full advantage of production subcontracting and technology capability-building through clusters. DIP is now promoting linkages in several layers including between

Thai SMEs and foreign enterprises. Foreign firms including those from Japan have set up smaller affiliates with greater access to technology, etc., thereby Thai companies are at a disadvantage. Inadequate technology, outmoded production processes and low management capabilities are recognized as constraints for Thai SMEs.

S&T policy and mechanisms

The national S&T policy is formulated and documented in the policy and plans of three government agencies, which are the Office of the National Economic and Social Development Board (NESDB), the Office of National Research Council of Thailand (NRCT), and the Office of Permanent Secretary, Ministry of Science & Technology (MOST). There are about a dozen scientific institutions including National Innovation Agency (NIA), and National S&T Development Agency (NSTDA).

The following are the official documents for development of S&T in Thailand:

- The Ninth National Economic and Social Development Plan (2002-2006)
- The Sixth National Research Policy and Plan (2002-2006)
- The National S&T Development Plan (1997-2006).

Although the three plans have some differences in details, but are based on similar policy framework. The Plan focuses on human resources development and research system to develop networking and effective dissemination of research to production sectors.

NSTDA has six main programmes to provide S&T support to industry including SMEs. These include: Support for Technology Acquisition and Mastery Programme (STAMP); Industrial Technology Assistance Programme; Company Directors Technology Development Programme; and Standards, Testing and Quality Control Programme. NSTDA comprises of four national research centres in strategic areas of biotechnology, electronics, etc. It is setting up the first science park in Thailand, and three more are planned in different parts of the country.

Future prospects for S&T Plan of action include: S&T development in production sector, linking of research with educational institutions, capacity in product designing and technology capability measures. The role and strategies of TNC subsidiaries seem to be shifting towards as greatly localization of deeper technological activities and strengthening of local technology development activities. There is very low R&D in SMEs and technological capabilities are limited. The policy envisages R&D expenditure to be increased to more than 0.3 per cent of GDP. A quick analysis of R&D in SMEs have indicated that R&D expenditure are more in resource based low technology and traditional manufacturing enterprises, and foreign subsidiaries spend much less on R&D in Thailand than local enterprises. Experimental development is the major R&D activity in enterprises. Lack of adaptation of technology research on product development and access to capita, are identified as obstacles in SME Master Plan 2002-06. The objectives of the Plan include increasing contribution to GDP by SMEs to reach 50 per cent of total GDP by 2006, to increase productivity and exports.

Innovation management

Bangkok statement of 23 September 2005 by National Innovation Agency on innovation management declared to strengthen knowledge and cooperation in IM, initiate linkages among R&D, private sector industries, promote technology transfer & intellectual property, etc.

Dual track approach toward innovation of SMEs

The Government's dual track approach relates to promoting both cash flow industries and SMEs grass roots sector simultaneously, so that the economy will not have to rely too heavily on the export sector. This is applied to innovation also. "One subdistrict one product" project (OTOP) is for creation of innovation from indigenous wisdom. Cluster developments, incubation centres, data networks of innovation and manufacturing are some of the initiatives to expand and network innovative SMEs. Innovative SMEs production would be based on appropriate balance between new ICT and living breath of indigenous intelligence.

Box 2.7 Brief about SMEs in Thailand

Thailand has now recognized the role and importance of SMEs in its economic developments and has taken several policy measures to promote and support SMEs, though SMEs continue to be weak link in the industrial manufacturing. TNC subsidiaries have not helped in technology capability-building and development of SMEs. Major constraints identified include access to technology, inadequate manpower, access to finance, and marketing. There is multiplicity of agencies and overlapping of SME related activities. R&D and technology capabilities are low in SMEs.

Technology-support systems available seem to be highly inadequate to address the problem of SMEs though objectives and strategies have been spelled out in various documents. SMEs do not seem to have yet fully realized the need for technology and innovation for competitiveness though government and related agencies have appreciated the need for technology capability-building. Limited resources are thinly distributed.

Role and importance of a national innovation system is beginning to be realized, and there is a need to link up the same with SME needs. S&T parks, clusters and incubators are also now being set up. SME linkages with R&D and academics are weak. R&D institutions themselves do not seem to have adequate resources, capabilities and infrastructure to efficiently meet the growing needs of SMEs. Entrepreneurship and sufficient trained manpower are other issues for development of SMEs. Ministry of S&T, Ministry of Industry and Bank of Investment need to coordinate better. In spite of all this, Thailand has come a long way in its industrial capabilities and SME development activities, though technological capabilities continue to be weak. Perhaps, a new perspective for SMEs need to be built up in various plans, and innovative and outward looking SMEs need to be encouraged through special measures including technology related support systems.

V. KEY ISSUES AND BEST POLICIES

A. Preamble

We have seen in the foregoing chapter that the SMEs are important contributors to manufacturing, exports, employment and regional & national development objectives in all economies though the objective and extent of contribution or nature of operations of SMEs may vary from economy to economy. The models, policies, mechanisms, and incentives for development and support to SMEs also widely vary, and their competitiveness depends upon their technological and innovation capabilities, among other factors, and their linkages with the national S&T innovation, and educational systems. Technology is multidimensional and multi-disciplinary. The definitions of SMEs also vary. Therefore, practices for technology capability-building for SMEs would also vary from economy to economy. UNESCAP region itself is characterized by composing different levels of economies and technological capabilities ranging from advanced to newly industrialized/industrializing, developing & in-transition, and least developed ones. However, an attempt is made here to identify key issues and some best practices with generic nature, which may be suitably modified to suit the needs of a particular economy.

B. Definition and status of SMEs

The definitions of SMEs in some of the countries are indicated in Table 2.16. The definitions are based on one factor or a combination of factors such as capital investment, investment in plant and machinery, turnover and number of employees. Definitions also vary with the industrial sectors of SMEs, and also whether in services or manufacturing, in some countries. Data related to the contributions and status of SMEs in some of the countries, is given in Table 2.17.

C. Key issues for SMEs

Main issues identified for SMEs are access to finance, access to technology, access to markets, access to human resources and expertise, and enabling environment, internal & external. Since the subject is so complex and wide, only some of the issues related to innovations and technology capability-building of SMEs for enhancing their competitiveness are indicated below:

- Conducive policy and implementation environment, including innovative financing
- Restructuring S&T education and training system to match supply and demand
- Preparation of strong and favourable IPR regime including education and awareness
- Encouraging technology transfer and commercialization
- Innovative enterprise creation
- Linkage of science and public research with industry
- Establishment of regional and global R&D network
- Close linkage of NIS or SIS to global innovation and production network (sound infrastructure, strong support system, stable/efficient legal and governance system)

- Access to technology global knowledge-base and networking through efficient linkage with local innovation systems
- Access to market and world trade information
- Industry-academy research collaboration
- Innovation cluster building and networking between firms
- Conducive competition and investment policy including FDI policy, venture capitals, risk financing, credit guarantee, promotion expenses, etc.
- Innovative SME Promotion
- Expanding research complex and S&T Park
- Internationalization and export competitiveness
- Utilization of natural resources and employment orientation
- Local and regional development
- Public-private partnerships and sustainable development
- Mind-set

D. Best practices for SMEs

As mentioned earlier, best practices depend on various factors such as levels of economic, industrial, technological and social developments; objectives at national, regional and enterprise levels, etc. Based on the studies carried out under the project, best practices adopted in some of economies in the ESCAP region or other developed countries, are given below. These best practices are mainly confined to technological capacity-building of SMEs towards enhancing their competitiveness, and need to be seen in conjunction with other aspects related to development of SMEs:

- One-spot administrative ministry/agency for SMEs
- Development of SMEs in selected sectors
- Easy and efficient implementation mechanisms
- Easy access to finance including soft loans, grants, tax concessions and fiscal incentives
- Encouraging services sector SMEs
- Encouraging access to foreign technologies and expertise, technology transfer, besides R&D networking and linkages with local academics/research institutions
- Venture capitalists, angel investors, etc
- Human resource and entrepreneurship development through restructuring of courses and mobility of professionals
- Increasing national R&D expenditures and R&D in SMEs. Innovative clusters, start-ups, S&T parks, etc. are being promoted around academic institutions and research organizations
- Encouraging innovative SMEs for internationalization and FDI in-flows and outflows
- Improving management practices
- Setting up information sources and networks for technologies and world market potential, rules etc.
- Strengthening technological and managerial capabilities of policymakers, intermediary institutions, and public-private partnerships, and putting right people at right places

- Preparing SMEs for WTO business opportunities and from other international arrangements
- Evaluation of policies and mechanisms
- Changing mind set of entrepreneurs
- Encouraging intellectual property generation in academia and IPR education in SMEs
- Encouraging ICT applications

There are wide differences in issues and best practices for development of SMEs in various economies, though generally there has been realization and understanding about the technological needs and constraints for SMEs in developing countries. Accordingly, national policy instruments and implementation mechanisms, with varying degree of successes, have been evolved, keeping in mind the national priorities and resources. Limited resources are being spread over a wider range of activities, without much of a focus and clarity in outcomes in newly industrializing and developing economies. Various economies have therefore to evolve their own best practices, based on learning from the experiences of more advanced economies.

There is no short cut than going through developmental stages and developing indigenous capabilities though there can be leap frog based on developments elsewhere. National and subnational innovation systems have a direct bearing on the technological capabilities of SMEs and their ability for competitiveness. Almost all economies have felt the need to step up R&D activities, development of human resources, and access to finance and technology for SMEs besides a conducive policy environment and efficient support mechanisms. A summary of the profile of SMEs in selected economies is given in Table 2.18. Technology related characteristics of SMEs in developing and developed economies based on the study are given in Table 2.15. These details may also guide the policies and best practices for technological development capabilities in SMEs in various economies. However, detailed studies are further needed for specific economies. The below are summary of SME promotion practices by country groups with different development stages and paths.

1. Developed countries

The main objectives of SMEs in developed countries such as Japan, the United States and Canada relate to development, maintaining technological and industrial leadership, enhancing competitiveness etc. Accordingly, the policies and mechanisms have been evolved catering to these objectives. However, the main concerns relate to customer needs, improvement in management, and productivity, and increasing profits. Lack of export financing, limited R&D investment, increase in raw material prices and lack of knowledge of foreign markets are some of the main problems of SMEs.

(1) Policies, mechanisms and incentives

In recent years, there has been increasing emphasis putting on strengthening competitiveness and internationalization of innovative SMEs through encouraging innovations and linkages with national and subnational innovation systems. Science-based technological developments and generation of intellectual capital as well as commercialization of new and emerging technologies, in corporation with public research facilities and academic institutions are a priority in the policy framework at national and regional levels. Labour laws and legal systems are also being geared up. A variety of incentives, financial and fiscal, grants, soft loans, etc. are provided efficiently. IPR education and support for patenting activities is priority.

Technological, industrial, trade and finance policies have recognized the needs and importance of SMEs. A variety of mechanisms are developed to promote innovative SMEs and their linkages with large industries as well as expertise and facilities in support institutions. These include development and dispersal of innovative clusters, technology incubators, high technology start-ups, S&T parks, innovation centres, support and advisory services centres mainly in and around the R&D and academic institutions. Promoting knowledge management and knowledge networking is a recent initiative. In Japan, a concept of "intellectual clusters" is developed which also have linkages with industrial clusters. The Ministry of International Trade and Industry also encourages the internationalization of SMEs and FDI-outflows, and provides market support and world trade information etc. Technology development and technology transfer is encouraged through a variety of support programmes including those related to skills up-gradation, WTO, identification of sources and acquisition or export of technology, training, etc. Technology management and knowledge management is encouraged. Policies are reviewed periodically and implementation mechanisms and impact assessed, and upgraded.

(2) Technology transfer and commercialization

SMEs are encouraged to transfer their technology abroad or to export technology or export of technology intensive products, projects and services. A variety of incentives are provided through participating in trade fairs and exhibitions, conducting market surveys, and establishing collaborations and partnerships abroad. Commercialization of new technologies is also encouraged through incentives, tax concessions, funds, soft loans and venture capitalism etc.

(3) World market and technological information

A number of technology and trade information centres and mechanisms have been developed to assist SMEs in obtaining and utilizing commercial and technology related information, to promote their businesses abroad, including those related to WTO and other world trade mechanisms.

(4) Information technology

SMEs are encouraged to use internet and other ICT tools to further their businesses as well as hasten their technology and business related activities. Training, software packages, affordable hardware etc. need to be encouraged for SMEs.

(5) R&D activities

The national R&D expenditures in developed economies are high, more than 2 per cent of GNP, and private sector contribution is more than 50 per cent. However, the R&D is predominantly in large sector, in house or sponsored to national R&D institutions. Innovative SMEs and technopreneurs are often resource hungry, and R&D in SMEs is limited, but technopreneurs are more innovative and supported. Further, new products and processes development is fairly practiced by SME sector, which at times are commercialized and marketed by large companies. There are many research companies or technology intermediaries which provide technology support to large companies or undertake contract or collaborative research.

The government encourages R&D and innovations in SMEs, by way of providing various types of tax concessions, soft loans, grants and sharing developmental as well as risk expenditures, and also in technology marketing including introduction or testing of new products/processes in markets and exports. R&D linkages and networking of SMEs with various institutions and large companies are also encouraged to facilitate their access to technology and technology capability-building. Technology is considered as a primary driving force for growth into global or transnational companies. Innovative clusters, intellectual clusters, incubators, high technology start-ups, etc. are the mechanisms to accelerate the technological capacity-building and innovations through sharing of costs and experiences.

National R&D and innovation systems directly impact SMEs technology capacity-building. The policy instruments have generally a synergy between the national thrust sectors for development for S&T and industry so that efforts get more focused. Scientists and technologists are encouraged to get involved in the management and decision-making processes at enterprise level. There are strong R&D and technological capabilities built up over the years in most developed countries, based on putting emphasis on science and industrial R&D. Subsequently, elaborate national innovation systems and subnational innovations systems are being developed. Technology developments in developed economies are more science based.

(6) WTO awareness

There has been considerable awareness about WTO Agreement and other world trade rules for competitiveness and technological requirements as well as capabilities required. The governments are taking measures to protect their enterprises from undesirable possible imports, through non-tariff barriers, high technical specifications and regulations, etc. The United States has the most developed system for WTO-related activities. R&D subsidies are yet not questioned in WTO, and therefore R&D expenditures are likely to increase at faster rate than in the past. The multilateral and bilateral partnerships, and facilitation of investments in other countries, are other measures to promote technology-based products and services. Trade related intellectual property system (TRIPS) Agreement is perhaps also encouraging the technology developments and innovations in SMEs in advanced countries with large R&D capabilities, to facilitate their technology businesses.

(7) Patenting and IPR

Entrepreneurs are encouraged to use patenting systems and other intellectual property right mechanisms to protect and commercially exploit their innovations. Service sector SMEs are likely to see a faster growth and internationalization of businesses in the coming times. There are basically two groups of SMEs: (1) generating and protecting their IPR; and (2) using patents, patented products and patent information for their production and innovation activities.

(8) Technology financing

Financing remains a critical issue for SMEs, and government shares risk financing. Encouragement to venture capital in new technology areas, specially at early stages of development, investment companies, angel investors, stock exchanges, technology credit guarantee, etc. are the examples. The government grants and funds are also preferred to innovative SMEs, especially those located in S&T parks, incubators and clusters. Government procurement policies also have preferential treatment for SMEs. The main focus is to develop and strengthen capacities of SMEs for long-term sustainability and competitiveness internationally. Innovation, export orientation and international partnerships are the main drivers. Some of the large banks are also now evolving strategies to finance and support SMEs since they see large business potential from this sector. Associations of venture capitals and investment companies are active and providing a range of services to entrepreneurs.

(9) Human resource development and education

Human resource development and training is an area of priority for development of SMEs, especially innovators and technopreneurs. Academicians and researchers are encouraged to promote their innovative businesses or work in companies, and are allowed partnerships or share holdings in enterprises, especially in commercialization of technologies. The entrepreneurs and employees of SMEs are also financially supported and encouraged for easy access to the training programmes, the utilization of R&D and other facilities or the expertise of the specialists/academics. A number of specialized training and business research institutions have been set up which are upgraded periodically. Educational course contents are reviewed and modified as per requirements. New methods of instructions with case studies and mutual interactions, focusing on specific needs of industry are in practice. Information technology including e-learning is increasingly used for in-service training and education. Entrepreneurship training and development institutions continuously upgrade and review their impact in industry. Mobility of professionals between R&D academics and industry entrepreneurs is encouraged.

(10) Public-private partnerships

Industrial associations and NGOs etc. are encouraged by the government to promote innovative enterprises including support to their initiatives for training, setting up of R&D and academic institutions and their linkages with SMEs, promoting S&T parks and clusters, and technology market promotion etc. High value-added and technology intensive exports are the main focus. Technology transfers and commercialization of technologies, setting up of information and R&D networks, promoting foreign collaborations etc. are some of focusing areas, which need to be supported by the government. Representatives of private sector including SMEs, are involved in decision making and government agreements with other countries. It is intended that maximum number of innovative SMEs should develop into large companies or TNCs in future. The society and political set-ups recognized the role and importance of R&D and innovations in national development.

2. Newly industrialized economies

Newly industrialized economies such as the Republic of Korea, Taiwan Province of China, and Singapore, are actively adopting approaches to build technological capacities of SMEs, basically similar to those in developed economies but modified as per their needs. The three economies have adopted different models for development. In case of Taiwan Province of China, the economy is very substantially based on SMEs which have been largely using existing technologies with efforts of upgrading, export-oriented, and internationalized.

The technological and management capabilities have been fuelled by attracting TNCs, with appropriate policies for domestic capability development and growth of SMEs. Along with this, a conducive policy environment and support system for SMEs is developed, including for financing and technological capabilities.

In the Republic of Korea, more emphasis is laid on domestic science and technological development, promotion of new and innovative enterprises, with strong emphasis on local developments and linkages with industry including SMEs. A variety of new mechanisms have been developed to support innovative SMEs, start-ups, and internationalized SMEs. In case of Singapore, emphasis is put on foreign technologies, infrastructure and support services for SMEs, besides entrepreneurship development and financing. Emphasis is also put on R&D and academics, and their networking with SMEs. Strong TNCs' presence is catalytic to SMEs.

3. Newly industrializing economics

Newly industrializing economics such as China, India, Malaysia and Thailand are also adopting similar practices as the above, for strengthening technological capabilities of SMEs. However, there are striking differences sometimes in objectives and approaches. The main objective is essentially to provide mass employment opportunities and local developments utilizing natural resources. Policies are more regulatory and protective for SMEs, though the same are being relaxed. Incentives are more towards physical support than intellectual capability-building. Role of national and subnational innovation systems is beginning to be realized for networking and development of SMEs. Entrepreneurship development and modified educational courses are being taken up or upgraded.

There are clearly two classes of SMEs. One is resource-based and low technology-based industries; and the second is medium or high technology-based, with large value addition activities. Therefore, a twin approach is being adopted. These economies also look for international support systems for development of SMEs, and encourage in-flow of foreign investments. Exports and international competitiveness are being emphasized. Further, a class of SMEs is preparing for an active role in international supply chain management rather than stand alone operations. Outsourcing businesses from developed economies is creating another class of SMEs. Retail and trade SMEs are needed for reorientation of their businesses.

4. Developing economies

Developing economies such as Indonesia, the Philippines, Viet Nam are more or less following the practices of newly industrializing economies though usually national and subnational innovation systems, technological capabilities, human resource development and infrastructure etc. are weaker than those countries. Some economies, as in case of newly industrializing economies, have prepared economic plans, incorporating the development of SMEs as one of the objectives. Administrative machinery and implementation of policies remain a matter of concern.

5. Economies in transition

Some of the economies in transition have joined European Union, and therefore are being integrated in the European development plan. However, there is a wide gap between technological and industrial capabilities between two groups of economies. There are fairly good national S&T capabilities in publicly funded institutions and large production facilities in public sector, but SMEs were conspicuously missing, besides the inefficiencies and non-competitiveness. The efficient commercialization of technologies as well as technology transfers has also been weak while a strong science base existed. These economies are now adopting practices for SMEs, as in case of European Union or industrialized economies. Financing and competitive technologies as well as marketing and other international collaborative arrangements or networking are on priority for development of industries including SMEs. National R&D expenditures are being increased along with private sector, which were at low level till some years back.

6. Least developed economies

SMEs in least developed economies are mostly labour intensive, resource based and low technology intensive. The policy focus is therefore to enhance the efficiency of production, reduce costs, etc. Those countries have also set up administrative and institutional mechanisms to promote and support SMEs, but with limited resources in finance and technology etc. The emphasis seems to be put on infrastructure facilities and support services for SMEs. International agencies and financial institutions are playing a major role in industrial development and restructuring. Education, training and R&D systems are being upgraded while clusters, incubators, etc. are being promoted for general support to SMEs. FDI is encouraged.

Table 2.15 Technology-related characteristics of SMEs in selected economies

Features	Developing Countries	Developed/Advanced Developing Countries
Objectives of SMEs	Employment, local development	National Competitiveness and internationalization
Thrust sectors for SMEs	Low tech and resource based	High-tech and innovations
Policies, incentives and mechanisms	Weak	Strong
NIS and SIS	Almost non-existent, synonymous with S&T	Advancing
National Competitiveness	Low	High
R&D	Weak	Strong
Private R&D	Very low	High
Innovativeness	Very low	High
IPR culture	Very low	High
Use of technology in SMEs	Low technology	High or innovations
Linkages with R&D and academics	Weak	Strong
Skill levels	Low	High
S&T manpower, training and education system	Weak	Strong
Clusters, incubators, S&T parks, etc.	General, employment	Innovative, specialized, Technology development encouraged
Technology acquisition, transfer, information etc. incentives	Weak	Strong
Technology Commercialization, 'start -ups'	Weak	Stronger
Standardization and quality control	Weak	Strong
Technology Financing	Very Weak	Innovative methods
FDI policies, venture capital, loans, grants, fiscal incentives, tax concessions, investment companies,	Not technology oriented, inefficient, FDI not encouraged	Tech. oriented, efficient FDI encouraged
Angel investors		
Internationalization, networking, Associations, preparedness for WTO	Very weak	Important and strong
ICT applications in SMEs	Weak	Widely used
Technology management, knowledge management and networking	Very weak, practically non-existent	Gaining
Public-private partnership	Very weak	Stronger
Technopreneurship	Weak	Stronger
Government Procurement	No specific incentives	Preferred, and incentives
Protection and reservations	Practiced	Competition encouraged
Political and societal commitment, including stable policy regime	Weak	Strong

Table 2.16 Summary of main definitions of SMEs in selected economies

Country	Definition of SME	Measure
Australia	Small enterprises: Manufacturing <100 employees; Services <20 employees Medium: manufacturing, 100-499 employees; Services, 20-499 employees	Employment
Canada	Manufacturing: Small enterprises <100 employees and <CDN$5 million in sales Medium 100-500 employees and CDN$5-20 million in sales Services: Small <50 employees and <CDN$5 million sales; Medium 50-500 employees and CDN$ 5-20 million in sales	Employment Sales
China	In general: Small enterprises, 50-100 employees; Medium, 101-500 employees Annual turnover and total capital RMB 50 million	Employment Sales Capital
India	Capital in Rs. 10 million	Employees
Indonesia	<100 employees	Employment
Japan	<SMEs> Mining, manufacturing, transportation, construction industries: <300 employees, or < ¥100 million invested capital Wholesalers: <100 employees, or less than ¥30 million invested capital Retailers, services: <50 employees, or < ¥10 million invested capital <Small-scale enterprises> Manufacturing and other industries: <20 employees; Commerce and services <5 employees	Employment Assets
Republic of Korea	Manufacturing: <300 employees, Won 20-80 billion of capital (assets); Mining, Transportation: <300 employees; Construction <200 employees; Commerce and other service business <20 employees	Employment Assets
Malaysia	Varies Manufacturing: up to 150 full time employees, annual sales turnover not exceeding RM 25 million. Definition for SMIs is different for Bumiputera enterprises	Employment Sales Shareholders Funds
New Zealand	Up to 50 employees	Employment
Philippines	Small enterprises: 10-99 employees, and P1.5-15 million in assets Medium enterprises: 100-199 employees, and P15-60 million in assets	Employment Assets
Singapore	Manufacturing: <S$15 million in fixed assets Services: <200 employees, and fixed assets <S$15 million	Employment Fixed assets
Taiwan Province of China	Mining, quarrying, manufacturing and construction industries: <200 employees, <NT$60 million of invested capital Service industries and others: <50 employees, <NT$ 80 million of sales volume	Employment Capital Sales
Thailand	Manufacturing: Small: <50 employees, <20 million baht of investment capital (not including fixed assets) Medium: 50-200 employees, 20-100 million baht of fixed assets, 20-100 million of invested capital (not including fixed assets)	Employment Capital Fixed assets
UNCTAD	Employees 100 small 500 medium	Employees
United Kingdom	Sales £2.8 million for small and £11.2 for medium Balance sheet £1.4 million for small and £5.6 million for medium	
United States	Manufacturing: <500 employees Non-manufacturing: <US$5 million in sales	Employment Sales
Viet Nam	Manufacturing and non-manufacturing: Small: <30 employees and <1 billion dong in capital Medium: 30-200 employees and 1-4 billion dong in capital.	Employment Capital

Source: Charles Harvie and Boon-Chye Leo, the Role of SMEs in National Economies in East Asia, 2002, Vol. II, p. 4-5

Table 2.17 The relative importance of SMEs in selected APEC economies

Country	Average GDP growth 1992-99 (%)	GNP US$ billion (1998)	Exports as % of GDP (1999)	Number of SMEs ('000s)	SMEs as % of all firm	% workforce employed by SMEs	% of SME sales in total sales volume	% of SME exports in total exports	% of GDP
United States	3.6	7 921.3	10.8	4 311	96.0	69.0	50.0	33.3	50.0
Japan	1.0	4 089.9	10.4	6 450	98.8	77.6	76.8	13.5	Na
Canada	3.1	612.2	43.3	2 200	98.0	66.0	Na	Na	Na
China	10.5	928.9	20.0	4 980	99.0	70.0	Na	40-60	Na
Australia	4.2	380.6	18.7	530	97.0	46.0	Na	50	Na
Republic of Korea	5.5	369.9	42.1	2 400	99.0	69.0	50.0	43.0	50.0
Taiwan Province of China	6.1	268.6	42.1	155	97.8	78.4	32.1	56.0	Na
Indonesia	3.8	138.5	35.0	105	97.0	42.0	Na	10.6	Na
Thailand	4.1	134.4	57.0	102	95.8	18.1	Na	10.0	Na
Malaysia	6.7	79.8	121.7	20	84.0	40.0	19.1	15.0	Na
Singapore	7.5	95.1	135.0	69	91.5	51.8	34.7	16.0	34.7
Philippines	3.2	78.9	51.3	78	99.5	66.2	30.8	Na	32.2
New Zealand	3.1	55.8	30.7	Na	98.9	52.9	35.0	23.0	Na
Viet Nam	7.5	25.6	40.1	14	83.0	85.0	65.0	20.0	65.0

Source: Charles Harvie and Boon-Chye Leo, the Role of SMEs in National Economies in East Asia, 2002, Vol. II, p. 6

Table 2.18 Summary of the profile of SMEs in selected economies

	Common Features	And Difference
Number of Enterprises	1. There are about 20 to 30 million SMEs in East Asia. 2. On average there are about 85 people for every SME.	1. Most of the SMEs are in China (8 million) and Japan (5 million) and Republic of Korea (2.6 million) in which together have 70 per cent of the SMEs in East Asia. 2. In developed economies there are only about 20 people per SME, but the ration is above 100 in the developing economies, especially in China, Viet Nam, the Philippines and Indonesia.
Employment	3. SMEs employ over 50 per cent of workforce. 4. Over 95 per cent of enterprises employ fewer than 100 people, and over 80 per cent employ. 5. SMEs seem to contribute about 70 per cent of net employment growth.	3. In developing economies (below about US$15,000 per capita income) SMEs employ about 75 per cent of people, above US$15,000 the level is closer to 50 per cent. Japan is a major exception – Japan's SMEs employ around 80 per cent of the workforce. 4. More developed economies seem to have more medium-sized SMEs and they play a greater role. Developing economies seem more likely to have a 'missing middle'. 5. In developed economies most of this growth probably comes from fast growth firms, in developing economies a higher proportion probably comes from net start-ups.

	Common Features	And Difference
Output measures (sales, value- added, etc.)	6. SMEs contribute about 50 per cent sales, value-added or output.	6. The contribution varies from lows of 15 per cent (Singapore) and 30 per cent (Australia) to about 60 per cent for most other economies.
Exports	7. SMEs generate about 30 per cent of exports, much less than the SME contribution to employment (about 69 per cent to 70 per cent) or output (about 50 per cent).	7. SME export figures are difficult to verify, but they range from about 5 per cent or less (Indonesia) to around 40 per cent (Republic of Korea) of total exports.
FDI	8. SMEs generate about 50 per cent of cases of FDI, but only less than 10 per cent of value of FDI.	8. Korean, Japanese and Chinese Taipei SMEs contribute most FDI originating in the East Asian region.
Entrepreneurial engine and international potential	9. SMEs already contribute the bulk of growth, and SMEs could make a much bigger contribution to the Asian regional economy if efforts were made to address impediments to SME internationalization. This could add as much as US$1 trillion per year in trade.	9. The developing economies need to create about 50 to 70 million more SMEs if they are to achieve 'benchmark' levels of SME activity.

Source: Charles Harvie and Boon-Chye Leo, the Role of SMEs in National Economies in East Asia, 2002, Vol. II, p. 46-47

VI. STRATEGIES, RECOMMENDATIONS AND CONCLUSIONS

A. Preamble

We have seen in previous chapters that the national capabilities and objectives for development of SMEs, issues and best practices for enhancing their competitiveness through technology capability-building, vary from country to country, and depend upon the national development stages including national and subnational innovation systems. The strategies and the actions to be taken to strengthen technological capabilities of SMEs would also therefore vary. The best practices in developed economies may be taken as benchmark for enhancing competitiveness of SMEs in advanced developing and least developed economies, and also in newly industrializing economies. It is clear that SMEs in all economies may not reach the same level of capabilities and competitiveness but their relative positions and gaps can be improved, or at least SMEs be not left behind in process of globalization and internationalization.

The present chapter outlines some of the strategies mainly for SMEs in developing countries in the ESCAP region, through technological interventions. It may be recognized that production and services tend to be technology and capital intensive, utilizing the labour and resources available anywhere in the world, besides other factors of competitive advantage such as quality of skills, infrastructure, policy environment, market size etc. Also, TNCs are no longer restricting themselves to home countries but internationalizing their production, R&D and services, and taking SMEs as an important player in supply-chain management. WTO and other international trade mechanisms are adding to the complexities in businesses. Based on the review and discussions, summary of SMEs in some Asian countries is given in Table 2.18. Also, a comparative status of some of the important features in technology capability development of SMEs in developing and advanced countries is prepared and given in Table 2.15. This comparison would be helpful as a guideline for development of strategies for SMEs in various economies.

B. Strategies

Since the policy objectives of SMEs in developing and least developed countries mainly relate to providing employment to masses, rural and local development, and utilization of natural resources, as contrary to promoting innovations, competitiveness and national development in advanced economies; the strategies for development of SMEs would also differ accordingly. Some strategies with generic nature are drawn up in the following.

(i) The technology policies, and NIS and SIS should recognize the trends that research & engineering, technology development, transfer and commercialization, and technology oriented production systems and marketing of products and services etc. are capital intensive, involving specialized skills and knowledge of world markets and trends in technologies. SMEs cannot have large investments in R&D. SMEs may invest as and when the earnings and profits increase with time. Therefore, sustainability is important. New business models may be necessary.

(ii) Since national capabilities and competitiveness including national and subnational innovation systems directly influence the technological capability in SMEs, it is necessary to strengthen the former and develop mechanisms so that SMEs are benefited.

(iii) Strategies need to be developed for parallel supporting two distinct categories of SMEs viz. SMEs in resource based and low technology sectors, with large employment opportunities, and the innovative SMEs in high technology sectors with potential of internationalization and to be global in future.

(iv) Universities and other academic institutions should be encouraged to generate intellectual property also, in addition to imparting quality level education. The linkages and networking with R&D institutions and industry, to encourage 'start-ups' and commercialization and transfer of technology need to be strengthened.

(v) The technology policy may be focused on development of technologies, which may not be readily available from elsewhere, and characterized by domestic resources and needs. In other areas, including emerging technologies, a selective approach, may be adopted. Short term and long term goals need to be specified. Advantage may be taken of developments elsewhere.

(vi) International collaborations, partnerships and foreign direct investment may be encouraged, with appropriate policy framework and infrastructural facilities.

(vii) Financing, marketing and skills are major concerns, besides technology, for SMEs. The long-term strategies may emphasize on capability-building and sustainability models for enhancing competitiveness of SMEs. The subsidies and direct support, based on physical inputs and outputs, may be phased out gradually or kept to minimal.

(viii) The policies and mechanisms should be considered that SMEs are usually centred around the entrepreneur (the promoter) and are supported by semi-skilled or low skilled labour. Therefore, entrepreneur should be encouraged to concentrate on productive and developmental activities rather than liaison activities or day-to-day problems solving, particularly for compliance of government rules and procedures.

(ix) Technology development and transfer is a complex process involving identification of needs, conceptualizing of R&D projects, testing and evaluation, pilot trials, assessing commercial viability, pricing and marketing etc. The choice between 'make or buy' or both or other modes of development have to be made by the entrepreneur. If it is technology transfer, identifying the technology suppliers, negotiating the terms, making an licensing agreement, procuring plant and machinery, producing the product as per the specifications agreed, etc. are important. A cordial relation between the two parties is important. These issues are unlikely to be handled by an entrepreneur alone, and external support is therefore important.

(x) The IPR strategy may aim at helping the mass SMEs in utilizing existing technologies and protecting or rewarding innovations in technology-based SMEs in new areas.

(xi) Private-public partnerships, industrial associations, non-governmental organizations may be encouraged for more effective implementation of policies. In fact, they may be involved even in policymaking. International promotional organizations such as UNESCAP and international mechanisms including regional networks may be dovetailed to the emerging needs of SMEs. SMEs usually do not have adequate information or easy access to these facilities, and are often inadequately involved or represented in these fora.

(xii) SMEs in service sector may be encouraged since service sector usually is based on utilization of existing technologies, though innovative models of doing businesses may be necessary.

(xiii) A new class of SME in ICT enabled services such as Business Process Outsourcing (BPO) and call centres have emerged in developing countries. Now, Knowledge Process Outsourcing (KPO) in areas such as engineering design, legal services, pharmaceutical R&D, and education outsourcing, is emerging a business potential for SMEs. It is estimated that KPO market world wide in 2003-2004 was at US$ 1.2 billion and is expected to grow to US$ 17 billion by 2010 (*Economic Times* dated 15 Nov. 2005).

C. Recommendations

1. Governments

(i) A coordinated policy framework, particularly those related to industry, trade & commerce, finance and technology or innovation systems, should be prepared. One-spot contact in the government for SMEs, manned by knowledgeable people, and preferably at national, state, regional and district levels, may be set up, to facilitate implementation, creating better awareness, and to avoid inconvenience to entrepreneurs.

(ii) Technology policies and incentives should differentiate between Mass SMEs and Innovative SMEs, and also the class of entrepreneurs, depending upon the risks involved. Access to existing technologies and support systems, technology transfers within the country or abroad, skill upgrading, IT facilities, should be encouraged for Mass SMEs. Productivity improvements, quality management & standards, etc. are equally important. However, these SMEs may be encouraged to move the value chain through better technologies and production method.

(iii) For promoting innovative SMEs, start-ups, internationalizing SMEs, export-oriented SMEs etc., new technology financing and support mechanisms may be evolved. These may include risk financing, special stock exchange, patenting facilities, greater mobility of personnel between research and industry, and easier access to R&D and academics. Academic entrepreneurship or start-ups may be encouraged through allocating a part of government funds to national institutions.

(iv) SMEs sometimes hesitate to pay taxes, in some developing countries and therefore do not much appreciate the tax concessions. The import duties or tariffs etc. are being gradually reduced or rationalized in line with WTO, in most economies. Therefore, the existing incentives etc. need to be reviewed and new forms of incentives are needed. Also, the R&D and technology efforts in mass SMEs are usually of incremental nature, and also depend upon the trade policies. In order to encourage innovations and strengthen competitive capabilities against imports or to export, new forms of incentives would be needed.

(v) Traditional sectors such as garments & textiles, toys, auto-components, chemicals, engineering, leather, food processing, metal and fabrication, gem & jewellery, etc. would continue to be important for most developing countries, and SMEs would continue to be major players, along with large companies and TNCs. Technology support services and technology capability-building and other incentives would need to be continued for such SMEs but forms may change. Technology network, information services, testing and standardization facilities, environmental testing, etc. may be crucial. The quality and availability of raw materials at reasonable prices, and other inputs would be necessary. Technology transfer and Business development consultants need to be promoted, besides promotion of agricultural and rural technology-based enterprises.

(vi) IT capabilities including hardware and software would be necessary for efficiency and compatibility with large companies and step up in value chain.

(vii) The mechanisms such as clusters, incubators, technology centres, consulting services etc. focus on infrastructural facilities, cost reduction and productivity improvements, information sharing, market development, etc. Therefore, setting up of 'technology services clinics' in the vicinity of SMEs, industrial estates, clusters, incubators, etc. is recommended, on a sustainable business model. Entrepreneurship development programmes for family businesses need to be actively evolved.

(viii) Innovative SMEs and SMEs in high technology areas would need to be supported through mechanisms such as innovative clusters around academic and R&D institutions, intellectual clusters as in case of Japan, venture capitalists and risk financers, etc. Mobility of scientists/technologists and entrepreneurs would need to be encouraged globally. A new class of technopreneurs emerging in recent years contrary to family or semi-literate entrepreneurs, will deserve greater thrust of the government and flexibility in rules or policies. Greater access to NIS or SIS would be necessary in such cases. Formation of teams from different disciplines such as finance, technology, legal profession, marketing etc. would be desirable, in such ventures.

(ix) FDI (inward and outward) and other forms of foreign partnerships, with appropriate domestic policy framework and parallel strengthening of indigenous capacity-building are desired, as in case of the Republic of Korea and Singapore. Financial institutions and banks need to reorient their thinking and approaches to support SMEs, and develop more risk taking capacity. Venture capitalist's and investment companies etc. also need to offer a package of services and should increasingly be ready for first stage financing.

(x) Policies, mechanisms and incentives need to be evolved for service SMEs. Recent trends in IT enabled services such as Business Process Outsourcing (BPO), Call Centres and Knowledge Process Outsourcing (KPO) such as design & engineering, legal services, consulting, clinical research and testing, project management, etc. are opening up opportunities for SMEs, besides subcontracting and vendor development for large companies or TNCs. Trading and retailing SMEs is another class needing reorientation of their business. Technology transfer policies may be reviewed and evaluated periodically new business models may be studied and their applications in practical situations need to be established.

(xi) With the liberalization of investment and trade policies and emerging world trade rules, the impact of globalization and outstanding issues for SMEs, need to be studied. SMEs need to be prepared for WTO implications and business opportunities. Training and awareness programmes, besides R&D and technological support services, need to be arranged or made available for them.

(xii) Dedicated technology transfer mechanisms or facilities need to be promoted.

2. Private sector

(i) Public sector companies or service sector are being privatized or thrown open to public-private partnership in many developing countries. In countries such as

India, reservation and other protective policies for SMEs are being liberalized and SMEs have to compete with large companies or TNCs even in domestic markets. The SMEs would themselves have to take initiatives and change their mind-set to compete globally. Large companies and TNCs also need to assist and network to develop technological and management capabilities of SMEs since they are now more active actual players in their supply-chain management.

(ii) E-learning methodologies, along with conventional modes of teaching or training would be useful for on the job training and skill development of entrepreneurs and employees.

(iii) The private sector should increasingly spend more on innovations and R&D or technology related capability-building.

(iv) There are practically no formal courses for training of management personnel for SMEs. Existing Management and other academic institutes generally cater to the requirements of organized sector. Private enterprises and government may take initiatives in this direction.

(v) Private sector including SMEs should take full advantage of government incentives and institutional facilities for their technological capability-building, and begin to trust the domestic expertise and capabilities. The higher is the risk, so are the gains. External capabilities may be utilized or tapped to compliment in-house capabilities.

(vi) SMEs should be more professional and transparent. Rating agencies may be promoted for various purposes such as evolving a policy framework, ascertaining the creditworthiness of SMEs, promoting foreign tie-ups, etc.

3. Industrial associations

(i) Industrial associations including SME associations, promotional agencies, NGOs etc. are important for the promotion and development of technological capabilities and strengthening competitiveness of SMEs. It is suggested that such organizations should assist SMEs through promotional programmes, besides representing their interests to the government. The programmes may include:

- Organizing training and skill development programmes;
- Market promotion through organizing and participation in exhibitions, trade fairs, conferences, etc. within the country and outside;
- Setting up information systems and providing advisory services;
- Forging partnerships in the country and abroad;
- Evolving sustainable models and public-private partnerships for implementation of government policies and incentives and running or managing institutions;
- Preparing case studies and data bases to help government in international negotiations or in policymaking;
- Creating awareness about government policies, world market information, certification and standards in other countries, export requirements, technological trends, etc.; and
- Encouraging exchange of experts/professionals etc.

(ii) Specialized associations such as those of clusters technology incubators and S&T Parks, venture capitalists, etc. should organize trade fairs etc. for innovative SMEs, especially to promote technology intensive trade and technology transfers etc.

(iii) Most of the activities can be undertaken with the support and cooperation of government agencies and international organizations such as SMEs Institute in Italy and APCTT at New Delhi.

(iv) Services of retired professionals and experts may be organized for SMEs as in some of the developed nationals such as the United Kingdom, Canada, and the United States.

(v) Public-private partnerships may be promoted for business development and technological capabilities of SMEs, in public funded projects and procurements.

4. International promotional organizations

(i) There is a need to review the existing policies programmes and mechanisms set up at regional or subregional or international levels for the promotion and development of SMEs, including strengthening technological capabilities. Awareness among SMEs needs to be increased.

(ii) There is a need to assess and review the viability and present status of various institutions set up in various countries, for assisting SMEs in areas such as tool rooms, training, design and testing, etc. It is observed in many cases that such institutions are no longer viable after the international funds dry up. An independent status report of the past projects may be sought before new projects are supported.

(iii) A quick literature survey indicated that many of the regional or subregional initiatives generally did not adequately address technology capability-building issues for SMEs, specially R&D and innovations etc. though technology transfer is considered at some places.

(iv) UNESCAP has taken several technology related initiatives for SMEs, especially the setting up of APCTT and its various programmes. However, the activities of APCTT need to be strengthened and involvement of SMEs need to be increased through more practical and demand oriented programmes.

(v) There is a need to prepare an atlas of SMEs related institutions in the UNESCAP region and widely disseminate the same to SMEs through their Associations and governments.

(vi) Programmes for exchange of expertise and experiences among member countries may be organized by ESCAP on sustainable basis for various groups of beneficiaries. Sector based national workshops to meet needs of UNESCAP countries may be organized in areas such as technology transfer for global competitiveness and new technologies, IPR, R&D globalization and its impact on SMEs, etc.

(vii) Information services and networking related to business needs and potential for SMEs may be set up on a sustainable business model. The functioning of existing information networks for SMEs may be reviewed, and a simpler network model, usable by SMEs, need to be conceptualized. Basic data collection and updating is most difficult, and national agencies would need to be identified for this purpose.

(viii) Studies should be mounted to document the experiences and issues related to WTO agreements and their implications on businesses of SMEs in the ESCAP region. The actions needed for preparing SMEs for WTO related challenges and opportunities need to be identified for groups of economies. The implications of regional and subregional trade agreements for SMEs also need to be studied.

(ix) Documentation and availability of information related to technology related requirements (regulations etc.) in importing countries is also needed by SMEs, specially in areas such as food and agriculture, pharma, biotechnology, etc.

5. Financial institutions

Financial institutions, banks, venture capitalists, etc. need to be more transparent and responsive to SME needs, and also be more risk oriented. At the same time, SMEs also need to be more transparent in financial transitions and records, specially internationalizing SMEs or those seeking to graduate to large companies or foreign tie ups.

D. Conclusions

SMEs are important for almost all economies, and contribute significantly to industrial production, exports, employment, and GDP. The total number of SMEs generally constitutes 80 to 98 per cent of total business entities in a country, though the definitions of SMEs widely vary. The role of technological capabilities for strengthening competitiveness of SMEs in the globalizing and liberalizing world is well recognized, but technology policies, mechanisms and incentives widely vary among the economies in the region, as the availability of resources and technology or innovation capabilities at national and enterprise levels. R&D capabilities are weak and R&D expenditures are low in SMEs.

The Republic of Korea, Singapore, and Taiwan Province of China clearly stand out in innovations and technological capabilities of SMEs, coupled with best practices adopted, with differing business models. China, India, Malaysia and Thailand are next. Indonesia, the Philippines, Viet Nam and Pakistan are among the developing economies, while the least developed economies have a long way to go. The countries with economies in transition and CIS countries have also to travel a long way in SME sector and entrepreneurship though some of them have a strong science base and large production experiences. Some of them have joined EU and are beginning to be developing along with it.

Technology development is a multidisciplinary activity and so is innovation. Therefore, technological capability-building in SMEs is closely linked to other dimensions of development of SMEs. Moreover, the business models for SMEs are undergoing a sea change due to globalization and intense international competition. SMEs are becoming a crucial link in the international value chain and supply-chain management.

A twin approach has emerged for development of SMEs in most developing countries. In advanced countries, SMEs are more innovative and up-in-value chain, some of them are being nurtured through technological and other support systems, for internationalization and being on global map in future, with the broad objective of enhancing national competitiveness. In other developing countries, traditional manufacturing sectors such as textiles, leather, food processing, consumer products, metals and fabrication, etc. continue to be important, and therefore SMEs based on natural resources and using low levels of technologies, continue to be crucial for employment, production, exports, etc. At the same time, these countries have also identified new and emerging technology areas for development, at least with the objective that they are not left far behind. As a result, the limited resources are widely spread over a large number of programmes, with sub-critical operations or investments for visible outputs. The work culture and sound mind-set to new developments, discipline, lack of transparency in implementation, etc. are some other factors.

The issues and best practices for SMEs vary widely from country to country. However, some of the best practices include supporting innovative SMEs in building their technological and management capabilities for long term sustainability and international competitiveness through a variety of measures, hoping that some of them might grow to be TNCs. Development of skills and resources, access to technology anywhere in the world, world trade and technology information, networking and linkage with R&D, academics, and international organizations, encouraging FDI flows, innovative clusters, technology incubators, S&T parks, mobility of entrepreneurs & scientists/experts, encouraging start-ups, innovative financing including technology financing, risk sharing, etc. are some of the measures adopted for strengthening of SMEs competitiveness.

Preparing SMEs for WTO and other international trade mechanisms, IPR literary and protection of R&D results or innovations, knowledge about world trade regulations and mandatory requirements, IT and internet applications, etc. are some other areas of support for SMEs. SMEs have to think forward, and increase their R&D expenditures. Profit making SMEs can at least invest a small part of their earnings into R&D for long term sustainability and competitiveness. Venture capitalist and investment companies also need to be more technology and risk savvy.

Strategies and recommendations basically relate to the national needs, resources, capabilities and objectives of SMEs, and therefore would vary from country to county. However, some generic approach might include review of existing policies and incentives, efficiency in implementation, training of policymakers and intermediaries, greater risk sharing, financing with easier access to SMEs, reorientation or upgrading of educational systems and training programmes, greater IPR awareness, management and generation; educational institutions to be more R&D oriented, development of intellectual and industrial clusters and technology incubators around R&D and academic institutions, etc. Technology flows with FDI, and management capability-building through linkages with large companies and TNCs.

Efficient technology transfer mechanisms and access to technology for SMEs is very important, especially for traditional sectors needing minor up gradation and improvements. Evolving sustainable models, preferably with public-private partnerships, for support and technological capacity-building as well as enhancing productivity in SMEs, ensuring quality raw material and other inputs at reasonable prices, infrastructural facilities, etc. would add to the efficiency and the competitiveness of SMEs. Service sector is another area for developing SMEs, mostly using existing technologies innovatively.

Besides the government, private sector, industrial associations and promotional agencies including NGOs, and international, regional or subregional organizations have major role to play in the technological capability-building of SMEs. There is a need to create awareness about various SME related programmes and institutional facilities available for SMEs. At the same time these programmes and mechanisms also need to be reviewed, and sustainable development models need to be evolved, with the active support of SMEs as per their requirements.

ESCAP should undertake promotional activities related to exchange of experiences and expertise, information systems, developing an atlas of SMEs related institutions and facilities, and mechanisms for information related to technology & business opportunities for SMEs. APCTT needs to be strengthened, with more active involvement of SMEs and commitment of member countries.

Financial institutions, banks, venture capitalists, SME stock markets, micro-financing, etc. have a major role in promoting technology related capacities in SMEs, and therefore need to be promoted or encouraged to finance transparently and be more risk taking approaches. Many banks see large business opportunities from SME sector.

Ethical issues in transfer and applications of new technologies need to be taken into account since there are always possibilities of adverse effects or use of technologies. For example, cyber crimes and implications of genetic engineering are a matter of concern in the society.

REFERENCES

1. Farakas Conn Irene; New Strategic Partnerships Between Large International Banks with Small and Medium Enterprises; Bulletin of the American Society of International Science, Vol. 25, No.5, June/July 1999, www.asis.org
2. SMEs: A world view; http://www.prospects.ac.uk/cms
3. Istanbul Ministerial Declaration: Fostering the Growth of Innovation and Internationally Competitive SMEs, OECD Conference, 3-5 June 2004.
4. INSME-International Network for SMEs, http://www.insme.org/page.asp
5. The 2nd OECD Conference for Ministers Responsible for SMEs, The Business Symposium, 4-5 June 2004, Istanbul, Turkey.
6. Linda Low; Enhancing the Development of International Production Networks Through Regional Cooperation Initiatives; Paper for Second Session of the Committee on Managing Globalization, Bangkok, 12-14 Oct. 2005
7. George T. Solomon, The George Washington University; et al.; An analysis of Small Business Training and Development in the United States, by size of Business.
8. RBC Economic-Economic Research and Analysis on Canada, USA and International, http://www.rbc.com/economics/news
9. 5th International Conference on Challenges and Opportunities of EU Enlargement for SMEs in CEI countries, 5-7 Nov. 2003, Piran, Solovenia.
10. Small and Medium-Sized Enterprises (SMEs) in EU Research; EU Initiatives within IS. Centre of International Technology, http://www.cit.org.by/fp
11. SME Procurement, http://www.silicon.com/research
12. In www.edecad.info, and Reports on KM, Technology Financing, e-status in SMEs in India; of IIFT New Delhi.
13. CEI (Central European Initiative) Executive Secretariat Geneva, 30 March 2004, CEI Working group on SMEs-Chairman's Summary.
14. Yu Shi; A Greenhouse for SMEs; Techmonitor, May-June March-April 2005, pp.25-31.
15. APEC and SME Policy: Suggestions for an Action Agenda; Chris Hall, University of Technology Sydney, http://www.apec.org.au/docs
16. The Highlights of the APEC Survey on Small, and Medium Enterprises, http://www.actetsme.org/archive
17. Asian Policy Blueprint for SME Development (APBSD) 2004-2014, ASEAN SMEs working group (SMEWE), 2003.
18. ASEAN Annual Report 2002-03-SMEs.
19. Promoting the Export Competitiveness of SMEs, UNCTAD, TD/B/Com.3EM.23/2, 20 Oct. 2004.

20. WIPO and Small and Medium-Sized Enterprises, World Intellectual Property Organization, Geneva.

21. Aharon Hauptman & Yoel Raban (ICTAF); Knowledge Integration and Network Expertise; University of Twente (NL), etc. GRID-CT-2002-00700, KINX D8.4; D8.4: Policy For Fostering KI in SMEs, European Commission.

22. Asia and Pacific Centre for Transfer of Technology (APCTT), www.apctt.org

23. Henri Angelino, et al.; Case study on Comparison of Innovation Policy and Transfer of Technology from Public Institutions in Japan, France, Germany and the United Kingdom, NII Journal No. 8 (2004.2).

24. Hiroshi Yasuda; Strategic Alliances for SME; Tech Monitor, May-June 2005, pp.16-22, www.techmonitor.com

25. Rosnah Mohd. Yusuff et al.; Advanced Manufacturing Technologies in SMEs; Tech Monitor, May-June 2005, pp. 23.29, www.techmonitor.com

26. Mc Donald, Frank, et al.; International Business; Academy of International Business, the United Kingdom Chapter, 2002.

27. Hazley, E.J.; Accelerating Growth of Small and Medium Enterprises via Internationalization: Best Practice Policy Initiatives; colin_hazley@lycos.com

28. Guerrero M; SMEs Internationalization and Transition of the Knowledge Based Economy, WASME, Bucharest, Romania 16 May 2005. www.wasmeinfo.org

29. UNCTAD; Geneva; Handbook on FDI by SMEs – Lessons from ASIA; 1998

30. Issue Paper on Bridging the Technology Gap; United Nations Commission on Science and Technology for Development; Inter-session Panel Rabat, Morocco, 10-12 Nov. 2005

31. Promoting Business and Technology Incubator for Improved Competitiveness of Small and Medium-Sized through Application of Modern and Efficient Technologies; UNESCAP, 2004

32. India Global Summit on MSMEs, Background Paper, 25-26 Nov. 2005, New Delhi; Ministry of Small-Scale Industries, and Confederation of Indian Industry

33. Agarwal, S.P.; Consultancy Services in India; Bookwell, New Delhi, 2005.

34. Agarwal S.P. and Jasmine Acharya; An Exploratory Study on Managing Knowledge in SMEs in India for Competitive Advantage – R&D Management Conference, CSIR, 6-7 December 2004, pp. 1-8

35. Agarwal, S.P; FDI in SMEs in India: International Conference for Development and Revitalization of SMEs in China, DMU, China, 14 July 2005.

36. European Competitiveness Report, 2002; European Commission, http://europa.eu.int

37. Global Competitiveness Report 2005; World Economic Forum.

38. ACTETSME, SME profile, the United States, http://www.actetsme.org/usa

39. Glenda Napier et al.; International Organization for knowledge Economy and Enterprise Development; Strengthening Innovation and Technology Policies for SME Development in Turkey, Dec. 2004.

40. Szabo antal; Internationalization of SMEs; www.unece.org/indust/sme

41. Agarwal, S.P.; Technology Financing and FDI in SMEs in India; International Research Seminar on Financing the Future; Financing SMEs Technology and Development, University of Central England, Birmingham, the United Kingdom, 16 June 2004.

42. Agarwal, S.P.; A Study on Development for Enhancing Local SMEs Competitiveness Based on Technology Capacity-Building; UNESCAP Fact-Finding Mission Report, 20-30 Sept. 2005, Oct. 2005

PART THREE

BENCHMARKING FROM SUCCESSFUL COUNTRIES: EXPERIENCES, LESSONS AND BEST PRACTICES ON SIS

I. PROSPECTIVES ON THE TECHNOLOGICAL INNOVATION: LESSONS FROM KOREAN EXPERIENCE[1]

A. Economic growth in the Republic of Korea

Over the last five decades, the Republic of Korea has been one of the fast developing countries in the world. From 1970s to 1990s, gross domestic product (GDP) has shown an annual growth rate of around 10 per cent: per capita income has increased over hundred times from just meager US$ 80 in 1960 to US$ 14,143 in 2004; its GDP has dramatically expanded from US$ 2 billion in 1960 to US$ 680 billion in 2004 as shown at Table 3.1. In 2004, the Korean economy ranked the 11th and the 12th reaching US$ 680 billion and 254 billion in the world in terms of GDP and exports respectively. As of 2004, the trade volume of the Republic of Korea reached US$ 478 billion, ranking itself the 12th in the world.

Table 3.1 Major economic indicators

	1960	1970	1980	1990	2000	2004
Population (1,000)	25,012	32,241	38,124	42,869	45,985	48,082
GDP (US$ billion)	2	8	62	253	512	680
Growth rate of GDP (%)	2.2	17.2	21.8	20.6	8.5	4.6
GDP per capita (US$)	80	248	1,632	5,900	11,134	14,143
Trade balance (US$ million)	-65	-597	-4,284	-2,004	11,787	29,382
Exports (US$ million)	32	660	17,214	63,124	172,268	253,845
Imports (US$ million)	97	1,256	21,598	65,127	160,481	224,463

Table 3.2.1 International comparison of GDP

Country	1980*		1990*		2000*		2004**	
	Rank	US$ million	Rank	US$ million	Rank	US$ million	Rank	US$ million
United States	1	27,700	1	57,600	1	97,600	1	116,675
Japan	2	10,600	2	30,400	2	47,500	2	46,234
Germany	3	8,930	3	16,670	3	18,700	3	27,144
United Kingdom	5	5,360	6	9,900	4	14,400	4	21,409
France	4	6,820	4	12,200	5	13,100	5	20,026
Italy	6	4,490	5	11,000	7	10,700	6	16,723
China	11	1,880	11	3,550	6	10,800	7	16,493
Spain	9	2,210	9	5,100	11	5,620	8	9,914
Canada	7	2,650	7	5,740	8	7,140	9	9,798
India	12	1,820	12	3,170	13	4,570	10	6,919
Republic of Korea	**29**	**638**	**15**	**2,640**	**12**	**5,120**	**11**	**6,797**
Mexico	10	1,940	16	2,630	10	5,810	12	6,765
Australia	14	1,660	13	3,110	14	3,890	13	6,313
Brazil	8	2,350	10	4,620	9	6,020	14	6,049
Russian Federation	-	-	8	5.170	17	2,600	15	5,824

*Source: * World Bank, WDI online DB/ **IMF, WEO DB*

[1] *This paper was prepared and presented by Mr. Young-Rak Choi, Chairman, the National Science and Technology Council, the Korea Research Council of Public Science and Technology (KRCPST), Seoul, Republic of Korea.*

Table 3.2.2 International comparison of export as of 2004

(Unit: US$ 100 million)

Rank	Country	Export	Rank	Country/Area	Export
1	Germany	9,123	11	Hong Kong, China	2,655
2	United States	8,188	**12**	**Republic of Korea**	**2,538**
3	China	5,933	13	Mexico	1,891
4	Japan	5,658	14	Russian Federation	1,835
5	France	4,487	15	Taiwan Province of China	1,824
6	Netherlands	3,582	16	Singapore	1,796
7	Italy	3,492	17	Spain	1,786
8	United Kingdom	3,469	18	Malaysia	1,265
9	Canada	3,165	19	Saudi Arabia	1,262
10	Belgium	3,065	20	Sweden	1,225

Looking into top ten export industries of the Republic of Korea over the past five decades, its industrial structure has been going continuously changed from natural resources based light industries in 1960s-1970s to export-oriented heavy & chemical industries and high-technology industries in 1980s-1990s to knowledge-based high-technology and service industries in 2000s (see Table 3.3). Since 1980s, the Korean economy has transformed its industrial structure to one of comparative advantage by participating in international network of production or global value chain in high-technology industries. In particular from 1990s, the government made great strides in promoting high-technology industries including ICT sector through pursuing continuing industrial restructuring and technological innovation along with the development of high-skilled human resources. Until the 1990s, the industrialization process followed the so-called "catch-up model" in which it imported, adapted, imitated and localized advanced technologies. Through this process it has gained the momentum for continuous economic growth and moved to technology-intensive and knowledge-based economy.

Table 3.3 Changes of Korean top ten exports

1970s: Natural resources and light industries			1980s: Light and heavy & chemical industries		
	Item	**%**		**Item**	**%**
1	Textiles	40.8	1	Textiles	28.8
2	Plywood	11.0	2	Electronics	11.4
3	Wig	10.8	3	Iron & Steel products	9.0
4	Iron ore	5.9	4	Footwear	5.3
5	Electronics	3.5	5	Ships	3.5
6	Fruits & Vegetables	2.3	6	Synthetic fibers	3.3
7	Footwear	2.1	7	Metal products	2.3
8	Tobacco	1.6	8	Plywood	2.0
9	Iron & Steel products	1.5	9	Fish	2.0
10	Metal products	1.5	10	Electrical goods	1.9
1990s: Heavy/chemical, and high-tech industries			2000s: High-tech, and heavy & chemical industries		
	Item	**%**		**Item**	**%**
1	Textile products	11.7	1	Semiconductor	15.1
2	Semiconductor	7.2	2	Computers	8.4
3	Footwear	4.6	3	Automobile	7.7
4	Ships	4.3	4	Petrochemical products	5.5
5	TV/VTR	4.1	5	Ships	4.8
6	Iron & Steel products	3.8	6	Wireless Telecom Equip	4.7
7	Textile fabrics	3.6	7	Iron & Steel products	2.8
8	Computer	3.3	8	Textile products	2.7
9	Audio	3.0	9	Textile fabrics	2.1
10	Automobile	3.0	10	Electric appliances	2.1

B. Growth of science and technology sector

1. Major R&D statistics

The science and technology (S&T) sector has made a substantial contribution to the overall economic development of the Republic of Korea. As Table 3.4 indicates, the quantitative S&T indicators have rapidly improved over the last five decades. The gross expenditure of research and development (GERD) has greatly increased from US$ 4 million to US$ 19,370 million, while the ratio of R&D expenditures per GDP has jumped to 2.85 in 2004 from meager 0.25 in 1963. The composition of government versus private sector R&D expenditure has also much improved with 93:3 in 1963 to 25:75 in 2004. The number of researchers increased to 209,979 in 2004 from 5,628 in 1970, while the number of full time equivalent (FTE) researchers reached 156,220 in 2004 and 108,370 in 2000.

Table 3.4 Major R&D statistics

	1963	1970	1980	1990	2000	2004
GERD (US$ million)	4	33	428	4,676	13,849	19,370
Government vs. Private	97:3	71:29	64:36	19:81	25:75	25:75
R&D/GDP	0.25	0.38	0.77	1.87	2.39	2.85
Researcher (persons)		5,628	18,434	70,503	159,973	209,979

Source: Ministry of Science and Technology

2. Evolution of R&D system

From 1970s as the focus of the government economic policy has been shifted to export-oriented industry, the role of government-supported research institutes (GRIs) has been largely centred on supporting technological capability of industries, when there were no in-house R&D activities in most of private companies. As a result, the public institute (GRIs) spent 84 per cent of GERD in 1970, while university and company spent 4 per cent and 13 per cent respectively in the same year. However, as can be shown in Table 3.5, since 1990, the private company has emerged as a major R&D actor, spending over 70 per cent of GERD. The ratio of university R&D expenditure in GERD has been remained around 10 per cent.

Table 3.5 Evolution of R&D system (Unit: GERD, per cent)

	1970	1980	1990	2000	2004
Public Institute (GRIs)	83 (25)	49 (27)	22 (16)	15 (11)	13 (10)
University	4	12	7	11	10
Company	13	39	71	74	77
Total	100	100	100	100	100

3. Academic papers and oversea patents

The scientific performance in terms of academic papers and patents has shown a significant growth over the last decade. For instance, academic papers have reached a total of 19,279 papers, 1.96 per cent share of total papers enrolled in science citation index (SCI) as of 2004, which increased over ten fold than that of 1997, 7,852 papers. In 2004, the Republic of Korea ranked the 14th in the world in terms of SCI papers. Meanwhile, in terms of overseas patents registered in the United States, the Republic of Korea marked the 6th in the world, reaching 4,132 in 2003, increased from 224 in 1990 (the 17th in the world).

Table 3.6 Academic papers (SCI)

	2000	2001	2002	2003	2004
Number	12,316	14,733	15,705	18,635	19,279
Increase (%)	10.5	19.6	6.6	18.7	3.5
Share (%)	1.39	1.61	1.71	1.85	1.96
Rank	16	15	14	14	14

Table 3.7 Overseas patents (the United States, Registrations)

	1999	2000	2001	2002	2003
Number	3,568	3,331	3,546	4,009	4,132
Rank	7	8	8	7	6

C. National innovation system in the Republic of Korea

The national innovation system is the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies (Frieman, 1987): some scholars define NIS as a the national institutions, their incentive structures and their competences, that determine the rate and directions of technological learning in a country (Partel and Pavitt, 1994). Looking at key features of the Korean NIS, it has been characterized by a large, vertically integrated firm model, with human resources being a key element, as well as evolved as an open system in which the nation has focused on the so-called self-reliance and export market-oriented strategy through importing basic knowledge and active technological learning.

In particular, the private sector has made strenuous efforts in building indigenous technology capacity to efficiently adapt and exploit imported technologies by promoting actively in-house R&D activities and pursuing strong application-oriented technology development particularly in production process. The government has driven its strong initiative for accumulating rapidly technological capability in the early stages, but the private firms became a major driving force from the later 1980s, by focusing on the rapid commercialization of new technologies and catching-up the global frontrunners in high technology industry sector.

Meanwhile, with respect to public-private partnership, the Korean NIS has developed relatively close government-business relations through the formation of formal as well as informal channels. There are various kinds of technology innovation partnerships between public and private actors, including general R&D support, informal collaboration, contract research, training programme, technology incubation, cluster formation and human resource development, etc. From the early 1980s, the government introduced national R&D programmes in order to support industrial technology development, along with the introduction of a variety of financial and tax incentives for stimulating firm's R&D investments, including technology development reserve fund system, tax credit on expenditures for R&D and human resources development, etc. Also, the government has increasingly liberalized its technology licensing system from a negative to a positive system in order to facilitate commercialize public-funded R&D results as well as to promote technology flows from overseas.

The Korean NIS has shown some unique aspects in the education sector. The government has continuously expanded the scale of science and engineering education at the tertiary level, which led to sufficient supply of mid-level engineers in production sites, while operating a large-scale vocational training programmes to provide skilled workforce to private sector. Especially, the government has put a special policy priority on the development of high-caliber S&T manpower to meet increasing demand for R&D.

To this end, the government set up research-oriented science and engineering universities such as the Korea Advanced Institute of Science and Technology (KAIST) and the Kwang-Ju Institute of Science and technology (K-JIST). The Pohang Science and Technology Institute (POSTECH) is the only research-oriented university initiated by the private sector to foster top- notch scientists and engineers. Special care has been taken by both the public and private sectors of attracting expatriates studying abroad, resulting in great contributions to technology capacity-building in both GRIs and in Chaebols (major large corporations in the Republic of Korea).

From 1990s, the private sector has emerged as a key driver in the Korean NIS. Since that time, the Korean economy has shown a remarkable performance of growth in the world through exerting its unique strategy of firm dynamics which is composed of the three factors below.

- **Economy of scale**
  - Strong mass production system in highly standardized items
  - Large-scale and massive in-house technological learning
- **Economy of speed**
  - Concurrent engineering and parallel product development system
  - Close interface between R&D and production departments
  - Active import and outsourcing of technological knowledge
- **Dynamic firm capability**
  - High risk-taking in terms of technology and market
  - Long-term commitments to technology development by Chaebols
  - Top management leadership with long-term vision as well as technological insights

The Korean NIS needs a new paradigm to upgrade the existing industrial structure: transforming from fast follower to innovation leader as shown in Table 3.8.

Table 3.8 Transformation of industry structure to innovation leader

Fast Follower	⇨	Innovation Leader
• Manufacturing & process technology • Skilled workforce and expeditious learning • Import of core tech. and capital goods	DRAM CDMA TFT-LCD Shipbuilding Automobile Steel	• Architecture & platform technology • Creative human resources • Fundamental tech., fusion tech., parts, S/W, service, etc. • Networking among innovation actors • Path-navigating innovation

D. Sources of corporate growth in the Republic of Korea

As shown in the table above, the Korean economy has been rapidly growing by improving manufacturing and process technology; promoting skilled workforce and expeditious learning; and importing core technology and capital goods. There are six champions in manufacturing sector which achieve remarkable performance in the world economy as follows:

- DRAM: world market leader since 1998 (46 per cent, 2004)
- CDMA: world market leader since 1998 (45 per cent, 2003)
- TFT-LCD: world market leader since 2001 (44 per cent, 2004)
- Shipbuilding: global market share - 34 per cent in 2004
- Automobile: global market share - 7.1 per cent in 2004
- Steel: global market share - 4.4 per cent in 2004.

In the following, success factors of the above-mentioned sectors including two venture companies are analysed at the firm's dynamic aspect.

(1) DRAM (Dynamic Random Access Memory): Samsung

- Long-term commitment and continuous large investment by Chaebol system
- Economy of speed: concurrent engineering
- Massive resource inputs for technological learning
- Close interface between R&D and production departments
- Ability to integrate internal R&D and outsourcing
- Top management leadership to provide favourable environment for R&D activities

(2) CDMA (Code Division Multiple Access): Samsung

- High risk-taking to overcome uncertainty of technology and market
- Ability to introduce new products with strengths in design and timeliness
- Good integration of fundamental technologies imported from Qualcomm Inc. and self-developed production of technologies

(3) TFT-LCD (Thin Film Transistor-Liquid Crystal Display): Samsung

- Aggressive investment even in hard times
- Focusing on global standard items rather than niche ones from the beginning
- Effective utilization of the accumulated technologies and manpower in DRAM area
- Initiatives in developing new products by focusing on two-step ahead of critical technologies

(4) Shipbuilding: Hyundai

- Economy of scale: Strengths in mass production
- Top class design power and skilled technicians
- Aggressive technological learning: All-out efforts to foster its own technical manpower through internal education system
- Active import of technologies, utilization of foreign engineers and overseas technical training

(5) Automobile: Hyundai

- CEO leadership to overcome several difficulties in its growth path
- Strong will to enhance internal technological capabilities to establish its own brand from the beginning
- Effective management of constructed crisis to boost up the fast internal learning of key technologies
- Active import of foreign technologies from various sources of different countries

(6) Steel: POSCO

- Strong support of government at the beginning including sufficient supply of infrastructure
- Adoption of the latest production facilities
- Securing long-experienced engineers and technicians by powerful internal promotion
- Active technological learning through in-house and overseas training

(7) MP3 Player: Iriver (Venture company)

- MP3 Player market share: domestic 50 per cent , global 25 per cent (2004)
- Product design innovation: prism-shaped triangular form
- Own brand: Separation from ODM
- Urgent issue: Overcoming tough global competition
- Key success factor: Product design first, circuit design follows

(8) Motorcycle Helmet: HJC (SME)

- No. 1 in global market share during the last 11 years
- World-best quality in surface-strength & shock-absorption
- 42 domestic and international patents
- Key success factor: Technology-intensive growth strategy during the last 30 years: invest 10 per cent of annual sales for R&D

E. Economic growth model of the East Asian countries

This section introduces and compares economic growth models of the East Asian countries/areas including Taiwan Province of China and Singapore in the national innovation system (NIS) perspective, particularly looking into their NIS key features, public-private partnerships, education sector, firm dynamics and pressing issues. This section also attempts to draw upon lessons replicable to other countries.

1. Taiwan Province of China: National innovation system

(a) Key features

- SME-public sector driven innovation network model
- Specialization in OEM (Original Equipment Manufacturing), ODM (Original Design Manufacturing), OBM (Original Brand Manufacturing), OIM (Original Idea Manufacturing), etc.
- Key element: human resources
- Open system: International division of labour and presence of substantial numbers of multinational corporations (MNCs)
- Networking economy through local sub-contracting networks

(b) Public-private partnership

- Role of GRIs: Industrial Technology Research Institute (ITRI)
  - Support for private sector's technological upgrades and applications
  - Creation of start-ups by employees' turnover and spin-offs
- R&D consortia to support industrial technology development and upgrading
- Introduction of financial and tax incentives to stimulate firm's R&D investment

(c) Education sector

- Vocational school to supply skilled workers
- Expansion of science and engineering education at the tertiary level to supply researchers and engineers for private firms
- Crucial role of returnees studying abroad and having overseas work experience
- Second-mover advantage
  - Production of mature high-technology products, yet the inability to create brand-name recognition in the world market
  - Capacity to increase the scale of production and to excel in the areas of production technology and management
- Incremental innovation capability and expeditious technological learning
- Flexibility and fast adjustment to the changing international market
- More than 60 per cent of Taiwan Province of China's exports are OEM-ODM products.

(d) Pressing issues

- Need to overcome the massive migration of Taiwanese firms to China
- Transform Taiwan Province of China into a R&D and manufacturing center in strategic industries

- Need to address the squeezing profit margins for local manufacturers
- Cross-road: More large firms, or sophistication of SMEs?
- Initiate radical reforms in education and human resources

2. Singapore: National innovation system

(a) Key features

- Leveraging model through foreign direct investment (FDI)
- Three-quarters of Singapore's manufacturing output from MNCs
- Manufacturing sector accounting for the bulk of private R&D: over two-thirds of manufacturing R&D concentrated in the electronics sector
- Until late 1990s, most R&D efforts have focused incremental, applied work.
- R&D spending by GRIs has rapidly increased since 1991, which is now matched by R&D spending by the higher education sector.

(b) Public-private partnership

- The government continues to encourage MNCs to upgrade their manufacturing processes and to bring in new and more advanced products which are manufactured in Singapore (government subsidies for MNCs are possible)
- Provision of 'Science park': First one set up in 1980, the second in 1993, the third recently completed: 'One North' launched in early 2000s
- Synergy through R&D consortia among GRIs, MNCs and local firms
- Linkages between universities/GRIs and the enterprise sector were less evolved, at least until the late1990s
- Activation of venture capital (VC) industry after late 1990s: establishing a US$ 1 billion 'Technopreneurship Fund' by the Government
- Financial and tax incentives for stimulating local firm's R&D efforts

(c) Education sector

- Expanding primary and secondary education to supply skilled workforce
- Setting up vocational and technical training institutes to upgrade industrial manpower
- Expanding polytechnics and university engineering courses for more advanced technicians and engineering manpower (three universities and five polytechnics)
- Promoting basic research in the higher education sector and GRIs' long-term strategic research to provide opportunities for training in the areas of R&D and technology commercialization skills in Singapore
- Initiating proactive policy to attract star researchers and foreign scientists

(d) Firm dynamics

- Efficient technology transfer from MNCs to local firms in the form of process technology as a major source of technological upgrading
- MNCs account for the bulk of R&D spending (60 per cent of the private R&D expenditure)

- Most local firms serve as suppliers and contract manufacturers to MNCs rather than OEM/ODM. A significant number of successful local electronics firms also emerge
- There have been recently created more high-technology start-ups and spin-offs from universities and GRIs.

(e) Pressing issues

- Promoting technology entrepreneurship
- Strengthening indigenous R&D capabilities
- Expanding R&D resources

F. Some lessons from the East Asian countries' experiences

There might be some similarities among those three nations in the practice of innovation system approach as an economic growth strategy as follows: maintain open system of national innovation for global networks and outsourcing; focusing on human resources as a key element; manufacturing-oriented economic development with some services sector existing in Singapore; maintaining closer government-business relations; setting up good interface between science, technology and innovation policies and economic/ industrial policies; recognizing importance of government's role and firm dynamics in technology innovation; and successful change of management with speed and flexibility keeping.

Meanwhile, some differences are also identified as follows:

Growth paths

- Republic of Korea: Large, vertically integrated firm model
- Taiwan Province of China: SME – Public innovation network model
- Singapore: DFI – Leveraging model

Contents of technological learning

- Republic of Korea: Process & product (own brand)
- Taiwan Province of China: Process & product (OEM, ODM)
- Singapore: Process (subcontracting)

Role of GRIs

- Republic of Korea: Indigenous R&D & technology diffusion
- Taiwan Province of China: Technology diffusion
- Singapore: Support for local firms' technological upgrades

Lessons from NIS experiences of the East Asian countries include: (1) all nations maintain conducive public-private partnership and follow second-mover advantage path particularly based on manufacturing; (2) they consider human resources as an utmost crucial factor for national economic growth; (3) continuous and speedy transformation of NIS has been made to meet the rapidly changing environment; and (4) beyond technological learning, there has been a strong government role in the context of clearly defined vision and strategy setting, sound system establishment, firm commitment and strong leadership of top management, etc.

Particularly, in case of the Republic of Korea, the following characteristics of and lessons could be drawn up from its NIS practice: (1) Strong production capability makes possible for Republic of Korea to be a world market leader in some selected sectors, even without world class technological novelty and technological breakthrough; (2) technological learning and absorptive capacity may be important elements, but agile strategies and the effective system for technological capability-building are most necessary to be a technological frontrunner; and (3) technologically known-paths are uncertain and risky to individual firms: in-house knowledge base is very important, but the ability to internalize production activities is more valuable. Samsung's perspective on technology innovation needs to be pointed out: "Everyone can get the same technology. But that does not mean they can make an advanced product or service" (*Business Week,* 16 June 2003).

II. DAEDEOK INNOPOLIS STRATEGIES FOR SMES: ITS ROLE AND MISSION WITHIN NATIONAL INNOVATION SYSTEM[2]

A. Introduction

The Daedeok Research Complex (DRC) is the first and biggest science town with the nature pure R&D oriented in the Republic of Korea. It was built in Daejeon Area in 1973. Over the past three decades, DRC has made a significant contribution to building national S&T knowledge base and technology capability (see Box 3.1). However, there have been little market-oriented activities to utilize the accumulated S&T knowledge though the S&T achievement is remarkable. Some key achievements are summarized as follows: (1) 30 years of R&D experiences – accumulated R&D know-how evolved over time, dominant support from central government, multidiscipline and nation-wise research activities; (2) high-quality R&D manpower; (3) advanced technology spin-offs and high-technology start-ups; and (4) early stage of R&D orientated innovation cluster (see Box 3.2).

In 2005, the Government designated DRC as a Research and Development Special Zone in 2005 according to the "Special Law on the Promotion of Daedeok Research Special Zone", in order to maximize its R&D potentials, expedite commercialization, and foster it to become the Mecca of technology innovation and new technology creation. DRC was renamed to "Daedeok Innopolis", a much more innovation cluster oriented entity, focusing on financing, marketing, commercialization of R&D, internationalization of R&D business (R&DB) and FDI.

[2] *This paper was prepared and presented by Mr. Lak-Kyung Song, Executive Director, and Mr.Yoo-Sook Kim, Team Manager, Planning Public Relation Team, Daedeok Innopolis, Daejeon, Republic of Korea.*

Box 3.1 Development history of Daedeok Research Complex

- 1970s: Infrastructure construction period
  - Started as Daedeok Science Town, National Science Park
- 1980s: R & D capacity expansion period
- 1990s: Innovative creation period
- 2005s: Cluster formation period
  - Reborn as "Daedeok Innopolis" as a part of National Innovation System
  - Enacted the "Special Law on the Promotion of Daedeok Research Special Zone"

Box 3.2 Key achievements of DRC over 30 years

- Core technology
  - IT: TDX – Reduced interruption in phone lines, exported products worth more than US$ 1 billion; CDMA – 90 per cent of domestic market and 54 per cent of the world market share
  - BT: Factive – first domestically developed medicine
  - ST: Launched indigenously developed satellites
  - RT: Achieved 95 per cent of localization of radiation technology
  - NT, ET, CT, GT, Fusion technologies, etc.
- Intellectual property
  - Published 29.9 per cent of domestic science dissertations (2004)
  - Accounted for 24.2 per cent in the domestic registered patents (2004)
- Education & Knowledgeable workforce
  - KAIST and four other educational institutes have graduated 30,000 scholars until 2004
  - KAIST graduated 20 per cent of the country's Ph.D. level researchers; 5,800 Ph.D. researching workforce (10 per cent of the total number of nation's researchers)

B. Vision and strategic plan of "Daedeok Innopolis"

Until the year 2015, Daedeok Innopolis will become a competitive "super-innovative cluster" transformed from the current R&D hub, as a growth engine for the Republic of Korea, through creating a virtuous cycle of R&D to commercialization to reinvestments. To realize this ambitious vision, the government is initiating the following five thrust areas: promote innovative R&D manpower; expand demand-driven R&D; facilitate commercialization of R&D results; create global-level R&DB environment as a venture ecosystem; and activate sectoral specialized clusters.

There are three development stages to promote Daedeok Innopolis in the following and its development goals within 10 years are shown in Table 3.9.

- Foundation Period (2005~2008): Establishment of innovative cluster and its business; and strengthening of competitiveness
- Growth Period (2009~2012): Creating successful cases; and accelerating innovation
- Further Development Period (2013~2015): Enlarging reinvestments; and developing integrated infrastructure

Table 3.9 Goals within 10 years of Daedeok Innopolis

	High-tech firm (start-ups, No.)	Gross Annual (US$ billion)	Patent Resist. (No.)	Foreign IR (No.)
2015	3,000	30	16,000	20
2010	1,500	12	5,000	8
2004	648	3.4	1,659	2

There are two strategies to achieve these goals. The first one is that in the short-term period, focus will be given on GRIs and universities with a strong R&D capacity for R&D commercialization, considering relatively weak infrastructure for start-ups promotion, conversely in the mid and long-term period focus needs to be put on strong start-ups infrastructure, growing with technological resources of GRIs and universities. The second strategy is to initiative changes from government-driven promotion (focusing on strengthening infrastructure) to private-led endogenous development by GRIs, universities and SMEs.

Key factors for the success of Daedeok Innopolis are: Commercializing technology items; strengthening capacity of GRIs and universities for R&D commercialization; enhancing capacity of enterprises for technology utilization; setting up cooperating and networking system among innovation actors; and expanding infrastructure for technology commercialization.

C. Policies for SMEs

One of the top priorities in revitalizing Daedeok R&D Special Zone is to activate R&DB activities, synergizing incorporation of its research function and production function through sophistication of R&D capacity, commercialization of R&D outcomes and globalization of R&DB activities. In recent years, Daedeok Innopolis is making strenuous efforts to promote technology-based SMEs by maximizing utilization of R&D results and their commercialization. Policies for SMEs promotion in Daedeok include commercialization of R&D results, establishment of efficient venture ecosystem, setting- up of global R&D networks, and active cooperation with other economic and social areas.

In particular, Daedeok Innopolis commit and concentrate all available resources to enhance competitiveness of existing SMEs and create new high-technology based SMEs through creating conducive venture ecosystem, strengthening interaction among industry, academy and research institutes, promoting public-own technology transfer and commercialization, and creating conducive support system and technology intermediaries for start-ups such as technology licensing organization (TLO), venture capital and consulting services.

Some support schemes and incentives to enhance SME competitiveness are:

- Top-down value-chain informatization through cooperation with large enterprises
- On-demand informatization focused on manufacturing
- Private-government strategic association for SME informatization
- Joint global marketing support, improved legal services & tax benefits
- Informatization of 1 million SMEs by 2008

Table 3.10 Statistics of IT sector in Daedeok

	Regional Average	Daedeok Innopolis	Rank
Company No.	1,419	583	7th
Employment	37,000	12,000	9th
Revenue	US$ 125 M	US$ 17 M	12th
Exports	US$ 3,084 M	US$ 228 M	11th
Capital Stock	US$ 83 B	US$ 3 B	12th
Ave. Employee	26	20	9th
Ave. Sales	US$ 88 M	US$ 28 M	12th
Ave. Asset	US$ 59 M	US$ 6 M	13th
Sales per capita	US$ 4 M	US$ 1 M	15th

Source: IT Industry Annual Report, 2005

SWOT Analysis in Deadeok R&D special zone for SME promotion

Strong points: Support of central government; 30 years of R&D experience; excellent R&D environment; high-technology start-ups; and R&D manpower. **Opportunities:** technology-driven economy; innovative clusters; and international recognition. **Threats:** Increasing overseas competition and economic recession. **Weak points:** Lack of international business activities; immature business environment; lack of networking; and lack of funds.

According to this SWOT analysis, Daedeok Innopolis will be developed towards direction for market-oriented R&D by creating a virtuous cycle: (1) Increase R&D capacity and expand infrastructure via change of R&D paradigm; (2) facilitate inbound globalization, market-oriented R&D projects and financing of early R&D stage; and (3) commercialization and enterprise growth. Consequently, this virtuous cycle results in promoting investment for R&D capacity-building and infrastructure, and facilitates acceleration of technology innovation.

D. Case study: Havit Information Inc.

Since the 1990s, spin-off companies and technology innovation-driven venture companies have been created based upon well-established R&D infrastructure. One of successful spin-off companies is *Havit Information Inc.*, which are technology innovation-driven SMEs in ICT area. The founder created this company with research outcomes and technological expertise obtained through working for the Electronic and Telecommunication Research Institute (ETRI).

Havit Information was founded in 1999 and listed on KOSDAQ in 2005. The Company primarily focused on the most highly optical product such as Grating, IR Cut-off Filter for phone camera. All core technologies have been patented in the Republic of Korea, Japan, China, and the United States. Their net sales have been rapidly increased from US$ 3 million in 2001 to US$ 37 million in 2005. They are now pursuing the following three strategies to keep global leadership in optical component business: people first; technology innovation; and social responsibility.

Looking into critical success factors, since its foundation, they continue to work in collaboration with ETRI in R&D and seek their growth through new product development. They also set up "Council of Technology Advisors" from external experts in order to tackle technical problems and get innovation advisory service. The third point is to get successfully involved supply & value chain and maintain good relationship with financial institutions.

Daedeok Innopolis will continue to provide benefits to SMEs through the following propgrammes: Larger investment opportunities by expanding venture capitals (e.g. Daedeok Special Investment Fund); tax reduction including corporate tax, income tax and custom tax; management consulting programme such as one-stop managerial, legal and marketing services; sharing expensive R&D facilities; and technology test-bed and marketability assessment service.

E. Conclusions

Over the past three decades, DRC has made a significant contribution to building national S&T knowledge base and technological capability. It is now the Mecca of science and technology in the Republic of Korea. Daedeok Innopolis, the new brand of DRC, has a gland vision to be a world-class innovative cluster as a growth engine of knowledge-based economy Korea in the 21st century. Daedeok Innopolis will commit all available resources to fostering market-oriented research capabilities and a global business environment for SMEs.

III. REGIONAL SCIENCE & TECHNOLOGY POLICY AND REGIONAL CAPACITY-BUILDING: WITH FOCUS ON KNOWLEDGE CLUSTER INITIATIVE[3]

A. Introduction

The provincial science and technology initiative traces beck to 1980s. In the early 1990s, the Government of Japan initiated the national strategy to construct technopolises with an attempt to concentrate high-technology industries in regions where industries, universities and local governments cooperate to develop leading-edge technologies. As a result of this initiative, since the mid-1980s a total of 26 regions were designated as technopolises, various core industries promoted, technological capabilities developed and regional R&D networks emerged. As the technopolis related law was repealed, these high-technology hubs have now grown themselves as the basis for regional development trough innovation.

Meanwhile, according to "Basic Guidelines for Activating Science and Technology Activities in the Regions (the Council for Science and Technology, 1995), local governments are able to formulate and implement their S&T policies. Thus the regions

[3] This paper was prepared and presented by Mr. Takaaki Matsuzawa, Director, 3rd Policy-Oriented Research Group, National Institute of Science Technology Policy (NISTEP), Tokyo, Japan.

in Japan are now becoming important components of collaborative R&D involving industry, university and government, as well as technology development of SMEs. The 2nd S&T Basic Plan also emphasizes the creation of "regional clusters" in order to facilitate R&D networks and collaborative research among actors. Two initiatives – knowledge cluster and industrial cluster have been executing by the Ministry of Education, Science, Sport and Culture (MEXT) and the Ministry of Economy, Trade and Industry (METI).

Against this backdrop, this paper attempts to highlight regional S&T promotion initiatives, particularly focusing on "knowledge cluster initiative." Also it looks at potential indicators on regional S&T and new methodology to review the national S&T policies, and the case study for Kobe will be made to draw up some policy implications.

B. Regional S&T policy in Japan

1. Unit of Region

In general, the "Unit of Region" for the Regional S&T in Japan means the "Regional Governments" such as Prefectures and Specified Cities. In Japan, there are now 47 Prefectures and 13 Specialized Cities. As can be shown in figure 3.1, some regional governments in Japan are considered to have potentials comparable to that of a small country in terms of its economic power (GDP) as well as overall S&T performance. Regional S&T input in Japan needs improvement in many aspects and therefore the national policy is prospected to have an important role to play. The study on 'National Innovation System (NIS)' of countries with the equal economic size could thus serve as a useful reference for the research on 'Regional Innovation System (RIS).' Comparison of government R&D expenditure between by major regions in Japan and major world cities is shown in Table 3.11.

Figure 3.1 Comparison of GDP between the regional governments in Japan and other nations

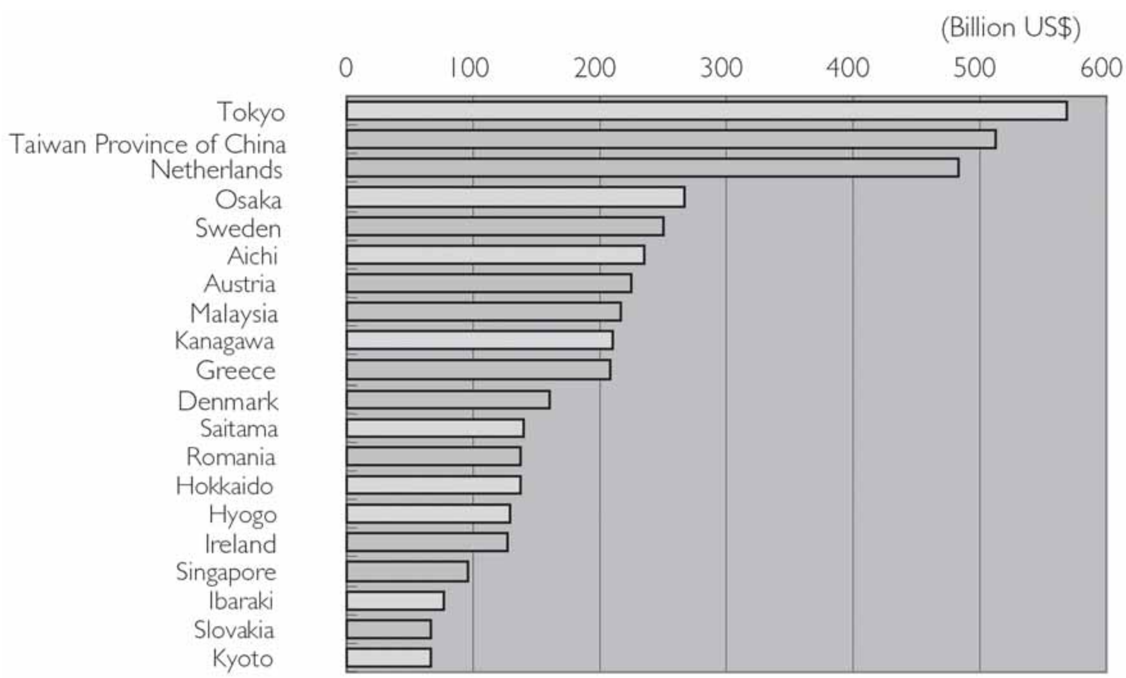


Figure 3.2 Government R&D expenditure

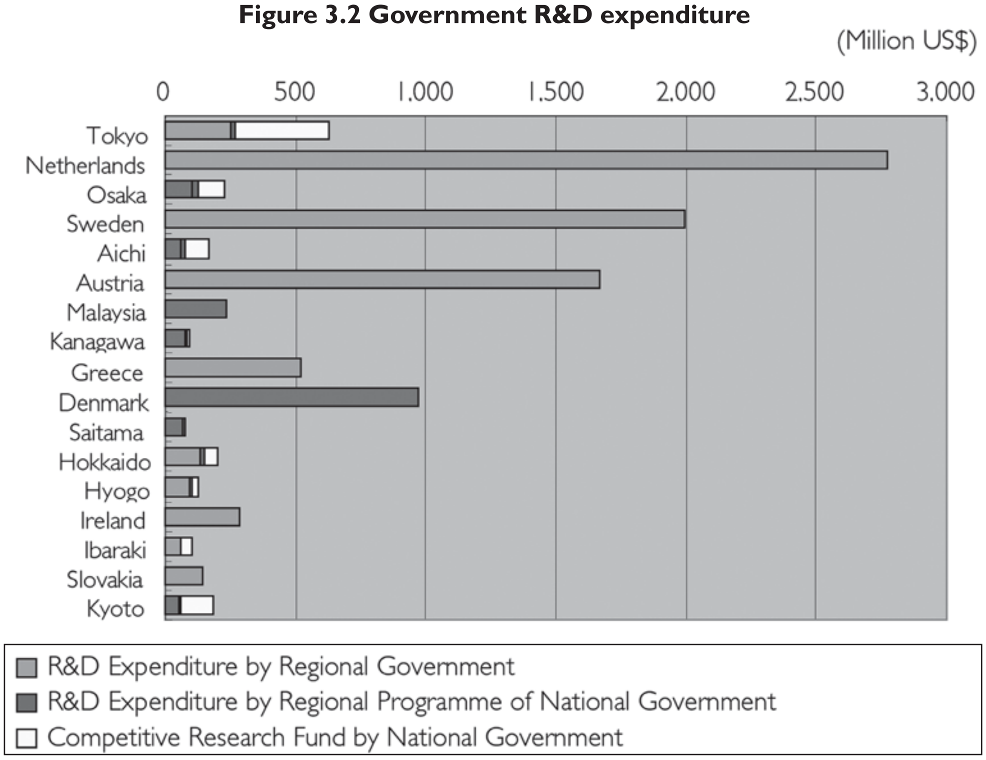


Table 3.11 Potential of region

Regional governments in Japan and other countries		Population (1,000 people)	GDP		S&T Input		S&T Output	
			GDP (1 mill US$)	GDP/ Capita (US$)	Expenses on national R&D in GDP (%)	No. of researches (No./1,000)	No. of papers (Total No.) (No./1,000 people)	No. of papers in each region or country (Total No.) (No./1000 people)
1G	Tokyo	12,064	569,677	47,221	0.04	1.7	1.49	1.05
	Netherlands	16,046	483,170	29,009	0.57	2.7	1.10	0.79
2G	Kanagawa	8,490	209,637	24,692	0.04	3.0	0.82	0.55
	Greece	10,020	207,965	18,439	0.25	1.4	0.49	0.33
3G	Fukuoka	5,016	120,882	24,101	0.05	0.4	0.77	0.56
	Ireland	3,854	127,992	32,646	0.22	2.4	0.67	0.43
4G	Ibaraki	2,986	76,622	25,663	0.07	5.1	2.69	1.82
	Singapore	4,131	96,000	20,906	0.76	4.4	0.91	0.63
5G	Ishikawa	1,181	31,342	26,539	0.11	0.5	1.04	0.73
	Slovenia	1,992	35,000	10,465	-	2.3	0.66	0.44
6G	Tottori	613	14,319	23,347	0.20	0.7	0.71	0.47
	Estonia	1,361	15,000	4,770	0.24	-	0.38	0.25

Source: NISTEP 3rd Policy Oriented Research Group (2006)

2. Regional S&T policy evolution

The national S&T policy in Japan has changed from decentralization of R&D bases led by the central government to the policy which focuses on regional autonomy due to the transition of interests toward regions from the balanced development of the national land to the international competitiveness. The regions concentrated their international competitiveness and advantages of their own region under the regional competitive environment.

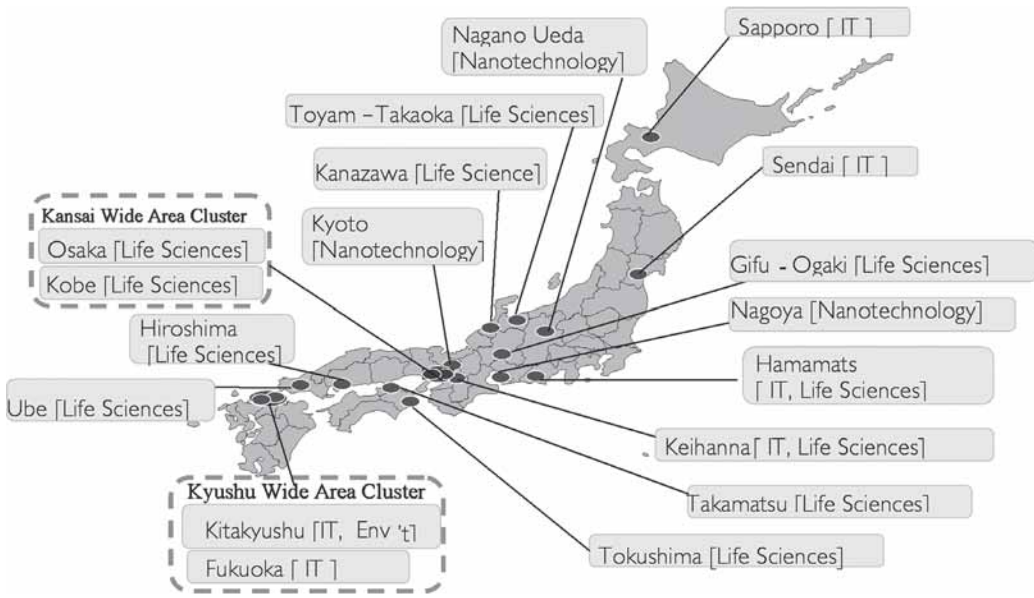
Box 3.3 Brief history in regional S&T policy evolution

- 1970: Decentralization of Science Bases: The Tsukuba Science City Construction Act (1970)
- 1983: The High-Technology Industrial Zone Promotion Act etc.
- 1990: Development of the Regional Government System
- 1992: The 18th Science and Technology Policy Outline
- 1995: The S&T Basic Law (Responsibility of the regional government (Article 4, Article 5))
- 1996: The First Science and Technology Basic Plan
- 2001: The Second Science and Technology Basic Plan (Strengthen the Regional Government Initiative on the Regional S&T Policy → Knowledge Cluster Initiative)
- 2006: The Third Science and Technology Basic Plan (Construction of Regional Innovation System' and 'Revitalization of Regions')

Since the 1990s, there have been much progress in implementation of S&T policies by regional governments as each regional government has gradually improved its own S&T and innovation system, their autonomy and active role rather than a complementary role for the central government has been much strengthened. For example, comprehensive promotion structure of S&T administration has been developed and all the regional governments have established one or more of the following: (1) Dedicated offices, (2) S&T conferences, (3) Advisory councils for S&T, and (4) setting general principles to promote S&T.

The most promising and innovative policy is "Knowledge Cluster Initiative (KCI)" initiated by MEXT and introduced in the Second S&T Basic Plan (2001-2005). By 2004, 18 regions had been designated as KCIs and its annual budget amounted to 10 billion yen in fiscal year 2005. The KCI programme has the following characteristics: initiative actively driven by each regional government; promotion agents allocate research budgets for universities and research institutions; exerting leadership of the cluster headquarters; and introducing the principle of competition among the regions.

Figure 3.3 Map of knowledge cluster



Evaluation and assessment of KCI programme is challenging due to the relatively short period of implementation. Nonetheless, interim evaluation was conducted by National Institute of Science & Technology Policy (NISTEP) in terms of long-term view and impact; focus on regions' autonomy and initiative; and competitive environment. The NISTEP identified common issues and conditions that are needed to be taken into account for the successful implementation of this initiative: (1) selection of appropriate topics for research and the well management of its progress; (2) strategies on commercialization; (3) strategies on intellectual properties; (4) cooperation with other regions; and (5) fostering and obtaining S&T human resources.

In the recent years, Japan's Regional S&T Policy emphasizes initiatives led by regional governments and stimulates competitive environment among them in the establishment of the regional innovation system (RIS). For instance, in the draft of the "3rd National S&T Basic Plan (2006-2010)", there has been included one chapter on the establishment of RIS and Revitalization of Regions. There are two major initiatives. The first is "Regional Clusters" to promote world-class clusters with comparative advantages of its regional characteristics through making long-term efforts under strategic initiative of the region as well as cooperation among relevant ministries. The government makes evaluation the international comparative edge of regions and provides intensive support to regions that could be grown to a world-class cluster. The other is harmonious development of regional S&T programmes with the regional government playing an active role, which need strengthened cooperation among government ministries; strengthening the coordination function; and human resource cultivation through cooperative relationship between local universities and industries.

3. Budget for regional S&T promotion

The S&T budgets of regional governments have steadily increased until the mid 1990s, and then started declining, depending on the economic situation in Japan. In case of research institutes established by regional governments, the amount of S&T budget increased steadily before 1995 (the Pre-First S&T Period), and then kept declining until 1999 (the end of the First S&T Period), while the S&T budget by regional governments increased significantly until 1997 (the mid First S&T Period) and then started shrinking. Meanwhile the amount of national government budget increased after the enactment of the Science and Technology Basic Law in 1995 until the mid Second S&T Period and remained flat thereafter.

Figure 3.4 The S&T budget of regional governments

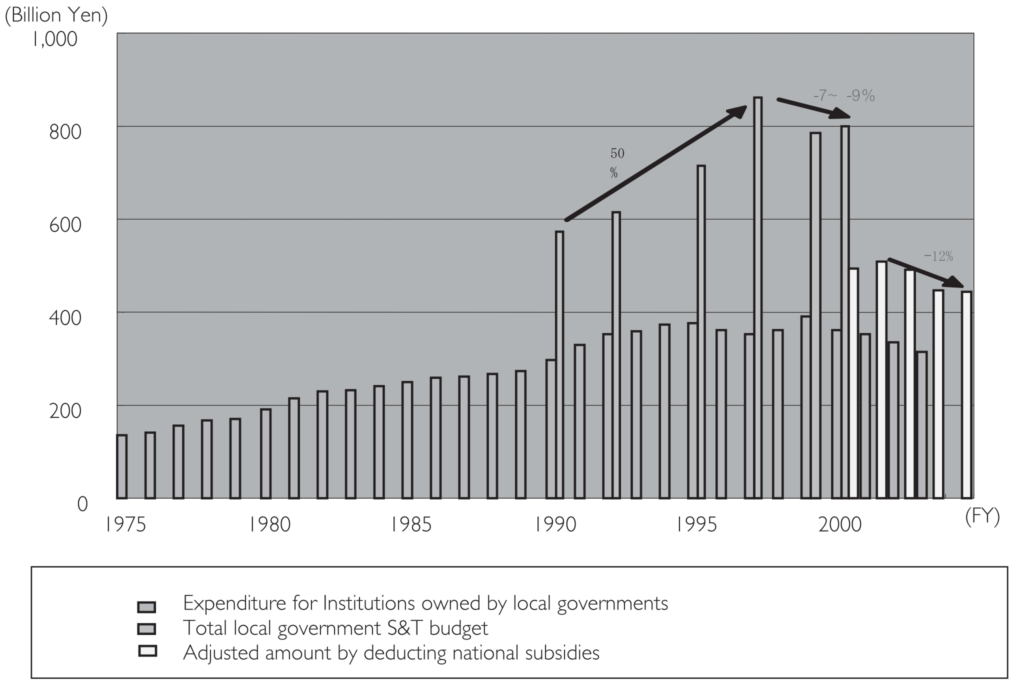
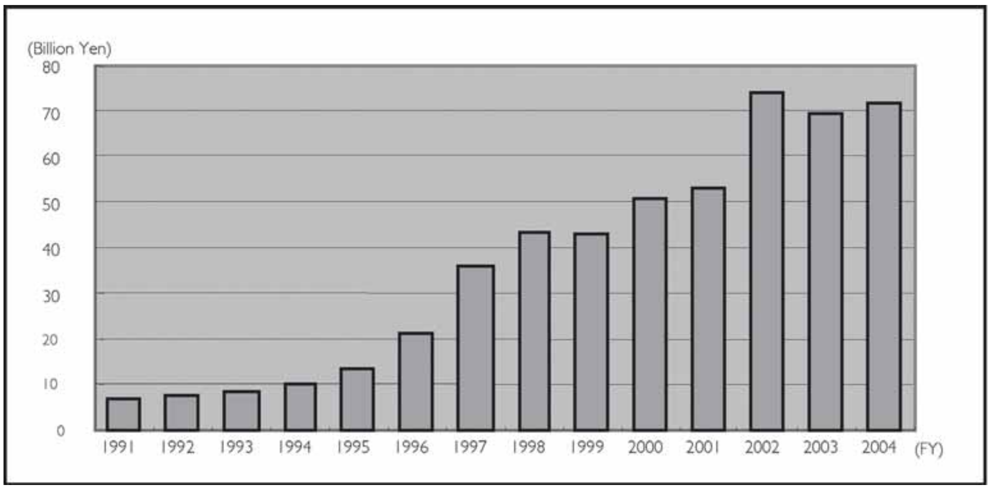


Figure 3.5 The national S&T budget for regional S&T



In order to complement the decrease of S&T budget by regional governments, the national government has been increasing the national budget for regions by significant amounts since the mid 1990s. With respect to the weakness in S&T input of regional governments as well as the changes above, the regional S&T budget provided by the national government may continue to play an important role for the S&T capacity-building of the regions.

C. Variety of region

In the research on Regional Innovation System (RIS), it is significantly important to prepare a clear set of quantitative measurement on the diversity of regions, taking into account characteristics of region – variety of R&D resources, management, governance etc. in different regions; and the asymmetric progress of efficiency in R&D and innovation in different regions. In this respect, our research group in NISTEP has been collecting the regional indicators and developing new methodology since FY 2005, with aims to review the national S&T policy in Japan. Meanwhile, in 2004 NISTEP identified conditional factors for the success of cluster formation according to the following development stages: formation (germinal period); promotion (exploratory formation period); and output (growth and maturity period), based on the study on "Conditions and Promotion Policy for Successful Regional Innovation: Developing Japanese-Type Sustainable Regional Clusters" (see Table 3.12).

Table 3.12 Conditions for successful regional clusters in Japan and overseas[4]

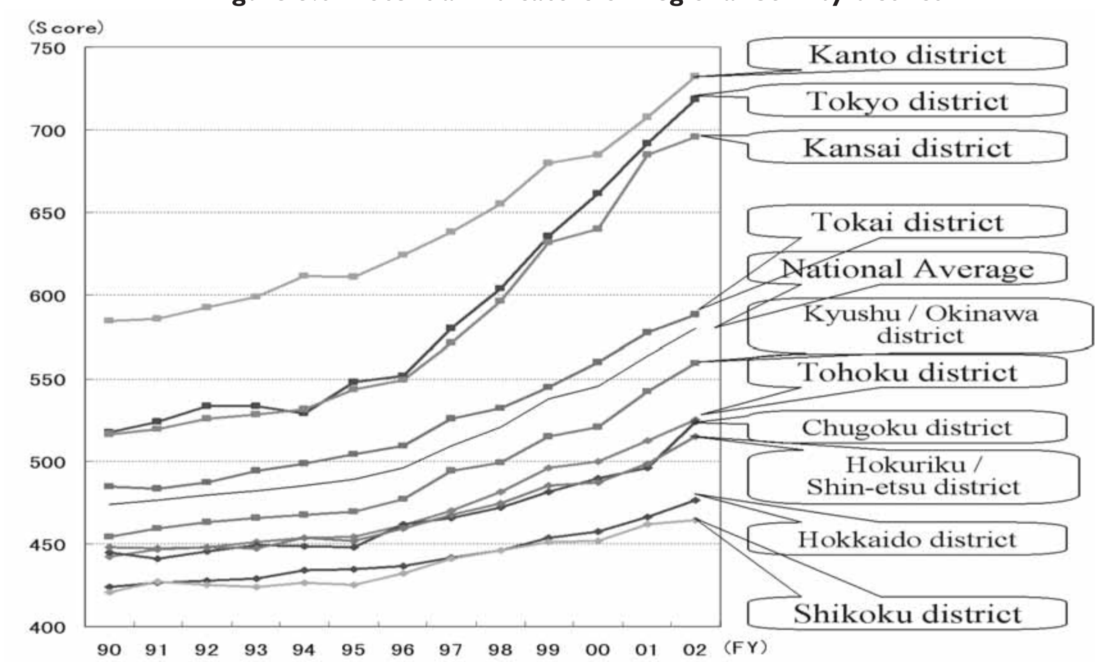
Japan	Overseas
1. Formation period ● Intellectual agglomeration ● World-class technology ● Local industries and technologies ● Core mid-sized corporations ● Core start-ups ● Sense of economic crisis	***1. Germinal period*** ● 30-minute access within the core ● Shared regional sense of crisis ● Industrial concentration and selection that take full advantage of regional assets ● Existence of several initial-period core enterprises and visionaries ● Attract world-class human resources and attractive residential environments
2. Promotion period ● Local government leadership ● Supporting infrastructure ● Industry-academy-research collaboration ● Collaboration with large firms for global Mkt. ● Collaboration/competition with other clusters	***2. Exploratory formation period*** ● World-class core R&D ability ● Industry-academy-public linkages ● Vitality of start-ups and high HR mobility ● Collaboration between start-ups and large firms and universities ● Existence of collaboration coordinators ● Existence of support infra, VC, incubators
3. Output period ● Emergence of groups of start-ups ● Visibility in the region and the nation ● Corporate and human resource migration	***3. Growth and maturity period*** ● Fusion with other clusters ● Increased exposure of the cluster ● Market expansion through global approach ● Improved credibility through IPO and high growth

[4] *This table was reproduced by the UNESCAP Secretariat based on the study report on "Conditions and Promotion Policy for Successful Regional Innovation - Developing Japanese-Type Sustainable Regional Clusters (NISTEP, May 2004)"*

We have currently measuring method of the 'Comprehensive Strength of the Region' using the Principal Component Analysis (PCA) and working on the research to gain knowledge of 'Regional Efficiency' through the Data Envelop Analysis (DEA). We should carefully deal with application of new approach, avoiding misunderstandings. Furthermore, the development of these researches requires the system for the collection and arrangement of the regional indicators which is going to be the foundation of them. In order to develop indicators for regional S&T activities, the third policy-oriented research group in NISTEP has been implementing the following two research projects: the study on the "Regional Potential by Principal Component Analysis (PCA) (2004~); and the study on the project the "Regional Efficiency by Data Envelop Analysis (DEA) etc. (2005~).

Meanwhile, NISTEP identified potential indicators related to four areas including input indicators, infrastructure indicators, output indicators and impact indicators. Figure 3.6 shows the trend of potential indicators on regional S&T of 11 districts during the period of 1990~2002. The 13 detailed indicators are: (1) input indicators – human resources for R&D, financial resources for R&D, research institutions, support for R&D and commercialization; (2) infrastructure indicators – living environment, attraction and recreation, educational environment for children, economic environment, transportation and telecommunication infrastructure, exchange activities; (3) output indicator – joint research conducted in universities, papers, inventors for patent applications and newly registered plant varieties; and (4) impact indicators – new products, sales increase, created jobs, gross value-added amount, university-initiated start-up companies, companies exited from incubators, and companies accredited by law to promote SMEs innovative activities. Of the 11 districts, Kanto districts ranked the highest score over 700 points in 2001 and 2002. Shikoku district scored the lowest all period of time frame. The national average is 550 points in 2000, and four districts such as Kanto, Tokyo, Kansai and Tokai exceed the average points. Figure 3.7 is the diagram showing potential indicators which were applied to Hyogo Prefecture.

Figure 3.6 Potential indicators on regional S&T by district



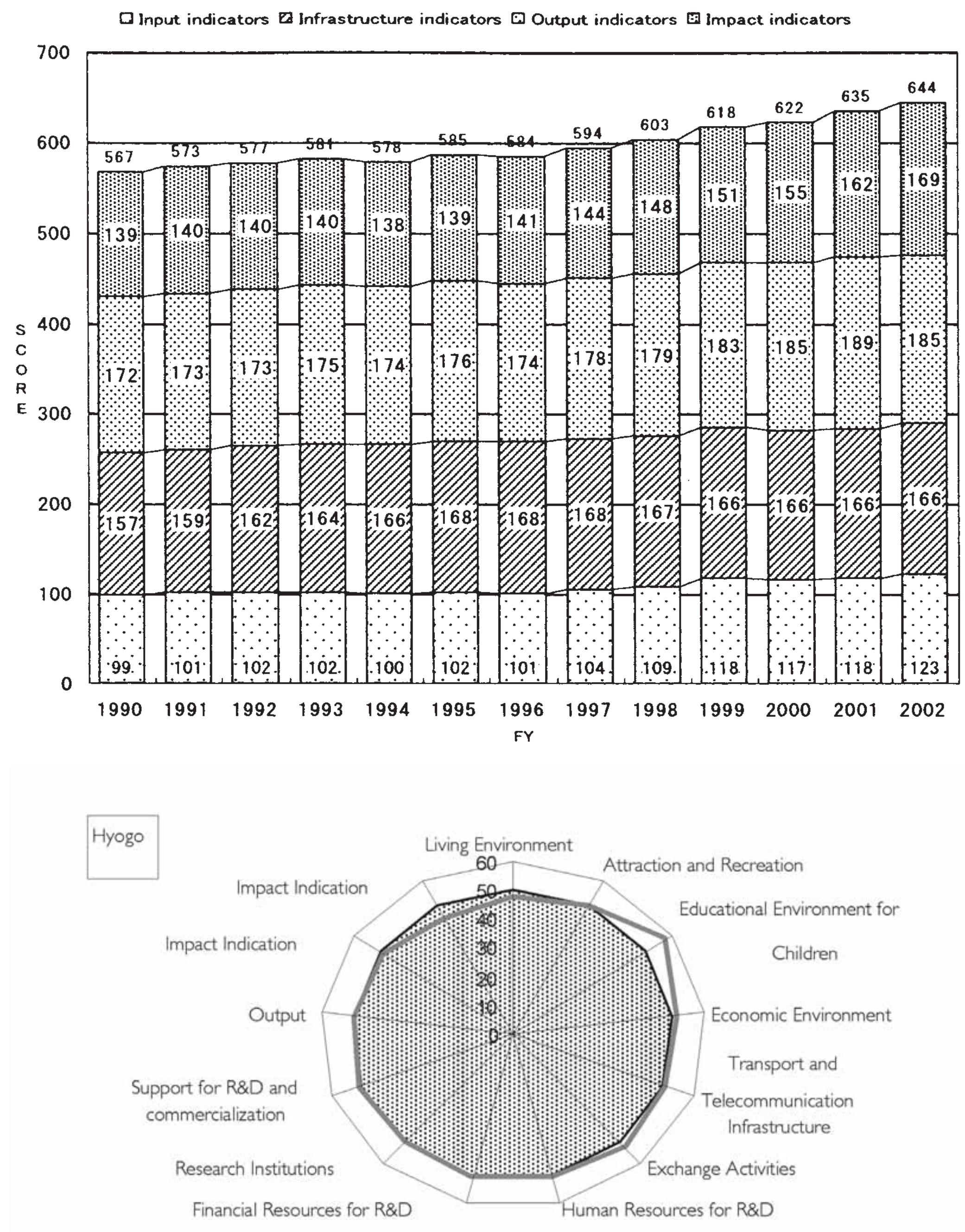


Figure 3.7 Potential indicators of Hyogo Prefecture (sample)

D. Case study for region

In addition to the macro-researches, we launched the case study on the selected regions in Japan. To this end, Kobe district was selected for the case study thanks to the following reasons: (1) Kobe is the typical region of "Bio-cluster" in Japan; (2) Kobe set up favourable regional governance including active regional government (Kobe city), clear vision and plan; and active regional R&D function; (3) Kobe is one of the regions attracting national support: excellent research institute (RIKEN); sufficient national support (Knowledge cluster initiative, etc.); and (4) Industrial development (emerging accumulation of 81 companies over past five years).

We have recently set up and have been making progress on the comparative study on the Bio-Clusters in Seattle and Kobe, including the survey research on the local businesses and a structural interview for regional actors. Through those studies, we are aiming to deepen our knowledge about the successful practices related to the Regional S&T Policy in Japan.

E. Conclusions

The unit of 'region' in Japan has been believed to have underlying potential in the context of the 'Regional Innovation System' approach. From 1990s, the regional governments themselves, to some extent with the support by central government, have undertaken the construction of their own innovation system. The S&T budget of the regional governments has also steadily increased. However, since the late 1990s, the amount of the S&T budget of regional governments started declining, therefore the central government increased politically its budget allocation for regional S&T promotion activities in order to complement the decrease of local governments' S&T expenditure.

Over the past several years, Japan's regional S&T policy emphasizes initiatives led by regional governments and stimulates competitive environment among them in the establishment of the regional innovation system (RIS) as manifested in the draft of the "3rd National S&T Basic Plan (2006-2010)". Hence, it is necessary to take into account characteristics and advantages of each regional government. NISTEP therefore has been contributing to the development of more effective regional S&T policy through the review of existing regional S&T policies and programmes as well as the development of innovative assessment methodology including the creation of the regional innovation indicators and the case studies.

IV. SUBNATIONAL INNOVATION SYSTEMS AND TECHNOLOGY CAPACITY-BUILDING POLICIES: THE CASE OF GERMANY[5]

Abstract

Since the second half of the 1990s, the Federal Government of Germany has paid great attention to the regions in the implementation of innovation and technology policy measures. Regions are equipped with a specific permutation of production factors, which can only be considered to be optimally allocated if they are made the basis for multilevel and multi-actor governance structures. The absorptive capacity of the political administration may vary between regions and regions are not identical functional or political-administrative units, but vary in size, political structure and economic strength. The paper gives an overview of recent developments

[5] *This paper was prepared and presented by Mr. Thomas Stahlecker, Research Fellow, Fraunhofer Institute for Systems and Innovation Research (FhG-ISI), Karlsruhe, Germany.*

with regard to policy-initiated subnational innovation systems. In doing so, three different "successful" examples of policy-led initiatives are presented. The experiences being made with these new approaches ("model-regions") show, that the interrelationship between regional and national governance of innovation can cause additional private initiatives (e.g. regarding network-building, private funding, creative technology-transfer mechanisms etc.) which are essential for the formation and sustainable development of subnational innovation systems.

A. Introduction

Germany's technological performance is essential for the country's companies' success in international technological competition. It is the basis for economic growth and viable jobs. Technological performance is documented by new, innovative products and processes which can compete on international markets. They depend on the creativity of the entrepreneurs and on the commercialization of the results of an efficient public research. But above all, Germany's technological performance will in future depend on the availability of highly qualified workers. Education and research are therefore a top priority for the government.

Despite prolonged slow growth and persistent labour market problems, a few positive signs can be observed in its technological performance. These signs however are offset by an unsatisfactory showing in a number of areas. As a result, the overall picture is a split one as follows (BMBF 2005):

- The export industry is currently experiencing unconditional success and is performing well in global markets. On the other hand, technology providers in the domestic market are getting more and more into trouble by products from foreign sources. Their competitors are increasingly coming from the Central and Eastern Europe and Asia.
- Although the industry's willingness to pursue innovation in Germany has increased, uncertainty over the medium-term sales and growth prospects has placed a damper on investment in research and development (R&D), highly trained personnel and fixed assets. Following an unexpectedly positive year in 2003, R&D plans for 2004 foresaw cutbacks that mean a return to the 'status quo' at best.
- Industrial research in Germany as well is increasingly geared to cutting-edge technologies which could offer the best prospects for growth. Focal areas include pharmaceuticals, electronics, information and communication (I&C) technology, and communications equipment (despite some set-backs) as well as the automobile industry. On the other hand, very few new firms that conduct R&D are entering the stage. The innovation process is becoming increasingly selective.
- Government budgets have also been assigning somewhat more importance again to education, science, research and technology in recent years. However, other countries have been much faster in purposefully gearing their budgets toward increasing investment to improve technological performance.
- Economic structural change and pressure to generate innovation increase the need for scientists and engineers enormously. Bottlenecks must be expected here in

the future: In Germany, there is generally too little propensity among young people to take up university studies - particularly in fields of relevance to technology.

- Looking at research and knowledge intensities in industry, Germany ranks high in comparison to other countries. Its innovative strength is further underscored by the fact that it produces 277 patents with global market potential per million employed persons whereas the European Union (EU) and Organization for Economic Cooperation and Development (OECD) average is 182 and 152 respectively.
- Sectors with technological strength are reporting increasingly higher levels of export trade. German enterprises account for 15.6 per cent of global trade in research-intensive goods, ranking second only to the United States. For years now, German exports of research-intensive goods have grown an average of more than 8 per cent a year. The ability of the country's companies to compete in international markets has improved noticeably since the mid-1990s.
- Correspondingly, production and employment in those industries that invest strongly in research and development are growing more vigorously than in sectors that do not. Gross output in these industries grew an average of 4.4 per cent a year (other industries: 1.5 per cent) between 1995 and 2003. Despite the crumbling of the new economy, R&D-intensive and knowledge-intensive fields have been the winners in structural change. Germany's specialization profile has shifted slightly in favour of cutting-edge technologies.
- Germany's technological strengths revolve increasingly around the automotive sector. This growing dependence on a single cluster is not without risks, particularly since a number of other countries have set focus on this area, too.

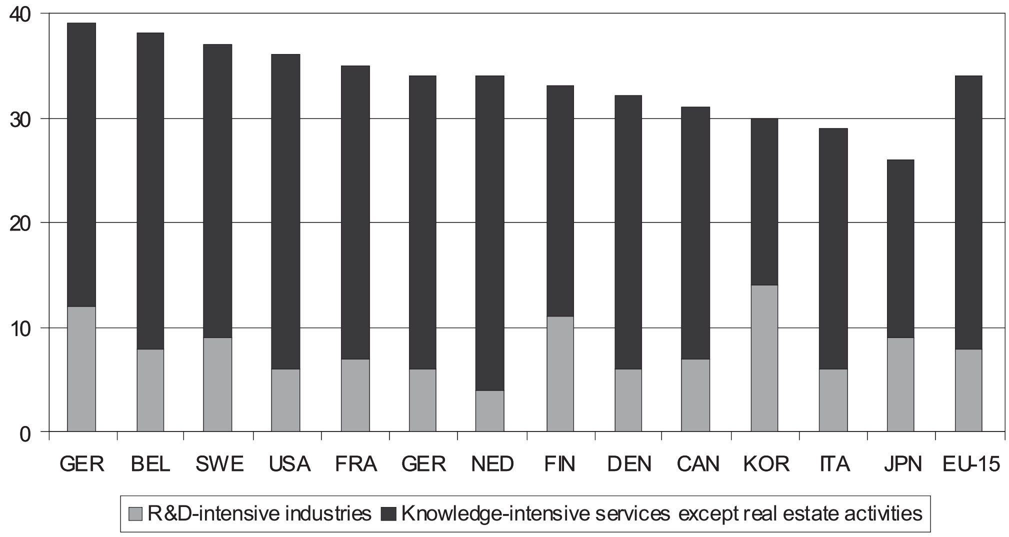
B. Key points and trends from a medium-term perspectives

Assessing technological performance always requires examining not only short-term performance in individual markets but also factors whose impact is evident only in the medium- and long-term. To keep the closer examination of short-term developments from obstructing awareness of Germany's medium-to-long-term position in international innovation-driven competition and the challenges arising from it, the following section offers a summary of these factors.

Innovation is only in few countries as widespread as it is in Germany. This is particularly due to the fact that an above-average share of small and medium-sized enterprises (SMEs) participates in innovation processes. Innovation is firmly established throughout wide parts of industry, facilitating the rapid and thorough diffusion of new technical knowledge from inventions. Generally speaking, this is a major advantage for Germany because SMEs are also the most likely to be in a position to transform innovation into jobs.

The high relevance of innovations observed in Germany correlates with the above-average contribution that research and knowledge-intensive industries make to value added. Germany is particularly geared to research-intensive branches of industry, with knowledge-intensive and technology-oriented services being well represented (Figure 3.8). However, labour-intensive consumer and household-oriented services are lagging behind – a situation that has led to the dismal situation on the country's job market.

Figure 3.8 Value-added share of R&D-intensive industries and knowledge-intensive services in selected countries 2002



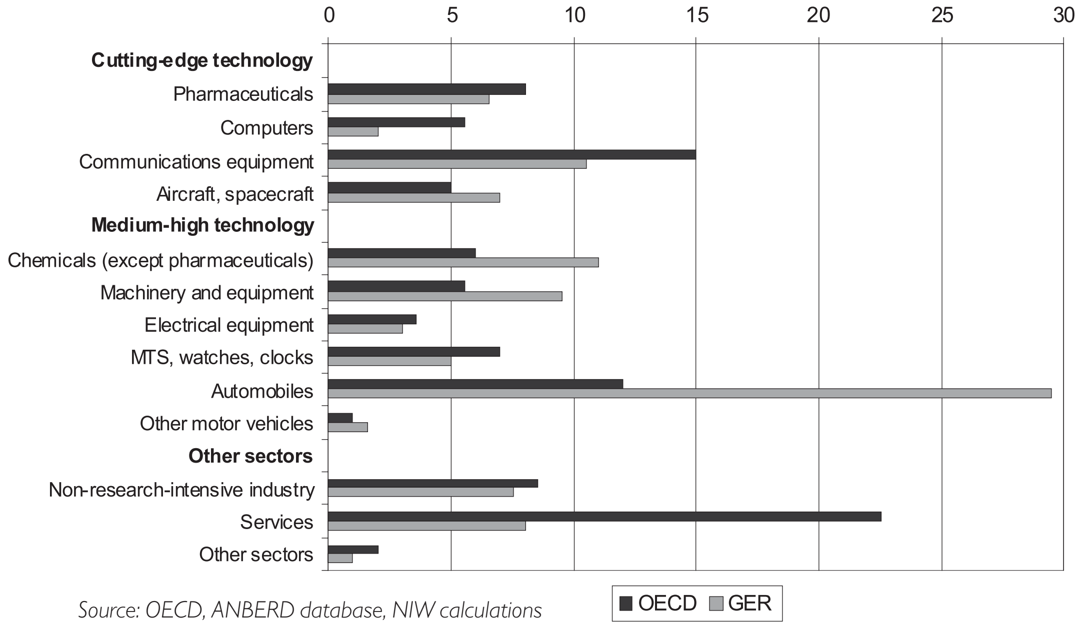
EU-15 without IRL or LÜX

Source: OECD; STAN Database 2004; DIW Berin calculations and estimates

Representing a good 2.5 per cent of Germany's gross domestic product (GDP), R&D expenditure in Germany is both sizable and stable. Combined public and private expenditure on R&D as a percentage of Germany's gross domestic product grew from 2.31 per cent to 2.55 per cent between 1998 and 2003 (BMBF 2005). However, Germany has been able to expand this share only with difficulty in the years since 2000. By contrast, many other global regions have increased their R&D expenditure by disproportionately large amounts. One important exception here has been the United States where the industry's high level of expenditure on R&D has fallen noticeably.

Services and cutting-edge goods led by pharmaceuticals, electronics/I&C technology and communications equipment – particularly determine how fast the global economy grows in the long term. With the exception of the automobile sector, cutting-edge technologies with enormous growth potential are not among Germany's focal areas – in its export pattern, economic structure, industrial R&D (Figure 3.9) or inventions. As a result, expansion opportunities will be limited over the short term.

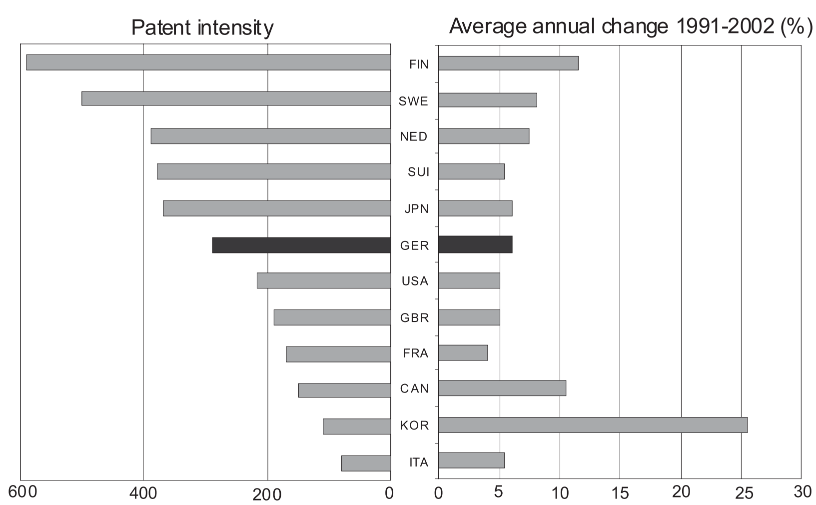
Figure 3.9 Sectoral pattern of R&D expenditure by Germany and the OECD 2000 (Share of total international R & D expenditure in percentage)



Source: OECD, ANBERD database, NIW calculations

Companies that conduct R&D are highly market-oriented, as evidenced by their technological inventions: Looking at the world's "major economies", only Japan tops Germany in patent intensity for inventions with global market potential (Figure 3.10). The upper rankings here hold economies which are not only R&D-intensive but also strongly export-oriented. Germany's many international patent applications are therefore also a reflection of the fact that its innovation system is highly export-oriented: no other important competitor country is as dependent on global markets for economic growth as Germany is. Impetus to develop innovation is coming increasingly from abroad. The country's industry has enormous competitive strength in export markets.

Figure 3.10 Patent intensities of selected countries 2002 and change in intensity between 1991 and 2002



* *world market relevant patents per 1 million inhabitants*

Source: EPATENT; WOPATENT;OECD Main Science and Technology Indicators; Fraunhofer ISI calculations

C. Research and innovation policy measures by the government

In a democratic system, policymaking does not take place in the form of top-down decision-making, but is a result of networking and bargaining between different societal actors, interest coalitions and systems, i.e. in multi-actor innovation policy arenas (Kuhlmann 2001: 961). The intervention of the government in technological development and diffusion is not indisputable (Dreher 1997: 26-31). Policy measures, be they oriented towards innovation and technology promotion or regional development, are only able to establish new, fundamental development paths in exceptional cases. This can be attributed, among others, to the fact that the development of new techno-economic paradigms (Freeman/Perez 1988) is beyond the reach of political action. Nevertheless, science, technology and innovation policy may strengthen the innovation and technology competence of enterprises, broaden the regional knowledge base and give impetus for continual learning process. As a result, the chances could be improved to create (regional) competence centres or clusters which would contribute to growth of the economy and to a reinforcement of the regional technological and economic competitiveness (Koschatzky 2005).

With regard to the German NIS, the Federal Government has taken numerous measures to sustain and to strengthen the technological performance (BMBF 2004, 2005):

- The future public investments into education, research, and innovation have grown since 1998 by about 37 per cent and remain to have high funding priority.
- The government follows the goal to develop or retain excellent research in Germany. It has proposed a competition for the development of elite universities. This proposal has been submitted to the heads of Germany's state (Länder) governments for a final decision. The Excellence Initiative is to be used to expand cutting-edge research at universities and scientific institutions and make it internationally visible. Far-reaching reforms to improve the structures and efficiency of non-university research have been carried out.
- National politics systematically gears its research funding to technology developments and processes that can potentially be leveraged into substantial growth and jobs with favourable future prospects.
- Boosting the ability of SMEs to produce innovations has also high political priorities. Policy actors are improving general conditions for start-ups and are re-designing the funding vehicles for technology-oriented start-ups in order to boost entrepreneurial activity and to increase financing for innovation work. The government has, inter alia, improved the general tax rules for venture capital through its "High-Tech Master Plan" to foster high-tech development and is developing a new three parted funding structure for high-tech start-ups to close existing financing gaps.
- In responding to the growing need for skilled-workers and the international competition for highly qualified workers, a number of measures aimed at strengthening Germany's education system and universities have been initiated. The government's reform of the "Federal Training Assistance Act" giving financial aid to students was an important factor in fostering the inclination to a university

education. The field of engineering or natural science has particularly benefited from these activities.

- The government has launched the "Partners for Innovation" initiative to boost momentum at all levels of the German innovation system: This initiative is jointly sponsored by leading representatives from industry, trade unions and the science community.

In addition to these national innovation and technology policy measures, regions have become the object of multi-actor and multi-level governance structures and hierarchies (Koschatzky 2005). Their policy arena is composed of a variety of political, corporate, social and scientific actors. According to Cooke (2003: 414), this move towards regional innovation "*...brought a stronger emphasis from the subnational, mainly regional level of intervention as animator of a public-private process of interactive and mainly incremental learning-based innovation*". With regard to the German situation, the Federal Ministry of Education and Research (BMBF) has therefore been supporting regional alliances in the new German Länder since 1999 but also with a focus on different technologies (e.g. Biotechnology) in Germany as a whole. The initiatives being supported aim to develop regional competences with innovation potential into regional clusters (e.g. subnational innovation systems) in a strategic manner, on a high technological level and according to entrepreneurial criteria. Government grants represent a form of venture and investment capital for regions which think, plan and act with entrepreneurial vision. The next chapter will highlight some of the more important subnational innovation systems initiated by political action in recent years.

D. Current status of subnational innovation systems and SME technology capacity-building in Germany

I. Regionalization of innovation and technology policy: Multi-actor and multilevel regional governance

Since the second half of the 1990s, the regional level in Germany (as well as in other European countries) has become the starting-point for policy measures aiming at making the better exploitation of innovation and technology potential. Within this context, the network idea or the "network paradigm" (Cooke/Morgan 1993) and the possibilities for making use of spatial and cultural proximity between firms and supporting institutions is considered as being crucial. While in the years before the network idea was at least also implicitly applied in public promotion measures and innovation supporting services (e.g. in the Steinbeis technology transfer concept, or in the promotion of joint research project between firms or between firms and research institutes), this paradigm – in the form of the creation of subnational innovation systems – is now made explicitly in innovation and technology policy (Koschatzky 2001: 10). Since these recent developments focus mainly on the region, i.e. a subnational spatial entity, as a platform for policy implementation, some of the most important approaches in Germany which have a regional focus are briefly described.

Before doing so, the question should be raised as to whether government, be it local, national or supra-national, has the legitimation to intervene in the initiation of subnational innovation systems which are usually organized by market forces. In general, firms depend highly on strong links with their external world. Production and marketing would not be possible without these links. It would be market distortion if the state were to intervene at this stage. However, the situation looks different when it comes to the point that overall public interests are tackled. This might be the case when the market is unable to adjust according to principles of social wealth and economic prosperity. Since innovative activity not only contributes to the economic success of firms, but to the technological development, competitiveness and employment generation of a whole nation, it is the task of the government to create framework conditions which enable economic actors to contribute to public priorities and wealth through increased innovative activity (Koschatzky 2001:10).

Regions are equipped with a specific permutation of production factors; these can only be considered to be optimally allocated if they are made the basis for regional technology and innovation promotion (Koschatzky 1997: 185-187). National technology policy is not usually in apposition to take regional problem situation adequately into account, since neither its goals nor its instruments are adapted to coping with regional peculiarities. A policy oriented towards the optimization of national innovation resources generally tends to increase regional disparities. Since important research institutions and industrial research laboratories are usually located in areas that are already economically favoured, public promotion of these locations tends to underline and reinforce existing regional disparities. Although financial transfers from a central government to regions in different stages of development may combat development and innovation barriers in individual instances, actions of this type will certainly cease to be suitable when measures are required which need to involve the education and training system, management competencies or information and consulting aspects. Nevertheless, regional development can also be promoted by the central government. According to Koschatzky/Gundrum (1997: 212) public regional innovation and technology promotion – which goes hand in hand with initiating subnational innovation systems – therefore has three tasks:

- The activation and careful complementing of regional resources for the development and application of new technologies (regional innovation conditions).
- The coordination and interlinking of these resources in regional innovation networks, bringing in all the relevant actors in industry, science and policy.
- The integration of these regional networks into national and international clusters of technology development and production, through the creation of active interfaces and the promotion of supra-regional cooperation.

Within the context of the above-mentioned multi-actors and multilevel governance structures and hierarchies, the policy arena is composed of a variety of political, corporate, social and scientific actors. The national, and even supra-national policies influence and shape regional development. Regional policies (and planning) have to be coordinated with upper hierarchical levels (Koschatzky 2005). Multilevel governance relationships create the preconditions for regional openness, the link-up to supra-regional, national and supra-national policy levels and the integration of regional innovation systems in globally operating technological and enterprise systems (Cooke 2002: 136-137). Multilevel governance relationships however can only enhance regional innovation potentials if the learning capability and absorptive capacity of the regional policy and promotional institutions, as well as the political networks existing between them are sufficiently developed (Furst 2001).

Closely related to the regional governance of innovation are the innovative and technological capacities of regional industrial and scientific organizations and the basis institutional fabric of a region. It has already been mentioned that the absorptive capacity of the political administration may vary between regions and that regions are not identical functional or political-administrative spatial units, but vary in size, political structure and economic strength. Therefore the scope for actively upgrading the innovation and technology base of a region depends on the available production factors and resources and is not equal across all regions. Important questions with regard to the regional governance of innovation are related to the knowledge, tools and resources regional governments have at hand and to the role which regional governments could and should play in developing their regional science and technology base. Against the background of the interrelationship between regional governance of innovation and national innovation and technology policy, a successful implementation of innovation promoting measures can only be achieved, if strategic intelligence and political implementation competence is existing. Among others, these pre-conditions can be considered as being crucial for the successful implementation of recent (national) programmes or initiatives to initiate subnational innovation systems in Germany.

2. Examples of programmes and schemes to foster SIS in Germany

(a) The BioRegio contest

As already pointed out, the Federal Government of Germany has for some time now paid great attention to the regions in the implementation of technology policy measures. A first successful attempt was made in 1996 by initiating the BioRegio Contest initiative. Its major objective was to stimulate firm foundations and the location of foreign biotechnology companies in Germany, to accelerate growth in existing biotechnology companies and to ensure the supply of sufficient seed and venture capital to improve the competitive situation of Germany in biotechnology (Koschatzky 2001: 14, BMBF 2004). BioRegio can be described as a policy-led attempt to initiate subnational innovation systems in the field of Biotechnology. In a competition procedure three regions with appropriate research potential were selected: Munich, the Rhine-Neckar Triangle (Heidelberg, Ludwigshafen, Mannheim) and the Rhineland Region (Cologne, Aachen, Wuppertal, Düsseldorf). Over a five-year period from 1997 until 2001 each of these model regions, which were selected from 17 applicants, and "Jena", which received a special award, received privileged access to special project funding from BMBF totalling € 90 million. These "starting funds" enabled the regions to attract considerably higher private and public funding. The regions and the advantage of spatial (and organizational) proximity between industry, research and venture capitalists were made the starting point for network generation in and between the regions and international biotechnology research, testing and production.

Within the context of the BioRegio contest and with the central aim to create lasting impulses or a sustainable development of the German biotechnology industry, the BMBF launched two additional programmes, which focus more on the growth phase of existing companies and on technological profile-building: BioProfile and BioChance.

The BioProfile competition, which was launched in November 1999 within the framework of the Federal Government's Biotechnology 2000 funding programme, carried on from the experience and results gained from the BioRegio competition. BioProfile was also targeted towards those regions with excellent conditions for translating biotechnological know-how into new products, production processes and services.

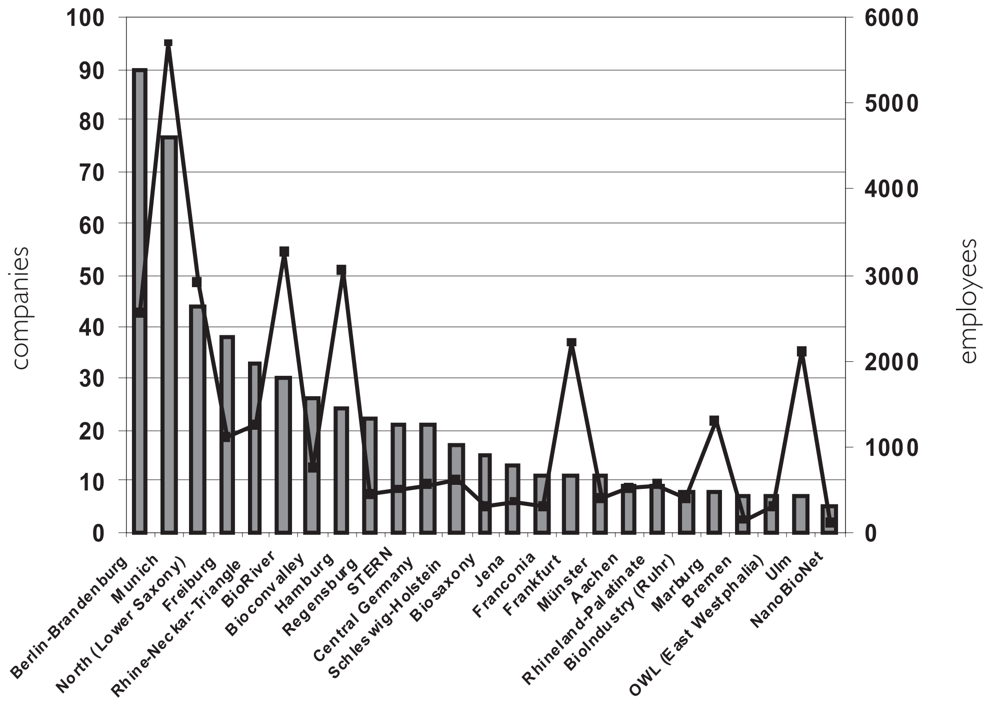
Emphasis was placed on specialist strengths in individual forward-looking applications in the field of modern biotechnology. These strengths were to be systematically identified and expanded. Special attention was also given to applications outside the health sector, e.g. plant biotechnology and nutrition. Of the original 30 applicant regions from throughout Germany, 20 took part in the decisive selection round. In the course of the selection procedure, the jury singled out three regions which had the potential to develop considerable economic strength in modern biotechnology applications which they chose themselves. The "winning regions" were Potsdam/Berlin with the profile "Nutrition-related Diseases", Braunschweig/Göttingen/Hanover with the topic "Functional Genomic Analysis" and Stuttgart/Neckar-Alb (STERN BioRegio) with a focus on "Regeneration Biology". Together the BioRegions of the BioProfile competition received BMBF project funding totalling € 50 million.

Since 1998, the biotechnology field has been supported with € 1.03 billion within the framework of project funding by BMBF, of which € 750 million was made available for funding research and development project at academic institutions and € 281 million was spent on support for R&D projects implemented by SMEs. Total project costs were in the range of € 1.35 billion, i.e. almost a fourth of the costs (about € 320 million) were covered by private capital (BMBF 2004: 84/85).

The goals of the different funding priorities of the BMBF are official precaution (e.g. prevention by proper nutrition, safety research), the expansion of basic innovations (genome research, neurobiology), technological development (bioinformatics, proteome research, nano-biotechnology etc.), measures to improve technology transfer and commercialize biotechnology (BioRegio, BioProfiles, BioChance), as well as support for young scientists. The greatest dynamic especially with respect to private fund raising was achieved in the model regions of Heidelberg, Cologne and Munich (see Figure 3.11), but smaller regions also demonstrate that they are aware of the importance of biotechnology as an industry of the future. In these regions, up to 40 per cent of the expenditure on research and development is financed by private capital.

Although the German biotechnology-industry or the BioRegions clearly reduced the gap with regard to international developments in this sector, critics point to the danger of neglecting "risk" as most important triggers for public R&D funding (Fier/Heneric 2005). It is assumed, that public R&D funding degenerates in a public policy without discriminating between firms which suffer from financial risk, technical risk or market risk. Especially in biotechnology every firm which likes to be funded will be funded, because the R&D policy does not care for different risks any longer. Bureaucrats and experts decide by their own which projects and firms will be funded and become totally screwed on the target population.

Figure 3.11 Biotech companies and employees in BioRegions 2004[6]



Source: IBS 2004

(b) The "EXIST – University-based start-ups" programme

EXIST intends to improve the start-up climate at universities and increase the number of start-ups from academic institutions. Models to motivate, train and support entrepreneurial personalities have been created in regional networks. In these networks the universities work together with external partners from academia, industry and politics, such as extra-university research institutions, companies, capital donors, technology and start-up centres, management consultancies, chambers of commerce, associations and local authorities. Together they develop an agreed offer for students, employees and graduates. EXIST is one element of the public support given by the Federal Government for facilitating innovative start-ups and, with its special objectives, it contributes towards improving the transfer of knowledge and technology from the universities. The "EXIST – University-based start-ups" Programme is based on four guiding principles:

- The permanent establishment of a "culture of entrepreneurship" in teaching, research and administration at universities.
- The consistent translation of academic research findings into economic wealth creation – also within the meaning of the universities' commission to transfer technology as reformulated in Article 2 Paragraph 7 of the Framework Act on Universities [Hochschulrahmengesetz – HRG].

[6] *This includes core biotechnology firms and also large enterprises with core business in the field of biotechnology. The persons employed in the biotechnology divisions of large chemical and pharmaceutical companies, however, could be reliably determined and were therefore not included.*

- The targeted encouragement of the great potential for business ideas and start-up personalities at universities and research institutions.
- A marked rise in the number of innovative start-ups and, thus, the creation of new and secure jobs.

EXIST started in December 1997 as a competition of ideas. What was wanted was cooperation between at least three different partners from a region, including a higher education establishment. In total, over 200 higher education institutions took part with 109 idea outlines for regional networks. An independent panel selected five model regions in a two-stage procedure: Bizeps (Wuppertal – Hagen), Dresden exists, GET UP (Ilmenau – Jena – Schmalkalden), KEIM (Karlsruhe – Pforzheim) and PUSH (Stuttgart).

Since summer 2002, ten additional regional networks are strengthened and developed within the framework of the new programme EXIST-Transfer, using the know-how from the existing five model regions. EXIST-Transfer also promotes the exchange of experiences with the five model regions.

From originally 45 applications a jury determined 20 regions for the second stage of the selection process. In May 2002 the jury selected the following ten regions which now receive a financial support of approximately 10 million euro altogether: BEGiN (Potsdam – Brandenburg), BRIDGE (Bremen), fit (Trier), G major (Dortmund), GROW (East Bavaria), Gruenderflair MV (Mecklenburg-Vorpommern), KOGGE (Luebeck – Kiel), route 66 (Frankfurt – Wiesbaden), START (Kassel – Fulda – Marburg – Goettingen) and SAXEED (South-West Saxony).

In addition to funding for structures (such as the establishment of the networks), there are also elements of individual funding in EXIST: EXIST-SEED funds the identification and development of promising business ideas at higher education institutions in the EXIST regions. With EXIST-SEED students, graduates and academics at the universities can receive payment for up to one year for living expenses as well as a lump sum for coaching and preparation for the start-up so that they can develop an idea into a business plan at the higher education establishment.

In early 2001 the EXIST Expert Advisory Board got personal information of the state of affairs on the spot in its interim evaluation of the five networks; on the whole it was very satisfied with the work done in the universities and regions. For example, it has been seen that the measures should largely be supported by higher education establishments - but not by individual professors alone or by circumventing the professors. The approach that has proved to be of value in passing on knowledge to students is events organized by members of the regular teaching staff, especially if they are enhanced by entrepreneurial personalities from practice. The questions as to whether and how the teaching offers should be incorporated in syllabuses or whether and how they can even be relevant to exams have not yet been resolved. Very intensive marketing by the EXIST initiatives to make students aware of the subject of start-ups and to arouse interest in obtaining the relevant qualifications is very important.

The incorporation of (consultancy) institutions from outside the academic world, which take care of network development tasks as well as the administration of measures, increases the flexibility and ability of the network to work.

The high degree to which the services of the network partner complement each other increases the diversity of offers to raise awareness and support potential entrepreneurs from higher education establishments within the EXIST initiative. Unproductive competition can thus be avoided, not only in the relationship between the network partners, but also between the network partners and the project coordination office. The EXIST HighTEPP college for postgraduates is a joint programme of the universities in Jena, Bamberg and Regensburg. In addition to imparting skills to young academics, its aim is also to support start-up projects and to train managers for dynamic high-tech companies. The college has an interdisciplinary orientation and is open to graduates from economic and scientific backgrounds.

It is an express objective of the EXIST programme to create conditions within the higher education establishments involved in the network that safeguard the permanent continuation of the activities relevant to start-ups in self-supporting structures even after the end of funding. For this reason, the higher education establishments involved have already undertaken on their own initiative to permanently incorporate the subject of start-ups in their range of services. They not only include changes in the courses offered and consideration of teaching events to train entrepreneurial personalities in syllabuses and examination regulations, but also clear budget shifts in the university finances.

In addition, for the future it is important to encourage other regions where start-up activities are still in their infancy to emulate this success and to promote the transfer of results and experience from the EXIST regions. The focus is always on model projects, the results and experience of which should be made accessible all over the country. In the future the EXIST programme will also contribute towards enshrining entrepreneurial independence as an educational and career goal at higher education establishments.

(c) The BMBF initiative "Entrepreneurial Regions"

The ability to create innovations has a significant influence on a region's economic and employment development. There are still substantial deficits in the development of innovations in Eastern Germany due to the structural weaknesses there. Against this backdrop, the Federal Ministry of Education and Research has systematically developed a series of programmes for the new Länder over the course of the last few years in order to improve the pre-conditions for innovation.

These programmes should

- Develop more regions with competitive business and science profiles,
- Drive forward the successful founding of innovative companies,
- Halt the migration of young experts and
- Create attractive development opportunities for talented young scientists.

The BMBF has now brought together five basic programmes under one roof in the innovation initiative "*Entrepreneurial Regions*".

The name of the initiative indicates its purpose and stands for a region-oriented, entrepreneurial support policy from the BMBF. The Ministry supports regional alliances in developing their own future-proof technological profile and consistently exploiting and expanding the strengths and potentials of their region. The BMBF wants to promote cooperation from which real competence clusters can develop. The support funds serve as start-up capital for regions which act with entrepreneurial vision. This success depends on close, market-oriented cooperation between the regional partners.

The idea behind this is based on one simple realization: innovations arise there where partners from the world of industry and science, education, administration and politics join together in alliances in order to increase value creation and competitive ability in their regions. The partners themselves define what the emphasis of their alliance will be – based on the business and research profile as well as the traditions and the available experts in their region. The heart of every regional initiative is a clear innovation strategy which is geared towards the implementation of newly developed products, procedures and services in the competitive landscape.

The BMBF umbrella initiative "Entrepreneurial Regions" is based on the following five programme pillars:

- InnoRegio,
- Innovative Regional Growth Cores,
- Centres for Innovation Competence,
- Interregional Alliances for Tomorrow's Markets – Innovation Forums, and
- InnoProfiles.

National policy plans to allocate funds totalling around EUR 90 million in 2005. A total budget of over EUR 500 million has been set aside for the period 1999-2007. The BMBF innovation initiative "Entrepreneurial Regions" stands for innovation-oriented regional alliances which develop the region's identified core competences on a high level and with strict market orientation to clusters. The programmes' aspirations are based on the fact that the most innovative products and applications are almost exclusively the result of highly specialized and integrative knowledge from many sources, minds and organizations of widely varying origins and orientation. In "Entrepreneurial Regions", this philosophy is closely tied to an entrepreneurial approach.

The programme "*InnoRegio*" began in 1999 as an open-themed contest ("bottom-up" approach) and serves as the basis for the three other programmes. The aim is to establish self-supporting innovation networks which pool the innovation potentials of their region to a competitive performance profile through new forms of cooperation. A total of 23 regional initiatives with a wide variety of industry specializations and topical points of emphasis were selected for development support from among 444 applicants (total budget 2000-2006: EUR 255.6 million)[7].

The "*Innovative Regional Growth Cores*" programme focuses on initiatives with market potential which can be realized in the mid- to long-term future. Ideas and activities from the regional innovation alliances should be oriented towards economic implementation on the market right from the start. The initiatives are provided with professional consulting services in the development of their innovation concept, which is based on a business plan. Each year, approximately five new initiatives are included in the three-year development support phase. Applications can be submitted at any time.

[7] *All figures in this chapter see: http://www.unternehmen-region.de*

The "*Interregional Alliances for Tomorrow's Markets – Innovation Forums*" programme is directed towards regional alliances in the early stages of development. The development support over a time period of six months and at a maximum of EUR 85,000 triggers an "ignition spark". The focus of the development support is an "innovation forum", a two-day event which serves to promote knowledge transfer, the establishment of contacts and the positioning in the competition landscape.

The programme "*Centres for Innovation Competence: Create Excellence – Foster Talent*" is the most recent component of "Entrepreneurial Regions". The goal of the programme is to establish interdisciplinary centres of excellence at universities and research institutes in Eastern Germany. These centres will engage in internationally competitive top-level research with young researchers from Germany and abroad and be able to make commercial use of their results in the mid- to long-term future. The focus is on the financing of two internationally staffed groups of young scientists until 2010 (development support from the BMBF: approx. EUR 60 million).

"*InnoProfiles*" especially supports cooperation between junior research groups and those businesses which represent regional core competences and hold the potential to contribute to their region's economic development in a significant way. Having started in June 2005, the programme is set out to support at least ten projects annually over the next four years. Like with all programmes within "Entrepreneurial Regions", "InnoProfiles" is not restricted to certain technologies or branches. Moreover, decisions will be based upon the projects' economic and technological potential for their specific region. Until the year 2012, the BMBF will allocate EUR 150 million to this programme. Figure 3.12 gives an overview of the "Entrepreneurial Regions" in Germany.

(d) Challenges and future activities

The scope for actively upgrading the innovation base of a region depends on the available production factors and resources and is not equal across all regions. The possible toolbox for national and regional governance regarding the creation of subnational innovation systems and technology capacity-building not only depends on the specific problem situation in a region, but is also influenced by the knowledge and implementation capacities of the regional political administration.

Against this background, the above-mentioned examples of policy schemes can have nothing more than a catalytic function and knock-on effect. By setting-up entrepreneurship-networks and providing young entrepreneurs with a share of funding needed for high-risk research projects, it is intended to develop regional technological and social competencies. Decisive, however, is the effect of public funding on the mobilization of private capital and on starting initiatives in regional institutions (e.g. intermediaries, technology-transfer organizations, regional public bodies etc.).

Figure 3.12 "Entrepreneurial Regions" in Eastern Germany 2005

Source: http://www.unternehmen-region.de

National policy and also supra-national policy are determined to further improve the framework conditions for the creation of subnational innovation systems and for the improvement of the technological base. Due to the complexity of regional systems and the difficulty in assessing sustainable, future-oriented trajectories for regional development, strategic competence is a necessary condition in governance and policymaking (Koschatzky 2005). After making first experiences with regionally oriented and implemented innovation and technology policy measures during the second half of the 1990s, new strategic concepts emerged in recent years – both on national and supra-national level (e.g. regional foresight, Delphi studies, participatory methods). The advantage of the regional level to implement these new concepts is that a wide constituency of societal stakeholders can be involved and new inter-group networks can be generated.

The approaches taken in Germany with BioRegio-, Exist- and Entrepreneurial Regions-funding have also improved European and international cooperation. Examples of the most successful subnational innovation systems show, that networking and technology capacity-building is not limited to the region but has a strong international aspect. This applies to the sheer market penetration as well as to informal contacts and also to private and public funding. The more attractive a region is – be it in relation to a certain technology (e.g. biotechnology, nanotechnology, optoelectronics), to a certain policy measure (e.g. entrepreneurship education, fostering university-based start-ups) or to the scientific expertise, the more it serves as a model or a benchmark for other regions – with the danger for catch-up regions to copy or implement policy programmes which do not fit in their regional context.

One of the biggest challenges from an innovation- and technology policy point of view in the years to come will be the identification of creative instruments to exploit regional technological and entrepreneurial potentials and link them with international developments. In this respect, supranational organizations will be in a position to supplement regional/national policy programmes and promote successful initiatives.

E. Conclusions

Recent examples of regionally oriented policy strategies to initiate subnational innovation systems and to foster technology capacity-building are the several initiatives of the German Ministry of Education and Research and of the European Commission (and of course of other countries). The need for targeted initiatives will be in a position to supplement regional/national policy programmes and promote successful initiatives at a regional level, directed towards already quite successful regions ("strengthen the strengths") and to less favoured areas results in various programmes, schemes and initiatives which bring together regional players by actions that are project-based or measure-based. These initiatives have to continually secure the cooperation process by the provision of resources (personal, finance, equipment) and by policy legitimation. They are mainly publicly initiated and carried out by regional key figures (promoters) in politics, industry and science, but they may be supported by external specialist advice, regional coordination and decision-making committees and by the promotion measures of policy at higher levels. Nevertheless, there is still room for research on the success factors of regional innovation strategies. Regarding the specific economic and social structures in regions and their different development potential, it is hard not to believe that strategies which were successful in one region could also be successful in another region. What is needed is the identification of strategy elements and the analysis of their impact under certain, well-defined framework conditions as a kind of guideline for good practice in regional innovation promotion. In this respect, the three German programmes "BioRegio", "Exist" and "Entrepreneurial Regions" appear to be models for different (national) techno-economic goals, in different spatial context situations and with different instruments. In the meantime, policy programmes in a few other countries in Europe contain similar initiatives, but adapted to the specific needs and context situations in the respective country.

ANNEX[8]

Suggested Policy Guidelines on "Subnational Innovation Systems" – Experiences from Germany and Europe –

(1) First of all, policymakers on the national level have to define public support or the fostering of SIS as a key policy field within the context of the national technology, innovation and research policy and also within the context of adjoining policy fields (e.g. education and economic policy).

(2) Depending on the size of the country and on the stage of its economic development (e.g. Eastern European countries as "catch-up economies" vs. Western European countries as mature economies), the decision has to be made, whether the SIS concept should be implemented as a bundle of policy measures directed towards already quite successful regions – in the national or international context – ("strengthen the strengths") or rather directed towards less favoured regions – with the aim to balance the techno-economic development.

(3) Selected SIS pilot or model projects may be one possibility to generate country and region specific policy tools without taking the risk to allocate large public funds into different thematic and spatial networks; regional contests as a policy tool to select regions which have the technological, administrative and economic pre-conditions for the improvement or the creation of an SIS can be considered as a new approach of the German technology policy in the last 5-10 years.

(4) Regarding the specific economic, technological and social structures in regions and their different development potential, it has to be considered that strategies which were successful in one region are not necessarily successful in another region. The identification of strategic elements and the analysis of their impact under certain, well-defined framework conditions as a kind of guideline for good practice in regional innovation promotion appear to be crucial.

(5) Such well-defined framework conditions should consider the already existing technological and innovation potentials in certain regions and the ability of the regional key players (e.g. companies, regional administration and other regional stakeholders) to adapt and implement the specific national measures directed towards an initiating of SIS. Within this context, the political system of a country and the different policy levels ("multi-actor system" in a federal state like Germany vs. more centralized policy measures in France) have to be taken into account.

(6) Most of the successful SIS policies in Europe can be observed in countries with "strong" regions which probably already have experiences with public initiated SIS or with supplementary policy measures directed towards primarily market-driven SIS (e.g. financial support of R&D projects on the firm-level, infrastructure measures, set-up of a steering units aimed at the "coordination" of an SIS etc.).

(7) The combination of "top-down" and "bottom-up" SIS policies depends very much on the national political system/culture and the ability of the regions to implement national SIS-programmes.

[8] *These draft policy guidelines were suggested by Mr. Thomas Stahlecker after the Seoul Regional Meeting as a reference for preparing a SIS conceptual framework and policy guidelines.*

(8) Examples of successful SIS in "new" technology fields (e.g. biotechnology, nanotechnology, optics, new materials) in Germany indicate, that they are mainly publicly initiated and carried out by regional key players (promoters) in politics, industry and science, but they may be supported by external specialist advice, regional coordination and decision-making committees and by the promotion measures of policy at higher levels.

(9) One of the main success factors of SIS policies seems to be the broad consensus among regional stakeholders towards the techno-economic priorities in their region, their endogenous technological potentials ("regional strengths") and the overall implementation of SIS policies (this also includes the ability to attract funding from supra-national organizations).

(10) The sustainability of a SIS depends on a multitude of different aspects, both with regard to national and international framework conditions; with a view to a short/mid-term perspective, SIS policies must be aware of the fact, that sustainable successful SIS are the result of stable national (and regional) framework conditions which affect the decisions of national and international companies to chose a certain SIS as their location and also of skilled people (engineers, entrepreneurs) to move to successful regions.

REFERENCES

1. BMBF – Bundesministerium für Bildung und Forschung (Hrsg.) (2004): BioRegions in Germany. Strong impulses for national technological development, Berlin.
2. BMBF – Bundesministerium für Bildung und Forschung (Hrsg.) (2004a): Bundesbericht Forschung 2004, Bonn, Berlin.
3. BMBF – Bundesministerium fur Bildung und Forschung (Hrsg.) (2005): Zur technologischen Leistungsfähigkeit Deutschlands 2005, Bonn, Berlin.
4. Cooke, P. (2003): Economic globalization and its future challenges for regional development, International Journal of Technology Management, 26, pp. 401-420.
5. Cooke, P. (2002): Regional Innovation Systems: General Findings and Some New Findings from Biotechnology Clusters, Journal of Technology Transfer, 27, pp. 133-145.
6. Cooke, P./Morgan, K. (1993): The Network Paradigm. New Departures in Corporate and Regional Development, Society and Space, 11, pp. 543-564.
7. Dreher, C. (1997): Technologiepolitik und Technikdiffusion. Auswahl und Einsatz von Förderinstrumenten am Beispiel der Fertigungstechnik. Baden-Baden.
8. Fier, A./Heneric, O.(2005): Public R&D Policy: The Right Turns of the Wrong Screw? The Case of the German Biotechnology Industry. ZEW Discussion Paper No. 05/60.
9. Freeman, C./Perez, C. (1988): Structural crises of adjustment: Business cycles and investment behaviour, in: Dosi, G./Freeman, C./Nelson, R./Silverberg, G./ Soete, L. (eds.): Technical Change and Economic Theory, London, pp. 45-47.
10. Furst, D. (2001): Regional governance – ein neues Paradigma der Regionalwissenschaften?, Raumforschung und Raumordnung, 59, pp. 370-380.
11. Koschatzky, K. (2005): Foresight as a governance concept at the interface between global challenges and regional innovation potentials, European Planning Studies, 4, pp. 619-139.
12. Koschatzky, K. (2001): Networks in Innovation Research and Innovation Policy – An Introduction. In: Koschatzky, K./Kulicke, M./Zenker, A. (eds.): Innovation Networks. Concepts and Challenges in the European Perspective. Heidelberg, New York, pp. 3-23.
13. Koschatzky, K./Gundrum, U. (1997): Innovation Networks for Small Enterprises. In: Koschatzky, K. (ed.): Technology-Based Firms in the Innovation Process. Management, Financing and Regional Networks. Heidelberg, pp. 203-224.
14. Kuhlmann, S. (2001): Future governance of innovation policy in Europe – three scenarios, Research Policy, 30, pp. 953-976.

V. PROMOTION STRATEGY FOR TECHNOLOGY-BASED INNOVATIVE SMES: MALAYSIA'S MSC CLUSTER AND THE MSC TECHNOPRENEUR DEVELOPMENT FLAGSHIP PROGRAMME[9]

Abstract

This paper describes the Multimedia Super Corridor (MSC) and its MSC Technopreneur Development (MTD) Flagship programme, one of the initiatives by the Government of Malaysia, an emerging economy, as a support system for technology based SMEs in Malaysia. A brief overview of the SMEs in Malaysia is presented and then the paper presents the case of the Multimedia Super Corridor (MSC) cluster initiative as regional system of innovation for supporting technology based innovative SMEs in the ICT sector. The MSC initiative, while considered as being successful in terms of attracting large firms and MNCs into the cluster, has not as successful in terms of being a support system to be able to spur the growth of SMEs in this sector. In order to rectify or overcome these lacunae, the government of Malaysia recently launched a promotion strategy called the MSC Technopreneur Development (MTD) Flagship programme. The paper describes the MTD programme as a Subnational System of Innovation (SIS) for SMEs. The MTD programme uses the entrepreneurial life cycle as a framework for developing the support programme to spur the growth of SMEs in the ICT sector. The programme is still very new and the results are yet to be seen but it is hoped that the paper will provide some valuable ideas for those interested in the concept of SIS for SMEs.

A. Introduction

This paper describes one of the initiatives by the Government of Malaysia as a support system for technology-based SMEs in Malaysia. The case of the MSC Technopreneur Development Flagship programme under the Multimedia Super Corridor initiative of Malaysia could provides some valuable ideas for developing subnational systems of innovation for SMEs.

At the outset a brief introduction to Malaysia and SMEs in Malaysia is presented, including the reasons why Malaysia needs to develop supporting industries and bird's eye view of the support system for SMEs at the national level is presented. The next section outlines the Multimedia Super Corridor, a policy driven cluster based imitative of the Government of Malaysia. Some of the weaknesses of the initiative in terms of supporting SMEs are identified, which provided the background to the development of the MSC Technopreneur Development Programme and then the final sections present the MTD programme as a Subnational System of Innovation to support SMEs in the ICT section.

1. About Malaysia

Malaysia is a middle-income country that transformed itself from 1971 through the late 1990's from a producer of raw materials into an emerging multi-sector economy. Growth was almost exclusively driven by exports - particularly of electronics. The economy was hit hard during the 1998 Asian Economic Crisis but with some economic

[9] *This paper was prepared and presented by Mr. Awari V. Mohan, Senior Lecturer and Chairman - Centre for Technology Management, Faculty of Management, Multimedia University, Cyberjaya, Malaysia.*

measures it has got back on the growth path and has grew 4.9 per cent in 2003 (with SARS and Iraq War) and growth topped 7 per cent in 2004 and 5 per cent in 2005. Healthy foreign exchange reserves, low inflation, and a small external debt are all strengths of the Malaysian Economy that seem to augur well for it over the near term. The economy remains dependent on continued growth in the United States, China, and Japan, top export destinations and key sources of foreign investment.

2. An overview of SMEs sector in Malaysia

SMEs in Malaysia represent an important segment of the economy playing an important role in strengthening both the forward and backward linkages with the nation's industrial development, particularly through their support to larger companies, including the multinational corporations (MNCs). Currently, SMEs account for more than 90 per cent of companies in the manufacturing sector, comparable to those of Japan, Taiwan Province of China and Germany of around 99 per cent. However, their contribution to the nation's GDP remains small at some 6 per cent in comparison to between 30~40 per cent in Australia, Japan and Germany; and exports at some 12 per cent, significantly lower than those in the European Union's 55 per cent of total export.

In 2004, SMEs comprised 89.3 per cent or 18,271 of the total 20,455 active companies in the manufacturing sector. SMEs contributed 16.29 per cent to the total manufacturing output, 17.55 per cent to value-added and 25.41 per cent to total employment. Compared with its performance in 2003, the contribution has increased by 7.46 per cent in terms of total output, 9.67 per cent in value-added and 2.50 per cent in terms of employment.

Table 3.13 Contribution by SMEs in the manufacturing sector

Indicators	2004^{e}	2003^{p}	Growth (%)
Total Output			
Value (RM Billion)	69.31	64.14	7.46
% Share to the Manufacturing Sector	16.29	16.16	
Added Value			
Value (RM Billion)	14.24	12.87	9.67
% Share to the Manufacturing Sector	17.55	17.41	
Employment			
Value (Number)	309,935	302,172	2.50
% Share to the Manufacturing Sector	25.41	25.26	

Source: National Productivity Corporation (SMIDEC Report)
Note: p: Preliminary, e: Estimation

The Government of Malaysia aims to making the SMEs to enhance their capacity and capability to become regional and ultimately, global competitive entities, and compete for access to global supply and production chains. The government has thus focused on a comprehensive approach towards SMEs development by increasing their access to capital, providing greater access to business services and improving their business enabling environment. In terms of funding, to date, a sum of about RM 13 billion has been put in place as special funds for the development of SMEs.

3. Some issues and challenges facing SMEs in Malaysia

Malaysian SMEs are still largely dependent on the domestic market. Based on a survey in 2004 by Small and Medium Industries Development Corporation (SMIDEC) and National Productivity Corporation (NPC), SMEs are only exporting 26 per cent of their total output. And their domestic market share is being challenged by the inflow of more competitive products from new emerging economies and other neighbouring countries.

Therefore, the main challenges confronting SMEs identified are:

- Market access
- Advancement of technology
- Innovation and creativity
- Access to financing
- Access to information
- Human resource development

The majority of SMEs are concentrated mainly in the food and beverages sectors (20 per cent), fabricated metal products (18 per cent), wood and wood products (17 per cent), and basic metal (4 per cent). Presently, only 20 per cent of the total SMEs in the country have made inroad into the export market. The SMEs are seen as assuming a significant role in the country's industrialization programme. SMEs as suppliers and service providers to leading industries, contribute towards the deepening and broadening of the industrial base through forward and backward industrial linkages. The Second Industrial Master Plan (IMP2) of Malaysia, which charts the strategic directions and strategies for industrial development for the next 10 years, set in place policies and programmes to further develop and integrate the domestic SMEs as the critical and strategic link in the development and strengthening of industry cluster formation, and increase domestic value-added.

With the globalization of trade and investment, as well as dynamic technological changes taking place, the Government of Malaysia understands that SMEs need to gear themselves to face stiffer competition in the future. Enhancing global competitiveness of the country's SMEs, thus, has become an essential development strategy underpinning most of the support programmes. This paper presents one such programme: the Technoprenuer Development Flagship for the promotion of technology-based SMEs, specifically in the ICT sector.

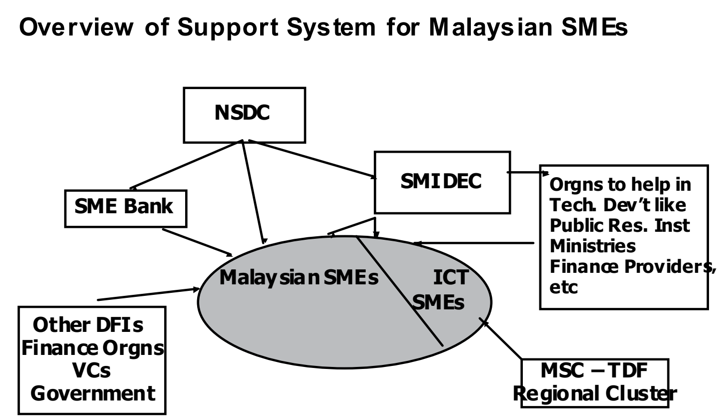
B. Some national level institutions for SME development

There are number of policy initiatives and institutions from the Government of Malaysia at the national level for the promotion of SMEs in general and also to enhance technological capabilities of the SMEs. The diagram below gives a bird's eye view of the support system for SMEs in Malaysia. The players include National SME Development Council (NSDC), Development Financial Institutions, SMIDEC and various other government institutions (like the Ministry of International Trade and Investment (MITI), MATRADE, National Productivity Corporation (NPC), etc. and non-governmental institutions (like the various Industry Associations) and others. For purposes of brevity only a few will be discussed here:

1. The National Small and Medium-Scale Enterprises Development Council

The National Small and Medium-Scale Enterprises Development Council has been set up to accelerate the process of strengthening infrastructure that supports the development of SMEs under the aegis of Bank Negara (the Central Bank of Malaysia). The important responsibility of this council is also to oversee the coordination of policy initiatives from the various arms of government and to ensure the effective implementation of these policies. The Council endorsed the "National SME Development Blueprint 2006" that includes a total of 245 programmes that will be implemented in 2006 to accelerate the development of SMEs. These programmes are aimed at strengthening the enabling infrastructure to support SME development; building capacity and capability of SMEs and enhancing further SMEs' access to financing aimed at enhancing the potential of SMEs to support the nation's economic growth. An allocation of RM 3.79 billion has been committed by the government for the implementation of these programmes. These programmes would cover all sectors, including SMEs in agriculture and agro-based industries, and those involved in knowledge-based industries.

Figure 3.13 Support system for Malaysian SMEs at the national level



2. Small and Medium Industries Development Corporation

The SMIDEC was established on 2 May 1996. The establishment of SMIDEC was in recognition of the need for a specialized agency to further promote the development of SMIs in the manufacturing sector through the provision of advisory services, fiscal and financial assistance, infrastructural facilities, market access and other support programmes.

SMIDEC's aim is to create resilient and efficient SMEs, in order for them to be able to compete in a liberalized market environment. The Corporation will promote SMEs to be an integral part of the country's industrial development capable of producing high value-added parts, components and finished products. SMIDEC will serve as the national focal point for the overall development of SMEs in the country.

Some specific developmental programmes have been formulated and implemented to enhance the capacity and capabilities of SMEs in providing world-class services and products to large companies or MNCs and their operations worldwide. Some of their programmes are as follows: (1) Industrial Linkage Programme (ILP); (2) Global Supplier Programme (GSP); (3) SME Expert Advisory Panel (SEAP); (4) Skills Upgrading Programme; (5) The Enterprise 50 Programme; and (6) Infrastructure Development and so on (Details about these programmes are available at www.smidec.gov.my).

3. Development Finance Institutions and the SME Bank

Development Finance Institutions (DFIs) are specialized institutions established to develop and promote strategic sectors for economic development. A key function of DFIs is to narrow the gap in the supply of financial services that are not normally provided by the banking institutions. There are DFIs in Malaysia catering to certain sectors like for the agricultural sector (including agro-based industries), for construction sector etc.

More recently Malaysia has established the SME bank – a DFIs largely funded by the Government to accelerate the growth among SMEs which have been identified priority sectors of the economy. The SME Bank – or Bank Perusahaan Kecil & Sederhana Malaysia Berhad started its new function on 3 October 2005, to nurture and meet the unique needs of SMEs as a one-stop financial centre responding to the funding and business growth needs of Malaysian SMEs to complement existing products and services offered by commercial banks through a comprehensive and integrated financial and business advisory services. Its primary role is to contribute towards the growth of a more robust entrepreneurial community in Malaysia. A wholly owned subsidiary of Bank Pembangunan Malaysia Berhad, the Bank operates through its head office in Kuala Lumpur and 15 branches nationwide.

While the above are institutions and mechanism for SMEs at the national level there have also been policy driven initiatives at the regional or subnational level to develop support systems for SMEs in Malaysia. In the following sections one of the major regional system for innovation in Malaysia will be described.

C. The Multimedia Super Corridor Cluster and MSC Technopreneur Development Flagship Programme as support system for SMEs

In this section the Multimedia Super Corridor Cluster – a Regional System of Innovation for ICT companies is described and the lacunae in this RSI are identified which led to the development of the MSC Technoprenuer Development Flagship Programme. The MTD programme is presented as a Subnational System of Innovation – the promotion strategy for development of SMEs in the ICT sector in Malaysia entrepreneur.

The MSC, as it is known, is a regional system of innovation for firms including SMEs in the ICT sector in Malaysia. The following were some reasons why the MSC project was conceived:

- Recognition that Malaysia was losing its comparative advantage in its traditional economic sectors;

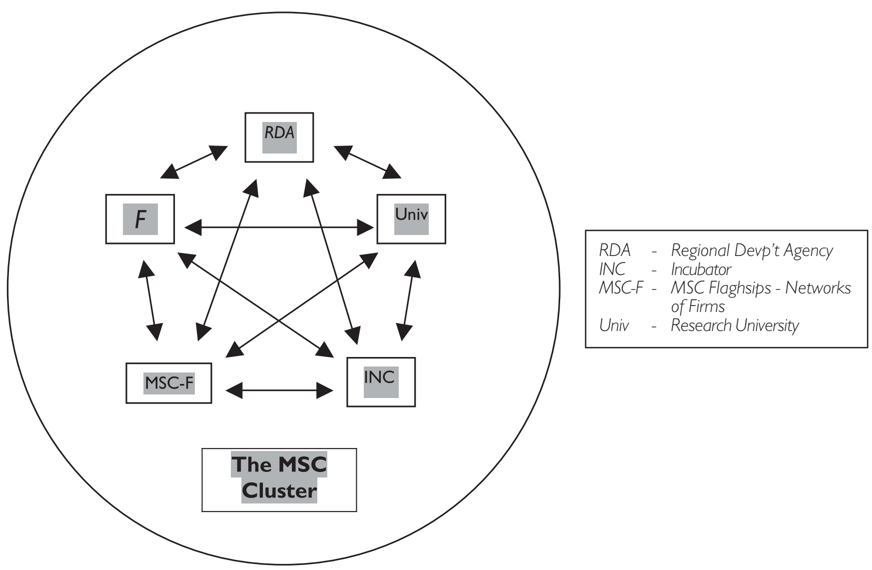
- Need to drive the economy towards higher productivity through technology and high value-added economic activities; and
- Information-age and converging technologies presented the best opportunities for socio-economic transformation.

The MSC project was modeled after the Silicon Valley and is a multi-billion dollar project started in 1995 and spans an area of more than 750 square kilometers. A policy driven cluster oriented approach, the MSC aimed to develop a friendlier environment for new business development in the ICT sector and also to spur high technology entrepreneurship in Malaysia. It uses the "regional clustering" approach and then intends to roll it out to the rest of the country. The focus was on building capacity in this sector and also to have applications for national development.

1. The MSC regional system of innovation – Elements of support for ICT SMEs

While the MSC regional system of innovation was not developed specifically to support SMEs only – many elements of the MSC project have been put in place to support the development of SMEs and building their technological capacities. These include a regional development agency (RDA) called the Multimedia Development Corporation (MDC), innovative finance schemes, the MSC Flagships Networks, a dedicated university and an incubator, others.

Figure 3.14 Some key elements in the MSC regional system of innovation



2. The Regional Development Agency – Multimedia Development Corporation

The Multimedia Development Corporation, the government-owned but autonomous organization, plays the role of a champion, facilitator, and partner of companies chosen to operate in the MSC. The MDC markets the MSC initiative globally. Some of the roles, among many others, set for MDC to develop the MSC Cluster include the following:

- Foster the development of "web" based collaboration in the MSC, in Malaysia and globally.
- Catalyse and nurture local companies and SMEs to become global players by forging successful smart partnerships between Malaysian and international companies.
- Realize the promise of mutual enrichment by making it easy and cost effective for companies to do business in the MSC.
- Promote technology and knowledge development in the MSC through incentives for commercial R&D and through the establishment of leading incubation centres.
- Facilitate innovation and entrepreneurship by supporting the development of a financial infrastructure that provides venture capital and public listings for smaller companies.

3. Innovative finance

In order to build technological capacities among SMEs, it was recognized that the existing traditional financial institutions could not help. In the MSC cluster more options have made available like venture capital (VC) from the MDC for creating tech-entrepreneurial culture in addition, to other VCs. The MDC also provides special grants for developing risk taking culture to help in developing an R&D culture.

In addition to the above, in September 2000, it was announced that Malaysia would lead the formulation of a RM 570 million (US$ 150 million) venture capital company together with investors in the United States, Saudi Arabia, and Bahrain with the stated purpose of investing in the IT sector in Silicon Valley. Another venture capital company, MSC Venture Corporation Sdn. Bhd. (MSCVC) – the venture capital arm of MDC – was formed to aggressively identify innovative and potential high-growth SMEs in this sector for investment. The MSCVC is a wholly owned subsidiary of MDC. It was established to provide venture capital financing to innovative and emerging IT and multimedia companies at the start-up, growth and pre-IPO stages. The company manages the RM 120 million MSC Venture One Sdn. Bhd. (MV1) Fund, which was established through investments by MDC and Khazanah Nasional Berhad, which is the investment arm of the Government of Malaysia.

4. Research university in MSC cluster – The Multimedia University

The availability of technically trained manpower for technology-based SMEs was recognized as a need in Malaysia and also support from a university had been recognized as an important factor for technology development in many clusters - The Multimedia University was set up within the MSC cluster in order do perform these roles. It not only provides the required manpower - but more importantly also serves as a research support base for SMEs which cannot afford to set up expensive infrastructure needed to conduct R&D activities for enhancing their technological capabilities. The university also has institutions like the Centre for Commercialization and Technopreneur Development (CCTD) to help in creating start-ups and also to help SMEs in the cluster.

5. MSC Central Incubator – infrastructure to nurture hi-tech SMEs

In order to enhance a number of technology-based SMEs in the MSC region – a central incubator was identified to be the nucleus for the National Incubator Network that would link eight other centres which are already in operation. These centres include Technology Park Malaysia (TPM), UPM-MTDC Incubator and Kulim Hi-tech Park. The establishment of this incubator network was considered crucial to help generate the much needed pool of SMEs to meet the demands of the MSC cluster project when it rolls out nationwide. The incubator is located within the Multimedia University (which is in the MSC cluster) with 62,500 square feet of space.

The incubator is one of the six major ingredients critical to the creation of sufficient technopreneurs. The other five elements are venture capital and financing, research and development, incentives, human resource development, and market access.

The MSC Central Incubator has been set up to help enhance the capabilities of SMEs by allowing its tenants to have access to the MSC's telecommunication infrastructure, research facilities, networking opportunities and venture capital funding. The MSC Central Incubator will also support the tenants by providing seminars, training, and other advance services such as business plan development, accounting, and marketing.

6. The MSC flagships firms – institutional and network dynamics for enhancing technological capabilities in SMEs

Another support element in the MSC cluster is the "MSC flagships" formed in order to develop technological capabilities and also for social development. The government has provided major government ICT projects to consortiums/network of companies – both local and foreign ones, in order to facilitate "learning" and also some sort of transfer of capabilities to the local companies while providing market to the foreign technology providing companies.

(a) Multimedia development flagships clusters

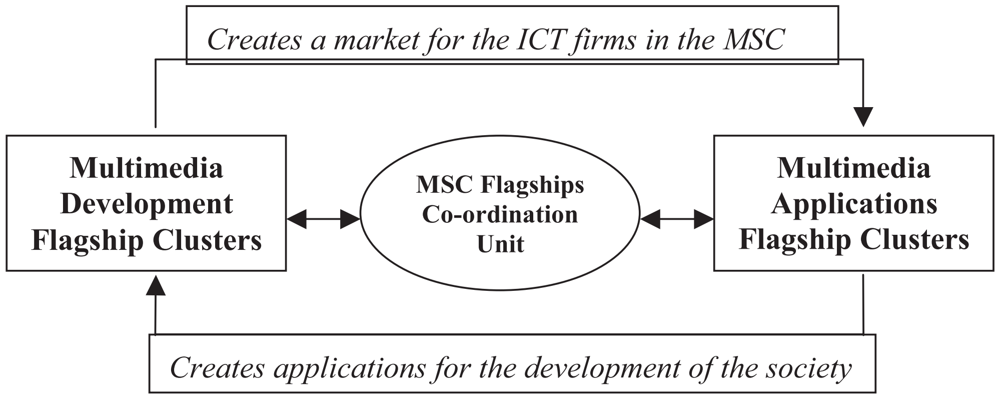
This comprises of firm networks that develop applications that offer concrete business opportunities to facilitate the development of society and government. The four identified "flagship applications" networks of firms within this group are:

- Electronic government flagship;
- National multi-purpose card flagship;
- Smart schools flagship; and
- Telemedicine flagship.

(b) Mu1timedia environment flagships clusters

In the case of this flagship, firms involved in carrying out their activities within interactive clusters to develop ICT technology, products and applications, designed for enabling the applications in the Multimedia Development Flagship. Thus the main aim of this flagship is to aid the Multimedia Development Flagship firms. This category consists of firms developing applications and classified under the R&D cluster, the E-Business cluster (combining the Worldwide Manufacturing Web and Borderless Marketing Flagships), and most recently the Technopreneur cluster - all this with the aim of providing specific support to companies in developing multimedia products and applications. Currently, in planning is also a Biotech cluster.

Figure 3.15 MSC flagships and coordination units



7. MSC Regional System of Innovation – favourable for SMEs?

The MSC project has had mixed reviews, and one issue was that given the number of incentives, not enough number of local start-ups and SMEs were emerging. Some of the elements in the MSC RIS that have been generally helpful are like the existence of a Regional Development Agency – the MDC as an one-stop shop for all things MSC and also Incentives (Financial and Non-financial) which have been instrumental in attracting MNCs and larger players to operate in the MSC but not helped the SMEs very much.

The business climate seems to favour large or MNC players – who are self-sufficient in terms of business services. The problems faced by SMEs have been that operating costs in the cluster are very high, many other hidden costs (including infrastructure costs, distance to market, lack of business services in the region, etc.) and the SMEs appear to lack an overall ecosystem to operate.

As for the MSC flagships, initially there was no specific focus on the SME sector. The flagship programmes with the "partnering or networking" approach had mixed results – once again this policy-driven system did attract foreign/MNC firms with "technology" and "business" competencies – with the lure of a "market" to partner/network with local firms. Technology transfer agreements were in place and there was some learning from both the local and foreign players in some flagships, the effect is still sporadic rather then rampant and significant spin offs or spill over effects yet to be seen. All this led to the re-vamping of the flagships clusters of firms in the MSC cluster and more impetus for the MSC Technopreneurship Development Flagship Programme, which is described in the next section.

D. The MSC Technopreneur Development Flagship Programme

The MSC Technopreneur Development Flagship (MTD) is a specific flagship cluster designed for the promotion of SMEs in the ICT Sector. In recognizing the need to further enhance the MSC's efforts to develop Malaysian SMEs in the ICT and other strategic high technology industries, the government launched the MTD programme in November 2001. The lead agency driving the flagship is the Ministry of Science, Technology & Innovation with the MDC acting as the implementing agency. The mission of the MTD programme is "*to catalyse, nurture, develop and grow technopreneurs and ICT SMEs to become sustainable and competitive ICT SMEs and grow them to be MSC globally competitive companies.*"

The core objectives of the MTD flagship programme are to:

- Facilitate the development of technopreneurs (Universities and Industry);
- Catalyse the start up of ICT SMEs;
- Facilitate the growth of ICT SMEs into MSC Status companies;
- Facilitate the growth of MSC Status companies into MSC global companies; and
- Catalyse the development of the ICT SME and Bio-Informatics clusters.

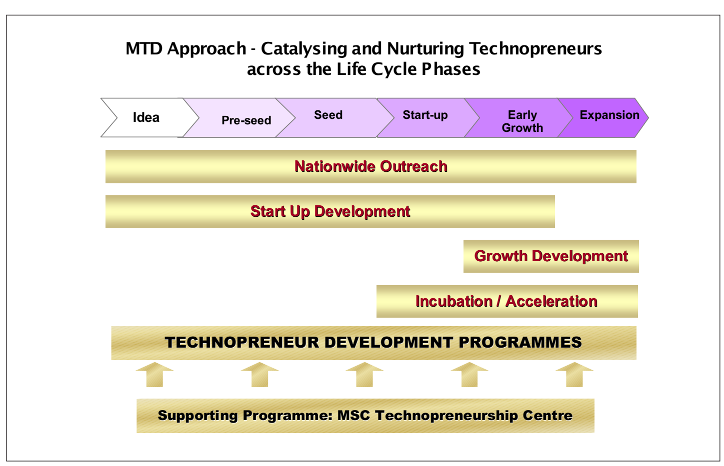
1. Catalysing SMEs using the ICT SME life cycle action model

Cognizant that business venture at different stages of growth require technopreneurs to have different competencies and skills set, the MTD programme has designed its development programmes to meet the needs of technopreneurs at different phases of the ICT SME development life cycle, from idea stage, pre-seed to growth and expansion stages of the enterprise. There are four key programmes identified (as in Figure 3.16.) to cover all the stages of an SME life cycle which are described in the following passages.

The "Nationwide Outreach" programme where the MTD programme personnel are involved in road shows, exhibitions, etc. in order to promote services and programmes available for potential entrepreneurs interested in starting up technology-based SMEs. This programme is an ongoing programme spanning all the stages of the ICT SME life cycle – with the aim of attracting Malaysians to set up SMEs in the ICT sector.

The second major activity of the MTD is 'Start-up Development' – at this stage the focus is on providing support in terms of "getting funding" for the SMEs. This involves organizing workshops, training and other support sessions to help entrepreneurs or SMEs in developing business plans. Here the SMEs are provided with free workshops where businessmen from other successful SMEs present their experience and also the free advice from a consultant firm in writing up business plans in order for the SMEs to submit these to financial institutions for funding – this consultant firm has hired only for this purpose and is paid for from the MTD programme funds.

Figure 3.16 Malaysia's MTD programme across the SME development life cycle



The third activity is "Incubation and Acceleration" where the government and private sector resources are leveraged to help start-ups to gain a foot hold in the market. It also involves provision of infrastructure for start-ups like the setting up of a special building for SMEs businesses in the regional cluster (at lower costs), incubators in the cluster university and private incubators like BT Exact, etc. with low cost rentals, proximity to "regional development authority the MDC" and also access to manpower and technology – from the university in the cluster. Technology-intensive MNCs have also been attracted to set up shop in the cluster incubator to provide support to the SMEs. The two competing giants Sun Systems and Microsoft have technology support programmes run from their offices located in the University Incubator in the cluster.

Once an SME has found its feet – the next stage of the MTS support programme is "Growth Development". This programme is for the SMEs that have got the funding and are in business. One of the elements of this programme is an annual awards scheme called the Asia Pacific ICT Award, which recognition is given to the small SMEs to help them gain visibility in the ASEAN region/market. A programme initiated by the Multimedia Development Corporation, APICTA consist of 16 member economies and they are China, the Republic of Korea, Hong Kong, China, Macau, Viet Nam, the Philippines, Myanmar, Pakistan, India, Thailand, Brunei Darussalam, Singapore, Indonesia, Sri Lanka, Australia and Malaysia. The objective of the APICTA awards is to help build the local brands regionally (in the ASEAN). This programme involves the APITA Awards. There is also the "Market Access" programme that helps the SMEs in strategic sales for finding customers.

2. Actors identified to play a role in the MTD flagship programme

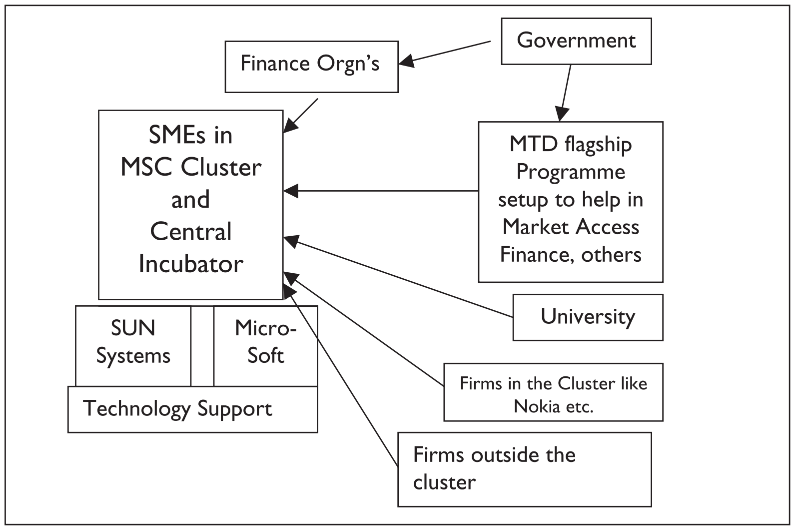
In order to achieve the objectives of the MTD flagship programme – the actors in the subnational innovation system to support the SMEs have been identified. They are:

- Institutes of Higher Learning,
- Local Firms and MNCs as Partners,
- For Markets and for Technology,
- VCs and any other Finance Providers, and
- Other SMEs in the market.

The Figure 3.17 illustrates the linkages in the MTD programme between the various actors in the subnational innovation system for SMEs to enhance their technology capabilities. The role of MTD in the development of SMEs in ICT sector is seen as a facilitator in linking up the actors in the system for building technological capability of the SMEs in the programme. An example of its role is when a SME client seeks help from MTD, the MTD personnel assess and then partners these ICT-SMEs with companies like IBM, Sun Systems, Maxis (a local mobile telecommunication giant). All of whom have "partnership development programmes" providing technology support in terms of hardware/software and also training programmes for SMEs.

In addition to the SMEs being networked through the MTD flagship programme there has been a slow and steady growth of ICT SMEs leveraging on the actors in the subnational innovation system and creating linkages with firms and other institutions locally and overseas - sometimes on their own initiatives and in come cases through interventions from the cluster players and are enhancing their technological capabilities.

Figure 3.17 MTD flagship programme catalysing actors like a SIS for ICT SMEs in Malaysia



E. Challenges, opportunities and best practices

The MSC regional system has been able to attract MNCs that are willing to collaborate with local SMEs for product Development. It has also been fairly successful in identifying the regional strengths and embarked on a development strategy of a sector-based on that – which is the shared services and outsourcing sector. But more could be done in terms of developing the interrelationships of MSC firms within the MSC itself. This will help to synergize the capabilities of the firms and organizations to make offerings to the market or to come out with innovations. In addition, there is a vital need to develop linkages of MSC firms and organizations with outside research institutes, universities and industries outside to synergize what is already there for the SMEs in the MSC cluster and also to increase the demand conditions for the MSC firms. This is where the MTD flagship programme could play a role as a subnational system of innovation focusing on the development of SMEs.

The regional system of innovation seems to have helped the local SMEs to 'lodge' themselves in global supply chains – giving them market access and also access to technology – but again the evidence is anecdotal and needs to be spurred on more. The MTD flagship programme where the SMEs have got linked with business consulting firms and also with technology providers is gaining popularity. Another element in the system of innovation is that the two rival technology providers (SUN and Microsoft) in the Incubator have been helpful to the SMEs to learn the tools to enhance their technological capabilities in one sphere of activity. While all the elements of a system are in place – there is a need to further develop the subnational system of innovation for SMEs more formally and get a threshold of companies are in place.

What's Next...... Phase II of the MSC project

In addition to rolling out the MSC to other regions (which has started with Penang), the focus is now on the "Shared Services and Business Processing (BP) Outsourcing" sub-cluster which has emerged in the region. The plan is to develop the value chain of the outsourcing sector in the MSC. There is a need to strengthen promoting of this sub-cluster in the region and also globally. A threshold of MNCs and large players that are already there can be leveraged by making them part of the subnational system of innovation for SMEs and attract SMEs related to this sector in all aspects of the "outsourcing value chain" to provide the needed services and technology. The other major strategic initiative is the "Brand the MSC project" and to promote it in order to grow.

Overall the key descriptors for the subnational system of innovation type promotion strategy to help SMEs develop technological capabilities are identification of key players/ actors in the system, developing linkages among them – in the case of Malaysia it's been partnerships between public and private organizations and also the partnership between MNCs and local business organizations for enhancing technological developments. Other important players in the system include research universities (for manpower and research support) and innovative funding mechanisms – which have been identified as important players in many regional systems of innovation.

REFERENCES

1. " Support Institutions in Development of R&D Activities in an ICT Cluster – The Multimedia Development Corporation in Malaysia's Multimedia Super Corridor Cluster", Avvari V. Mohan and Isshammudin Ismail, Science, Technology and Society (STS), (Sage UK), Vol. 10-1. 2005.
2. "ICT Clusters as a Way to Materialize a National System of Innovation: Malaysia's Multimedia Super Corridor Flagships", Avvari V. Mohan K. Aziz, and A. Omar, Electronic Journal of Information Systems for Developing Countries (EJISDC), HK. Vol. 16, January 2004.
3. Revving Up SMEs as the Engine of Growth, Keynote Address by Tan Sri Nor Mohamed Yakcop, Minister of Finance II, CEO Forum of Development Finance Institutions 2005, 12 September 2005, The Regent Hotel, Kuala Lumpur, Malaysia.
4. Development of SMEs, 2005 – Report from SMIDEC, Malaysia.
5. About Malaysia, The CIA World Fact Book, Accessed from the following website: http://www.cia.gov/cia/publications/factbook/geos/my.html
6. National SME Council set up, Sa'odah Elias in The Star, Saturday, August 14, 2004 http://biz.thestar.com.my/news/story.asp?file=/2004/8/14/business/8662590&sec=business
7. Interviews with: Executives from the MSC Technopreneur Development Flagship Unit of the Multimedia Development Corporation, Cyberjaya, Malaysia
8. Information Gleaned from Websites:
   - 8.1 The Multimedia Development Corporation – http://www.mdc.com.my
   - 8.2 The MSC Technopreneur Development (MTD) Flagship – http://www.technopreneurs.net.my

APPENDIX: Standard definition of SMEs in Malaysia

1. Primary Agriculture

General definition:

"A small and medium enterprise in primary agriculture is an enterprise with full-time employees not exceeding 50 or annual sales turnover not exceeding RM 5 million."

Specific definitions:

"A microenterprise in primary agriculture is an enterprise with full-time employees of less than 5 or with annual sales turnover of less than RM 200,000."

"A small enterprise in primary agriculture is an enterprise with full-time employees of between 5 and 19 or with annual sales turnover of between RM 200,000 and less than RM1million."

"A medium enterprise in primary agriculture is an enterprise with full-time employees of between 20 and 50 or with annual sales turnover of between RM 1 million and RM5 million."

2. Manufacturing (including Agro-Based) and Manufacturing-Related Services (MRS)

General definition:

"A small and medium enterprise in manufacturing (including agro-based) and MRS is an enterprise with full-time employees not exceeding 150 or with annual sales turnover not exceeding RM25 million."

Specific definitions:

"A microenterprise in manufacturing (including agro-based) and MRS is an enterprise with full-time employees of less than 5 or with annual sales turnover of less than RM 250,000."

"A small enterprise in manufacturing (including agro-based) and MRS is an enterprise with full-time employees of between 5 and 50 or with annual sales turnover of between RM 250,000 and less than RM10 million."

"A medium enterprise in manufacturing (including agro-based) and MRS is an enterprise with full-time employees of between 51 and 150 or with annual sales turnover of between RM10 million and RM25 million."

3. Services Sector (including ICT)

General definition:

"A small and medium enterprise in services is an enterprise with full-time employees not exceeding 50 or annual sales turnover not exceeding RM5 million."

Specific definitions:

"A microenterprise in services is an enterprise with full-time employees of less than 5 or with annual sales turnover of less than RM 200,000."

"A small enterprise in services is an enterprise with full-time employees of between 5 and 19 or with annual sales turnover of between RM 200,000 and less than RM1million."

"A medium enterprise in services is an enterprise with full-time employees of between 20 and 50 or with annual sales turnover of between RM 1 million and RM5 million."

Source: Bank Negara Malaysia – http://www.bnm.gov.my/index.php?ch=8&pg=14&ac=1037

VI. SUBNATIONAL INNOVATION SYSTEMS FOR REGIONAL DEVELOPMENT POLICY AND PONDERABLES[10]

A. Introduction

In looking at the UNESCAP's Subnational Innovation Systems Project, it is quite apparent that UNESCAP has embarked on a very ambitious project albeit one which has enormous significance to developing and less developed countries. Several features dot the background of the project.

Firstly, the emphasis on developing local SME competitiveness is obviously one of more enlightened policies that has made much inroads in the realm of government policies the world over. This emphasis was apparently born out of a realization that a nation needs to develop its indigenous industry to ensure that the benefits of development are experienced widely by its citizens. Overdependence on multinationals on the part of some nations together with its attendant ill effects on their citizens seem to have provided enough evidence for the need of a rethinking of national development strategies in support of local SMEs. In addition, some countries have seen the significant contributory role played by their SMEs in national development thus cementing the importance of SMEs in their national economic development plans.

Secondly, the contribution of innovation to a nation's economic progress has been so widely accepted that any national plan of worth would have to include the enhancement of its national innovation performance and its innovative capacity among its top national priorities. Of late, innovation systems of all shapes and sizes – national, regional or subnational, sectoral and organizational – have become the preferred tools of analysis.

Thirdly, many nations and analysts, looking at the development experiences of the more advanced countries, especially members of the Organization for Economic Cooperation and Development (OECD) have been persuaded that the path to development lie in the technological prowess of a nation. SMEs and innovation systems have mainly been seen through technological eye-lenses leading to a strong focus on the technological capacity of SMEs. In examining innovation systems, technological innovation seems to have usurped most, if not all of the analyst's attention.

Even so, there are benefits to be reaped from any systematic analysis with a starting point that is quite well understood by most analysts. It is in this light that the author has been requested by UNESCAP to share on Malaysia's science and technology policies together with some thoughts on a possible generic SIS policy approach for the Asian and Pacific region context.

B. The Policy

Malaysia's Second National Science and Technology Policy (NSTP2) has seen science, technology and innovation (STI) as central to success in today's modern economy. STI is deemed the basis and therefore forms the vital resources and strategic investments for building a more innovative and vibrant economy. The NSTP2 attempts to put in

[10] *This paper was prepared and presented by Mr. Yeoh Beng Keat, Principal Assistant Director, Policy and Planning Unit, Ministry of Science, Technology and Innovation, Putrajaya, Malaysia.*

place programmes, institutions and partnerships to enhance Malaysia's economic position including the quality of life of the people.

The vision contained in the NSTP2 is for Malaysia to become a nation that is competent, confident and innovative in harnessing, utilizing and advancing its science and technology towards achieving the goals of Vision 2020. The policy seeks to maximize the utilization and advancement of science and technology (S&T) as a tool for sustaining economic development, the improvement of quality of life and national security. It aims to accelerate the development of S&T capability and capacity for national competitiveness.

The twin objectives of the NSTP2 are: to increase research and development (R&D) spending to at least 1.5 per cent of Gross Domestic Product (GDP) by 2010 in an effort to enhance national capacity in R&D; and to achieve a competent workforce of at least 60 researchers, scientists and engineers (RSEs) per 10,000 labour force by 2010 to enhance national capability in S&T.

The NSTP2 provides a framework for improved performance and long-term growth of the Malaysian economy. The policy aims to:

- Increase the national capability and capacity for R&D, technology development and acquisition;
- Encourage partnerships between public-funded organizations and industry as well as between local and foreign companies for the co-development of technologies with a view to increasing indigenous technology capability;
- Enhance the transformation of knowledge into products, processes, services or solutions that add value across every industry for maximum socio-economic benefit;
- Position Malaysia as a technology provider in the key strategic knowledge industries such as biotechnology, advanced materials, microelectronics, advanced manufacturing, information and communication technologies, aerospace, energy, pharmaceuticals, nanotechnology and photonics;
- Foster societal values and attitudes that recognize S&T as critical to future prosperity, including the need for life-long learning;
- Ensure that the utilization of S&T accords emphasis towards approaches that are in conformity with sustainable developmental goals including alignment with societal norms and ethics; and
- To develop new knowledge-based industries.

As a nation with relatively limited resources, Malaysia has to ensure the desired results and high rates of return from every investment made in developing S&T. The allocation of resources should therefore be closely aligned to national priorities for the country's transformation into a knowledge-driven economy so as to maximize economic and social returns. The NSTP2 therefore addresses seven key priority areas as follows:

1. Strengthening research and technological capacity and capability

S&T investments by the government have increased tremendously since the introduction of the Intensification of Research in Priority Areas (IRPA) programme in 1988. Despite such increases, Malaysia's R&D investments pale in comparison to that of the advanced countries. The gross expenditure in R&D up to year 2000 is 0.5 per cent of GDP, a figure that compares unfavourably with other more developed countries. Absolute

R&D expenditures by both government and industry have increased in recent years especially by the latter and this trend is encouraging. But, Malaysia needs to invest more in order to keep abreast with the explosive pace of changes in scientific and technological developments.

Success will go to countries and firms that continuously invest in knowledge intensive activities. R&D is a key activity in enhancing the generation of new products, processes, services or solutions. Proficiency in R&D, however, is not automatic. The government's role is to establish an environment conducive for industry to invest in R&D and other technological development activities. Industry too must complement the government's efforts in commitment and accept responsibility for R&D in order to reap for itself the resultant benefits. In order To remain competitive in the future, the government must support the development of critical bases for future specialization and competence in carefully selected areas.

2. Promoting commercialization of research outputs

Success in innovation is determined by the ability to transform ideas and knowledge into products and processes that are demanded by market. The government plays a key role in forging linkages between the generators of knowledge and the users of knowledge. The government-funded research organizations must play a more proactive role in making connections with industry. Such an active stance, incorporating the introduction of new mechanisms and incentives is consistent with the mission of conducting research for the benefit of the nation especially when the outputs are commercialized.

3. Developing human resource capacity and capability

Investments in the "intangibles" such as education and training, R&D and new managerial skills are very crucial. Investments in these intangibles must achieve two main objectives: achieving the numbers; and attaining quality. While Malaysia's Information Technology (IT) and Multimedia agenda are powerful initiatives for economic advancement, the broader scope of the S&T agenda encompasses a wider range of activities that include the Biosciences and Engineering. The development of these areas will further enhance the wealth creation processes consistent with the expansion of the knowledge-driven economy. A specialized core group of scientists and engineers should be developed in tandem with the expansion and setting up of new research centres and labouratories.

Current statistics indicate that Malaysia has to expand the human resource base in S&T to fulfill the requirements for scientists and engineers in ten years time. This means that there will have to be a substantial injection of investment in human resource development in the setting up of more S&T institutes and universities. The shortage of S&T personnel is estimated at between 20 to 30 per cent across all levels of scientific, engineering and technical areas. The situation is particularly acute for small and medium-scale industries. Malaysia therefore has to adopt a broad-based approach to human resource development to support its S&T agenda. In the long term, Malaysia requires a much more effective delivery system for human resources to drive economic growth and progress. This must translate to a high component of S&T graduates as well as a culture of life-long learning.

4. Promoting a culture for science, innovation and techno-entrepreneurship

Developing a supportive attitude in society for change through increasing S&T awareness and appreciation programmes is crucial towards engendering a climate for invention, innovation and techno-entrepreneurship. Techno-entrepreneurship is one of the major driving forces behind technological advancements. Malaysian society tends to be averse to risk in technology. But, taking no risk is the greatest risk of all. It closes the door to a new and more rewarding future. The government will do more to share the risks with industry and individuals in new technological developments.

5. Strengthening institutional framework and management for S&T and monitoring of S&T policy implementation

Proficiency in S&T does not happen by chance. It must be made to happen. Decisions on S&T developments must be taken based on well-informed options and not on exigencies. The current institutional framework for S&T is characterized by a lack of resources devoted to S&T policy analysis and the diffusion of responsibilities throughout various arms of government. A well-defined system for the management of national S&T agenda needs to be set in place. Ability, agility and adaptability must underpin the efforts in enhancing the National Innovation System (NIS). Towards this direction consideration will be given to strengthening the NIS.

A NIS will involve a set of distinct processes involving institutions that jointly as well as individually contribute to the development and diffusion of new technologies. It will provide the framework within which government forms and implements policies to influence the innovation process. Developments in S&T cannot be undertaken in a vacuum. They must be sensitive to the needs and concerns of society, which ultimately influence the quantum of resources devoted to the development of S&T. Rapid advances in the new technologies especially in the field of genetics are raising serious moral and ethical concerns. These issues have to be addressed in consonance with acceptable societal norms and ethics.

6. Ensure widespread diffusion and application of technology, leading to enhanced market-driven R&D to adapt and improve technologies

Dissemination of technology is vital in creating the infrastructure and environment within which the needs of the technology and business communities can work together for mutual benefit. For maximum effectiveness, the private sector has to be encouraged to take the long-term view of business ventures through investments in R&D, and the research community has to reorient its activities in line with industry needs.

7. Build competence for specialization in key emerging technologies

Technology is never static. Markets are constantly changing. New technologies and applications are surfacing. A forward-looking approach to the key technologies of the future is crucial to sustain an active and competitive industrial economy.

The NSTP2 is a continuation and yet an evolution and updating of the NSTP1 and the Technology Action Plan (TAP) of 1990. A comparison between the old and new S&T

Policies in Malaysia can be observed in the following table which highlights the different strategies outlined in the policies:

Table 3.14 Comparison of S&T policies (1986-2002)

NSTP 1 (1986)	TAP (1990)	NSTP 2 (2002)
• National Development, Security and Social Well-being • Science Policy in relation to other policies • Scientific upgrading • Self-reliance • Scientific information • Research and Development • Manpower • Role of the private sector • Transfer of Technology • Computerization • Centres of Excellence • Plan of Action	• Provide leadership to strengthen the institutional and support infrastructure for industrial technology development • Ensure widespread diffusion and application of technology, leading to enhanced market-driven R&D to adapt and improve technologies • Build competence for specialization in key emerging technologies • Strengthen the institutions and mechanisms for continual development and elevation of technical proficiency of the human resource base • Elevate S&T awareness and appreciation to provide the most conducive climate possible for invention, innovation and technological advancement	• Strengthening research and technological capacity and capability • Promoting commercialization of research outputs • Developing human resource capacity and capability • Promoting a culture for science, innovation and techno-entrepreneurship • Strengthening an institutional framework and management for S&T and monitoring of S&T policy implementation • Ensure widespread diffusion and application of technology, leading to enhanced market-driven R&D to adapt and improve technologies • Build competence for specialization in key emerging technologies

C. The Ponderables

In attempting to develop a policy framework for a SIS for the Asian and Pacific region, certain issues need to be thought out carefully. Since the development of the concept of innovation and national innovation systems, new revelations and realizations arising from attempts to implement policies in many countries have compelled many analysts to rethink certain widely held views and perspectives. The changing nature of business brought about by globalization has also caused many to rethink the conventional understanding of innovation. Recent studies of regions have compelled a rethinking of the drivers of competitiveness in SMEs together with the key driver of economic development of subnational regions.

1. Innovation: the science and technology perspective

The pattern and nature, and therefore, the concept of innovation have undergone significant changes in the last few decades. The evolution of innovation have been well documented, a sampling of these are as follows:

(1) "The pattern of innovation is changing as enterprises merge, change locations, outsource manufacturing, etc."[11]

(2) "The determinants of innovative performance are....evolving, reflecting new patterns of knowledge creation, dissemination, and appropriation."[12]

(3) "The nature of innovation is....changing in the knowledge-based economy. Innovation in a knowledge-based economy is diverse and pervasive. It is not just

[11] *Heikki Kotilainen, Deputy Director of Finland's National Technology Agency, 2005*
[12] *OECD, Science and Innovation Policy: Key Challenges and Opportunities, 2004*

based on research, or science and technology, or enterprise and ingenuity – although all of these remain very important contributing factors. Innovation.... also depends on organizational, social, economic, marketing and other knowledge. It frequently requires intellectual and artistic creativity."[13]

(4) "The Knowledge-driven economy affects the innovation process and the approach to innovation. The traditional idea that innovation is based upon research (technology-push theory) and interactions between firms and other actors is replaced by the current social network theory of innovation, where knowledge plays a crucial role in fostering innovation." [14]

(5) "While the link between R&D and innovation received a lot of attention, there was general agreement about seeing innovation essentially as an economic, rather than a technological process. In the European policy context, the perspective of scientific development has been linked to innovation. As a result, policymakers often think of science and innovation as similar activities. In fact this is not the case. The two activities are linked to different forms of organization and incentive structures. Sound science policy is not the same as sound innovation policy."[15]

The European Commission, which is the most prolific body undertaking research on innovation and innovation policy, defines innovation thus:

"*Innovation is the renewal and enlargement of the range of products and services and the associated markets; the establishment of new methods of production, supply and distribution; the introduction of changes in management, work organization, and the working conditions of the workforce.*"[16]

Rand Corporation, while analysing government structures, policies and processes aimed at encouraging innovation in a number of countries, including Germany, Ireland, the Netherlands, Singapore, the Republic of Korea, Sweden and the United Kingdom, recorded "*the broadening of the innovation concept from its traditional science and technology focus to an orientation that encompasses the entire economic structure...*"

An understanding of the nature of innovation and its contribution to the national economy can help facilitate the formulation of pertinent and effective national economic strategies. Innovation has various components. The understanding of the contributions of each component can help ascertain the appropriate policy measures for the acceleration for each component of innovation.

2. Innovation: the non-technological component

Leading proponents of innovation policy studies such as the OECD, the EU, the Nordic countries, Ireland and Singapore have continued to raise the issue of the understatement of the contributions of the non-technological aspects of innovation. In writing on the role of non-technological innovation in Ireland, the Enterprise Strategy Group stated: ".... To date, Ireland has focused its R&D funding on science and technology for products or manufacturing processes. Non-technological innovation has not been adequately recognized. This is a clear deficit if we aim to develop as a service economy and further develop indigenous companies in terms of productivity and efficiency...."[17]

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[13] *European Commission, Innovation Tomorrow, 2002*

[14] *European Commission, Innovation Management and the Knowledge-Driven Economy, 2004*

[15] *European Commission, Future Directions of Innovation Policy in Europe, 2003*

[16] *European Commission, Green Paper on Innovation, 1995, from which this definition is taken, also provides a concise, albeit a less clear, definition of innovation: "the successful production, assimilation and exploitation of novelty in the economic and social spheres."*

[17] *Enterprise Strategy Group, Ahead of the Curve: Ireland's Place in the Global Economy (page 63), 2004*

The European Commission speaks of innovation as both *technological innovation*, and *non-technological innovation*. Low innovation orientation (the enterprising spirit) leading to poor performance in non-technological innovation – *organizational innovation* (workforce management, distribution and finance), *business model innovation* (e-commerce, freebies), *presentational innovation* (design and marketing) and *network innovation* (strategic alliances and collaborations with competitors and upstream/ downstream market players) – has been seen to be the reason behind Europe's lag behind the United States:

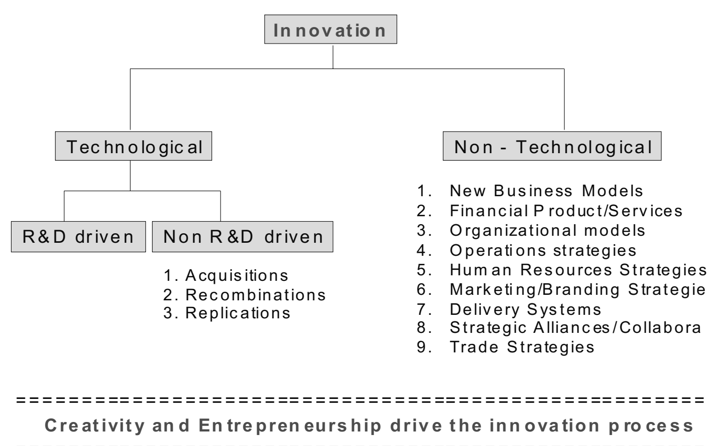
"*Evidence from the European Competitiveness Report and other sources suggest that the advance of the United States over Europe in productivity growth is not only a matter of technological innovation. The United States enterprises also seem to be better in reshaping their organization and management methods in order to maximize profit from new technologies. In many cases, new business models, innovative delivery modes and integrated product and brand management are crucial elements for the transformation of technological innovation into new markets. Non-technical innovation may well be the "missing link" that prevents Europe from taking full advantage of new technological opportunities. Hence there is renewed interest in the assumption that "technological and social change must go hand in hand.*"[18]

3. Innovation and novelty

A study commissioned by the European Commission observed that almost all innovation consists of a recombination of existing ideas or knowledge, put together in a novel way to create a new product or process.... As such, it emphasized, ".... innovation without research deserves attention as an important source of technical advance...."[19]

Another perspective of innovation worth pondering over is as follows:

"*Innovation is the successful introduction of ideas perceived as new into a community or as the first commercial or genuine application of some advancement outside of experimentation. From a community economic development perspective innovations may be based on ideas that are inventive, borrowed or imitated. Again from the community perspective, what is already established in one place may, by borrowing or imitation become innovation in another.*"



[18] *European Commission: Innovation Scoreboard, 2004*

[19] *European Commission, Innovation Policy in A Knowledge-Based Economy, 2000*

4. Innovation and entrepreneurship

Many studies have called for the recognition of non-technological innovation as an important component of innovation and not only as an adjunct to technological innovation. This is due to the central place of creativity and entrepreneurship in non-technological innovation.

"Innovation is less a question of technology than a way of thinking and of viewing the enterprise and its surroundings."[20]

"Innovation is a fundamentally economic process. [It] can be the result of an invention. But it can equally involve the exploitation of natural resources, copying an idea from a distant market, or describing an old product in a new way. Entrepreneurship – the act of making innovation – is not something related to science and research, but about changing the rules of the game in economic competition. Exploiting an invention is, therefore, an important special case of innovation but it is not a general case."[21]

"It is time for third generation innovation policy driven by entrepreneurship, start-ups, SMEs, intrapreneurs. First generation innovation policy was science based innovation; we are still in the second generation of....technology transfer innovation policy...."[22]

5. Innovation: Services

The traditional focus of innovation on product and process innovation unnecessarily confines the discussion on innovation to the manufacturing sector. Recently, efforts to explore innovation in services have gained momentum as advanced nations realized that their economies are increasingly dominated, in terms of employment and value-added, by service activities. In Malaysia the services sector which comprised 57 per cent of GNP in 2004 is expected to rise into the mid sixties within the next 10 years. MOF and MITI expects that the contribution will come from the major subsectors of transportation, communications and logistics, distributive trade, tourism, financial and business services and education. The explorations of innovation in services have brought to light the importance of market innovation, organizational innovation and network innovation.[23]

6. Innovation and SMEs

Science and Technology policies including SIS policy frameworks originated in the advanced countries where SMEs are very much involved in manufacturing, R&D and a substantial number of high-tech industries. These SMEs in the developed countries were producing to meet the needs of the large corporations in their countries or multinationals, both in their country or globally. Most SMEs in developing countries of the Asian and Pacific region are traditional, low-technology and mainly in the service industry (mainly trading) rather than in high-technology manufacturing. The policy must focus on the dominant characteristics of such SMEs as the starting point to formulate any policy framework.

There are more than 500,000 SMEs in Malaysia, "of which 80 per cent are involved in the services sector and 7.6 per cent in manufacturing."[24] If this proportion is similar to

[20] *European Commission, Innovation Management: Building Competitive Skills in SMEs, 2000. This publication has been touted by the EC as".... a practical guide for SMEs, innovation agencies, technology institutes, consultants and other bodies concerned with innovation...."*

[21] *European Commission, Future Directions of Innovation Policy in Europe (page 2), 2003*

[22] *Prof. Alain Quevreux sees entrepreneurship driven reform of innovation policy as the main policy challenge in the field of innovation for 2004*

[23] *Bruce Tether, Do Services Innovate (Differently)? CRIC Discussion Paper, November 2004*

[24] *Statistics given by Datuk Kalsom Abdul Rahman, Chairman of Small and Medium Industries Development Corporation (SMIDEC) as quoted by The Edge Daily, 12 April 2006.*

that of the other countries in the Asian and Pacific region, there may be a need to expand the traditional focus on manufacturing innovation to examine the nature of service innovation and the role of non-technological innovation in order to make the generic SIS policy more relevant to SME development in the region.

7. The evolving concept of national/subnational innovation system

The changing concept of innovation has also helped bring about a parallel revisit of the concept of "national innovation system". The other equally important, if not more important, impetus for the revisit of this NIS concept arose from the various attempts to apply the concept that was developed in the rich countries to the countries in the South.

The modern version of the concept of national systems of innovation was developed mainly in the rich countries - the United States, the United Kingdom, France and Scandinavian countries - and to begin with only a narrow circle of academics interested in science and technology policy in those countries used it.[25] In order to make this concept applicable to less developed countries and to ensure that it helps to stimulate policy learning, a major step proposed by Lundvall is to broaden and deepen the concept and to make it more dynamic:

"*....A narrow focus on the role of science and science-based activities is not what is most needed. We need a concept that covers all aspects of competence building in socio-economic activities. We also need to deepen the concept by getting a better understanding of processes of interactive learning....*"[26]

Lundvall went on to state:

"*....a broad concept of innovation system implies a new perspective on a wide set of policies including social policy, labour market policy, education policy, industrial policy, energy policy, environmental policy and science and technology policy. Specifically, the* concept calls for new national development strategies with coordination across these policy areas...."[27]

This broad concept of NIS is deemed to be more useful as an analytical tool and as a tool for promoting sustainable economic growth and well-being of countries in the South. The broad concept therefore needs to be considered in the formulation of the generic SIS policy approach.

8. Factor conditions enhancing innovative capacity

A well-functioning NIS is characterized by a continuous flow of quality knowledge fostered through complementary interactions within the system leading to the effective diffusion and absorption of that knowledge. The factor conditions that enhance such knowledge flows can be found in the 3F Innovation Model below:

The objective, and therefore, the focus of the innovation agenda in the above innovation model is the development and sustenance of a critical mass of innovative enterprises. The manpower needed to set up this critical mass of commercial enterprises and provide the innovative impetus in them calls for the ready supply of creative and innovative risk-takers. A free-spirited and enterprising population that possesses a

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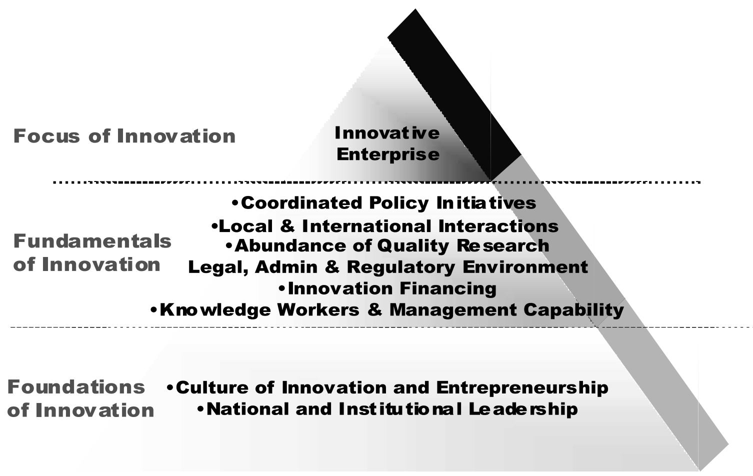
[25] Lundvall, Bengt-Ake, et. al., National Systems of Production, Innovation and Competence Building, in Research Policy No. 31 (2002), pp. 213-231

[26] Ibid. Edquist (ed) Systems of Innovation: Technologies, Institutions and Organizations, London 1997 observed a deepening of the research agenda on NIS while OECD: Dynamizing National Innovation Systems (2002) recorded a broadening of the concept of NIS.

[27] Ibid.

mindset of curiosity, creativity, and problem solving is foundational in such a model. In Malaysia, where government intervention has been a central feature of the economy, national leadership buttressed by institutional leadership is crucial to providing the steam to jump-start and sustain such a national innovation agenda. Weak leadership in either of these areas will inadvertently compromise the success of the innovation agenda.



THE 3F INNOVATION MODEL

Source: Yeoh (2005)

A culture of innovation and entrepreneurship [28] together with national (government) and institutional leadership[29] form the foundations for sustainable enhancement of the nation's innovative capacity. Six other elements are the levers of the country's innovative capacity. These "innovation fundamentals" build upon the innovation foundations. While the foundations determine the potential for innovation performance, the fundamentals will influence the extent of a nation's innovation performance. The innovation foundations form a launching pad for the innovation agenda while the fundamentals provide the engine for progress.

The government performs an important role in accelerating innovation activities in the nation by coordinating policy initiatives and ensuring a favourable legal, administrative and regulatory environment that facilitates and catalyses innovation. An abundance of quality research (produced by quality researchers) is needed to ensure maximum knowledge-creation in the system whilst the availability of knowledge workers and management capability, coupled with a strong entrepreneurial mindset, are needed to ensure that enterprises are innovative, both technologically and commercially. Innovation needs interactions (and human capital mobility) within a national system to facilitate knowledge flows. Due to the increasing globalization of knowledge, interactions must increasingly take on an international dimension. Innovation finance is the lubricant to smoothen the path towards the conduct of innovative activities in enterprises and a vibrant capital market is needed to facilitate such innovative activities.

[28] A culture of innovation and entrepreneurship is seen as essential to the innovative capacity of a nation and has been given high priority by nations such as the United States of America (Council on Competitiveness: Innovate America - National Innovation Initiative Report), The European Union (European Commission: Green Paper on Innovation), the Nordic countries (Good Practices in Nordic Innovation Policies) and Ireland (Enterprise Strategy Group: Ahead of the Curve). It has been found to explain the difference in innovative capacity between the United States and Europe: "....European cultural attributes inhibit the development of ambition and independence by teenagers and young adults, in contrast to their encouragement in the United States...." (Phelps E. S., "Economic Underperformance in Continental Europe: A Prospering Economy Runs on the Dynamism from its Economic Institutions," lecture, Royal Institute for International Affairs, London, March 18, 2003.) See also Robert Gordon, "Five Puzzles in the Behaviour of Productivity, Investment and Innovation" in The Global Competitiveness Report 2003-2004 (World Economic Forum).

Any consideration for the formulation of a generic SIS policy approach must necessarily consider how a culture of innovation and entrepreneurship can be nurtured in a region. It must also look into the extent of the reinvention of regional or local government in order that innovation can be engendered in the region.

9. The main driver of innovation in a cluster/subnational region

Although innovation is but one subject, the focus of the various types of literature is varied. Some look at innovation as a R&D issue, while others see it as a technological issue. Some practitioners see it as either a commercialization issue or even a funding issue. Still others see it as an organizational or environmental issue. However, analysts increasingly see innovation as a people issue. Even the celebrated Silicon Valley of California is being increasingly seen from a new angle. Statements such as the following reflect this new perspective:

"*Silicon Valley is more an economy of concepts than products, more of entrepreneurship than technology*"[30]

"*People, not networks (nor even technology, for that matter) are shown to be the prime movers in high-technology clusters.*"

"*The cornerstone of a cluster is its innovators, its entrepreneurs and the means by which they drive enterprise creation and growth.*"

This being the case, the SIS policy will be more relevant if it gives cognizance to the entrepreneur as the driver both of innovation and also of cluster and regional development.

10. A generic SIS policy approach that is country-relevant

A "one-size-fits-all" solution is guaranteed to fit none at all. In formulating a generic SIS policy framework, such a framework must allow for a policy formulation process to begin with a nation's cultural, historical and economic characteristics and then move on to use their framework to assist the planners to develop a policy that is relevant and helpful to the nation in its development efforts. Such a SIS policy that is developed must be able to integrate into the overall socio-economic plan of the nation. It should move in the same direction as the overall national plan. It should assist the nation in meeting national objectives.

D. Conclusions

The attempt at developing a generic SIS policy framework for developing SMEs is a very noble one indeed. However the complexities are enormous. They deal with very fundamental issues of perspectives and concepts that originated and were developed in the context of advanced countries. The concepts came from a science and technology perspective that emphasized laboratory R&D. Even the pilot testing ground consisted of SMEs that were structurally different from those found in the Asian and Pacific region. The challenge for us is therefore to push aside the thick foliage of alien concepts to discover one that is founded on local realities.

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[29] *This has been emphasized by the OECD (Dynamizing National Innovation Systems), the Nordic countries (Good Practices in Nordic Innovation Policies) and the United Kingdom (The Innovation Report) and practised in the Republic of Korea, Taiwan Province of China and Singapore (among others). In each of these countries, the government has not only tried to set the national direction, they have also tried to provide the national innovation role model in the nations concerned.*

[30] *Koepp, Rob, Clusters of Creativity, (2002)*

The equally challenging task before us is to avoid any compartmentalization of a reality but to discern the "bigger picture." Thus there is the call for a holistic examination that must necessarily be multidisciplinary in nature tapping upon the expertise of experts in various disciplines.

Finally, the challenge is also to move abreast with the evolutions in innovation brought about by globalization, the expansion of knowledge and the fusion of technologies.

VII. TECHNOLOGY OUTSOURCING AND POLICY INSTRUMENTS FOR SME TECHNOLOGY CAPACITY-BUILDING[31]

A. Technology outsourcing from developed countries

In general, there are three major routes of technology outsourcing from developed countries including technology trade, international collaborative R&D and foreign direct investment affiliates. Technology flows are usually channeled through the following vehicles:

- Capital-embodied technology: machines, equipment and products;
- Human-embodied technology: people;
- Disembodied technology: written documents, audio-visual or other media.

International transfer of technology is taken place following such mechanisms as: a licensing agreement supplemented by the supply of technical assistance; the sale of equipment or engineering studies and training; and an agreement on know-how. In general methods of technology sourcing in a company are: Technology trade through direct or intermediaries; recruitment of very skilled, knowledgeable employees; mergers and acquisition; reverse engineering; and publication: research reports, proceedings, newspapers, etc. What a company needs to prepare for new technology introduction as prerequisite include: absorption and assimilation capability, firm mind-set and corporate culture conducive for innovation; sound downstream technologies; and eligible manpower.

Meanwhile, R&D collaboration international or national has been generally taken place with the following motivations:

- Escalating costs of conducting fundamental science at the research frontier
- Substantial fall – in real terms – in the cost of travel and of communication
- Science advances depend crucially on interactions with other scientists
- Increasing need for specialization within certain scientific fields, especially those where the instrumentation required is very complex

Benefits and costs of R&D collaboration are:

- Sharing of knowledge, skills and techniques
- Transfer of knowledge or skills, particularly new knowledge and tacit knowledge
- Cross-fertilization of ideas, which could generate new insights or perspectives

[31] *This paper was prepared and presented by Mr. Se-Jun Yoon, Director, Asian and Pacific Centre for Transfer of Technology (APCTT), New Delhi, India.*

- Intellectual companionship and enhanced visibility of work
- Collaboration brings certain costs in terms of time
- Collaboration brings certain costs in terms of administration

Table 3.15 Most common area of collaborative R&D

Basic Research	Applied Research	Experimental Development
Experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view.	Original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.	Systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed.

Motivation of inward and outward R&D investment includes:

- To access and generate scientific and technical capital
- Develop new product ideas
- Develop new science and technology
- Obtain access to technical talent
- Obtain information on S&T
- Develop links to the scientific and technical community
- To obtain access to offshore markets and manufacturing
- Customize products for local markets
- Access to offshore manufacturing skills and facilities

Host country benefits from FDI:

- Inherent strength of MNCs includes better management techniques, better production technology, and better technical knowledge of employees.
- Host country can get benefits from MNCs in the form of international technology transfers, diffusion of best practices and demonstration effects (spillover effects).
- Contribution to industrial R&D: In Hungary and Ireland foreign companies account for 70 per cent of industrial R&D, in the Czech Republic, Portugal, Spain and Sweden over 40 per cent and in Japan less than 5 per cent.
- Lower productivity domestic firms become more competitive through introduction of new technologies and improved efficiency of management, or they are forced to form domestic market (market stealing effects).

Some technological aspects arising from MNCs:

- No possibility to copy foreign technology free of charge because information searches, reverse engineering, training personnel in the use of new production methods is costly.
- Average age of technologies transferred to overseas subsidiaries in developing countries is about 10 years and about 5 years in developed countries.

- Existing inefficient local firms may be forced by the competition of foreigners to become more productive by investing in physical or human capital or by importing new technology.

Table 3.16 Policies and factors affecting inward FDI

	Industrial policies	Macro-economic policies
Affecting potential foreign investors ("attraction")	• Financial and fiscal incentives • Efficient administrative • FDI promotion • Kick-starting agglomeration and clustering • Export promotion zones (EPZs)	• Infrastructure; workforce skills • Macro-economic performance and prospects • Privatization opportunities • Financial market development • Liberal trade regime
Affecting established foreign investors ("upgrading")	• Tax/subsidy system • Performance requirements • Research institutions and R&D promotion • Training policy	• Labour market policy • Trade policies, export promotion and infrastructure • Competition policy • Development of financial market.
Affecting the response of domestic firms ("linkages")	• Encouragement of linkages with TNCs • Encouraging technological capabilities (R&D) • Encouraging human resources (training) • Supply side management	• Education and skill generation • Labour mobility • Competition policy • Export promotion

Table 3.17 Policies to encourage investment and derive benefit from foreign affiliate R&D investment

Framework conditions	Selected issues	Policy examples
Labour markets	Shortages of skilled S&T labour	Hungary and the Czech Republic widened access to higher education and increased graduation rates.
		Norway introduced a programme to provide two years of workplace training to prepare vocational school graduates for the needs of the modern business world.
		The United States provides limited term visas for foreign S&T workers, which the IT industries would like to see expanded to deal with labour shortages.
	Low mobility of skilled S&T labour	To facilitate mobility of researchers, Sweden established university-linked competence centres.
	Brain drain	Belgium commissioned a study to understand the causes and propose solutions for the flight of its S&T PhDs abroad.
R&D base	Weak public S&T infrastructure	Japan's Basic S&T Promotion Plan aims to double government investment in basic science and to deregulate public sector hiring and research decisions by 2002.
	Interdisciplinary research barriers	Finland has set up a new system of graduate schools which include networks of departments and research institutes that cross disciplinary barriers.
	S&T not responsive to industry needs	Sweden encourages doctoral programmes to adapt research to the needs of industry.
Fiscal and financial conditions	Low private sector investment in R&D	Australia offers R&D depreciation allowances that amount to 125 per cent of current R&D outlays to encourage industry investment in R&D.
	Lack of funding for risky R&D	Germany's BMBF provides direct investment capital for small technology-based companies to encourage their formation.
		Secondary markets, like the pan European EASDAQ set up in 1996, provide investors in new technology-based firms with an exit strategy to encourage higher risk investment.

Measures to promote inward and outward R&D investment include:

- Build scientific excellence in a few selected areas
- Strengthen the development of high-caliber human resources especially to support for higher education institutions
- Target and support national strategic R&D in a few selected disciplines
- Develop sector specific or multidisciplinary R&D clusters
- Promotes global giants in a few selected industries (like Nokia in Finland, watches and chocolates in Switzerland)

B. Policy instruments for SME technology capacity-building

Common policy instruments for SME technology capacity-building are:

1. Grant for innovative idea
2. Collaborative R&D between industry & research community
3. R&D tax relief
4. Knowledge transfer networking
5. One-stop advisory business service

1. Grant for innovative idea: Promote start-up businesses; encourage development of a new product, process or service.

(a) The United States: "Small Business Innovation Research Programme (SBIR)" supported by major R&D departments of the government.

- Phase 1: Up to US$ 100,000 for 6 months to support for feasibility study of an idea.
- Phase 2: Up to US$ 750,000 for 2 years to support R&D for winners from Phase 1.
- Phase 3: No financial support – a shifting stage from the laboratory to the market.

(b) The United Kingdom:

- Grant for innovative idea: provide 75 per cent of consulting costs usually between 2,500 and 7,500 Pounds to examine commercial feasibility of an idea.
- Grant for R&D: provide between 2,500 and 20,000 Pounds within 12 months covering 50 per cent of the project costs for individuals and SMEs to undertake R&D projects to develop an innovative product or process.

(c) India: Technopreneur Promotion Programme (TePP) to provide up to US$ 1,100 for a technopreneur and up to US$ 22,000 for innovators covering 90 per cent of the project costs.

2. Collaborative R&D between industry & research community

- Pooling ideas and experience, cutting costs, reducing risks, accelerating the time for innovative technologies, products, processes and services into the market.
- Reducing time span from R&D to commercialization.
- Most countries encourage collaborative R&D and provide financial support for SMEs.

3. R &D tax relief

- Tax relief for R&D in private companies is common practice both in developed and developing countries, providing more support for SMEs.
- Definition and scope of R&D expenditure for tax relief is to some extent different from one country to another.
- However, this tax relief mainly comprises: corporation tax relief or income tax deduction for staff costs, durable and consumable materials and subcontract activities; and customs duty exemption on equipment, components and consumables.

4. Knowledge transfer networking

- Promote transfer of knowledge from science and technology base to industry.
- Create knowledge transfer networks among technology sectors and/or regions.
- Establish science & technology parks and business incubators.

5. One-stop advisory business service

- Business start-up: business planning, marketing, regulatory/legal requirements, financing, etc.
- On-going business: employment, taxes, sales and marketing, international trade, merge and acquisition, business management, training, etc.
- All businesses: technology transfer, technology partnership, technology consultancy, etc.

National policies in the global economy:

- Policies to promote S&T infrastructure and diffusion system of innovation
- Policies to promote competition and fair play
- Policies to make good institutional failure
- Policies to promote the global level "playing field"

C. APCTT activities for SME technology capacity-building

1. Tech Mart

- Regional and country specific technology transfer web-portal for technology transfer transaction, technology offer, technology request.
- Tech Mart portal provides such information as new technologies, high-technology products and market news; science and technology events; linking technology transfer web-portals of member countries such as India, China, the Republic of Korea, Malaysia, etc.
- http://www.technology4sme.net

2. Business-Asia

- A national specific web-portal relating to laws and regulations for business management and business start-up in member countries; business support provisions including grants, subsidies, tax reduction, employment, consultancy service; FDI and joint venture policies.
- Business-Asia portal provides such information as proficient management of SMEs; basic knowledge and current trend of business management; articles on business management; case studies on success and failure in business; linking Business-Asia web portals of the member countries to promote joint-ventures, FDI in the region.
- http://www.business-asia.net

3. National R&D information network

- A web-based national R&D information service to R&D communities in the Asian and Pacific region will be established, including such information as national R&D programmes and projects, research organizations, leading researchers, salient R&D successes, and international cooperation activities.
- R&D community in the Asian and Pacific region includes major R&D events (seminars, conferences, workshops, etc.); partner search for cooperation; employment opportunities; sharing salient R&D successes experiences; online communication among researchers.

4. National innovation system

- This project initiated in 2005 by the Ministry of Science and Technology of the Government of India and APCTT is aiming to promote national capability to build and explore national innovation strategies in member countries.
- Participating countries (13): Bangladesh, China, India, Indonesia, Islamic Republic of Iran, the Republic of Korea, Malaysia, Nepal, Pakistan, the Philippines, Sri Lanka, Thailand and Viet Nam.
- Schedule of meetings:
  - Asia-Pacific Meeting of High-Level Policymakers: April 2005, India.
  - National workshops focusing on knowledge flow and partnerships: September 2005 (Thailand), October 2005 (Sri Lanka), March 2006 (the Philippines), June 2006 (Islamic Republic of Iran).

PART FOUR

COUNTRY PAPERS

I. BANGLADESH[1]

A. Introduction

Bangladesh is an emerging economy experiencing steady growth with the development of infrastructure, supporting policies for trade, investment and huge potential human resources. In view of the changing composition of GDP it is evident that a predominantly agrarian country is now on transition. With a proven reserve of natural gas and coal together with an ever-expanding home market as well as overseas market and substantially labour intensive industries. Bangladesh has become one of the world's most prospective business destinations.

1. Country profile

(a) Society and geography

The People's Republic of Bangladesh, the official name of Bangladesh, is situated in South Asia between 20.3A to 26.38 north latitude and between 88.01 to 92.41 east longitudes. It is bordered by India in the west, north, and east and by the Bay of Bengal on the south and a small border strip with Myanmar on the south-east. We have the parliamentary form of Government headed by Prime Minister. Bangladesh, most liberal Muslim society in Asia, is culturally disciplined society. This country is abundant in hard working, easily trainable and capable human resources with its 137 million populations. Our labour force is 44.3 million, gradually rising literacy rate is 62.66 per cent (as of 2004), "Bangla" is our official language and English is generally understood and widely spoken.

(b) Economy and investment climate

The economy of this country is growing with a persistent growth rate at 5 per cent since 1991 in spite of some natural disasters like flood, cyclone. Last year GDP growth rate achieved 6.38 per cent, this year we expect growth rate more than 6 per cent. Total investment in last year was 24.43 per cent of GDP against national savings 26.49 per cent of GDP. The Government investment is gradually decreasing taking place more investment from private sector. From 2002 to 2004 FDI was US$ 1,430.5 million. Total export earnings in 2004-2005 was US$ 8.7 billion with a growth rate 13.8 per cent though our export is heavily dependant on few commodities like ready-made garments, knitwear, frozen food, leather and leather products, jute and jute products, tea, ceramics, textiles etc. Against this export scenario total import was 13.1 billion. Present foreign exchange reserve is above US$ 3 billion.

(c) Investment destination

At present Bangladesh is an investment destination in South Asia. As the country has a huge population of more than 137 million there is a logical potential of dramatic increase of domestic consumption with every incremental improvement in national income. Per capital GNI has reached to US$ 470. Most Bangladesh products enjoy complete study free and quota free access in European Union, Japan, United States,

[1] *This paper was prepared and presented by Mr. Mohammed Ibrahim Khalil, Deputy Secretary, Ministry of Commerce, Bangladesh Secretariat, Dhaka, Bangladesh.*

New Zealand, Norway and China. Cost of business in Bangladesh is comparatively lower than that of many South Asia and East Asia countries.

(d) Foreign direct investment (FDI)

To attract more FDI the government has announced some incentives in the following:

- Ownership: Foreign investor can set up venture either wholly owned or in joint collaboration with local partner.
- Tax exemption: 5 to 7 years, however, for power generation exemption is allowed for 15 years.
- Accelerated depreciation: Generally 5 to 7 years.
- Duty exemptions: No import duty for export oriented industries, for other industries it is 5 per cent only.
- Avoidance of double taxation: Double taxation can be avoided in case of foreign investor on the basis of bilateral agreements.
- Tax law: Exemption of income tax up to 3 years for the expatriate employee in industries specified in the relevant schedule of income tax ordinance.
- Repatriation: Facilities for full repatriation of invested capital, profit and dividend.
- Remittance: Remittance of royalty, technical know-how assistance fee.
- Exit: As investor can wind up an investment either through a decision of the AGM or EGM. Once a foreign investor completes the formalities to exit the country he or she can repatriate the sales proceeds after securing proper authorization from the central Bank.
- National treatment: There is no discrimination in case of duties and taxes for the same type of industries by a foreign investor or a local investor.

(e) Small and medium-sized enterprises (SMEs)

Small and Medium-sized Enterprises have historically been on staples of the enterprise land scope within economies globally. The contribution of SME was hardly recognized. Across the developing world during the 1980s, the structural adjustment programmes, the gradual market liberalization process, privatization and break up of large State-owned enterprises and increasing level of education and business skills helped emerge a large number of new & generally small firms at private initiative. Bangladesh was no exception. A historically accelerated pace of trade liberalization since the early 1990s by spurring a veritable deluge of imports has quite significantly increased competitive pressures on SMEs in Bangladesh. The Government of Bangladesh formulated a comprehensive industrial policy 2005 by putting special emphasis for developing SMEs as a thrust sector for balanced and sustainable industrial development in the country to help deal with the challenges of free market economy and globalization.

According to a survey conducted in 2003, there were approximately six million micro, small and medium-sized enterprises (MSMEs) which included enterprises with up to one hundred workers. MSMEs employ a total of 31 million people equivalent to 40 per cent of the population of the country of age group 15 years and above. About three quarters or more of the household income in both urban and rural areas are provided by the MSMEs. The survey also found that the industrial structure of the SMEs consisted of primarily wholesale and retail trade and repairs (40 per cent), production and sale of agricultural goods (22 per cent), services (15 per cent), and manufacturing only (14 per cent). Another vital finding of the survey under discussion was that SMEs contributed TK 741 billion or nearly 25 per cent of the GDP (TK 2,996 billion in 2003).

The sectoral contribution of the SMEs to the GDP is also interesting to see as manufacturing already contributed the highest proportion (38 per cent followed by agriculture 24 per cent and closely following it wholesale and retail trade and repairs 23 per cent).

Table 4.1 Contribution of MSMEs to GDP by sector in Bangladesh

Sector	Total contribution to GDP (TK)	Percentage of contribution
Agriculture	177,729,637,637	23.97
Fishing	32,872,674,464	4.43
Manufacturing	282,344,700,575	38.09
Construction	7,196,460,200	0.97
Wholesale & retail trade and repairs	171,335,861,390	23.11
Hotels and restaurants	28,599,263,975	3.86
Transport, storage and communication	8,950,171,356	1.21
Real estate, renting and business	13,771,436,794	1.86
Education	151,808,506	0.02
Health and social work	2,743,049,893	0.37
Other service activities	15,632,094,785	2.11
Total	741,327,159,609	100.00

Source: ICG/MIDAS Survey, 2004

In Industrial Policy 2005 "Medium Industry means an industry in which 25 to 100 workers work" and "Small Industry means an industry in which fewer than 25 workers work (unlike family members in cottage industry)." In Industrial Policy 1999 the definition of SMEs was based on value of assets and number of persons employed which created a difficulty to interpret data on SMEs and target assistance for SME sector development.

Rapid and sustainable growth of SMEs is undoubtedly one vehicle for accelerating national economic growth to the point of having a measurable impact in the way of reduction of poverty and unemployment, generation of more employment. More than 90 per cent of the industrial enterprises in Bangladesh are in the SME size class i.e. with up to 100 employees.

2. Policy implications

(a) The Industrial Policy-2005

The Industrial Policy-2005 defines industries in the manufacturing sector in four categories as follows: (1) Large industry, (2) Medium Industry, (3) Small Industry and (4) Cottage industry. This policy identifies 33 sectors as thrust sectors (those industries/ industrial subsectors which have already been able to successfully contribute to the country's industrialization and poverty alleviation by increasing GDP, creating employment opportunities and increasing export income.), for which some special incentives and financial facilities can be considered.

(b) Export Policy 2003-2006

In the Export Policy 2003-2006, the government had identified the following five sectors needing to be placed high priority:

- Software and ICT products
- Agro-products and agro-processing products
- Light engineering products (including auto-parts and bicycles)
- Leather goods
- High value-added ready-made garments.

The Export Policy promises some supports to the above sectors of high priority such as (1) Supply of investment credit at reduced rate on high priority basis, (2) Moratorium on income tax, (3) Various cash assistances, (4) Export credit on easy terms and reduced rate of interest, (5) Subsidized rate for air transportation, (6) Duty drawback and bond facilities, (7) Assistance for establishment of related industries including infrastructure development for reducing the cost of production, (8) Institutional and technical assistance for improving quality of products and quality assurance, (9) Assistance for marketing access, (10) Assistance for search of external market, and (11) Cooperation for foreign investment.

The Export Policy 2003-2006 classifies the following products as special development sector: Pharmaceutical sectors, Cosmetics and toiletries products, Luggage and fashion goods, Electronic products, C-R coil, Greeting cards and calendar, Stationery goods, Silk cloth, Handicrafts, and Herbal medicine. Similarly some facilities have been promised for the above special development sectors.

B. Current status of SIS and SME technology capacity-building

The horizon for technological development and skill development remains hazy. International cooperation in this regard through schemes like TCDC (technical cooperation among developing countries) has been most frustrating. Import of technology has not been very cheap; in any case, foreign countries are not expected to be able to develop and supply ready-made technologies and machineries for Bangladesh's needs, hence there is no alternative to development of local R&D capabilities, SMEs cannot finance R&D costs and efforts and the only industrial research institution of the country in the public sector, BCSIR (Bangladesh Council of Scientific & Industrial Research) has been engaged in rather inconsequential pursuits. Government has to sharpen its kind in this regard and start taking effective actions for developing R&D capacity within country, may be in cooperation with others within and outside the country. More particularly, research institutions, universities and private sector nexus ought to be built up quickly. UNCTAD is believed to have been doing a lot of studies on the subject of technology needs for sustainable growth of SMEs. Their guidance may be also of help in this regard.

1. Poverty reduction strategy paper (PRSP)

In "National Strategy for Accelerated Poverty Reduction" technology has been identified as one of the major tools for poverty reduction. It has identified four strategies for technological promotion. Firstly, the country depends in large measure on importation of technology and, in some cases, its adaptation to local conditions. Here the role of the government will be to facilitate technology transfer through import of capital equipment and intermediates and foreign direct investment. Secondly, for poor people the accessibility to improved technology is important. There is in fact a virtuous circle whereby advances in agricultural technology lead to improvements in health, education, labour productivity and human capabilities to use and develop new technology. The government will enhance access through increased access to credit. Thirdly, institutions play an important role in adoption of new technology by the poor. The government will provide support or facilitate the development of proper institutions to enhance use of technology by poor people. Fourthly, benefit from general purpose technology like ICT (in contrast with specific technology like biotechnology) depends on the level of literacy both basic and computer type.

In Industrial Policy 2005, the government emphasizes more and effective activities of training institutes that are engaged in human resources development in the industrial sector. These institutes include (a) Bangladesh Institute of Management (BIM); (b) National Productivity Organization (NPO); (c) Small and Cottage Industries Training Institute (SCITI); (d) Training Institute for Chemical Industries; (e) The Textile Industrial Development Centre; (f) the training institutes under the Bangladesh Jute Mills Corporation; and (g) Bangladesh Handloom Board and Bangladesh Silk Board, etc.

2. Policy strategies for development of SME

The government is committed SMEs as vehicles for quality of life improvement, economic growth and poverty alleviation of the common people. For this purpose government constituted a National Task Force on SME Development to draw up a realistic strategy for promoting rapid growth and vigorous competitiveness among SMEs in Bangladesh. The Task Force submitted its report including a comprehensive slate of recommendations that, if implemented, will mount a coherent strategy to promote the development of SMEs in Bangladesh in three phases: short, medium and long term. The government has set up cell for SME only known as "SME Cell" and formulated a policy strategy for development of SME. The main features of this policy strategy are as follows:

(a) SME Foundation:

The government shall form an SME Foundation as a pivotal platform for the delivery of all planning, development, financing, awareness-raising, evaluation and advocacy services in the name of all SME development as a crucially-important element of poverty alleviation.

(b) Definitions:

(i) Manufacturing enterprise: Small enterprise – if total investment were to be up to TK 15 million (excluding land and building value); Medium enterprise – total investment were to be up to TK 100 million (excluding land and building value).

(ii) Non-manufacturing activities: Small enterprise – if it has less than 25 workers in full time equivalents; Medium enterprise – if it has from 25 to 100 employees.

***(c) Booster sector*:**

This strategies have identified 11 booster sectors include Electronics and electrical, Software development, Light engineering and metal-working, Agro-processing/ agro-business/ plantation agriculture/ specialist farming/ tissue-culture/ and related business, Leather-making and leather garments, Knitwear and ready-made garments, Plastics and other synthetics, Healthcare and diagnostics, Educational services, Pharmaceuticals/ cosmetics/toiletries, and Fashion-rich personal effects, wear and consumption goods.

Tactical Plan of Action:

Policy strategies have set the following action:

- Strategic skills upgrading
- Enabling environment
- Supply chain for technopreneurship
- SME web portal
- Towards a virtual SME front-office
- Exports-friendly content on the SME portal
- Electronic-governance with a human touch
- High-performance communications backbone
- International technology-exchange programmes

Capacity-building and training:

For capacity-building and training the strategies have formulated a package such as:

- Specialized professional expertise
- Re-skilling boot camps
- Institutional capacity for training
- Capacity for coordination among multiple institutions
- Technical assistance and investment
- Private-public collaboration
- R & D with potentially high-impact profiles
- Curriculum development for vocational training

C. Challenges, opportunities and best practices

The relevant determinant issues for scope of participation and challenges of SMEs are:

- Technology and skill requirement
- Access to capital
- Cost of sharing activities
- Market access
- Value addition
- Infrastructure
- Access to information

Opportunities and best practices

Most of these SMEs that exist in Bangladesh today grew on their initiative. Among them the most successful sector did benefit from relative freedom from over-regulation and assistance from the government. Readymade garments being the success story of Bangladesh enjoyed significant relaxation in government control, innovative assistance like provision for bonded warehouse facilities, transfer of many of the regulatory functions to the BGMEA and to some extent, somewhat relaxed enforcement of the provisions of Factories Act, Labour Laws, etc. But for a small number of brave and leading entrepreneurs of earlier days, most of the investors followed others more or less blindly and machinery procured for production has been mostly candor driven. No special effort was made by them to import technical training to the 1.8 million women workers with little education, thus their productivity has remained deplorably low. Initially the entrepreneurs had no skill of international marketing when they were mostly dependent on Korean, Indian and Sri Lankan 'buyers' who were nothing but self-appointed agents of the western importers. Value addition to the industry except for knitwear has been low for lack of indigenous backward linkage supplies of fabrics and accessories.

Most significantly, the industry benefited from quota for North American and GSP facilities in European Union markets. After the faze out of MFA the bulk of the present RMG operations starts falling behind affecting their own income as well as the export earning of the country of which 80 per cent is contributed the RMG sector. Besides loss of job for a large proportion of the 1.8 million female workers and 2.0 million or so in the related services there were huge social impacts that need not to be discussed here.

D. Future plan and prospects

(a) Selection, acquisition and application of the appropriate technology for production that would enable production of goods of the competitive quality and competitive price, maintaining optimum productivity while environmentally not injurious. It would be important to determine the correct balance between labour intensive and capital intensive processes for achieving required productivity and quality.

(b) Bangladeshi workmen are extremely good at acquiring skills for production to high degrees to tolerance and are capable of production by copying samples. But due to limitations in education skill and technical knowledge they are unable to produce goods from blueprints and drawings adhering to the standard specifications. This deficiency has to be removed quickly by establishing appropriate training and skill development facilities.

(c) Many countries have developed their small and medium-sized industries by copying products from other countries but this is no longer possible under WTO rules for Intellectual Property Rights (IPR). It is essential that indigenous R&D capabilities are developed quickly.

(d) Most manufacturing processes are today electronically controlled. Hence, adequate skill has to be developed for using and maintaining electronic components and control devices.

(e) Institutional facilities are needed for entrepreneurship development including particularly capturing the high entrepreneurial ability of the women of Bangladesh.

(f) SMEs must have logical linkages between the micro below and large industries above. Efficient subcontracting culture has to be developed and well functioning regulatory regimes should be put in place so that the network among the subcontracting firms works efficiently.

(g) Most potential investors in the SMEs sector are not in the real sense entrepreneurs, in as much as do not have an already developed capability to decide on viable investment avenues, develop project profiles and set up the appropriate establishments for production, management and marketing. Free of cost technical assistance will have to be provided to them for accessing information, and developing bankable project proposals in the sectors in which they might have knowledge, preference and perhaps some experience and expertise. Similar assistances will also be needed to meet the various compliance issues under the WTO rules.

(h) Prospective investors would have to be given all kinds of facilities for getting started in an unreserved manner and without any kind of hassles.

(i) Designated Financial Institutions should not only be encouraged but also helped to develop expertise in industrial financing, technology assessment and acquisition of relevant sectoral knowledge and also capability of working with the clients so that project finance by them can be successfully implemented overcoming all the usual bottlenecks experienced from sources of financing.

Actions for SMEs

Suggested actions for the development of SME in Bangladesh in the "National Strategy for Accelerated Poverty Reduction" include the following:

- Adoption of an unambiguous definition of SME
- Strengthening of BSCIC's capacity to provide market information
- Simplification of regulatory procedures
- Setting up an appropriate credit guarantee scheme for lending without real estate based collateral
- Enlarging the base of conduit lending institutions
- Making BSCIC's industrial estate programme demand-driven
- Priority development of the road network and supply of gas and electricity
- Extension of BOI's One-Stop Service to cover SMEs
- Greater public-private cooperation for the design and implementation of effective business support services
- A differentiated and hassle-free indirect tax system for SMEs
- Calibration of trade policy reform to support SME development

E. Conclusion

It would be a good idea to extent assistance to the existing and prospective entrepreneurs in the SMEs sector with a focus more concentrated on the 'thrust sector' identified in the government which are supposed to have both better growth prospects and have some comparative or competitive advantage for Bangladesh.

II. CAMBODIA[2]

A. Introduction

Cambodia is at the crossroads of economic development. Development is taking place in an increasingly competitive regional and international marketplace, making it imperative that SME issues and challenges are successfully identified and addressed. Given that the economy is dominated by SMEs (including microenterprises), the future development strategy of the country must take into account the SME sector so that its rapid growth and transformation will result in increased productive employment and reductions in poverty. This paper provides a brief background to the sector and identifies the issues and challenges facing the country's SME sector in Cambodia.

Small-scale enterprises dominate economic activity and account for a substantial part of employment. The sector is made up mostly of unregistered farmers and agricultural enterprises. Women constitute about 52 per cent of the economically active population of which approximately 45 per cent are self-employed, primarily in the informal sector. In 2005, the Ministry of Industry, Mines and Energy (MIME), through its annual survey of industrial enterprises, determined that there were 28,747 small industrial establishments with fewer than 50 employees (see Table 4.2 below).

To encourage further growth, the Government's industrial policy is focused on diversifying production away from reliance on a few key sectors, increasing its range of exports and improving productivity. It intends to do this by focusing on: (i) developing labour-intensive industries, such as garment, toys and footwear; (ii) promoting the development of agribusiness by strengthening, first, the legal framework for longer-term land management, and second, to provide tax incentives for establishing factories to process agricultural products, such as cotton, jute, sugar, palm oil, cashew nuts, rubber, cassava and fruits; and (iii) developing industries based on processing existing natural resources such as fish, meat, cement production, brick and tile. As part of the industrial strategy, the government also intends to promote SMEs, microenterprises, and handicrafts.

Table 4.2. Small industrial establishments by ISIC, 2002

ISIC Code	ISIC	Number	Total Labour	Average size by labour	Licensed	% Licensed
31	Food, beverages and tobacco	21,568	51,885	2.4	11,069	51.32
32	Textile and wearing apparel and leather industries	1,417	5,463	3.9	132	09.32
33	Wood & wood products	13	29	2.2	9	69.23
34	Paper products, printing & publishing	15	207	13.8	15	100.00
35	Chemicals	275	1,077	3.9	117	42.55
36	Non-metallic mineral products except petroleum & coal	757	8,963	11.8	596	78.73
38	Fabricated metal products, machinery and equipment	1,899	5,627	3.0	1,537	80.94
39	Other manufacturing industries	976	3,117	3.2	514	52.66
	Total Manufacturing	**26,920**	**76,368**	**2.8**	**13,989**	**51.97**

[2] *This paper was prepared and presented by Mr. Nou Thara, Director, Department of Small and Medium-scale Enterprises, Ministry of Industry, Mines and Energy, Phnom Penh, Cambodia.*

Over the last decade the macroeconomic performance of the Cambodian economy has been one of strong growth but highly vulnerable to external shocks. This can be explained by Cambodia's relatively small and emerging market economy, which is characterized by a lack of: (i) diversification in economic activity; (ii) functioning institutional structures required for economic activity; and (iii) small fragmented markets.

Special mention should be made of the agriculture sector, since it is the largest sector by GDP and employment. Agriculture accounted for about 27.6 per cent of GDP share and for over 70 per cent of employment. In order to maximize the benefits from this sector, productivity will need to increase significantly. Currently, agriculture accounts for three-fourths of all employment, yet agro-industry provides less than 1 per cent of total employment and accounts for only 3.2 per cent of GDP. Thus, there is significant potential in agro-industry for job creation and poverty reduction by increasing the value-added to products.

The value-added per worker in the agro-industry sector is 2.6 times lower than for the dominant export sector – garments.[3] In comparison to other rural-based economies, it is also lower. For example, Cambodia's value-added per agro-industry worker is four times lower than Bangladesh and 7 times lower in comparison to Pakistan (according to the World Bank). These differences indicate possibilities for efficiency gains and growth in agro-industry exports. In addition, the Early Harvest programme with China offers SMEs the potential to export nearly 300 products tariff free.

Several studies have been carried out to diagnose and identify other major issues facing Cambodian SMEs. In discussions held between the government, private sector representatives and donor community, several issues and constraints were identified. Key issues are grouped and analysed in more detail under the five broad categories of:

- Regulatory and legal framework
- Access to finance
- SME support activities
- Policy coordination
- Science and technology and enterprises development.

B. Current status of SIS and SME technology capacity-building

With the vast technology development taking place across the world, there is a need for Cambodia to come together with other countries to share information/experiences towards promoting capacity/capability-building, both by way of infrastructure and human resources' development based innovation system and technology. The changing scenario with the globalization of technologies, with the shift from manufacturing to a knowledge-based economy, has enormously affected the competitiveness of the companies and the country.

Currently, however, Cambodia does not have much opportunity to pay attention on the development of Science and Technology particularly Innovation System and Technology due to the government's resource allocated are comparatively pro-poor, no standardization in length of programme, accreditation process and staff quality,

[3] *Cambodia: Seizing the Global Opportunity: Investment Climate Assessment & Reform Strategy, World Bank, August 2004.*

limited attention paid to business, management and information technology, which are key ingredient for private sector development and outdated equipment and books in many training institutions and so on.

Moreover, there is very little training offered to the micro and small enterprise sectors, and very little information about firm level training in Cambodia due to unable to establish training and R&D centre. Companies, on the other hand, provide necessary on job training, but are less concerns with skill improvement or capacity-building of the employees needed for their career advancement. The Ministry of Education Youth and Sport (MOEYS) and the Ministry of Labour and Vocational Training (MLVT) and the Ministry of Industry Mines and Energy (MIME) addressed this issue in Social Economic Development Programme II (SEDP II) and has committed to expanding workplace-based training. The Cambodia Chamber of Commerce is also planning to be more active in providing on and off-the-job training and technical expertise development for employees and labours to support business community and SME development.

C. Opportunities and best practices

The success or failure of public intervention aimed at supporting innovation and in particular the emergence of a national innovation system depends on several factors. Thus, the literature generally recognizes that to be effective, public involvement measures have to be based on a regional strategic planning approach in particular ASEAN, GMS to take place in space left vacant by the market upstream and downstream of innovation and act in a balanced, sustained manner on the infrastructure and social components of innovation so that they support each other.

A national innovation system, in order to support enterprises and jobs offering high added value based on knowledge-based economy and integration of advanced technology, has to be built around the following pillars:

- Producers of innovative technical knowledge, technologies and processes R&D and technology transfer infrastructure and centres.
- Those asking for and using this technical knowledge and technology and processes.
- Catalysts and matchmakers intermediary business service organizations whose mandate is awareness, training, linkages, and dissemination of knowledge in support of enterprises' innovation process.

In order to implement the government's SME development strategies, the Prime Minister established the Inter-Ministerial SME Subcommittee to take the lead. The first task of the SME Subcommittee is to create an SME Development Framework, which presents the strategy and action plan of the Government for supporting SMEs. This SME Development Framework was completed and adopted in July this year by the Council of Ministers, and presents a detailed 'road map' which includes a wide range of actions to be taken by several ministries over the medium and long-term.

Although the implementation of the SME development framework poses great challenges for government policymakers and will require the concerted efforts of several implementing agencies, the government has made a commitment to take ownership of the reform process and to work with donors and the private sector to achieve the visions set out in the document.

D. Future plan

Against this backdrop, the establishment of Cambodian-India Entrepreneurial Development Centre, once completed, will intend to facilitate the transfer and subsequent innovation system and technology developed in the country as a whole. It is expected that within the period of time the centre will provide specific knowledge include:

- Technology transfer and information
- Technology and entrepreneurship development
- Innovation system and management which is SME oriented
- Technology and business partnership development
- Strategy and expertise development activities leading to business opportunities
- Competitive advantages by developing its main industrial clusters
- Economic structure by supporting enterprises' innovation and diversification projects to integrate new technology and develop export markets.

E. Conclusion

In order to achieve these objectives, all relevant ministries concern should assist toward through strengthening the capability development and supervise national innovation system for a smooth transfer of technology. In addition to these, the centre itself should also carry out some other necessary functions such as research and examine trend, condition and opportunity of innovation system and technology; best practice of technology and management; disseminate information; build the capacity of personal and staff on science and technology related activities.

III. CHINA[4]

A. Government agencies for SME development and innovation

The National Development and Reform Commission (NDRC) has responsibility to build core strategic policies and plans to develop and reform the economy. In particular, the Commission makes policies to promote various types of property ownership and SME development. Its major responsibilities include projects to lead strategies in forming and improving the industrial structure, and studying various kinds of "ownership" economies, and private organization and enterprises.

The Department of Small and Medium-Sized Enterprises was established to study the relationship between SMEs and development of a Non-State-owned economy. As its major activities, the department promotes fair competition, and development of private companies, researches policies and measures beneficial to the development of SMEs, facilitates joint ventures with foreign companies, built an SME service system and

[4] *This paper was prepared and presented by Mr. Zhang Wei, Assistant Consultant, Department of Small and Medium-sized Enterprises, National Development and Reform Commission (NDRC), Beijing, China.*

promotes cooperation and coordinates balancing SME development and that of the private economy.

The Ministry of Information and Industry is in charge of national strategies, and overall plans for development of the information industry. Its objectives are:

- To oversee management of the national communications infrastructure (including the mainland and electronic networks), the TV network (both wired and wireless) and other communications networks and related industries.
- To establish policies, systems, and standards in regard to technologies in electronics, information, product manufacturing, communications, and software.
- To study and propose plans to develop new technologies in the engineering industry.
- To allocate and manage public communications resources such as spectrum for wireless and satellite communications, network codes, domains and addresses.
- To promote R&D activities in electronics, information, product manufacturing, communications and software, address difficulties in developing important sectors in the science and technology industry, facilitate the introduction, creation and commercialization of new technologies developed through scientific research, and develop the engineering industry as a key national industry.

The Innovation Fund for Industry of IT was established to financially support the research, development and commercialization of core technologies in the electronic and information industries, including software, integrated circuits, computers, communications, networks, digital media and newly developed component technologies. Its main responsibilities include managing the budget for the fund, responding to inquiries on budget and account settlement, and ratifying and monitoring allocation and use of the fund. In regard to budget management, it manages accounts, reporting on funding applications, carrying out preliminary examination on accounts, and budgeting procedure.

The Ministry of Science and Technology (MOST) was established to build a long-term strategy to develop science and technology, policies to facilitate technology-led economic and social development, study the relationship between science and technology and socio-economic development, identify priorities in technological development and research, pursue the strategy to build a "Chuangxin" (innovation, recreating old technology) structure for national science technology and enhance creativity of national science and technology.

As major projects, the MOST conducts research on development of new technology in the engineering sector and industrialization policy and set up plans to develop state-of the-art technology in the engineering sector. It also initiated the R&D plan to develop advance technologies in information, automation, energy and the new material sector, leading the Chuangxin process of science and technology as well as preparing plans to clear obstacles to science and technology. Its responsibilities include overseeing a national-level technology industrial complex, reforming the science and technology structure in the engineering industry and pursuing plans to build a technical service system.

The Innovation Fund for Small Technology-Based Firms was raised to promote development of SMEs and facilitate technological innovation and SME development of new technology. Major roles of the Innovation Fund for Small Technology-Based Firms are:

- To support technological innovation at technology-intensive SMEs
- To help technology-intensive SMEs develop technologies
- To facilitate commercialization of developed technology
- To develop technology-intensive SMEs with Chinese characteristics
- To accelerate development of advanced technology.

B. Areas identified as important for SME innovation

(a) Developing human resources and technology through linkage between industry and educational and research institutions

Human resources and technology development are the raw material for innovation. Since educational institutions are responsible for human resource development, and research institutions are responsible for research and development of science and technology, it is important to facilitate cooperation between industry and educational and research institutions.

(b) Accessing to specialist assistance and advice

SMEs face barriers in fully exploiting innovative opportunities due to size and capability constraints. Allowing them to gain easy and inexpensive access to specialist technical and managerial expertise should help them in getting their innovative products and services to market more quickly.

(c) Enhancing availability of capital to innovative SMEs

Capital is the fuel for SMEs engaged in innovation. Thus, healthy SME innovation requires adequate availability of capital, both debt and equity, for credit-worthy enterprises.

(d) Networking and clustering for innovative SMEs

Networking and clustering have been shown to have positive externalities. Further, networking and clustering accelerate innovation by gathering resources, for example, specialists and experts, and allowing them to share knowledge.

(e) Establishing appropriate legal and regulatory structures

Robust legal and regulatory structures designed to establish and enforce intellectual property rights, competition policy, and facilitate the quick and inexpensive establishment of firms are vital to all SMEs and especially important in encouraging innovation among SMEs. The absence of such structures can stifle innovation while undermining the ability of SMEs to compete.

(f) Establishing a market consistent economic environment

Under a market consistent economic environment, innovative, efficient SMEs will have the greatest opportunities to access the resources they merit and require while facilitating firms to freely enter and exit the market.

(g) Developing methodologies for effectively measuring progress in the imple mentation of innovation programmes for SMEs.

IV. INDIA[5]

Abstract

Proliferation of Subnational innovation networks, a relatively new concept, promises to be an alternative to centralized national innovation system. To be an independent entity, its growth must come from within. This paper attempts to develop the concept further in the Indian context. It provides a background of Indian government policies on SMEs, challenges faced by SMEs due to globalization and prepares scenarios for SMEs to survive and prosper in knowledge economy by networking for innovations – innovations that can be appropriated and those that diffuse easily.

A. Government policy tools

Several policies influence science and technology (S&T) activity and each country employs different tools to achieve its objectives. In developed countries there has been a shift in focus from science policy to technology policy to innovation policy and now competition policy. As the link between technological innovation and economic performance became better understood and more widely appreciated, S&T leading to innovation has become the explicit basis for a series of government programmes.

Classification of policy tools

Several factors condition the design and implementation of S&T policies. Some of the tools, selected by India to implement their science/ technology/ innovation policies are given in the table below:

Table 4.3 Government policy tools

Public tool	Examples
Public enterprises	- Setting up of new industries like BHEL, HMT, HEC - Pioneering of new techniques by public bodies like BARC - Innovation by public sector units
Scientific and technical institutes	- Setting up of research laboratories like CSIR, IARI, IMRC - Support for research associations like ARAI - Support to learned societies like IISc - Support to professional associations like INSA
Education	- General education - Universities - Technical education - Apprentice schemes - Open universities/ continuing education/ literacy programmes/ retraining
Information	- Information networks and centres (NIC, ERNET) - Libraries - Advisory and extension services - Databases - Liaison services
Financial	- Grants/ loans/ subsidies - Financial sharing arrangements - Provision of equipment/ buildings/ services - Loan guarantees - Export credits
Taxation	- Tax allowance

[5] *This paper was prepared and presented by Mr. Aynampudi Subbarao, Advisor, Department of Scientific and Industrial Research, Technology Bhawan, New Delhi, India.*

Public tool	Examples
Political	- Planning - Regional trade blocks - Awards/ honours - Public consultation
Legal and regulatory	- Patents - Environmental and health regulations - Checks and inspections - Monopoly regulations/ Restrictive trade practices
Procurement	- Central or local government purchases and contracts - Public corporate R&D contracts - Prototype purchases
Public services	- Purchase/ maintenance/ supervision and innovation in health service - Public building construction - Transport - Telecommunication
Commercial	- Trade agreements - Tariffs - Currency regulation

B. SME sector

In India, the Ministry of Small-Scale Industries is the nodal ministry for formulation of policy, promotion, development and protection of small-scale industries in India (http://ssi.nic.in). Small-scale industry (SSI) is defined as an industrial undertaking in which investment made on plant and machinery, whether hold on ownership terms or on lease/hire purchase basis, does not exceed a limit (one million Indian Rupees with effect from 21 December 1999).

The small-scale industries sector plays a vital role in the growth of the country. It contributes almost 40 per cent of the gross industrial value-added in the Indian economy. It has been estimated that a million rupees of investment in fixed assets in the small-scale sector produces 4.62 million worth of goods or services with an approximate value addition of ten percentage points. The small-scale sector has grown rapidly over the years. The growth rates during the various plan periods have been very impressive. The number of small-scale units has increased from an estimated 0.87 million units in the year 1980-81 to over 3 million in the year 2000.

SSI sector in India creates largest employment opportunities for the Indian populace, next only to agriculture. It has been estimated that 100,000 rupees of investment in fixed assets in the small-scale sector generates employment for four persons. Food products industry has ranked first in generating employment, providing employment to 0.48 million persons (13.1 per cent). The next two industry groups were Non-metallic mineral products with employment of 0.45 million persons (12.2 per cent) and Metal products with 0.37 million persons (10.2 per cent). In Chemicals & chemical products, Machinery parts except electrical parts, Wood products, Basic Metal Industries, Paper products & printing, Hosiery & garments, Repair services and Rubber & plastic products, the contribution ranged from 9 to 5 per cent, the total contribution by these eight industry groups being 49 per cent. In all other industries the contribution was less than five per cent.

SSI sector plays a major role in India's present export performance, contributing 45 to 50 per cent of the Indian exports. Direct exports from the SSI sector account for nearly 35 per cent of total exports. Besides direct exports, it is estimated that small-scale industrial units contribute around 15 per cent to exports indirectly. This takes place through merchant exporters, trading houses and export houses. They may also be in the form of export orders from large units or the production of parts and components for use for finished exportable goods.

It would surprise many to know that non-traditional products account for more than 95 per cent of the SSI exports. The exports from SSI sector have been clocking excellent growth rates in this decade. It has been mostly fuelled by the performance of garments, leather and gems and jewellery units from this sector. The product groups where the SSI sector dominates in exports are sports goods, ready-made garments, woollen garments and knitwear, plastic products, processed food and leather products. By its less capital intensive and high labour absorption nature, SSI sector has made significant contributions to employment generation and also to rural industrialization.

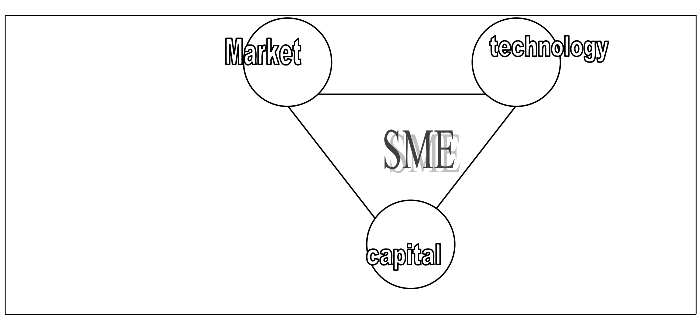
C. Emphasis on market

The policy of encouraging growth of small-scale industries is based on several promotional measures – one of these is reservation of products for exclusive manufacture in the small-scale sector in areas where there is techno-economic justification for such an approach. Large and medium units can, however, manufacture such reserved items provided they undertake to export 50 per cent or more of their production. Reservation of items for exclusive manufacture in SSI sector statutorily provided for in the Industries (Development and Regulation) Act, 1951, has been one of the important policy measures for promoting this sector. The Reservation Policy has two objectives: (1) Ensure increased production of consumer goods in the small scale sector; and (2) Expand employment opportunities through setting up of small scale industries. A total of 812 items were reserved for exclusive manufacture in the SSI sector. Reserved items according to the Second all India Census of Registered SSI Units (1987-88) accounted for:

- 11.3 per cent of the items produced in the SSI sector
- 28.3 per cent of the production in SSI sector
- 36 per cent of the working SSI units for which data was compiled in the Census

Thus primary emphasis of Indian government policy was to provide small industries access to market, by shielding them from competition both internally and externally, though due to low entry barriers, there was fierce competition within small scale in all product areas.

Figure 4.1 SME triangle



(1) Impact of globalization

In the early rounds of the GATT, including last Uruguay Round, member countries agreed to: (i) provide tariff liberalization on large number of commodities/items, and (ii) remove all types of prohibitions or restrictions (other than duties, i.e. tariff). In the tariff liberalization, member countries have submitted to the WTO the "offer rates", sometimes called "bound level" or "bound trade of duty", for agreed commodities/ items. The member countries are required to maintain the applied rate at or below the "bound rates". India has agreed to make adjustments in tariff rates to the level of "bound rates" for more than 3,300 commodities. It has also agreed to phase out quantitative restrictions on all commodities (except for around 700 commodities at 8-digit or 10-digit HS level, for security and other reasons) by 2002/3, as per mutual agreements with major trading partners and WTO.

The definition of the products contained in Indian small-scale industry is based on industrial classification, while 'binding' is carried out as per Harmonized System (HS) of International Trade Classification (ITC). They are converted into HS Classification at 8-digit level based on Abid Hussain Committee report and Mehta6 (1999). This Harmonized System (HS) of coding and description of commodities has been adopted by the Export and Import Policy administered by the Ministry of Commerce with effect from October 1995, sometimes known as India HS-1996. The two-digit HS coding and description of commodities (broad commodity groups) is called as HS Chapter. The products of small-scale industry falls under 49 broad commodity groups (defined by Chapters of HS Classification).

RIS paper addresses the impact on World Trade Organization (WTO) negotiations on Indian products, which are for exclusive manufacture by small-scale sector. The WTO Cancun Ministerial Text aims for bettering Non-agriculture Market Access (NAMA) through negotiations. Most of the products of small-scale sector fall under the negotiation process of NAMA. The study finds some interesting results- at present around 66 per cent items of Indian small-scale industry are bound, which is higher than all India level.

(2) Competitiveness

Issues facing small-scale industries in stringent global competition was analysed by Bhavani. Till 1990s the policies of the Government of India provided complete protection to Indian industry by eliminating the scope for foreign as well as internal competition. Within this generally sheltered business environment, small-scale units have been protected further through measures such as reservation of certain products for exclusive production in the small-scale sector, reservation of some of the products produced in the sector for purchase preference by government agencies, supply of scarce materials, input price concessions like lower interest rates and numerous fiscal measures such as excise duty exemptions and other tax concessions.

Indian small-scale units have remained mostly tiny, technologically backward and lacking in competitive strength. Notwithstanding their lack of competitive strength, small-scale industrial units in India could survive due to product and geographical market segmentation and policy protection. The business environment has been changing drastically in recent times, reducing the importance of these three factors.

After citing developments in various dimensions of technology, Bhavani concluded that unless Indian industrial units continuously upgrade their technologies, it will be difficult for them to withstand international competition arising from liberalization and globalization, and this observation applies more particularly to the small-scale units as they lag both in terms of technology and competitiveness.

The reservation policy has hampered the growth of important sectors like light engineering and food processing. It has also stunted the exports of toys, textiles and leather: small enterprises are simply unable to supply large volumes of high-quality goods in time.

(3) Thriving entrepreneurship

Simultaneous opening of competition internally and externally, jolted Indian SMEs out of slumber. What saved the day for them was their entrepreneureal skills. Tarun Khanna, argued that the government's lower level of intervention in capital markets and its decision not to regulate industries that lack tangible assets (software, biotech, media) have created room for entrepreneurs. Entrepreneurial activity is fueled both by incumbent (often family-owned) enterprises and by new entrants. The former use cash flows from diverse existing businesses to invest in newer ventures. In biotechnology, Biocon emerged from pure entrepreneurial effort, as did Infosys Technologies in software. Similarly, hundreds of smaller versions of companies such as Infosys and Wipro Technologies have no government links. Brick and mortar companies also survived, leveraging their skills of running business with frugal amount of capital, infrastructure bottlenecks and cut throat competition.

The entrepreneurial spirit of Indian SMEs is evident from their response to globalization. The initial response of fear & apprehension which reflected in the large number of anti-dumping investigations has given way to marked confidence in meeting global competition with India signing free trade agreements with Sri Lanka, Thailand and Singapore backed by industry support. Now the press is daily filled with stories of Indian firms going global. It is evident that Indian MNCs are keen on M&A (mergers and acquisitions) worldwide; that they are adopting an acquisition led growth strategy, coupled with a strong foothold in the domestic market. Indian firms bought up about 75 firms abroad in 2003. Sectors being eyed by Indian MNCs are: Pharmaceuticals, Information Technology, Chemicals, Light Engineering and Entertainment. Many Indian firms have slowly and surely embarked on the global path which lead to the emergence of the Indian multinational companies. Entrepreneurial dynamism is buoyed by government policies, now directed towards "technology" and "venture capital". Some important policies are highlighted here.

D. Emphasis on technology and venture capital

(1) Credit linked capital subsidy scheme for the technology upgrading of the small-scale industries (CLCSS)

The scheme aims to facilitate technology upgrading of SSI units in the specified products/ subsectors by providing 12 per cent capital subsidy for induction of well-established and improved technologies approved under the scheme. Technology upgrading would ordinarily mean induction of state-of-the-art or near state-of-the-art technology. In the varying mosaic of technology obtaining in more than 7,500 products in the Indian small-scale sector, technology upgrading would mean a significant step up from the present technology level to a substantially higher one involving improved productivity, or/and improvement in the quality of products or/and improved environmental conditions including work environment for the unit. It would also include installation of improved packaging techniques as well as anti-pollution measures and energy conservation machinery. Further, the units in need of introducing facilities for in-house testing and on-line quality control would qualify for assistance, as the same is a case of technology upgrading.

(2) Quality upgrading/environment management for small-scale sector through incentive for ISO 9000 /ISO 14001 Certifications

The small-scale sector has emerged as dynamic and vibrant sector of Indian economy and it has been making significant contribution to industrial production, export and employment generation. The process of economic liberalization and market reforms has opened up the Indian small-scale sector to the global competition. In order to enhance the competitive strength of the small-scale sector, the government introduced an incentive scheme for their technological upgrading/quality improvement and environment management. The scheme provides incentive to those small scale/ ancillary undertaking who have acquired ISO 9000/ISO 14001 certifications. The scheme for ISO 9000 reimbursement in operation since March 1994 has now been enlarged so as to include reimbursement of expenses for acquiring ISO 14001 certification also from October 2002. More than 2,375 SSI and ancillary units have already been benefited from the earlier scheme of ISO 9000 till 31 March 2002.

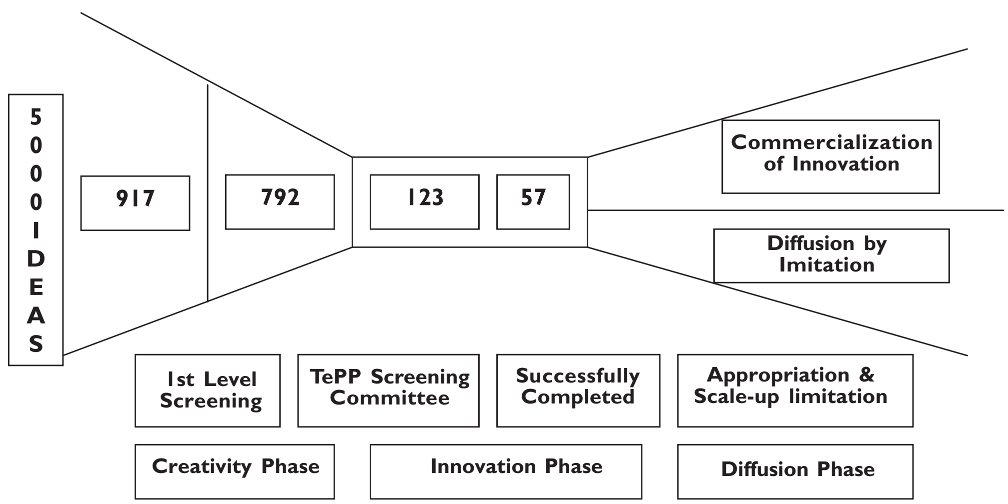
(3) Small industry cluster development programme

Small-scale industries contribute significantly in industrial production of the country. They produce a variety of products ranging from traditional to hi-tech. Although the volume of production from small-scale industries is quite large, the quality of products, the productivity, energy and environmental issues have always been a concern. These concerns have accentuated with the opening of the economy where productivity and quality play a major role for the survival of the small-scale industries. The Office of the Development Commissioner (small-scale industries) has launched a scheme namely the "Integrated Technology Upgrading and Management Programme" (UPTECH) in 1998, now renamed as 'Small Industry Cluster Development Programme'. The scheme applies to any cluster of industries where there is a commonality in the method of production, quality control and testing, energy conservation, pollution control etc. among the units of the cluster. The scheme aims to take care of the modernization and the technological needs of the cluster. It covers a comprehensive range of issues related to technology upgrading, improvement of productivity, energy conservation, pollution control, product diversification and their marketing, training needs etc.

(4) Technopreneur programme (TePP)

The phenomena of start-ups started in Silicon Valley and their first round of funding comes from angel investors. Angels are the earliest of early-stage investors. For many entrepreneurs, angels provide capital and frequently valuable guidance and strategic assistance-that they would likely not find anywhere else. The ideal angel is someone who is a generation ahead of the entrepreneur in creating value in the industry. They will provide financial capital as well as intellectual capital, which could be even more important than the money. Angels are sometimes said to invest '*emotional money*,' while venture capitalists are said to invest '*logical money*'. In poor developing countries like India, there are no angels- a critical gap in the innovation chain. To bridge this gap, the TePP programme was started. This provides "angel capital" to individual innovators at ideation stage to work to prove their concepts as the first prototypes. Over 5,000 ideas have been accessed and over 100 supported under this programme. See TePP funnel in Figure 4.2.

Figure 4.2 TePP innovation funnel



(5) Capabilities

The competitive advantage of firms today stems from difficult to replicate knowledge assets and the manner in which they are developed. Assets can be the source of competitive advantage only if they are supported by a regime of `*strong appropriability*' or are '*non-tradable*' or '*sticky*'. Once an asset is readily tradable in a competitive market, it can no longer be a source of firm-level competitive advantage.

The SMEs in transition have seen transformation of their capabilities. Their capabilities can be grouped as under:

- Capabilities based on regulations
- Capabilities based on geographic positioning
- Capabilities based on assets
- Capabilities based on personal
- Capabilities based on relationships

A regulatory capability results from the entry barriers placed on their better endowed competitors like reservation policy. Geographic positioning was successful in days of poor infrastructure. Technology for many in SIS comes in the form of assets like capital goods. Quality standards were drawn from capabilities based on personnel, a functional capability related to the ability to do specific things; it results from the knowledge, skill and experience of employees. The last is capability based on relationships, networking to facilitate innovations, a cultural capability applied to the organization as a whole. It incorporates the habits, attitudes, beliefs and values, which permeate the individuals and groups that comprise the organization. When the organizations culture results in, for example, a perception of high quality standards and an ability to react to challenge, to change, to learn, etc, then that culture is a contributor to competitive advantage.

In summery, positional and regulatory capabilities are related to assets, which the business owns, while personal and networking capabilities are based on competencies or skills. The first two capabilities are therefore concerned with 'having', while the second two are concerned with `doing'.

E. Subnational innovation networks – the two emerging scenarios

Networks can be defined as linkages among firms. These linkages can be based on material (input-output) links, a traditional focus of production systems or on information and technology flows. Trade networks refer to the linking of users and producers of traded goods and services and knowledge networks focus on the flow of information and exchange of knowledge irrespective of its connection to the flow of goods. The scope of meaning of the term network is wide ranging, encompassing contacts (who knows whom), technological capabilities and other complementary assets of production. For the individual firm, networks provide external sources for inputs that complement or substitute for the firm's internal capabilities.

In India, subnational innovation networks can emerge from two different streams:

- Collective innovation system for clusters
- Individual innovators support system

(1) Collective innovative system for clusters

Collective invention, also called informal know-how trading, technology trading, information exchange, is a significant element of technological collaboration. A collective governance is implicit in most of the literature on industrial clusters. Collective invention is directly or indirectly formulated as a type of knowledge spill over under a regime of collective governance. There are three similar but distinct concepts of collective invention.

- Free release of information that could advance a process, but would not be novel enough to be granted a patent. Released information is then used by others who in turn would freely release their experiences, leading to cumulative advance and eventual development of important intermediate products.

- Informal know-how trading, which involves exclusion of knowledge from those who are not members of the trading coalition. Thus, the potential exclusion from informal trading implies reciprocity to individual members as well as benefits to the trading coalition.

- Knowledge spillovers take place in a cluster without an expectation of reciprocity.

Collective invention can be defined as an informal release of knowledge or technology among an internal or external combination of agents, be they individuals, firms, or not-for-profit organizations. The units of information released are small, incremental and individually complementary. Since the exchanged and generated knowledge consists of small advances with potentially large cumulative effects, both the costs and risks to member firms are less than through independent pursuit or formal collaboration. See illustrations in Box 4.1.

Box 4.1. Kolaphuri chappal and Baukura handicrafts

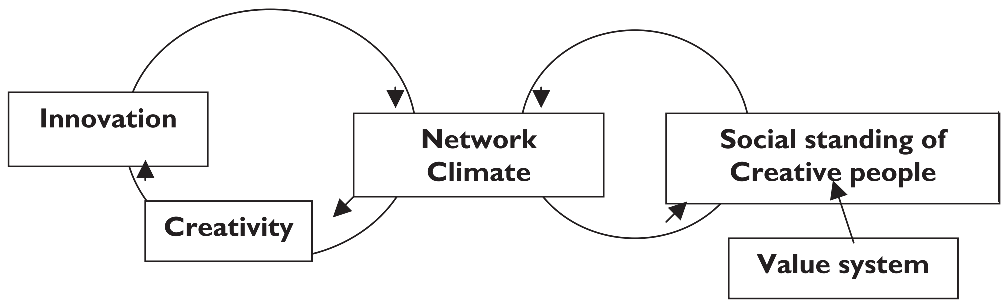
Kolaphuri chappal: About 1,200 families in the border areas of Maharashtra and Karnataka are engaged in the production of ethnic footwear under the generic name Kolhapuri. Due to lack of standardization and poor quality, the product was loosing market. CLRI developed 120 new designs and technology packages for quality assurance and product standardization. The improved product has gained export markets in Italy, Japan, Spain, and the United States.
Bankura handicrafts: The National Institute of Science, Technology and Development Studies (NISTADS) has set up a S&T field station at Bankura, west Bengal to upgrade technologies for artisans and craftsmen by blending the traditional with new technologies. A software package called MADHU (Modernization of Artistic Design for Handloom Unit) was developed in collaboration with IIT, Kharagpur. This CAD software package facilitates computerized digitization of the pictures/ design produced by the artist/designer. This package has been successfully demonstrated to designers and weavers of Banura. As a result a large number of craftsmen have adopted blending of this new technology to increase efficiency, quality, flexibility and cost effectiveness.

(2) Individual innovators support system

Innovation flows out of creativity and favourable conditions need to be created for creative energy to bloom. A systems approach is presented here. Peter Senge introduced system thinking, the causal or feedback loop shows the cause and effect relationships between the variables in a system. Folk wisdom speaks of reinforcing loops in terms such as 'snow-ball effect', 'Bandwagon effect'. Individuals improve themselves for a period of time, then plateau. Working groups get better for a while, but stop getting better. Networks grow for a while, but then stop growing. In each of the case of limits to growth, there is a reinforcing (amplifying) process of growth or improvement that operates on its own force period, then it runs up against a balancing (or stabilizing) process, which operates to limit the growth. When this happens, the rate of improvement slows down or even comes to a standstill.

The first loop is the reinforcing loop and next to it is the balancing loop, constrained by a limited condition. Quality circles' activities begin to lead to more open communication and collaborative problem solving, which builds enthusiasm for more quality circle activity. But the more successful the quality circles become, the more threatening they become to the traditional distribution of power in the firm. Managers are often unprepared with workers whom they have mistrusted in the past. They end up participating in quality circles but only going through the motion. They gracefully acknowledge workers suggestion but fail to implement them. Innovation systems can be portrayed in a similar way.

Figure 4.3 Creativity loop



Example: Honey Bee Network of grass-roots innovators (http://knownetgrin.honeybee.org/prof-IT-3.htm)

This network pioneered by Prof. Anil Gupta, has proved that technological and institutional innovations developed by individuals and communities can provide a new way of thinking about (a) conservation of diversity, (b) generation of sustainable alternatives for natural resource management through self-supporting viable economic and non-economic options, and (c) augmenting self-reliant livelihood strategies.

Networking is knowledge

The network determines not only access to information, but also constitutes in itself capabilities that support coordination and learning among member forms. The value of a firm is partly derived from the wider network, shown as below:

"Output of a firm = *residual constant + weighted inputs (such as value of capital and labour) + weighted value imputed to membership in a network."*

This value is gained because firms through cooperation generate joint rents (benefits). Structure of a network implies principles of coordination that not only enhance the individual members capabilities but also lead to capabilities that are not isolated to any one firm. Informational benefit of a network refers to the ability of a firm to access information in a network, like effect of accessing the technology of a research centre, on its subsequent innovation. Cooperation also generates capabilities inherent in the relationship itself such that parties develop principles of coordination that improve their joint performance. Such principles may be rules by how supplies are delivered, such as by JIT or more complex rules governing the process by which innovations are collectively produced and shared.

In this sense network is itself knowledge, not in the sense of providing access to distributed capabilities, but in representing a form of coordination guided by enduring principles of organization. The most tangible expression of the direct value of external knowledge to the firm is the compelling evidence that rapid product development depends on the reliance on outside suppliers. The capability to speed up commercialization of products seems to rest on the successful exploitation of the knowledge of other firms. Networks are thus often more than relationships that govern diffusion of innovation and norms. Networks contribute capabilities that augment the value of firm.

REFERENCES

1. T. A. Bhavani , "Small-Scale Units in the Era of Globalization- Problems and Prospects", *EPW Special Article, 20 July 2002*
2. John Williamson, The World Bank "On Markets and Regulation", Paper presented to a conference held at the University of California, Santa Cruz, 20-21 November 1998.
3. Ref: RIS Discussion Paper, "WTO Market Access Negotiations and Indian Small-Scale Industry" Rajesh Mehta and Pooja Agarwal , RIS-DP # 74/2004, May 2004
4. Wharton paper "TQM, ISO 9000, Six Sigma: Do Process Management Programmes Discourage Innovation?" http://knowledge.wharton.upenn.edu/article/1321.cfm
5. Diana Farrell, Tarun Khanna, Jayant Sinha, and Jonathan R. Woetzel "China and India: The race to growth. The world's two biggest developing countries are taking different paths to economic prosperity. Which is the better one?" The McKinsey Quarterly, 2004 Special Edition : China today
6. S&T policy, http://dst.nic.in
7. A.S. Rao, " Management of Corporate R&D and Innovation", 1995, Global Business Press, New Delhi

V. INDONESIA[6]

Abstract

Materializing the national development on Science and Technology (S&T), the Government of Indonesia has implemented the National System of Innovation approach. The S&T related Law and Regulation have been promulgated with the objective to create and encourage the S&T institutions to have a close collaborative network among them. The incentive schemes related with S&T activities that bridges and facilitates researchers into economic scale of activity, has also been made possible. Furthermore, the government has also set up incubators as an intermediation body facilitating research to innovation that is expected to expedite the creation of technology based SMEs. The small adoption of R&D products has, however, impeded the progress of technology based SMEs creation. Further reviews show that this matter seems to relate with various kinds of conditions, among others, a low percentage of S&T budget to GDP. This report discusses existing data related with the effort of the Government of Indonesia in establishing the National System of Innovation.

A. Introduction

In the modern age, it is realized that the key to national prosperity lies in effective combination of three factors: technology, natural resources and capital. The first is the most important factor since the creation and adoption of new scientific techniques can make up for a deficiency in natural resources, and reduce the demands of capital. Indeed, the depth of the innovative ideas and technologies implanted in services, products and manufacturing processes determine the capability of a nation in fostering high standard of living and job creation within her society. We are now entering a transition period bridging the changing from traditional economy to knowledge-based one or information society. There are three fundamental items that have affected overall life of the people, and thus competitiveness of a state, and those are Globalization, Information, Knowledge, and Networking and Connectivity.

The information technology turns out to be the main core of means in connecting and accelerating the operation and process of development in the future. Speed have lessen the time lack and shorten the distance, and thus inflict the 24 hours a day operation and process. Information and knowledge goes into the place where no bottleneck exist, milieu determines the price and value. And it confirms that the key component of knowledge-based economy lies on the human capital and competencies.

As an initial approach toward the afore-mentioned problem, the Ministry of Research and Technology (MoRT) of Indonesia enacted the Law on the National System of the Research, Development and Application of Science and Technology. The Law has emphasized on efforts in providing and adopting innovation as a means through the approach of manifesting the National System of Innovation. Appreciation for an innovation will be facilitated and implemented through various kinds of operational policies such as incentive policies in promoting research, development and engineering activities. Furthermore, the development and the impact of technology in the modern era required obedient people who responded to the technology's demand. Only by committing to permanent practice of management of technology, will organizations

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experience technological change as a principle driver of competition. Through that approach, it is expected that the creation of innovation-based SMEs can be facilitated.

This paper discusses the growth of SMEs in Indonesia, the available incentive programme and schemes as well as the intermediary mechanism introduced by the government. A brief discussion on the important function of incubators in facilitating the commercialization process is touched upon. The R&D budget that pose important support for the creation of technology-based SMEs is also reviewed.

B. SME in Indonesia

There is no doubt that SMEs in Indonesia – as also generally occur in many countries – can be trustworthy. The crisis took place several years ago had proven themselves. Therefore, their position is very strategic. In 1998, based on the National Statistic Bureau (BPS – in Indonesian), the total number of SMEs reaches approximately 37 million. Despite the crises, the number increases to 42.3 million in 2003. The SME's contribution to the non-oil and gas exported product had risen from US$ 7.55 million in 2000 to US$ 7.59 million in 2003.

Apart from its great number, SMEs has also a very strategic role in workforce absorption, poverty alleviation and a safeguard during the crisis. The existence of SMEs has absorbed 99.40 per cent work force in 1998, despite its small contribution to the GDP, which is only 39.8 per cent. But, in 2003 the labour absorption attains 99.45 per cent and shares 56.71 per cent of GDP. In 1999, Kaswanto run a survey on 167.000 SME in the manufacturing sector observing their technological problem [1]. It can be concluded that (i) although the number of SME is very potential, it seems structurally very weak, (ii) the constraint faced by SME related with technology is very significant, and (iii) the technological problem that can be connected to Management, Production, Competition as well as Material Access, arrives at approximately 69 per cent.

It is presumable that within the SME, only a small portion adapts to innovation and technology, and that is the medium-sized one (15 per cent). Our recent investigation shows that only 11.5 per cent within this group admits to apply management of innovation and technology at their organization [2]. This reproduces result of survey by Kaswanto [1] that more than 68 per cent of SME faced technology related problem. The Government has, in fact, offered SMEs to adopt research results through research incentive policy mechanisms, either in the form of direct fund or others such as proliferation of product. On the R&D side, the problems seem to not only relate with the adoption and transaction processes, but also regulation.

It is widely accepted that the human resources in the R&D institutes especially the public one are very potential and highly capable, their performance and working culture are exceeding the average level of their counterparts in non-R&D Institutes. The number of regulation has, however, caused the number of research products fail to reach an ambient number or critical level that can regenerate resources. On the other hand, Sudarsa [3] reiterated the problem that SMEs faced on transferring technology. The process of internalization within the organization is hampered by various kinds of causes. Technology transfer in Indonesia still needs direct involvement of the government. Our survey supports the Sudarsa's presumption in term of participation in the government programme on technology development (21.4 per cent) and acquisition (7.4 per cent) in the period of 2000 – 2004 [2].

C. Policy on science, technology and innovation

The Indonesian S&T and Innovation Policy and its implementation derive from various kinds of legal products. By constitution the Government of Indonesia ought to develop the national S&T Policy based on religious values and the unity of the nation in order to ensure the human civilization and the national prosperity (Art 31 clause 5 of the Amendment of the 1945 Indonesian Constitution - UUD 45).

Under the State Guidelines covered within the Decree of the People's Consultative Assembly (No. 4/1999), it has been affirmed that the empowerment of SMEs and cooperatives as well as the improvement of national competitiveness shall be conducted through the mastering and utilizing S&T. It furthermore stresses that technology shall be further utilized to conduct activities to improve national health, education, food fulfillment, industry and others, in order to meet self-sufficiency and improvement of the nation competitiveness.

The Law No. 18/2002 on the National System of the Research, Development and Application of S&T was enacted in 2002. This Law aims at enhancing the support on National S&T, in order to accelerate the national achievements and to improve national competitiveness, self-reliance and excellence for supporting economic importance in international forum. It functions as a guideline to the formulation of the National System of Innovation. In this regard, the role of the central government, regional governments and society especially business players should be in synergy and harmonist in order to develop the national S&T. Furthermore, it also emphasizes on the importance of the networking among universities, R&D institutions under the Ministries and the Departments, supporting institutions, aiming to establish the joint cooperation which will be supporting, encouraging, and completing one another, in order to avoid the overlapping of R&D activities.

This Law has been made operational through the Presidential Instruction No 4/2003. This instruction reaffirms the function of MoRT as the coordinator for the formulation of a national S&T policy and its implementation. Figure 4.4 shows the interrelation among the institutions within the perspective of this policy.

The promulgation of Laws No. 18/2003 has given a foundation on the operational and implementation level. Basically, there are four aspects included in that Law. The aspects intrinsically describe the basic pillars of the National System of Innovation, i.e. (i) institutional synergy covering resources and S&T Network, (ii) utilization of S&T product for economic purposes, (iii) protection for S&T doers, and (iv) encouragement of society within the utilization and development of S&T activities.

Aiming at facilitating the national S&T activities and products in order to become the main core of national industrial product, the State Ministry of Research and Technology strive at creating an environment that conducive in transforming S&T activities and products into economic scale of activity. The improvement of competitiveness position is, therefore, aimed at, such as: (i) enrichment of resource advantage by encouraging society to cultivate national assets and capabilities so that they can collectively become part of the national competitiveness, (ii) betterment of positional advantage by strengthening production value-added chain for domestic as well as international markets, and (iii) sustaining regeneration advantage process by disentangling all competition that weaken the regional bargaining position and by encouraging the activities that can regenerate and renovate the sources of national competence.

Figure 4.4 Scheme of relationship among government institutes in the perspective of S&T activity

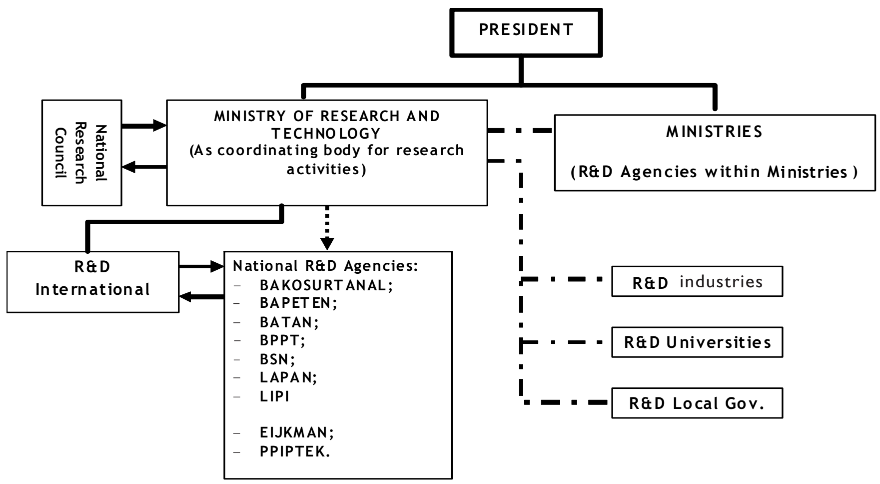
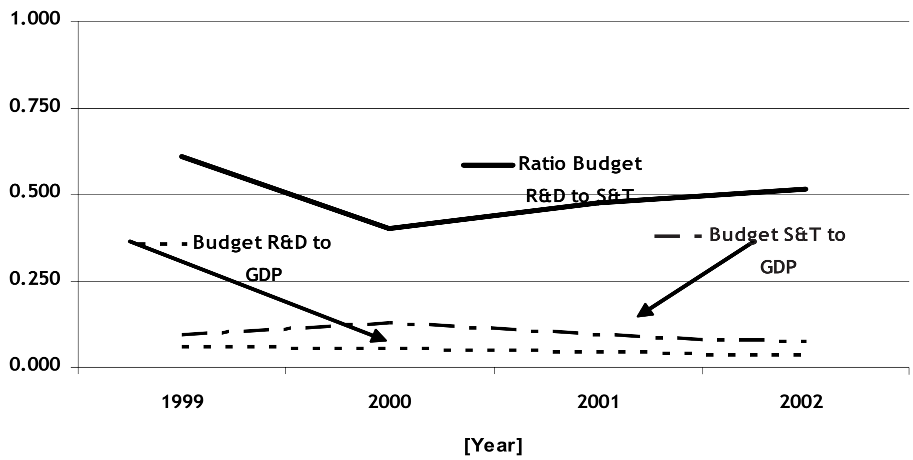


Figure 4.5 The ratio of S&T expenditure to GDP



Those three efforts were implemented through the instrument policy in the form of incentive programmes. Until in the year 2004, there were about 32 incentive programmes, ranging from basic research till the proliferation and dissemination of technology products. Table 4.4 shows a matrix of the incentive programme mapping seen from the perspective on sustaining activity from research to commercial activities.

Percentage of S&T budget as well as R&D tends to decrease. It can be seen that the S&T budget in 2002 decreases from that of in 2000. Not only did the nominal amount of the budget decreases, but also the percentage of R&D budget to GDP within the last three years. The ratio of S&T budget utilization for R&D tends to grow lately (Figure 4.5).

The source of research funding in the universities is supported by the government 76 per cent, internal source of income within the university 11.2 per cent, private companies as well as foreign sources shares 5.6 per cent each, respectively. The government is central to the development of S&T.

Table 4.4 Mapping of the MoRT's incentive programme

Items	Early	Development	Fortification	Strengthening
ACTIVITIES [4]	• Idea • Assessment • Literature search • Prior Arts • Patent search • Research	• Market assessment • Financial business analysis • Product development • Product validation • Trial production	• Pre-commercial business analysis • Preliminary production	• Stock market
SOURCE OF FUND	• Private fund • Sponsors • Government	• Business angels • Sponsor • Government	• Venture capital • Bank	• Stock market • Societies
% OF REQUIREMENT [4]	5.63%	46.48%	21.11%	26.78%
INCENTIVE PROGRAMME	• RUT • RUKK • RUSNAS • RUTI • RPK • *RKDM* • R-MIPA	• RUK • KATALIS TEK • Siptekman • Inotek • Oleh Paten • *Sentra Paten* • Oleh Desain	• Lintrad • Standlab • *Warintek* • PRIDA	• Asuransi Teknologi • SUCP

In the last 5 years, within the institutes that directly coordinating the S&T activity, the funding is distributed into 8 institutions under the coordination of MoRT. The ratio of budget utilizing the 0.2 per cent of GDP between MoRT and the R&D agencies is 60 per cent to 40 per cent. And, within the MoRT, 65 per cent of the budget is allocated to run the incentive programmes.

The total funding disburses through the incentive programme, although it creates support for SMEs especially for technology-based ones, is still not sufficient to fortify the 42.3 million SMEs. Moreover, as it can be reviewed that, although the government support is needed during the early period of research, but majority (> 60 per cent) of funds is, however, required during the development, fortification and sustaining the product.

A case of example can be taken from the RUT Programme (Integrated Priority Research Fund) which was started in 1993. It is aimed to encourage researcher to collaborate with their colleagues to propose research topic in the subject defined. This programme has funded more than 1,307 research topics. Each topic is granted for – at the longest – three years. In average each researcher is granted for US$ 10,000 annually.

Table 4.5 Number of proposal granted through RUT programme

93/94	94/95	95/96	96/97	97/98	98/99	99/00	2000	2001	2002	2003	2004	2005	2006	2007
I.1	II.1	III.1	IV.1	V.1	VI.1	VII.1	--	VIII.1	IX.1	X.1	XI.1	XII.1		New
109	149	142	106	153	148	110	--	163	90	69	68	82		
	I.2	II.2	III.2	IV.2	V.2	VI.2	VII.2	--	VIII.2	IX.2	X.2	XI.2	XII.2	
	103	135	131	95	143	121	92	--	146	62	62	59		
		I.3	II.3	III.3	IV.3	V.3	VI.3	VII.3	--	VIII.3	IX.3	X.3	XI.3	XII.3
		83	85	70	35	104	66	50	--	80	43	23		
109	252	360	322	318	326	335	158	213	236	211	173	164		

Research proposals are categorized in three groups, i.e. basic research, applied research and technology product development. Among the research funded, approximately ~17 per cent is basic research, ~ 68 per cent applied research, and the rest is technology product development. The programme has successfully reduced the idle capacity of laboratories, increased the communication among researchers in various places in Indonesia, and facilitated many new ideas. However, the adoption of the result apparently smaller than what is expected. The monitoring and evaluation conducted in 2001 showed that adoption of research result was less than 4 per cent [5].

Many developing countries have implemented the idea of Technology Based Incubator (TBI) as an intermediary between researches to innovation. The goals of incubator are, among others, technology transfer and commercialization, fostering innovation and technology based SMEs, promotion of a market-oriented economic system and private sector economic development [6]. Through the TBI, a newly start-up S&T based SME is made capable of affording premises, appropriate business services as well as seed capital or working capital. This is seen as factors that increase rates of entrepreneurship and entrepreneurial success. Bearse [7] speculated that without TBI, any policy that stimulates R&D would have a limited impact. In this regard, the TBI is seen as a tool of transformation – catalyst in the transformation of small-scale research activities into the economic scale ones.

Table 4.6 Number of tenants [8]

Period	New Tenants	Drop-out	Graduated	Anchor Tenant	Total
1997 – 1998	8	-	-	-	8
1998 – 1999	3	6	-	-	7
1999 – 2000	2	2	1	1	7
2000 – 2001	6	6	-	1	7

In Indonesia, there are not many incubators available. It may be said that only one incubator so-named Technology Incubator, because most existing incubators are business ones. It was established in 1996 and located within the National Centre of Research Science and Technology (in Indonesian – PUSPIPTEK), which is now being coordinated under the Agency for the Assessment and Application of Technology (In Indonesian – BPPT). The number of tenants and graduated companies are still far from satisfying and less than 5 per cent annually. Table 4.6 shows the statistics of tenants at the Technology Incubator from 1997 to 2001.

In brief, as noted by Sakya's study, the incentive schemes have encouraged some interest among researchers. However, the results, in term of economic of scale, are still not encouraging. The number of incubators dealt with the R&D is still far from the ability to push the R&D products into the market. The existing VCs seem to be risky in dealing with the newly found products. An intermediary agent, such as a credit guarantor that facilitate a new established technology-based seems to pose an alternated solution to sustain R&D product in Indonesia [8].

D. Concluding remarks

A brief review on the SME development in Indonesia has been outlined. The S&T activity that related with the growth of SME-based technology has also been drafted. The number of incentive schemes has been initiated by the government as part of the national policy to foster the national system of innovation. The adoption of technology or innovation produced by the schemes is still far from being able to push self penetration of S&T activity into economic scale of activity. But, this can also be connected to the other policies such as small budget of R&D, education and SMEs and cooperatives.

REFERENCES

[1] Kaswanto, B.T., *Potensi Pengembangan Industri Kecil dan menengah pada Industri Komponen*, Majalah Pengkajian Industri No. 7/Agustus/1999, Badan Pengkajian dan Penerapan Teknologi, Hal. 25 – 31.

[2] Sakya, A.E., *Promoting Management of Innovation and Technology through Awareness Dissemination Programme for SME based Innovation*, APEC International Forum – Economy Globalization and Business Incubators, Beijing – China, 18 – 20 October 2005.

[3] Sudarsa, M., *Policy on Strengthening SMEs*, Seminar on the Perspective of Strengthening Technology within the SME, Jakarta, 3 – 5 March 2005.

[4] Cooper, R.G., *Winning at New Product, Accelerating the Process from Idea to Launch*, Perseus Publishing, Cambridge, Massachusetts, 2001.

[5] Assistant to the Deputy for Programme Evaluation, Monitoring and Evaluation of RUT's and RUK's Economic Outcomes, Ministry for Research and Technology, Jakarta, 2001.

[6] Schoen, C., *Design Principles for the Incentive Structure of Industrial R&D, Assessment Workshop on Design Principles for the Incentive Structure of Industrial R&D*, UNDP, March 11, 2002.

[7] Bearse, P., *Development of Technology Business Incubators for Technology Innovation and Entrepreneurship Development*, UNDP, July 1993.

[8] Sakya, A.E., *Seeking the Proper VC-s Complementing the Incentives Programme Schemes to Accelerate the Creation of Technopreneurs – Indonesian Cas*e, APEC – Forum – Venture Capitals' Role in Science Parks and Business Incubators, Xi'an – China, 20 – 23 May 2002.

VI. LAO PEOPLE'S DEMOCRATIC REPUBLIC[7]

A. Introduction

Science and technology play an important role in the socio-economic development of the Lao People's Democratic Republic. They are particularly important for the country in its efforts to achieve the government's stated goal of preparing the country for industrialization and modernization as well as graduating from the ranks of the least developed countries by 2020. This means to maintain GDP growth of 7 per cent per annum. Furthermore, faced with increasing regional and international economic competition the government has made great efforts to build up socio-economic development capacity of the country. The efforts include acquiring modern science and technology knowledge and seeking funding supports, integrating science and technology activities into the national socio-economic development policies and plans, and increasing investment in human resource development.

B. Current status of SIS and SME technology capacity-building

SMEs account for a large share of the enterprises active in the Lao People's Democratic Republic, and in the late years are emerging as the private sector instrument for economic growth with equity. Loa SMEs are characterized by relatively small, low-technology and labour-intensive manufacturing industries. According to the UNIDO study of May 2003 entitled "Lao PDR: Medium-term Strategy and Action Plan for Industrial Development," relative shares of manufacturing industries at different technological levels are 11 per cent high-technology, 15 per cent medium-technology and 74 per cent low-technology. Therefore, to achieve the above-mentioned goal of the government, science, technology and innovation are vital to enhance competitiveness of the SMEs.

Great efforts have been made in developing a National Innovation System. In addition to the industry itself, a number of institutions and technical laboratories are already in place, although they can hardly be said to cooperate and coordinate so as to constitute a coherent NIS. The two main central bodies responsible for coordination in the areas of science, technology and innovation are the Science, Technology and Environment Agency (STEA) and the National Science Council (NSC). The STEA was created in 1995 with mandates to determine and administer policies in the areas of science, technology and environment, as well as monitoring and controlling information technology. The NSC was established in 2002 with mandates to:

- Promote the development of various scientific research activities to be upgraded to the international level; and
- Promote the applied and adaptive researches as far as the modern science and technology in the world is concerned aiming for better serving the development of the country with the highest benefit.

[7] *This paper was prepared and presented by Mr. Somdy Inmixay, Director, Small and Medium-scale Enterprise Promotion Development Office, Ministry of Industry and Handicraft, Lao People's Democratic Republic.*

Furthermore, having recognized the importance of science and technology, in 2003 the Government adopted the National Science and Technology Policy of Lao People's Democratic Republic up to the year 2010. The Policy specifies two types of the science and technology priorities for upcoming years. They are:

- National cross-sectoral priorities – the collaboration of sectors in the implementation of works defined in the policy.
- Sectoral priorities – a sector to implement activities according to its roles and functions by spreading from the national policy. The sectoral priorities include the development and promotion of small and medium-sized industries, agro-forestry processing industries and small-scale industry and handicraft units.

In the area of SME promotion and development, in the past few years the government has paid more attention by issuing the Decree No. 42/PM on SME promotion and development in April 2004, in which 6 policies towards SME promotion and development were formulated. They are:

- Creating an Enabling Regulatory and Administrative Environment;
- Enhancing Competitiveness;
- Expanding Domestic and International Markets;
- Improving Access to Finance;
- Encouraging and Creating Favourable Conditions for Establishment of Business Organizations; and
- Enhancing Entrepreneurial Attitudes and Characteristics within the Society.

With relation to "Enhancing Competitiveness," the government has shown its commitment to promote the development of SMEs' competitiveness through training of existing and potential entrepreneurs and the SME workforce and providing technical assistance to improve the productivity of production and service operations, quality, technology and entrepreneurs' management skills. It is also to support and closely cooperate with organizations, academic institutions, research institutes and technical institutes in implementing projects to develop entrepreneurs and skills of the workforce.

In order to implement the government policies in relation to SME promotion and development, the implementation of the Decree No. 42/PM in particular, the National SME Promotion and Development Committee (SMEPDC) in the form of public-private partnership was established. The Committee has the responsibilities to advise the government on SME promotion development policies and programmes. Furthermore, the National SME Promotion and Development Office (SMEPDO) was also established. The Office has technical functions and serves as the secretariat to the National SME Promotion and Development Committee. The SMEPDO has set up the Productivity, Quality and Standard Division in efforts to help SMEs tackle their technological and competitiveness bottlenecks. At the same time, two major issues in relations to technology and innovation have been included into the action plan for SMEPDO, as follows: Promoting research and development, including transfer of modern and appropriate technology to SMEs; and Promoting and supporting copyright, patent, trademark and other intellectual property.

Recently, the SMEPDO in cooperation with German Agency for Technical Cooperation (GTZ) and Asian Development Bank (ADB) has initiated the formulation of SME development strategy for the country.

However, an effort to develop Subnational Innovation System (SIS) as well as technology capacity-building policies to enhance competitiveness of SMEs has been limited. At the same time, realization of the above policies and programmes is still at initial stage and little progress has been achieved and many challenging tasks are still ahead. In addition, there is a need to develop unique SIS policies and SME strategies tailored to meet the needs of SMEs.

C. Challenges, opportunities and best practices

There are a number of challenges and opportunities in initiating SIS initiatives as well as strategic issues for enhancing local SME competitiveness in the Lao People's Democratic Republic.

Challenges:

- Awareness on SIS among policymakers as well as firms, SMEs in particular, is limited;
- The SMEs have limited ability to access to information;
- Low technological and innovation capacity among SMEs.

Opportunities:

- The government has set up policies to promote science, technology and innovation in the country;
- Efforts have been made to transform the country from landlocked to land-link by connecting the country to its neighbours; and
- Efforts have been made to promote foreign direct investment (FDI) of large companies and multinational corporations that will help technology transfer to SMEs through clustering.

D. Future plan and prospects

There is no doubt that to survive and to be competitive in the increased global competition and rapid technological change, the SMEs have to be innovative and responsive to changes. In particular, the SMEs have to be prepared for being a member of the ASEAN Free Trade Area (AFTA), other Free Trade Arrangements (FTA) as well as accession to the World Trade Organization (WTO). Therefore, to further promote and develop SMEs of the country the government is developing SME development infrastructure and has a plan set up local representative offices and centres. The SMEPDO in close coordination with the STEA, the national body responsible for science and technology shall study specific policies to set up SIS and enhance competitiveness of the SMEs. Furthermore, it is expected that with its experience and expertise UNESCAP will have closer cooperation and extend assistance to SMEPDO in carrying out its tasks. The followings are possible areas of cooperation:

- Assisting in formulation of unique SIS policies;
- Transferring best practices from other UNESCAP member countries;
- Assisting in setting up regional and local representative offices and centres.

E. Conclusion

In order to successfully enhance competitiveness of SMEs there is a need to effectively implement government policies and programmes. Furthermore, coordination networks among UNESCAP member countries will ensure experience sharing and technology transfer. It is further believed that this Regional Meeting as well as the technical cooperation project implemented at the moment by the UNESCAP will give new momentum in developing SIS in UNESCAP member countries to make SMEs competitive and remain a driving force of growth and source of employment for the region.

VII. MONGOLIA[8]

A. Introduction

In the past, the Government of Mongolia has undertaken a number of measures in facilitating the development of technology transfer. Such measures include the Policy of Science and Technology, Guidelines for the Implementation of Science and Technology Projects, Law of Technology Transfer, and other trade and economic related laws and regulations.

As result of the above-mentioned package policies, the general economic condition of the country has improved dramatically. This is particularly so in the hard infrastructure sector such as intensification of a road construction and improvement along the vertical and horizontal axis, installation of digital cellular telecommunication links in rural areas and connection of isolated areas to the national grid. However, the government's own regulatory actions impose unnecessary costs and burdensome requirements on private enterprises. Such actions on the part of the government cause the private enterprises to operate inefficiently.

As of 2004, there have been registered 25,356 active business enterprises in the country of which 96 per cent were employing up to 50 workers. According to the European standards for countries in transition, these businesses are considered as SMEs. SMEs in Mongolia employ over 300 thousand people and consequently contribute 1.8 per cent to the state budget. SMEs are in lack of financial resources necessary for upgrading their operations and technologies and do its expansion. These SMEs are accountable for approximately 60 per cent of the GDP.

Therefore, the government is paying a significant attention to the development of SMEs by introducing new technologies including information and communication technology (ICT) with a right proportion/combination of the human resources. Within this framework, the government will implement further actions to eliminate regulatory impediments and governmentally imposed business costs. The removal of such obstacles will create a business friendly environment, assist in finding financial sources for SMEs, facilitate the opening of business opportunities and create new

[8] *This paper was prepared and presented by Mr. Sh. Mungunbat, Head, Small and Medium-scale Enterprises and Technological Development Division, Ministry of Industry and Trade, Ulaanbaatar, Mongolia.*

job opportunities. As result of these package policies, the government should provide a right policy on the introduction of new technologies to encourage the SMEs.

B. Current status of SIS and SMEs technology capacity-building

The Great Hural of Mongolia has passed the Concept for the Development of Mongolia in 1996 and the Concept for Foreign Policy of Mongolia in 1994. As result of ratification of the Concept for Foreign Policy of Mongolia, the Great Hural has passed the laws and regulations related to technology transfer and foreign investment issues.

Today the majority of Mongolian SMEs are operating in the light industry sector such as sewing, textile and agricultural processing industries, and raw material processing industries for animal origins. Recently, the Government of Mongolia has passed the Programme for Support SMEs to facilitate the development of SMEs.

The Government of Mongolia is recognizing the importance of the technology transfer. The Parliament has passed the Law on Technology Transfer in 1998. SMEs could achieve their objectives by introducing new technology, information technology and innovation. Since the approval of the Law on Technology Transfer, the government has taken a number of measures in formulating and implementing the transfer of technology-related regulations such as the following:

(a) Mongolian Civil Law (2002)

(b) Law of Science and Technology (1998)

(c) Patent Law (1993)

(d) Copyright Law (1993)

(e) Set of Laws about Education (2002)

(f) Law of Environment Protection (1995)

(g) Law of Environment Assessment (1998)

(h) Law of Protection of Gene Pool and Health of Domestic Animals (2001)

(i) Customs Control Law (1996)

(j) Law of Foreign Investment (1993)

(k) The Government Policy of Science and Technology (Resolution of the Mongolian Great Hural, No. 55 of 1998)

(l) Guidelines for the Implementation of Science and Technology Projects (14th Resolution of the government of 1998)

(m) Instructions for Technology and Transfer Contracts and Registration (Enlightenment Minister's order No. 46 of 1999)

(n) General Instructions for Estimation of Technology Level (Enlightenment Minister's order No. 271 of 1998)

The above-mentioned documents show that a basic legislative background is already regulating a technology transfer's related issues for the first instances. However, with the new achievements of new technology and information technology, the society will face new human health and environmental related concerns which need a suitable regulation.

C. Overview of SMEs in Mongolia

Although the government undertakes an effort to develop the SME sector, there has been no definition for SMEs in Mongolia.

Table 4.7 Structure of enterprises by sectors in 2004

Sector	Number	Percentage
Manufacturing and service	7,038	27.8
Trade	10,146	40.0
Social sector	8,169	32.2
Total	25,353	100.0

Source: Mongolian Statistical Yearbook 2004

The manufacturing and service sectors constituted a minor part of enterprises with 27.8 per cent of share, while the retail and wholesale enterprises comprised only 40.8 per cent.

Table 4.8 Structure of enterprises by regions in 2004

Region	UB region	West region	Region of Hangai	Central region	East region
Percentage	62.9	9.0	10.9	12.7	4.5

Source: Mongolian Statistical Yearbook 2004

As Table 4.8 shows, the majority of Mongolian companies are located in the capital city of Ulaanbaatar.

Table 4.9 Structure of enterprises by number of employees in 2004

No.	Number of employees	Number	Percentage
1	1-9	20,690	81.6
2	10-19	1,913	7.5
3	20-49	1,751	6.9
4	50 and more	999	4.0
	Total	25,353	100.0

Source: Mongolian Statistical Yearbook 2004

Approximately 82 per cent of Mongolian enterprises employ up to nine employees while only 10.9 per cent employ more than 20 employees. These are unfavourable conditions for export development.

Table 4.10 Structure of enterprises by number of employees and regions in 2004

	1-9		10-19		20-49		50 and more	
	Number	%	Number	%	Number	%	Number	%
UB area	13,436	64.9	711	37.2	607	34.7	532	53.3
Local areas	7,254	35.1	1,202	62.8	1,144	65.3	467	46.7
Total	20,690	100.0	1,913	100.0	1,751	100.0	999	100.0

Source: Mongolian Statistical Yearbook 2004

Ninety-six per cent of enterprises are in the private sector with about 70 per cent located in Ulaanbaatar, Darhan and Erdenet.

D. Challenges, opportunities and best practices

Since 1990, Mongolia experiences a transition period from the central planned economy to free market economy. GDP in Mongolia has declined more than by 20 per cent during 1990-1993. However, starting since 1994 the growth resumed with 2.3 per cent in that current year, 6.3 per cent in 1995 and 3.3 per cent in 1997. The inflation rate also declined, by a factor of the three times in 1997 compared with that of 1996 to 17.5 per cent.

Although the economy of the country is experienced many transition difficulties, it has been undergoing a radical structural changes providing conditions for multifaceted economic relations. The private sector role in the economy has been increasing with the continuing privatization of the state assets. The industrial sector is an active consumer of natural resources and extensively pollutes the environment. At present stage, the industrial sector in general is suffering from obsolete machinery and technology and lacking of the latest scientific and technological advances. A study on the current situation of industrial machinery and technology in the country reveals that only 40 per cent of all equipment within the social industry has been utilized for less than five 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 partially 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's production is usually faced with obstacles due to the lack of a proper research and testing facilities in specific industries other than the mining and light industry sectors, coupled with a weak development of innovative design facilities. In the 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.

(1) Preparatory actions to be undertaken to transfer the environment-friendly technologies

In order to take advantage of the opportunities for the environment-friendly technologies diffusion, the following preparatory actions should be undertaken at the national level:

- To identify technology needs for main sectors
- To evaluate in-depth the priority mitigation technologies
- To identify the opportunities to promote the technologies diffusion
- To identify barriers to the development and transfer of technologies
- To identify the priority of barriers and practical steps should be undertaken to remove the barriers
- To establish a capacity-building and institutional arrangements
- To identify the ways to participate in the bilateral and multilateral mechanisms for technology transfer
- To promote the participation of the private sector in technology transfer

(2) Capacity-building needs

Mongolia has a limited experience in technology transfer in the context of manufacturing industry. There are a few initiatives related to technology diffusion in terms of manufacturing industries' consideration in Mongolia. Therefore, the future of technology transfer will depend on suitable capacity being created and institutional arrangements being established for the successful implementation of industrial policies. In order to develop the necessary conditions for the promotion of investment and technology transfer, the national capacity-building will be highly required.

The knowledge of the decision makers and stakeholders on technology transfer-related problems as well as the environment-friendly technologies are very limited. Also, lack of human capital with the requisite technical knowledge and skills is crucial 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 combining know-how in selected organizations with responsibility for implementing the suitable choices of technology in other organizations.

(3) Barriers to technology needs

As mentioned earlier, Mongolia has a very limited knowledge on technology transfer in terms of manufacturing industry. Market imperfections and institutional barriers have been identified as the main causes of lack of successful diffusion and implementation of technological innovations. There are a number of difficulties which the Government of Mongolia faces in choosing climate-friendly technologies. One of the main barriers is the high initial capital cost of many climate-friendly technologies. In addition to the financial barrier, there are a number of institutional and information barriers which the government has to address before the deployment of climate-friendly technologies that will become more widespread in the government facilities. These are distorted prices and limited competitive pressures; and weakness of structures for generating and managing technical change in response to price signals and competitive environment. This weakness has the following features:

- Limited human and organizational resources needed to plan and manage the environment and operations involved in the use of technologies.

- Low technical capability to operate and maintain reasonable efficiency levels. In many situations the technologies are operated at sub-optimal levels and usually below the design levels and standards of efficiency.
- Lack of a system of innovation that would allow maintaining or increasing a high efficiency levels through incremental technical and organizational changes.
- Weakness of the service-supplier network which means that the operation of technologies stalls when some spare parts or after-sale service are lacking.

In Mongolia, the projects and programmes focusing on the implementation and development of new and renewable energy technologies offer good opportunities. Population and extension of these technologies has faced a number of constraints including the following factors:

- *Lack of funds and routine maintenance:* After project operation of the equipment and facilities will depend on availability of spare parts and its systematic maintenance.
- *High cost of investment:* In some cases successful demonstration has not been followed by successful extension because of the high investment cost of units such as windmills and photovoltaic.
- *Technical assessment problems:* Lifetime of the equipment and facilities installed under the project will depend on pre-project technical assessments and analysis.
- *Lack of people's participation* right from initiation to implementation of the projects.
- *Negative attitudes* where in some cases the sponsors were unwilling to teach the beneficiaries how to operate the plant because they did not believe they could not grasp "sophisticated" technology.

A proper choice of technology is the key element of any technology process. Technologies will be selected using a certain criteria based on the special conditions in terms of current state of technologies-their adaptation and absorption, market, infrastructure and human resources etc.

(4) Opportunities for investment and private sector participation

In case of Mongolia, since early 1990s the Government of Mongolia is paying a significant attention to the Foreign Direct Investment (FDI), which would create more opportunities to bring new technologies, know-how and information technology into Mongolia. Therefore, the Parliament has passed the Law on Foreign Investment, which was based on more technology transfer issues including tax incentives and other promotion policies. Including the Representatives from leading private sectors, industrial units and NGOs in policy formulation and implementation is a background of successful transfer of technology.

Technology transfer is not a merely 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 an essential element that has to be put in place before any development or flow of hardware actually comes about, relates to the establishment of local capacity only to adopt, and if necessary adapt and use the appropriate technologies for the purpose of reducing the 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.

The main economic sectors and subsectors where can be transferred the environmentally-sound technologies are as follow:

- Power and heat generation (end-use efficiency improvement, system loss education efficiency improvement, coal beneficiation, etc.).
- Renewable energy development (solar, wind, hydro and bio-mass energy for small appliances and in remote areas with a long-term goal of development of large-scale renewable energy system, etc.).
- Mining and natural resource's 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 a technology of pasture use and livestock breeding, generate extra feed supply, change a cattle breeding technology, generate a 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 a water supply for watering and water management policies, and develop a 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).

(5) Notable elements of a framework for meaningful and effective actions to enhance the implementation of Article 4.5 of the Convention

In order to achieve the technology transfer's opportunities, the UNFCCC consultative process for technology transfer should be focused on the following factors:

- Mechanisms that facilitates the flow of information on technology transfer.
- Bilateral and multilateral mechanisms for technology transfer. May be a new mechanisms are needed.
- An inventory of the environmentally-sound technologies ready for transfer.

- Terms of technology transfer.
- Technology needs of developing countries.
- Setting up specialized centres or coordination mechanisms.
- Capacity-building in developing countries.
- Opportunities for investment and participation of private sector in technology transfer.

E. Future plan and prospects

The Government of Mongolia has been undertaking or will take actions on the following policy measures and programmes to strengthen technological capability of SMEs:

- National Action Plan on Technology Transfer
- Setting up of Technology Transfer Centre
- Introduction of Competitive and Environment-friendly technology transfer to SMEs in rural areas (e.g. Programme or Support of SMEs in rural areas /2003/, Export-oriented Product Support Programme /1998/)
- Constructing Industrial and Technology Park.

The Government of Mongolia is ready to cooperate with International organizations and donor countries in order to implement the proposals and projects on transferring a new technology and information technology at bilateral and multilateral levels.

F. Conclusion

Since studies have incorporated aspects regarding the technological developments and efficiency in production, it aims to link these aspects with the national development plans and programmes, as well as the national sectoral policies. It is also intended to develop the National Action Plan on Technology Transfer on the basis of these findings, as well as facilitating evolution of possible implementing projects or programmes to facilitate in transferring new technologies and information technology to SMEs.

Furthermore, since one of the development scenarios for Mongolia involves regional cooperation, there is a need to conduct a study on the impact of regional collaboration on development of Mongolia as well as to seek the avenues of implementing small and medium-sized manufacturing industries through regional collaboration and technology transfer.

APPENDIX

1. Country profile

Map courtesy Magellan Geographix

Mongolia Overview

Polity:	Presidential-parliamentary democracy
Economy:	Mixed capitalist (transitional)
Population:	2.5 million*
Nationality:	Mongolian
Ethnic groups:	Mongol (90 per cent), Kazakh (4 per cent), Chinese (2 per cent), Russian (2 per cent), other (2 per cent)
Area:	1.6 mln. square kilometres
Capital:	Ulaanbaatar
Per capita income:	US$ 508 (2004)*
Total enterprises:	25,356**
SMEs:	21,500**
SMEs share:	60 per cent
Annual growth:	3.5 per cent
Inflation:	8 per cent
Major Industries:	Copper, livestock, cashmere, wool, gold mining
Major Trading Partners:	Russian Federation, China, Japan, the United States

2. Mongolia Economic Overview

	1997	1998	1999	2000	2001	2002	2003	2004
GDP, mln.tog					1,115,641.4	1,240,786.8	1,461,169.2	1,807,985.9
Gross national income /mln. MNT					1,147,363.2	1,307,297.4	1,533,170.1	1,968,223.6
GDP per capita /thous. MNT					424.5	435.4	453.8	495.9
Industrial output (bln.MNT)					726.2	750.8	879.2	1164.4
Investment (bln.MNT)					309.5	329.3	418.0	406.9
Annual inflation rate	20.5	6.0	10.0	8.1	8.0	1.6	4.7	11.0
Currency in circulation (mln.MNT)					119,205.8	134,642.8	152,826.6	168,521.1
Exports (mln USD)	451.5	345.2	358.3	466.1	521.5	524.0	615.9	869.7
Imports (USD mln)	574.7	503.3	512.8	614.5	637.7	690.8	801.0	1021.1
External trade balance (mln MNT)	-123.2	-158.1	-154.5	-148.4	-116.2	-166.8	-185.1	-151.4
Unemployment (rate)	15.5	11.8	9.4	9.1	9.3	6.9	7.0	7.2

VIII. MYANMAR[9]

A. Introduction

Myanmar is situated in the South-East Asia and is bordered on the north and north-east by China, on the east and south-east by Lao People's Democratic Republic and Thailand, on the south by Adaman Sea and the Bay of Bengal and on the west by Bangladesh and India. The map of Myanmar is shown in Figure 4.6. Myanmar is one of the ASEAN 10 countries and also member of UNESCAP since 1948. Myanmar is the world's largest exporter of teak, and a principal source of jade, pearl, rubies and sapphires. It is endowed with extremely fertile soil and has important offshore oil and gas deposits.

The Budget Estimate of the Union of Myanmar is published annually by the Budget Department of the Ministry of Finance and Revenue. The Summary of the Budget Estimates of the Union of Myanmar is shown in table below:

Particulars	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000
Receipts	128,576.5	164,295.4	274,500.0	361,859.5	423,873.3
Expenditures	167,396.0	216,034.8	331,741.1	453,735.0	533,598.3
Surplus (+), Deficit (-)	-38,819.5	-51,739.4	-57,241.1	-91,875.5	-109,725.0

[9] *This paper was prepared and presented by Mr. Than Myint, President, Myanmar Engineering Society, Hlaing Campus, Myanmar Engineering Society, Hlaing Township, Yangon, Myanmar.*

B. Current status of SMEs

Myanmar, realized that SMEs play a major role in the development of economy and activities to develop SMEs, are going on under the guidance of Industrial Development Committee. The current situation of SMEs contribution to GDP is shown in Figure 4.8. The salient indicator of Myanmar Economy is shown in Figure 4.9. In Myanmar, SMEs have become a key component of the strategy towards the industrial-based development. SMIs are considered as crucial to become a modern nation. Therefore the promotion of SMIs is paid more attention.

Data on the sectoral composition of GDP for recent years show that slightly more than 35 per cent of GDP originated from the agricultural sector and reached to 44 per cent when livestock, fishery and forestry sectors are included. The processing and manufacturing sector accounted for 10 to 12 per cent of GDP. Service sector accounted for 19 per cent and trade sector's share is 21 per cent of GDP. The ownership structure of industries in Myanmar deserves special attention. In terms of number of establishment, private industries accounted for an over whelming majority of all industrial units (96 per cent) while contributed 75 per cent of total manufacturing value.

The agencies involved in SME development in Myanmar are as follows:

- Industrial Development Committee
- Ministry of Industry (1)
- Ministry of Industrial (2)
- Ministry of Science and Technology
- Technology Universities
- Research Centres
- Financial Institutions
- Industrial Zones
- Non-Governmental Organizations

C. Industrial development

Myanmar Industrial Development Committee

The State Peace and Development Council (SPDC) had formed the Myanmar Industrial Development Committee (MIDC) in 1995 with 15 Ministries as members and 2 Deputy Ministers as Secretary and Joint Secretary. The Committee then organized a Working Committee (MIDWC) with the Minister of Ministry of Industry (2) as Chairman and the Director-General and Director of the Directorate of Myanmar Industrial Planning as Secretary and Joint Secretary respectively.

The objectives of the MIDC are given as follows:

- Development of industrial with agriculture as the base
- Enhancement of quantity and quality of industrial products
- Increased production of new types of machinery and equipment
- Production of machinery and equipment for industrial use
- Creation of suitable conditions for the changing over to an industrialized state.

The Working Committee implements all the tasks laid down by the MIDC with assistance of the following nine Subcommittees:

- Production of Agricultural Machinery & Equipment
- Standardization & Quality Improvement
- Drafting of Industrial Laws
- Small-Scale Industries Development
- Industrial Information
- Human Resource Development
- Motor Vehicles Production Supervision
- Iron and Steel Development
- Industrial Research Development & Dissemination of Technology Information

D. Science and technological development

For the development of science and technology in Myanmar, the Science and Technology Law was annexed in 1994. Initially, Myanmar science and technology development works are done under Applied Research Institute. The Union of Myanmar Applied Research Institute Act 1954 is repealed in 1994.

The main objectives of the Science and Technology Development Law are as follows:

- To carry out development of science and technology for promotion of industrial production contributing towards the National Economic Development Plan.
- For providing guidance and supervising the S&T development works and R&D activities conducted by government organizations.

Establishment of the National Council for Science and Technology Development is mentioned in the law and also coordinating the S&T development works and R&D activities of governments, non-governmental organization and private sectors is clearly mentioned in the council objectives.

(1) Ministry of Science and Technology

In order to promote effectiveness and success in the development of science and technology, the Ministry of Science and Technology was established on 2 October 1996. The Ministry of Science and Technology is based on Myanmar Science and Technology Research Department which carries out research and development work for the development of the nation's industry since 1954.

Departments under the Ministry of Science and Technology are:

- Myanmar Science and Technology Research Department
- Industrial and Vocational Education Department
- Advance Science and Technology Department
- Nuclear Energy Department

Technological Institutions under the Ministry of Science and Technology are:

- Technological Universities
- Government Technical Colleges

- Universities of Computer Studies
- Government Computer Colleges

(2) Ministry of Education

The Ministry of Education of the Union of Myanmar in consonant with the motto "Building a modern, developed nation through Education" has adopted on effective agenda and appropriate strategies to harness education for the advancement of the nation. With the aim of further developing the education sector, in particular to strive for the development of qualified human resources and to introduce regional human resource development programmes, the Ministry of Education formulated the Special Four-Year Plan for Education (2000 - 2001 FY to 2003 – 2004 FY) with the conviction that education plays a pivotal role in the national, economic and social development programmes. The Special Four-Year Plan for Education (Higher Education Subsector) focused on the five core areas: promotion of the quality of education, introduction of electronic education, advancement of research, development of a lifelong learning society and enhancement of international collaboration. Many universities and colleges are opened during this period.

(3) Research Centres

In Myanmar, quite a number of research centres are doing research works under different ministries and different institutions, some of the research centres of Myanmar are mentioned below:

- Food Technology Research Centre
- Agricultural Research Centre
- Rubber Technology Research Centre
- Pharmaceutical Research Centre
- Yangon University Research Centre
- Myanmar Science and Technology Research Centre
- Irrigation Research Centre

Financial Institutions are as follows:

- Government Economic Banks
- Myanmar Industrial Development Bank
- Myanmar Foreign Trade Bank
- Myanmar Investment and Commercial Bank
- Private Banks

(4) Industrial Zones in Myanmar

For the development of SMEs and related industries, Myanmar Industries Development Committee designated 19 industrial zones in those areas where there exist substantial number of private industries. Each industrial zones are managed by a zone management committee. The industrial zones now in existence are as follows:

- Yangon East District Industrial Zone
- Yangon West District Industrial Zone
- Yangon North District Industrial Zone
- Yangon South District Industrial Zone
- Mandalay Industrial Zone
- Myinchan Industrial Zone
- Meikhtila Industrial Zone
- Monywa Industrial
- Yenanchaung Industrial Zone
- Pakokku Industrial Zone
- Bago Industrial Zone
- Pyay Industrial Zone
- Myaungmya Industrial Zone
- Hinthada Industrial Zone
- Pathein Industrial Zone
- Myeik Industrial Zone
- Taunggyi Industrial Zone
- Mawlamyine Industrial Zone
- Kalay Industrial Zone

The following government agencies are actively involved in the development of SMEs in Myanmar: Small and Medium-Scale Industries Development Subcommittee (Myanmar Industrial Development Committee); Directorate of Industrial Supervision and Inspection (Ministry of Industry 1); Directorate of Myanmar Industrial Planning (Ministry of Industry 2); and Cottage Industries Department (Ministry of Cooperatives).

The following non-governmental organizations are actively involved in the development of SMEs in Myanmar: Myanmar Industrial Association (Union of Myanmar Federation of Chamber of Commerce & Industry); and Myanmar Small and medium-scale enterprise Committee (Myanmar Engineering Society).

E. Issues and challenges

It was recognized that SMEs and SMIs sector consisted of different types of enterprises. Thus, their problems are equally varied and complex depending both the sectors they are in and their level of development. The following are the issues and challenges of SMEs in Myanmar:

Issues:

- Inadequate level of technology and managerial skill
- Lack or inadequacy of R & D, difficult access to technological information
- Use of obsolete machineries
- Low level of productivity
- Inadequate access to financial institutions

Challenges:

- Increasing imports, global competition
- Emergence of new technologies and its impact
- Increasing costs which impact on export competitiveness

Towards establishing innovation system

In order to improve our current position and situation it is convinced that, we do need a proper innovation system to suite our local condition and environment. According to the paper on "The Finish National Innovation System", the innovation system consist of the following actors and sectors: General policy framework; S&T Policy formulation, financing and co-ordination; R&D facilities and institutions; R&D performers; Knowledge and technology transfer; and Good and services producers.

F. Conclusion

For having a sound innovation system for Myanmar, we need to find out where the draw backs are in our country. We are lacking behind in many areas. We are limited in Human Resources, Financial and Technology. We need more coordination, collaboration but we are quite weak in this area. Dedicated institutions are urgently needed. Detail study for formulating the National and Subnational Innovation Systems are immediate need for the development of SMEs. Sound policies to enhance competitiveness and capacity-building for SMEs, should be laid down for the year to come, after studying and review of the past performance of its own and good practice of others.

Figure 4.6 Map of Myanmar

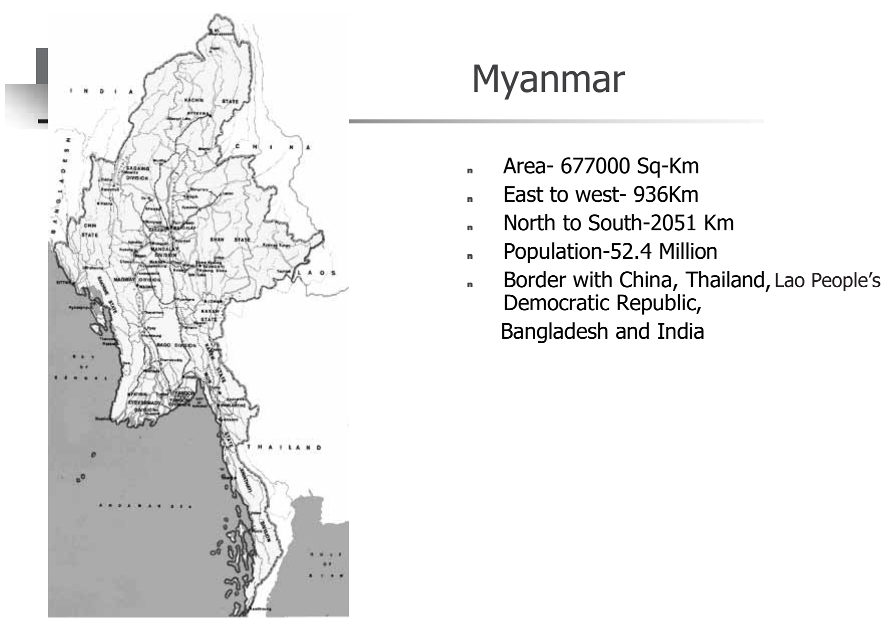


Figure 4.7 Change of the Government budget

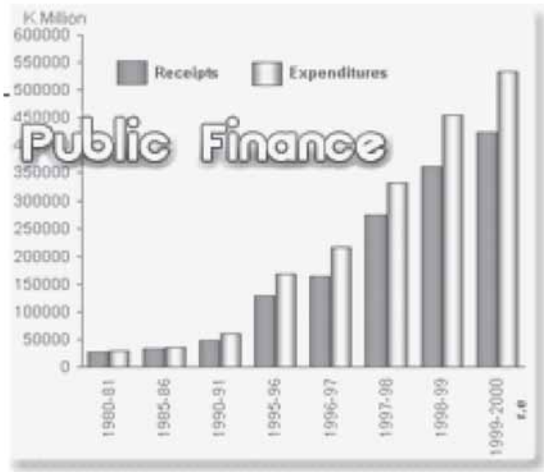


Figure 4.8 Salient indicators of Myanmar's economy

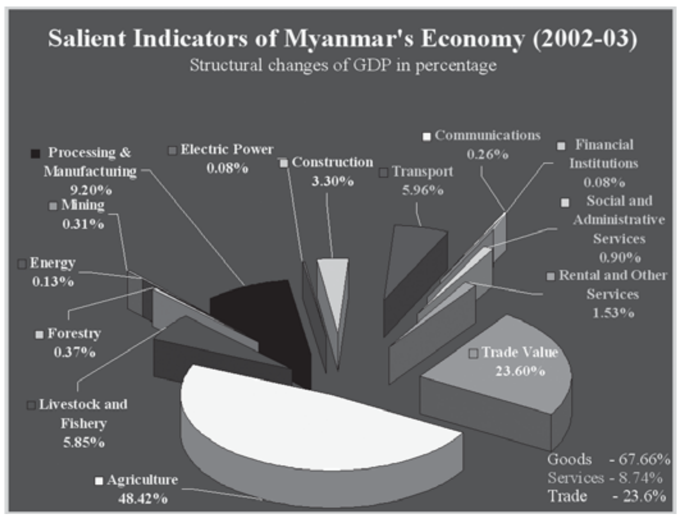
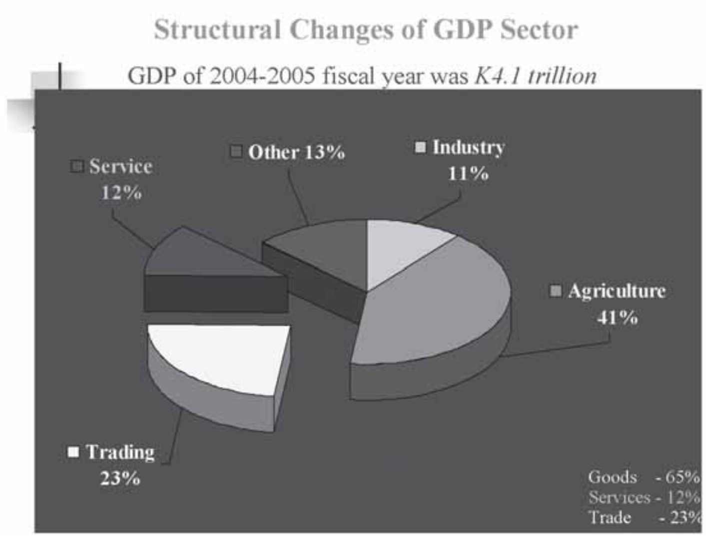


Figure 4.9 Salient indicators of Myanmar's economy



IX. NEPAL[10]

A. General background

Nepal is a beautiful country situated in the mid-Himalayan Mountain section of Asia. It borders Tibet on the north and India on the east, south and west. It is a landlocked country situated at a distance of about 1,120 km from the nearest sea i.e. Bay of Bengal. The country extends from 26^0 22' N to 30^0 27' N latitude and 80^0 4' E to $88^0$12' E Longitude.

Nepal has a total land area of 147,181 sq km. that is 0.3 per cent of the total land of Asia and 0.03 per cent of the total area of the Earth. Its east to west extension is nearly 885 km and north to south average extends is 193 km. However its breadth varies from the maximum of 241 km on the west to 145 km in the middle. Topographically Nepal is divided into three zones: (i) the Snow Capped High Himalayas; (ii) the Mountainous region including long terraces & fertile valleys; and (iii) sub-tropical plain Terai Region.

The high Himalayan region extents in the north of the country consisting the world famous peaks like Mt. Everest (8,848 meters), Kanchanjunga (8,586 meters), Makalu (8,463 meters) and many others. There are 8 highest peaks among 10 highest peaks of the world. The highest point of the country is Mount Everest (8,848 meters), which is highest peak of the world. To the south of the great Himalayas, there lies Mahabharat range of elevation about 2,000~3,000 meters. Siwalik hills, south of the Mahabharat range with average elevation of 1,000 meters to 2,000 meters. And south of Siwalik range there is plain Terai region.

B. Economic situation

The population of the country is 25.3 million (2005 projection) which is growing at a rate of 2.2 per cent per annum. Estimated per capita GNP for the year 2005 is US$ 300. Nepal is one of the least developed countries in the world. Its economy is largely dependent on agriculture and tourism sector. The composition of Nepalese economy can be broadly divided as Agriculture sector 40 per cent; Commercial sector 10 per cent; Industry sector 10 per cent out of which, Small and Cottage Industries are nearly 90 per cent, and rest 40 per cent are service sector and others. Literacy of population in 2001 was 54.1 per cent.

Of late, because of influences of outer world and the government's initiative, manufacturing industries in Nepal started making notable progress. Industrialization is a key factor in the process of economic development. Being an agrarian country, manufacturing sector is dominated by agro-based and forests-based industries of consumer goods. Besides these, there has also been establishment of manufacturing units of construction materials like cement, iron bars, bricks, stone crushing as well as textile, packaging and others. Nepal has attained nearly a self-sufficient stage in some consumer and construction materials. And at the same time the import of foreign consumer goods is growing faster. In the process of industrialization, the foreign capital

[10] *This paper was prepared and presented by Mr. Tej Raj Shakya, Director General, Department of Cottage and Small Industries, Ministry of Industry, Commerce and Supplies, Tripureshore, Kathmandu, Nepal.*

investment and transfer of technology is found insignificant. In Nepal, despite repeated emphasis on productivity and quality improvement, remarkable and sustainable results are not visible. Less than 30 per cent of registered industries are only running in satisfactory level. This is the loss of resources, efforts and time.

However, during the past four decades of planned development in Nepal, the proportion dependence on agriculture and non-agriculture sector have not changed significantly. Limited agricultural land and natural resources to support the growing population signifies serious social and economic problems associated with the weak capacity of the manufacturing and service sectors of the economy in absorbing the surplus population which is increasing in the agriculture sector. The situation is quite worst in rural economy of the country. Thus, promotion and development of sustainable and local resources based micro and SMEs might be reliable option for the economic development of the country.

Classification of industry:

Industrial Enterprise Act 1992 has classified industries in terms of investment as below:

- ***Large industries:*** Industries with fixed assets of more than 100 million rupees shall be termed as large industries.
- ***Medium industries:*** Industries with fixed assets between more than 30 million rupees to 100 million rupees shall be termed as medium industries.
- ***Small industries:*** Industries with fixed assets up to an amount of 30 million rupees shall be termed as small industries.
- ***Cottage industries:*** Traditional industries that utilize specific (indigenous) skills or local raw materials and resources, labour-intensive and are based on national tradition, art and culture and industries shall be termed as cottage industries.
- ***Microenterprises:*** In addition to the above-mentioned classification to address the issues of poverty reduction, create employment and income opportunities in rural areas, the government and UNDP have initiated Micro-Enterprise Development Programme (MEDEP). The goals of this programme are: Poverty reduction of low-income families by means of self-employed microenterprises; and Capacity-building and development of service delivery mechanism to promote microenterprise.

In the Nepalese context, large & medium industries are considered as large enterprises and small & cottage industries are considered as small enterprises. Therefore, by most of the entrepreneurs generally refer small & cottage industries as SMEs.

Industrial Enterprise Act 1992 has classified industries as:

- ***Manufacturing industries:*** industries that produce goods by utilizing or processing raw materials, semi-processed materials, by-products or waste products or any other goods.
- ***Energy-based industries:*** industries which generate energy from water resources, wind, solar, coal, natural oil, gas, biogas or any other forms of such resources.

- ***Agro- and forest-based industries:*** enterprises mainly based on agriculture or forest products such as integrated sericulture and silk production, horticulture and fruit processing, animal husbandry, dairy industry, poultry farming, fishery, tea gardening and processing, coffee farming and processing, herbs processing, vegetable seed farming, mushroom farming, vegetable farming or processing, tissue culture, greenhouse, bee keeping, honey production, floriculture, and forestry-related enterprise such as lease-hold forests, agro-forestry etc.
- ***Mineral industries:*** Mineral excavation or processing thereof.
- ***Tourism industries:*** tourism, lodging, motel, hotel, restaurant, resort, travel agencies, skiing, gliding, water rafting, cable car complex, pony-trekking, trekking, hot air ballooning, parasailing, golf-course, polo, horse-riding, etc.
- ***Services industries:*** Services industries include workshop, printing press, consultancy service, ginning and bailing business, cinematography, construction business, public transportation business, photography, hospital, nursing home, educational and training institution, laboratory, air services, cold storage, etc.
- ***Construction industries:*** Industries such as road, bridge, ropeway, railway, trolley bus, tunnel, flying bridge, industrial/commercial and residential complex construction and operation.

C. Policy implication on promotion of industrial sector

Industrialization offers prospects for the expansion of employment and income. At the same time, it helps to create the idea on the innovation and better technology changes that brings production improvement there by accelerating the growth of productivity and quality. This is the one of the objectives of 10th Five-Year (2002-2007) Plan of Nepal, which is now in implementation.

Objectives of Tenth Plan of Nepal in Industry Sector (2002-2007)

The Plan, being the first one leading to the twenty-first century and the new millennium, is destined to enhance the concept of developing cultured, competitive, affluent and equitable Nepali society reflecting the ultimate aspirations of Nepal and Nepali People at large. The Plan attends to encompass strategic development of poverty alleviation and the objectives are as follows:

- To increase the contribution of the industrial sector in GDP by promoting and facilitating the private sector;
- To contribute to poverty alleviation goal by increasing the income and purchasing power of the rural people through employment generation in the micro, cottage and small-scale industries; and
- To increase industrial competitiveness by attracting FDI and adopting appropriate technology.

The Government of Nepal has adopted an open and liberal policy to pave the way for the accelerated economic and social development of the country. Especially in the field of industry and trade, the government policy is aimed at giving the private sector a dominant role. The private initiatives and enterprises are expected to increase efficiency and productivity. The government's role will be that of a facilitator providing infrastructure and a favourable environment conducive for investment.

The Industrial Policy places an emphasis on simplification of procedures, transparency in implementation and improvement of productivity through the upgrading of technical know-how and efficiency of the industries in order to complete in the free and competitive world market by utilizing comparative advantages of the country with minimum adverse effects on environment.

D. Current status of SIS and SME technology capacity-building in Nepal

1. Background

SMEs are an integral part of the economy all over the world. In many developing countries SMEs have played a significant role in the economic development. It is the fact that the importance of SMEs is contributing to job creation and output growth is now widely accepted in both developed and developing countries. In Nepal also cottage and small industries play a pivotal role to accelerate economic development of the country through income and employment generation activities. Even then SMEs in Nepal are unorganized, informal and traditional. Therefore it is utmost urgent to give an emphasis in promoting and developing SMEs in a country like Nepal where the unemployment rate is greater in scale. Now, in order to remain in this competitive world, SMEs must be aware of venture business because it has high innovation potential, high market share and sustainability.

Dynamic SMEs tend to survive longer than most SMEs and create jobs that yield higher return, thus multiplying their impact on economic growth. Due to many reasons even the good policy framework for enterprise development, globalization and opening of domestic market as part of liberalization policies the enterprise structure in many countries has not benefited. In particular SMEs are continually losing ground in terms of their competitiveness.

Entrepreneurship development, particular the growth of SMEs, is still constrained. Factor such as landlocked position of the country, low incomes and lack of capital and technology have resulted in the slow pace of development growth oriented SMEs. Other constraints include problems of access of inputs, marketing etc.

Technological development with fast changing environment has emerged enormous pressure of competition on SMEs. The increasing number of bankruptcies and the shrinking number of enterprises prove this clearly. Changing demands and needs and an intensified competition are the most mentioned reasons for open up new markets. Hence in these respect venture business support programmes are very essential.

The process of globalization and liberalization, combined with rapid advances and communication technologies, are creating new dynamics of production, enterprise development and international competition. Any government is concerned about promoting venture business for developing SMEs and should therefore carefully examine the impact of its existing policies and programmes for developing enterprises.

In Nepal, the government adopted more open, market oriented and private sector led policies. Consequently, wide-ranging trade liberalization and substantial reforms in industrial policies were initiated through the trade policies and Industrial Enterprise Act of 1992. The reform encompassed privatization, deregulation, delicensing, export and import liberalization. Developments of information technology, along with incentive for foreign investment, were considered vital for the effectiveness of these policy measures. The foreign investment and one windows policy and foreign investment and technology transfer act were also initiated in 1992.

The overall awareness on the role of technology in the development of industrial and other business activities has been quite low in Nepal. The entrepreneurs until now seem to be satisfied with the status quo and there is not much enthusiasm for future growth. The opening of markets and immediate threats from vast range of products and services coming from neighbouring countries, India and China, that compelled business people to seek cost effective technology.

2. Institutional framework for SMEs technology capacity-building

Some of the government and private sector organizations directly or indirectly involved in SMEs technology capacity-building in Nepal are discussed below:

Government organizations

The prominent government organizations that regularly conduct enterprise development programmes and provide necessary support are as below:

- The Department of Cottage and Small Industry (DCSI)
- The Cottage and Small Industry Development Board (CSIDB)
- The Industrial Enterprise Development Institute (IEDI)
- Department of Commerce
- Department of Industry
- Export Promotion Board
- Trade Promotion Centre
- Micro-Enterprise Development Programme (MEDEP)
- National Productivity and Economic Development Centre (NPEDC)

The Department of Cottage and Small Industry and Department of Industry are the main government agencies for enterprises development. As the name suggest DCSI provides supports only to cottage and small industry. DCSI activities focus on entrepreneurship development and small enterprise promotion through training in business creation, business management, skill training programmes and technical consulting services. In addition, the NPEDC and the Industrial Enterprise Development Institute (IEDI) are also responsible for dissemination of information technology to small enterprise, business management and consultancy services. The Export Promotion Board is the main agency for export facilitation. In addition the Trade Promotion Centre encourages large and small enterprise to identify potential supplier for the SMEs sector. It organizes SME trade fairs, publishes directory of SMEs and facilities interactions between large and small enterprises.

Private sector institutions

Most of the private sector organizations, actively involved in enterprise developments are either federations or associations of entrepreneurs and businessmen. There appears to be very few other private organizations that specialize in the field of enterprise development. Some of the major organizations of the private sector actively involved in enterprises development are as follows:

- Federation of Nepalese Chamber of Commerce and Industry (FNCCI)
- Federation of Nepalese Cottage and Small Industry (FNCSI)
- Nepal Chamber of Commerce (NCC)
- Federation of Women Entrepreneurs Association of Nepal (FWEAN)

Technology acquisition, adaptation and transfer to SMEs

Technology transfer and development is the use of knowledge and when we talk about transfer of technology, we really mean the transfer of knowledge. Transfer does not mean movement or delivery; transfer can only happen if technology is used. So, it is application of technology and considered as process by which technology developed for one purpose is used either in a different application or by a new user. Technology transfer is usually considered as dissemination of information, matching technology with needs and creative adaptation of items for new uses. It equally applies in the context of Nepal too.

Organizations involved in technology transfer and development

In Nepal there is no strong institutional mechanism developed solely for technology transfer in the SME sector but various institutions are found involved, in some way or the other, in the field of technology development and transfer in general. Such organizations can be found in the government, non-government and private sectors. But the majority of them are involved basically in skill development training for cottage and microenterprises level based on the human resources and physical infrastructures available. It is observed that national priority areas for science and technological research and development (R&D) have not yet been adequately determined. On the other hand, the science and technology-related organizations are not in a position to contribute significantly even in areas indicated by the state policies due to lack of adequate budgetary support from the government. Their yearly budget reveals that the fixed cost is far more than that of programme budget. As a result, even the capable public sector organizations appear to have involved in donor-supported small projects (international non-governmental organizations' aid projects) as and when asked for, rather than working on a long-term basis on the national priority areas.

Despite the non-existence of strong technology transfer mechanism within the country, there are many examples of technology transfer and foreign investment in public as well as private sector companies. The technology transfer in public companies was arranged through government-to-government agreements, while such agreements in the private sector are found to have materialized through negotiations between technology recipient and provider companies. Though not directly related to the SME sector, technology development and transfer/diffusion in the alternative energy sector in Nepal appears to be remarkable. These technologies, particularly including the biogas, solar power and micro-hydro power plants, spread to several districts in Nepal. Spread of these technologies has been made possible from various foreign assistance projects.

Short description of the activities of some national level technology related institutions/ organizations are outlined below:

(a) **Ministry of Environment, Science and Technology:** The Ministry of Science and Technology is the apex body within the government in the field of environment science and technology (S&T) development in Nepal. Ministry is in the process of formulating S&T policy. There are some foreign assistance projects which are affiliated with this Ministry. However, there is no technological infrastructure established yet within it.

(b) **Royal Nepal Academy of Science and Technology (RONAST):** This academy was established in 1982 for contributing to the development of the nation in the S&T sector. However, its contribution to industrial development is not noticeable. Although, the human resources of RONAST consist of a number of scientists and technical experts in different scientific disciplines, it is reported that the academy is not able to contribute significantly in the field of technology development and transfer due to budgetary constraints. The academy is occasionally involved in small donor supported projects in the field of alternative energy and other technology development.

(c) **Research Centre for Applied Science and Technology (RECAST):** RECAST was established in 1976 under Tribhuvan University with an objective of undertaking research and development in the field of S&T. It has human resources as well as fairly developed physical facilities (laboratories) for some specific scientific work. Despite the availability of physical as well as human resources, it is learnt that the Centre could have made significant contribution in technology transfer and development, particularly in the SME sector.

(d) **Nepal Agricultural Research Council (NARC):** NARC was established in 1990 for the research and development in the agriculture sector. The Council has physical and human resources (scientists) in different disciplines of agriculture science. Obviously, the Council's research activities are focused on agriculture field, hence there is not much contribution made to the SME sector. However, the Council can possibly make substantial contribution to agro-based industry development.

(e) **High-Level Commission for Information Technology (HLCIT):** HLCIT is an apex body formed under the chairmanship of the Prime Minister of Nepal with a view to providing crucial strategic direction and helping formulate appropriate policy responses for the development of ICT sector in the country as well as harnessing these technologies to meet key developmental challenges including governance reform and catalysing economy growth for poverty reduction. The key objective of the commission will be to oversee the implementation of National IT Policy and strategy as well as to provide strategic policy direction and support to the government in concert with its vision to build a knowledge-based society by creating enabling environment for the development and growth of knowledge based institutions and industries. The operational ambit of the Commission will also include playing a key role in formulation of appropriate policy instruments in concert with the dynamism that characterizes the ICT sector and strategies aimed at harnessing information and communication technologies for development, economic growth and poverty reduction.

(f) **Other organizations:** Apart from the above, there are a number of organizations in the public, non-governmental organizations and the private sector involved in technology improvement in enterprises as well as in other areas. Giving details of all of them is out of the scope of this paper. To name few of them, the Department of Cottage and Small Industries and Cottage and Small Industries Development Board under MoICS have network all over the country, and are involved primarily in technology transfer through skill development training programmes. Similarly, the Intermediate Technology Development Group (ITDG) is one of the international non-governmental organizations which is mainly involved in the alternative energy, food industry and rural transportation sector. Furthermore, the Asia Network for Sustainable Agriculture and Bio-resources (ANSAB), a non-governmental organization involved in the bio-resources conservation, is actively engaged in non-timber forest products-based enterprise promotion through dissemination of technical and market information to the small entrepreneurs. But most of these organizations are primarily involved in skill development training programmes, and lack adequate physical infrastructure and human resources (technologists/scientists) for technology transfer (from abroad), adaptation and innovation.

Technology transfer in industrial sector

(1) Legal provisions

As part of the modernization drive the country has opened to direct foreign investment and other types of technology transfer from abroad. Legally speaking the only law that governs technology transfer (from foreign countries) in Nepal is the Foreign Investment and Technology Transfer Act 1992, which has laid down the regulations and rules governing foreign investment and technology transfer.

This Act defines technology transfer as any transfer of technology to be made under an agreement between an industry and a foreign investor on the following matters:

- 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 service.

Looking at the definition adopted by the Act, technology transfer encompasses a broad range of know-how transfer including management and consultancy services. However, the Act appears to be more focused on foreign investment than on technology transfer as such. Except for the legal provisions contained in the above Act, there is no other legal framework that governs and promotes technology transfer to Nepal. However, it is learnt that S&T policy is being formulated by the Ministry of Science and Technology. A number of facilities and concessions have been provided to foreign investors as per the Foreign Investment and Technology Transfer Act. Such facilities include:

- Except for the projects listed in the negative list, 100 per cent equity participation by foreigners is allowed in almost all sectors. The industries listed in negative list are cottage industries.
- Technology transfer is allowed even in projects where foreign investment is not allowed.
- Firms established with foreign participation are treated equally as 100 per cent Nepalese-owned firms.
- Interest paid on loans obtained from foreign source is tax free.
- Income from royalty and technical management services is levied a standard tax rate of 15 per cent.
- Residential and business visa is provided for foreign investors and their dependents.
- Non-nationalization of industry is assured.
- Provision of dispute settlement between the contracting parties.
- Expatriate employees in firms with foreign equity can take back up to 75 per cent of their salary income abroad.

(2) Status of technology transfer and foreign investment projects

Most of the technology transferred to Nepalese industries in the past was in the form of turnkey plants to the state sector, financed through international aid and/or loans. However, in the latter years, many large and medium-scale industries have been established with foreign collaboration in the private sector as well. This has taken place through a variety of mechanisms such as direct foreign investment via joint ventures, technical collaboration, import of machinery and equipment, technical assistance through human resources, etc. While these are more formal modes of technology transfer, a lot of technology gets transferred informally through books, journals, promotional literature and personal contacts. As many Nepalese industries, particularly in the small and cottage industry sector, use Indian machinery and equipment, the informal mode of technology transfer is more prevalent in such industrial units. It is difficult to find out, thus, not only the level and extent of informal technology transfer, but even the numbers of such units, as the details regarding technology transfer are not found in the government records. The only data available relating to technology transfer agreements is of the companies for which permission is sought under Foreign Investment and Technology Transfer Act.

Intellectual property rights (IPR) regime in Nepal

The evolution of IPR in Nepal dates back to the Patent, Design and Trademark Act 1937. Later the Act was replaced with another Act with the same name in 1965 and it was amended in 1987. Even the new Act is more comprehensive than the earlier one people are not much more aware about the compliance of intellectual property rights. Hence, so to say, the protection of intellectual property is very poor.

The industries using trademark on their products can register trademarks as per patent, design, and Trademark Act, 1965. The Department of Industries (DOI) under Ministry of Industry, Commerce, and Supplies is the designated organization to administer aspects related to the intellectual property rights. The registration summary statistic of Intellectual property (Trademark, Patent, Design from the beginning to fiscal year 2004/2005 (2061/62 B.S.) is mentioned in the following table.

Fiscal year	Trademark			Patent			Design		
	National	Foreign	Total	National	Foreign	Total	National	Foreign	Total
Up to 2004/05	13,288	8,445	21,733	26	31	57	12	35	47

Technology Park and IT Park

With increasing demand of IT related business and possible benefits that could result from clustering such businesses so as to maximize, efforts aimed at ensuring their growth and development, vision of IT park come into existence in the last decade to set up a virtual technology park. Establishment of IT Park will serve the long-term national interest of Nepal. A major indirect benefit will be the creation of a dedicated IT base, which will help Nepal in getting a due share of growing International Market in software and enabled services. Objectives of these parks are as follows:

- To facilitate the promotion, development, and export of computer software and other ICT related products and services.
- To prepare skilled human resources and help develop software-related expertise and create working environment in the field of IT.
- To attract national and international agencies to set up their information-based activities including foreign investment in IT sector.
- To create model IT Park to promote private entrepreneurs to invest on such parks in other areas of the countries.
- To provide one-window service to entrepreneurs in the software and development field.
- To encourage Non-Resident Nepali (NRN) investment in IT sector.
- To facilitate research and development in IT sector.

E. Challenges, opportunities, problems of the SMEs technology capacity-building

The numbers of challenges, opportunities and problems in the SMEs technology capacity-building of Nepal are enumerated in the following areas:

Technological development

The process of technology development must be a larger framework, because technology is applied in a productive system and this will progress the existing socio-environment of the country. In Nepalese context most of the applications of technology are conventional. Thus depth information about different technologies and identifying better options should be exercised.

Most of the Nepalese entrepreneurs are not aware of technology assessment because of lacking knowledge about the trend of technological change. Even if they afford to do so, there is a lack of appropriate mechanism as well as human resources required for this purpose. It is therefore, an appropriate system with dissemination of technological information should be provided in order to enhance the capacity of Nepalese SMEs.

The technological developments in the developed countries are in higher level and those countries have invested much more for innovation and achieved success. In this regard it is great opportunities for the developing countries to adopt the technologies with appropriate means of technology transfer. In Nepal's context, there is need for appropriate mechanism for technology adaptation, reproduction/modification, innovation and absorption, which in turns will be easier and cheaper build nation's technological capability.

Innovation is inevitable for the technology development and this should be played roll by SMEs at the firm level. However SMEs of Nepal could not create technology creation mechanism due to limited resources, therefore it is necessary on the part of the government and private sector to built necessary technology infrastructures. Adaptation of technology and innovation of new technology is not happening in Nepalese industrial sector due to lack of R&D facilities, capital etc. Nepal felt urgent need for the supporting and developing the existing science and technology-related organizations.

Technical manpower

Numerous institutions in public sector including The Cottage and Small Industries Training Centre and private sector are providing technical and vocational training. The lack of adequately trained manpower for operation and maintenance of imported machinery is a serious problem in several industries. Inadequate training of technical people of the industries from technology suppliers is one of the causes to handle and maintain the technology transferred to Nepal. This has led to dependency on foreign experts even to run and maintain the machinery, which is expensive and is not affordable by most of the large-scale industries. Thus one way to resolving this problem is to ensure training programmes included in the technical contracts.

Research and development

Nepal is far behind in the research and development (R&D) sector. Some institutions are involved in R&D activities in areas as agriculture, food, health, forestry, quality and standardization, and applied science and technology. The most of the R&D activities are supported by government initiatives. Despite capability built-up in SMEs, science and technology, and R&D has been emphasized in National development plan. Nepalese SMEs and government could not practically concentrated on theses areas. The investment in this sector is almost negligible.

Information technology

Nepal is still at the initial stage of IT development, but recent trends indicate growing prospects. The present progresses in respect to IT related services are mainly available to Kathmandu valley and other major cities only. The government has emphasized the great importance of IT development in the country and recently the information technology policy has been formulated to create conducive environment in making information technology accessible to the general public and increase employment through this means. It also emphasized in building a knowledge-based society, and also establishes knowledge-based industries. The policy has already been made effective however; effective implementation of the Act is not secured.

Policies and plans

The main legal frameworks are Industrial Policy 1992, Industrial Enterprise Act, 1992 and Foreign Investment and Technology Transfer Act, 1992 but it has been able to attract foreign investor to some extent only. In the context of innovation/business creation these acts do not clearly mentioned the provisions for the innovation/business creation strategies. Thus Nepal has to develop separate Act for innovation/business incubation issues.

Policy implementation has found ineffective mainly due to influence by the political instability, within 15 years of period, the country witness numerous changes of government. Political turmoil has resulted in frequently changes of key decision maker and thus resulted in interruptions, delays and bottlenecks and reversal of reforms etc. Consequently, the situation has created low confidence to the private sector investor.

Other issues

Entrepreneurship development in order to build the capacity of the SMEs is still constrained. The other factors such as landlocked position of the country, access to input and marketing, low income, lack of capital, and adoption of modern technology, non-existence of national innovation system, infant stage of business incubation activities, lack in fostering human resources etc. are some of the major reasons in resulting the slow pace of development or growth in SMEs.

F. Future plan and prospects

Measures to overcome challenges and problems

Despite SMEs play important roll in the development of the national economy in Nepal there is not strong entrepreneurial culture. Low technical capabilities, inadequate finance for entrepreneurial companies and weak international profiles of Nepalese are the major obstacles securing a supportive SME environment. Based on the current scenario of the country the following are some of the measures to be taken in regard to innovation and SMEs development:

- A separate policy need to be formulated so that coordinated and functional structure for innovations can be formed.
- Developing local/ regional action plans for innovation.
- Fostering better conditions for SME growth and entrepreneurial activity.
- Strengthening the supply chain of financial sources.
- Facilitating foreign direct investment.
- The private sector possess wealth of entrepreneurial drive, financial resources and intellectuals personnel it is therefore these assets should be levered with policy action to strengthen business conditions and growth prospects for SMEs.
- Increase level of education among Nepalese.
- Include entrepreneurship courses in schools and universities.
- Increase awareness of innovation, business incubation among Nepalese SMEs.
- Increase availabilities of SME support services.
- Improve national ICT infrastructures.

Policy and strategies for promoting SMEs

Nepal has felt importance on major three prongs strategic approach for promoting and developing SIS and SMEs competitiveness:

- Revitalizing the traditional attitude of entrepreneurs to the modern business dynamics.
- Supporting for creation of new venture businesses.
- Improving the sustainability of the existing enterprises and newly created enterprises through capacity-building.

Business incubation as a catalyst for promoting SIS and SMEs

The business incubation is a new concept for Nepal. The government is in a position to establish a Technology-based Business Incubation Centre for the Growth of Venture Business. Recently government has allocated budget as seed money for the development of Business Incubation in order to gear up development and venture business activities. With the various discussion and reports it is identified the need to focus on business incubation in order to produce successful business entrepreneurs. Business incubation, which is a process of converting ideas into enterprises, provide support services to marketing, management, training counseling and finance to start up enterprise and potential entrepreneurs with innovative ideas. The department is taking initiative to operate technology-based incubation centre in full fledge. However, the business incubation activity in Nepal is in infancy state.

Venture business

Venture businesses are innovative, R&D intensive enterprises. Normally, this could be identified by evaluating firms' R&D intensity and the share of new product development in relation to turn over. R&D intensity is measured by the share of the R&D expenses in respect to turn over. In this concept Nepalese SMEs and government virtually not realized the importance of investment in R&D despite all positive policy formulation.

Venture capital

Venture capital is an essential tool to commercialize innovative entrepreneurial ideas. The raising of required funds is must for the venture capital motive and the conventional financial sector may not fulfill the current need. It is therefore the clear-cut laws, regulatory provisions and institutional arrangements need to be developed for the introduction of venture capital which can be a catalyst for enterprise growth and innovation. In this regard, it is suggested the following recommendations.

A venture capital fund should be established on the basis of equal participation from the private and public sector. In this regard, the government and the private sector, preferably all the national level commercial and development banks make equal contribution in setting up an initial venture capital fund. Necessary regulatory and legal framework should be created to govern venture capital investments. In this regard the internal resources of the country are quite low. The external assistance is also desirable.

Recommendations and suggestions

- Regular interactions between concern agencies and beneficiaries and target groups can be a good mechanism in order to avoid contradictions among various sectoral policies.
- Effort should be more focused and coordinated to develop business incubation centre in true sense.
- A situation has to be created in which the business community invests in R&D for the development and commercialization of technology and skills.
- Networking among various agencies and promotion activities are crucial and capabilities of the service providers need to be enhanced so as to make business development services more demand driven.
- Some of the successful business incubation or new venture business cases from outside the country need to be replicated with some adaptation.
- There is need for encouraging financial support for small, especially young enterprises.
- Incorporating mechanism for evaluating policies during their implementation.
- High-level policy exchange and learning both within and with other countries.
- Develop incentives for more R&D investment.
- Improve existing efforts to promote government and private sector initiatives.

G. Conclusion

Nepal became 147^{th} member of the World Trade Organization (WTO) on 23 April 2004. Nepal is the first LDC to complete the accession procedure by adopting its trading system. Being a WTO member country Nepal has made a number of commitments which become the major challenges and opportunities to the local enterprises especially to the SMEs. In Nepal, SMEs productivity is very low, workforce are abundant but not high skilled and efficient. Business environment, infrastructure is weak. Market access and its network is weak, proximity to market (mainly the United States & the European Union) is very weak. Availability of raw materials is the major constraints mostly due to landlocked situation. With all these considerations, Nepal is facing a strong challenge to meet sufficient capacity and technical know-how. Externally, sharing and comparing the experiences with other developing and developed countries will greatly help Nepal to overcome the impediments to having an effective competition regime. Taking up a new initiative Nepal has to be adopted the endeavours to accelerate the process toward a formal competition law and policy. Advocacy on capacity-building activities are gaining up but still a long way to go.

Nepal's policy development in favour of market-oriented economy was intended to cerate enabling business environment for mostly private sector development. Even the shift of policy towards market-oriented economy SMEs do not seem to have growth from the changes due to many reasons. In this regard, improvements are necessary to address policy measures to promote industrial development in efficient manner. The policies should encourage the progressive expansion of enterprises, and support services for entrepreneurship development and particularly technology capacity-building and innovation is necessary for the promotion of SMEs. In respect to SMEs, there is a need to develop measures for encouraging financial institution to service the SME sector. Such measures should be complemented by strengthened business development training & services and marketing know-how.

Nepal is now facing challenges associated with poor economy, low level of technology transfer, infant stage of business environment to further the industrial development and economic growth are desired at a stage where the basic foundation of political, economic, social, industrial and many more aspects are not secured. In these respects Nepal hold fragile position. However learning from the developed countries Nepal can benefit in every sectors. Particularly, the knowledge of manufacturing & trade, capital market development, R&D, technology transfer and promotion of private sector all need urgent attention and assistance in a view to develop conditions for long term development. One way for ensuring progress in technology capacity-building and innovation is joint participation and action by all the major stakeholders. In this respect the entire main stakeholder groups 'private and public' should tackle the structural as well as microlevel issues to enhance the competitiveness and technology capacity-building of the SMEs.

REFERENCES

1. Industrial Enterprise Policy 1992, Nepal.
2. Industrial Enterprise Act 1992, Nepal.
3. Foreign Investment and Technology Transfer Policy 1992, Nepal.
4. Foreign Investment and Technology Transfer Act 1992, Nepal.
5. The Tenth Plan (2002-2007), National Planning Commission, Kathmandu, Nepal.
6. Industrial Sector Study Document- unpublished.
7. Industrial Statistics, Published by Department of Industry, Kathmandu, Nepal.
8. Nepal in Figures 2005, Central Bureau of Statistics, Kathmandu, Nepal.
9. Hug, M.M., (1997), "Transfer of advanced technologies to developing countries", paper presented at the national workshop on "Promotion of New Technologies in Nepal", organized by the Royal Nepal Academy of Science and Technology, Kathmandu, 24-25 March 1997.
10. Institute for Integrated Development Studies (IIDS) (1994), Inhibitors/Barriers to the Development of Small and Medium-scale Enterprises in Nepal (Kathmandu), (2000) Strategic Alliances in SME Sector in Nepal (Kathmandu).
11. Intermediate Technology Development Group (ITDG), Nepal, Brochures and Booklets.
12. Islam, Rizwanul (ed) (1992). Transfer Adoption and Diffusion of Technology for Small and Cottage Industries, ILO-ARTEP (Bangkok).
13. Maskey, B.K. (ed.) (1999). Small and Medium-scale Enterprise Promotion through Local Capacity-Building (Kathmandu, Community Development Group).
14. Peters, Geoffrey and others (1995). Microenterprise Services in Nepal: Recommendations for USAID Involvement, GEMINI Technical Report No. 97 (New York, PACT Publications).
15. Pyakuryal, B. (1998). "Nepal's National Policies and Measures for Small and Microenterprises", submitted to the United Nations Conference on Trade and Development (Geneva).
16. Research Centre for Applied Science and Technology (RECAST). Brochures and Reports, (Kathmandu).
17. Royal Nepal Academy of Science and Technology (RONAST) (1998). R&D Investment in Nepal (unpublished, Kathmandu).
18. Shrestha, Chandi (1998), "Bidesi Lagi Kina Aakarsit Bhayena?" (Why foreign investment could not be attracted?) in Khula Bazar (Open market), (Kathmandu, March-April).
19. Documents Presented by Dr Chiranjibi Nepal, Executive Director, Industrial Enterprise Development Institute (IEDI), Kathmandu, Mr Bishwa Raj Karki, Marketing Manager, IEDI and Mr Kabya Prasad Niraula, Manager, Technology Transfer and Development Project, IEDI.
20. Storz, Cornelia. Venture Business in Japan- Protagonists of a new Economic Order? (2000).

X. REPUBLIC OF KOREA[11]

A. Introduction

1. Current economic status of the Republic of Korea

(a) GDP and trade

The Republic of Korea's GDP increased by 7.1 per cent from US$ 608 billion in 2003 to US$ 680.1 billion in 2004, registering the eleventh largest in the world. In the same year, its per capita income amounted to US$ 14,162, ranking itself the 30th in the world. In particular, the Republic of Korea's dependence on trade in light of economic growth has been increasing due to its export-oriented growth policy. As of 2004, the trade volume of the Republic of Korea reached US$ 478 billion, ranking itself the 12th in the world.

Table 4.11 GDP and per capita income (2002~2004)

(Unit: US dollar)

	2002	2003	2004
GDP	546.9 billion	608 billion	680.1 billion
Per capita income	11,499	12,720	14,162

In terms of the trade volume, the amount of export increased by 38.0 per cent (US$ 38.9 billion) in 2004 compared to that of the previous year. Export in the SMEs sector also increased by 33.0 per cent (US$ 13.9 billion) in the same period owing to the regaining of the world economic dynamism. Export of SMEs accounted for 42.1 per cent of the entire trade volume in 2003 and has been in an increasing rate since 1998 when SMEs accounted for 31.0 per cent.

Table 4.12 Export amount

(Unit: US$ billion, per cent)

	2002	2003	Jan~July 2003	Jan~July 2004
Export amount*	162.4 (8.0)	193.8 (9.3)	104.5 (17.0)	144.3 (38.0)
Conglomerates	94.1 (9.7)	112.0 (9.1)	62.3 (19.0)	87.9 (41.2)
SMEs	68.3 (5.7)	81.6 (9.6)	42.2 (14.3)	56.1 (33.0)

Note: (*) is increase rate

Source: National Statistical Office, Statistical information system (http://kosis.nso.go.kr)

(b) Industrial structure

The Republic of Korea's industrial structure has been going through a transitory phase from the manufacturing-oriented industry to a service-oriented one. The service industry takes up 92.52 per cent of the total enterprises with earnings of 44.28 per cent in sales. The manufacturing industry, in the meantime, accounts for a meager 4.75 per cent of all enterprises, but it accounts for 46.73 per cent of sales with 23.77 per cent of employment.

[11] *This paper was prepared and presented by Mr Bae Tae Min, Director, S&T Innovation System Division, Office of Science and Technology Innovation, Ministry of Science and Technology, Gwachon, Republic of Korea,*

Table 4.13 The Republic of Korea's industrial distribution (2003)
(Unit: number, per cent, billion US dollars)

	Number of enterprises	%	Number of employees	%	Sales volume	%
Mining	635	0.03	16,682	0.14	1.8	0.15
Manufacturing	112,662	4.75	2,735,493	23.77	564.3	46.73
Construction	64,044	2.70	1,719,074	14.94	106.6	8.83
Service industry	2,193,073	92.52	7,035,792	61.14	534.7	44.28
Total	2,370,414	4.78	11,507,041	100	1,207.5	100

Source: National Statistical Office, Statistical information system (http://kosis.nso.go.kr)

2. Status of R&D activities

(a) Total R&D expenditure

In 2004, the total amount of R&D expenditure invested in science and technology amounted to US$ 19.4 billion, which increased by 16.3 per cent compared to the previous year's US$ 16.6 billion. The ratio of R&D expenses per GDP was 2.85 per cent, which is an increase of 0.22 per cent in the same period. When comparing with some major advanced countries, the volume of the Republic of Korea's R&D expenditure per se still remains one-fifteenth of the United States, one-seventh of Japan, and one-third of Germany. However, in terms of the ratio of R&D expenditure per GDP comes to 2.85 per cent, which is higher than the average ratio (2.24 per cent) of OECD member countries.

(b) R&D human resources

In 2004, the Republic of Korea's human resources in R&D field (researchers, research assistants, and other supporting personnel) increased by 5.1 per cent compared to the previous year, amounting to as many as 312,314. The number of researchers increased to 209,979, which is 6.0 per cent increase compared to the previous year, and the number of researchers per economically active population 1,000 was 6.7. Meanwhile, the number of full time equivalent (FTE) that takes into account researchers' R&D participation ratio reached 156,220, which is 3.3 per cent increase compared to the previous year.

(c) Status of R&D activities by modes of firms

Looking into R&D expenditure invested by the private sector in 2004, out of the total R&D expenditure of US$ 14.9 billion, large firms accounted for 79.1 per cent (US$ 11.8 billion), SMEs 11.1 per cent (US$ 1.7 billion), and venture companies 9.8 per cent (US$ 1.5 billion) respectively. When comparing with the year 2002, the amount of expenditure used by large firms increased by 7.1 per cent, while both SMEs and venture companies decreased by 2.9 per cent and 4.2 per cent respectively. In 2004, researchers working for large companies account for 59.5 per cent (79,910 persons), SMEs 21.4 per cent (28,683 persons), and venture companies 19.1 per cent (25,707 persons) respectively.

Table 4.14 R&D expenditure & researchers per types of firms (2002~2004)

(Unit: billion US dollars, personnel)

	2002		2003		2004	
	R&D expenditure	Researchers	R&D expenditure	Researchers	R&D expenditure	Researchers
Conglomerates	7.4 72.0%	62,459 52.9%	9.3 76.4%	71,698 57.8%	11.8 79.1%	79,910 59.5%
SMEs	1.4 14.0%	28,470 24.1%	1.5 12.6%	27,390 22.1%	1.7 11.1%	28,683 21.4%
Venture Companies	1.5 14.0%	27,231 23.0%	1.3 11.0%	24,942 20.1%	1.5 9.8%	25,707 19.1%
Total	10.3 100.0%	118,160 100.0%	12.2 100.0%	124,030 100.0%	14.9 100.0%	134,300 100.0%

Source: MOST/KISTEP, 2005, the Report on Science and Technology R&D Activities

3. Status and R&D activities of SMEs

SMEs are the backbone of the nation's economy. There are over three million SMEs, which account for 99.8 per cent of the nation's total enterprises. Their employment accounts for around 87 per cent of the nation's entire employment, which registers 10.47 million persons. The number of SMEs and their employees reached 51,126 and 89,000 respectively between 2002 and 2003. The fact that the total number of employees increased in spite of the decrease of large companies' employees (decreased to 23,895 between 2002 and 2003) demonstrates that SMEs have continuously created job opportunities. SMEs' contribution to the export market reached 31.0 per cent of the nation's total export volume in 1998 and 42.2 per cent in 2003. Since 1998, their contribution to the nation's export market has increased steadily.

Number of SMEs (unit:10,000) **Employees of SMEs (unit:10,000)**

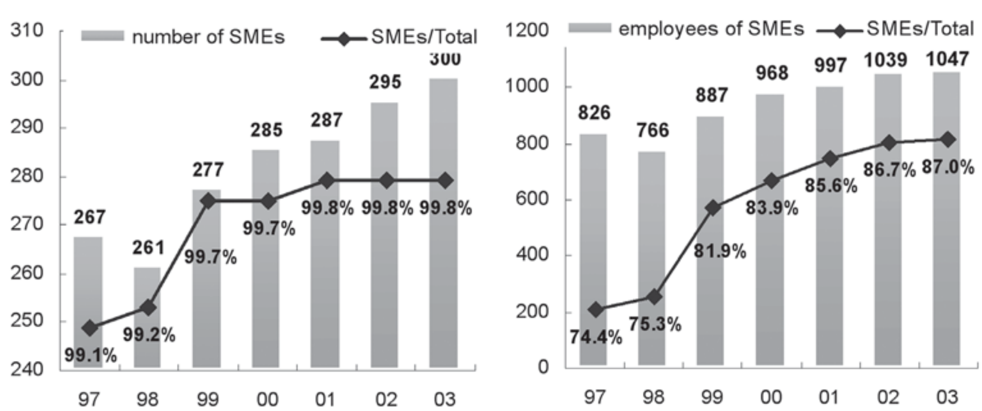


Figure 1 Number of SMEs and Employees of SMEs

As of 2003, the regional distribution of SMEs demonstrates that SMEs are centred in the Greater Seoul area; 46.7 per cent (1,401,069) of SMEs and 50.2 per cent (5,260,927 persons) of the entire employees working for SMEs are located in the aforementioned region. In terms of the number of employees, the Yeongnam region accounts for 27.6 per cent, the Honam region 9.0 per cent and the Central region 9.2 per cent respectively. The percentages show that in spite of the government's effort to stave off regional disparity in development, this predicament failed to gain much improvement.

Table 4.15 Change of SMEs by region

(Unit: per cent)

	Number of SMEs				Number of Employees			
	2000	2001	2002	2003	2000	2001	2002	2003
Greater Seoul	45.1	45.8	46.2	46.7	49.0	50.1	50.0	50.2
Yoengnam Region	29.1	28.8	28.8	28.5	27.6	27.6	27.7	27.6
Honam Region	11.1	10.7	10.6	10.4	9.9	9.2	9.2	9.0
Central Region	9.8	9.8	9.6	9.6	9.3	9.1	9.1	9.2
Others (Kangwon, Cheju)	4.9	4.9	4.8	4.8	4.2	4.0	4.0	4.0

Source: National Statistical Office, 2003 Basic Statistical Survey Report for Businesses (Dec. 2004)

R&D activities in the private sector are largely led by conglomerates. However, the post-recession era witnesses an increase of R&D activities conducted by SMEs. With respect to the changes that occurred around the time of the recession, large companies' R&D intensity (R&D investment ratio in light of sales volume) decreased from 1.56 per cent in 1997 to 1.52 per cent in 2001 while that of manufacturing SMEs showed a slight increase. However, after the dot-com bubble burst around the early 2000s, the R&D intensity of SMEs decreased.

Table 4.16 Changes of R&D investment ratio in light of sales volume

		1997	1999	2000	2001	2002	2003
R&D investment ratio in light of sales volume (%)	Manufacturing SMEs	0.63	0.47	0.71	0.99	0.85	0.78
	Conglomerates	1.56	1.77	1.47	1.52	1.72	2.02

Source: Korea Bank, Management Analysis of Businesses

Despite recent shrink of the R&D investment of SMEs, another noteworthy change is a steady increase in the number of in-house research institutes of SMEs and in the number of small and medium-sized technology development investment manufacturers. This trend demonstrates that major programmes for SMEs implemented by the Government of the Republic of Korea recently focused on supporting the R&D-intensive new technology-oriented firms and venture companies, which can be one of the key actors in the innovation-driven economy for local areas as well as for the entire nation. Such policies for SMEs are also expected to bring about strengthening of the private sector's R&D activities.

Table 4.17 Changes in R&D activities of SMEs

		1997	1999	2000	2001	2002	2003
The ratio of technology development investment manufactures out of the total small & medium manufacturers (per cent)		8.0	8.3	12.0	12.4	18.1	19.6
In-house research institutes (number)	Total	3,060	4,810	7,110	9,070	9,705	9,810
	SMEs	2,278	4,013	6,307	8,217	8,863	8,927
	Ratio (per cent)	74.4	83.4	88.7	90.6	91.3	91.0

Source: Korea Federation of Small and Medium Business, Statistics of SMEs, Apr. 2005.

B. Establishing a subnational innovation system and strengthening the competitiveness of SMEs

1. SIS policy framework

With the recognition of the important role of regional science and technology development for the establishment of an innovation-driven infrastructure for regions, the Government of the Republic of Korea has devised and is putting the "Comprehensive Plan for Promoting Regional Science and Technology" into implementation. The first phase of the Plan that started in 2000 mainly focused on intensive investment in R&D infrastructure for regions outside the Seoul Metropolitan Area.

The "Second Comprehensive Plan for Promoting Regional Science and Technology" that began in 2005 zeroes in on expanding regional R&D investment and on the software aspect of the Plan, which includes regional technology and human resources development, and building networks among key strongholds that are already established. The importance of a regional innovation policy was highlighted on the occasion of the "First Five-year Balanced National Development Plan" that was initiated in 2004. The implementation of this Plan provided regions with an opportunity for further growth. The first-phase plan addresses the establishment of the SIS through regional specialized development, pursues technology development centred upon four strategic industries per region, and takes various measures to build networks among such innovation entities as regional SMEs and universities. The government's support policy to promote regional SMEs' innovation capabilities in relation to the establishment of SIS is the most integral part of the nation's balanced development plan aimed at creating indigenous growth engines of regions.

The government's support policy for SMEs went through changes according to the government's policy priority, but it has been steadily and continuously developed since the economic development era of the 1960s. The legal framework for supporting and promoting SMEs were put in place in the embryonic period for SME support in the 1960s when the SMEs Cooperation Association Law and the SMEs Basic Law were enacted in 1961 and 1966 respectively. These initiatives aimed at rectifying the unbalance that occurred in the process of economic development bent on large companies and protecting and nourishing SMEs. However, with the inception of the WTO system in the 1990s and changes in the economic environment that brought about autonomy, openness and competition, the Government of the Republic of Korea took various measures to cope with these changes. As a part of these measures, it founded the Small and Medium Business Administration in February 1996, and has been devising and implementing policies to promote SMEs and venture companies that are geared toward global competitiveness.

The development of regional science and technology and the promotion of SMEs are not confined to the regional matter but are directly linked to the benefit of the nation. These are important emerging strategic alternatives for supporting sustainable economic growth of the nation by strengthening competitiveness of SMEs and venture companies through the utilization of regionally accumulated technology innovation capabilities. To this end, the Government of the Republic of Korea created the Office of Science and Technology Innovation (OSTI) under the Ministry of Science and Technology in October 2004, with a view toward strengthening linkages and coordination among industry, human resources, and regional innovation policies. The OSTI has been mandated with the overall coordination and allocation of the Government's R&D investment; thus, providing an institutional framework for the efficient and coherent regional innovation policy, including regional SMEs support strategies.

2. Status of support for SMEs

Currently, various policy measures are being implemented in order to strengthen competitiveness of SMEs at both central and regional government level. There are 37 central government bodies and regional government organizations with 2,794 employees, and the number of related organizations and NGOs throughout the nation is 488 with approximately 38,396 persons. In other words, the total number of persons supporting SMEs reach approximately 38,396, which means one person covers 88 SMEs (2005, the Presidential Commission on SMEs).

Table 4.18 Organizations and human resources related to SMEs support

	Number of organizations	**Supporting personnel (persons)**
Central-regional government bodies	37	2,794
Related organizations	462	31,753
NGOs	26	3,822
Total	**525**	**38,369**

Source: Presidential Commission on SMEs, Special Commission on SMEs Meeting, Jan. 2005

The volume and ratio of the budget for supporting SMEs by relevant ministries are listed in the Table 4.19. According to this table, the Small & Medium Business Administration (SMBA) is the central agency of administering the largest budget spending for supporting SMEs in 2003, accounting for 57.3 per cent with the amount of US$ 3.1 billion. The Ministry of Commerce, Industry, and Energy (US$ 1 billion) was the second in investments behind the Ministry of Information and Communication (US$ 0.3 billion), the Ministry of Labour (US$ 0.3 billion), and the Ministry of Science and Technology (US$ 0.2 billion).

Table 4.19 Volume of investment for supporting SMEs by Ministries & Government bodies

(Unit: billion US dollars, per cent)

	2001		2002		2003	
	Size	Ratio	Size	Ratio	Size	Ratio
SMBA	2.424	53.7	2.532	53.8	3.116	57.3
MND	0.008	0.2	0.008	0.2	0.013	0.2
MOST	0.179	4.0	0.164	3.5	0.187	3.4
MCT	0.127	2.8	0.162	3.4	0.137	2.5
MAF	0.031	0.7	0.068	1.5	0.097	1.8
MOCIE	0.882	19.5	0.949	20.2	1.005	18.5
MIC	0.426	9.5	0.315	6.7	0.298	5.5
MOHW	0.003	0.1	0.007	0.1	0.014	0.2
ME	0.109	2.4	0.107	2.3	0.101	1.9
MOLAB	0.268	5.9	0.207	5.8	0.297	5.5
MOGEF	-	0.0	-	0.0	0.008	0.2
MOCT	0.001	0.5	0.086	1.8	0.120	2.2
MOMAF	0.031	0.7	0.032	0.7	0.040	0.7
KIPO	0.002	0.0	0.002	0.0	0.005	0.1
Total	4.491	100.0	4.639	100.0	5.438	100.0

The government's policies for supporting SMEs can be divided into seven categories in terms of function: (1) fund and start-up support; (2) technology support; (3) sales and marketing support; (4) productivity improvement and restructuring; (5) ICT and information support; (6) human resources support; and (7) promotion liaison with and networking among other firms. The amount of budget for implementing each category policy is as shown in Table 4.20.

Table 4.20 Classification of major policies for supporting SMEs

(Unit: million US dollars)

Category	**Policy**	**Government investment**	**Loan**	**Ministries in charge**
Finance and start-up support	SMEs and venture companies start-up fund Technology start-up evaluation guarantee		380.7	SBC, KOTEC, Local Credit Guarantee foundation
	Start-up centre expansion and Management	14.6		SMBA
Technology support	SME Technology innovation development programme	141.3		SMBA
	Technology innovation-driven SME promotion programme	2.0		SMBA
	Production on-site technology guidance	2.8		SMBA
	Development & patent and technology commercialization fund		97.6	SBCK OTEC

Category	Policy	Government investment	Loan	Ministries in charge
ICT and information	Informatization, Innovation and overall consulting support	14.3		SMBA
Sales and marketing support	Collaboration fund		273.4	SBC
	Export finance support fund		68.3	SBC
	SMEs consulting	14.6		SMBA
	SMEs joint brand development	1.5		SMBA
Productivity improvement & restructuring	SMEs process innovation	3.5		SMBA
	SMEs restructuring fund		1,757.3	SBC
Human resources support	Industrial functional personnel system	-	-	KFSB, KICOX
	Specialized research personnel system	-	-	KITA
	Industrial training system for foreigners	-	-	KFSB
External linkage & inter-firm cooperation	Industry-academia-research institute joint technology development consortium	41.1	-	SMBA
	Strengthening cooperation between conglomerates and SMEs	2.0	-	SMBA

3. Support for regional SMEs through the establishment of SIS

Recent major policies for supporting SMEs shed light on fostering technology innovation-driven SMEs through the "Inno-Biz" supporting system, which selects and supports firms that possess future growth potential with technological competitiveness and active promotion of venture companies. Taking into consideration the fact that SMEs and venture companies are small in size and lack resources, it is imperative that they should secure necessary technological capabilities through linkage between firms or with universities and research institutes. Therefore, it is a strategy of great efficiency to render support to regional SMEs and venture companies through the establishment of a subnational innovation system. This policy addresses securing strongholds for nourishing start-ups, strengthening linkages among industry, academia, and research institutes, and creating the clusters. Detailed strategies for technology capacity-building of local SMEs are elaborated in the following.

(a) Securing strongholds for nourishing start-up

With a view to facilitating knowledge flow and innovation diffusion within the nation's economy and creating new job opportunities, the government is focusing its policy effort on securing strongholds for fostering business start-ups. Particularly, the government is making efforts to create a conducive environment by easing business start-up regulations as well as to elevate the success rate of the start-up firms of technology innovation-driven, including venture companies.

SMBA is actively implementing the initiative to promote business start-ups. It designated and is managing 289 business incubators (BIs) across the nation as of 2004. The promotion of technology diffusion through linking BIs with universities or research institutes is expected to strengthen innovation capability and dynamism of the economy. Various ministries and government bodies other than SMBA are operating specific BIs as shown in the Table 4.21.

Table 4.21 Status of BIs supported by major R&D Ministries

(Unit: million US dollars)

	MOST	MOCIE	MIC		MCT	SMBA
Title of centres	High-tech venture centre	Techno-park (TP)	Software Support centre	IT Business Incubator	Cultural industry support centre	Business incubator
Number of centres	1	14	18	17	10	289
Areas of start-up	All industrial areas	All industrial areas	S/W	ICT	Cultural industries	All industrial areas
Programme entities	KAIST	Foundation	Regional government bodies	Universities	Foundation	Universities
Budget (2005)	-	17.5	3.9	0.9	-	13.1
Tenant firms	90	340	217	216	300	3,972

(b) SME support through linkages among industry, academia, and research institutes

In order for technology innovation-driven SMEs to successfully start a business in regions, it is important for them to have access to research results of regional universities and research institutes. Therefore, it is necessary to render technology development support to them through collaborative work among industry, academia, and research institutes. Toward this end, the government designated thirteen regional universities in the eight regions as industry-academia collaboration-oriented universities and established an industry-academia collaboration division within these universities to put industry-academia collaborative projects and other national programmes into efficient implementation through cooperation between industry and academia. In addition, the government initiated the "Industry-Academia-Research Institutes Joint Technology Development Consortium Programme" in 1993, in cooperation with major municipal entities, which aims at tackling technology-related problems facing SMEs through the close collaboration with regional universities and research institutes. The government is rendering support to the establishment of industry councils by sector to expedite technology innovation through the sharing of technological information among industry, academia, and industry. The government plans to increase the number of industry councils from 26 in 2004 to 100 by 2008.

(c) Promoting complex for technology development support for regional SMEs

Under the current circumstances where a firm's competitiveness depends largely on the local business environment, an industrial complex that is a spatial agglomeration of firms now plays an integral role in determining its competitiveness. Therefore, given the fact that bringing diverse innovation resources together is an important element for the growth of SMEs and venture companies, the government is taking various measures to create clusters for the promotion of regional SMEs, such as the establishment of a techno-park and the designation of a venture company development promotion complex. One of the major programmes for promoting technology innovation-driven SMEs is the Venture Company Promotion Cluster Programme, which was initiated by SMBA in 2001. Venture companies and related facilities within the cluster receive various preferential incentives, including tax exemption, establishment of regional network among innovation actors, sharing of equipment and facilities, and expansion of venture infrastructure.

Another important programme is the Techno-park (TP) programme initiated by MOCIE. The Techno-park programme was launched in 1997, aiming at strengthening technology capability through close collaboration and expediting the commercialization of the research results. It also aims to create an innovation cluster for building up potential innovation capabilities within the region. There are sixteen TPs (14 TPs supported by the government and two by the private sector). The programme has made a considerable contribution to promoting regional innovation system through such diverse schemes as new technology development, venture start-ups promotion, and innovation cluster building. Technology development projects are focusing on practical R&D activities which could produce substantial outputs with potential commercialization.

(d) Establishing a base for regional SMEs innovation through cluster building

With the rise of clusters based on networks among industry, academia, and research institutes as a core element in the regional development, the government is implementing the initiative to establish "innovation clusters" surrounding regional industrial complex. Cluster policy is the key policy initiative for the overall regional development and economic growth, which encompasses policies related to industry, regions, and science and technology. The basic plan for revitalizing Industrial Agglomeration Areas was devised in 2004, designating seven pilot clusters in Chagwon (machinery), Kumi (digital electronics), Ulsan (automobile), Panwol-Shiwa (parts and components), Kwangju (photonics), and Wonju (medical equipments). Based upon the existing industrial estates and complexes with dynamic networks built among regional innovation entities, the government seeks transition of these industrial complexes into innovation clusters to assist them in building up R&D and technological capabilities.

Figure 4.10 Innovative clusters and R&D special zone

Particularly, as clusters become a driving force for regional development, both the central and regional government actively pursue the establishment of clusters, and the "Daedeok R&D Special Zone" is the oldest and best one which is newly named as "Daedeok Innopolis". According to the Special Law on the Promotion of the Daedeok R&D Special Zone" with effective in 2005, the government firstly designated Daedeok R&D complex as the "Daedeok R&D Special Zone" with a view to fostering the region as a hub for an innovation-driven economy. Daedeok Innopolis takes up much of the nation's R&D activities in terms of input and outcomes of R&D resources. In this vein, it is significant to develop it into an important base for creating national growth engines through the utilization of research outcomes and enable it to lead the nation's economy in this era of the knowledge-based society.

C. Successful cases of innovation-driven regional SME promotion policy

(1) Opportunities and challenges in the strengthening of regional SMEs' competitiveness

Recent years have witnessed the expansion of the government's policy support for promoting regional innovation, which is aiming at the nation's balanced development. As a result, the ratio of facility investments by firms in regions is nowadays increasing. It reached 51.7 per cent in 2001, 55.3 per cent in 2002, and 56.9 per cent in 2003 respectively. In addition, the number of patents, utility model registrations, and innovation-driven SMEs in regions has greatly increased, resulting in expanding the ground base for building up regional innovation capabilities. The number of patents issued by entities in regions excluding the Seoul Capital Area and Daejeon increased from 58,000 in 2002 to 66,000 in 2004.

The current social agenda in which balanced development of the nation and expansion of R&D investment in regions are highlighted provides an important opportunity for the promotion of regional innovation-driven SMEs. In particular, in order to strengthen regional innovation capability, the government is initiating various policy measures with the goal of raising up to 40 per cent of the nation's total R&D investment in regions, excluding Seoul, Greater Seoul area, and Daejeon by 2007. This policy direction is also reflected in a set of recent government initiatives, including the "Comprehensive Strategies for Strengthening Competitiveness of SMEs" (July 2004), the "Strategic Planning for SMEs Innovation" (January 2005), and the "Strategy for Fostering Venture Companies" (June 2005).

In spite of this paradigm shift of policies on SMEs, a large number of SMEs in the Republic of Korea still remain poor, which is well demonstrated in low per capita value-added productivity and the ratio of R&D investment. Apropos of per capita value-added productivity and the disparity between large companies and SMEs shows a tendency to decrease since the 1980s; however, SMEs still have a long way to go. Due to the lack of strong innovation capability resulting from their insecure financial status, the ratio of SME R&D investment is low when comparing to advanced countries. The indigent status of SMEs poses challenges to the government's policy to foster innovation-driven SMEs, and this is why there are various policy measures to support

SMEs for strengthening their innovation capabilities.

Table 4.22 Per capita value-added productivity

(Unit: thousand US dollars, per cent)

	1980	1985	1990	1995	1997	1998	1999	2000	2001	2002
Manufacturing	6.6 **(35.3)**	12.3 **(8.4)**	33.2 **(32.2)**	70.1 **(22.1)**	70.6 **(11.7)**	54.4 **(13.3)**	67.4 **(5.4)**	73.2 **(3.2)**	64.4 **(0.4)**	71.7 **(8.3)**
SMEs	4.7 (30.1)	8.2 (12.3)	23.8 (28.5)	47.1 (15.3)	47.3 (9.7)	37.1 (15.2)	44.6 (2.4)	49.6 (5.7)	43.9 (0.9)	48.2 (6.9)
Conglomerates	8.5 (40.3)	17.4 (6.3)	48.3 (36.7)	121.0 (28.1)	123.2 (13.6)	95.7 (14.2)	128.7 (14.4)	140.1 (3.5)	128.5 (4.7)	150.0 (13.5)
Disparity between SMEs and Conglomerates	55.0	47.2	49.3	38.9	38.4	38.7	34.7	35.4	34.1	32.2

Note 1: ( ) shows the ratio of increase or decrease compared with the previous year
Note 2: Disparity with conglomerates denotes value-added productivity of SMEs when that of conglomerates is 100.0
Source: National Statistical Office, Mining-manufacturing statistics survey report, re-edited each year's report

Table 4.23 Proportion of SMEs and ratio of R&D investment of major countries (1999)

(Unit: per cent)

	Republic of Korea	United States	United Kingdom	Germany	France
Number of SMEs	99.5	98.5	99.3	99.2	99.6
Number of employees	74.7	41.1	66.4	56.8	63.5
Amount of production	53.3	24.8	51.4	42.5	49.7
R&D investment	12.9	18.7	17.2	15.1	21.1

Note: SMEs has less then 500 emplyees
Material: OECD, Small and medium-scale enterprise Outlook 2002
Source: Lee, Byonheon et al., 2005.

(2) Successful cases (Best practices)

The Daedeok area's SMEs was pronounced to be a successful case in the nation's initiative to foster technology innovation-driven SMEs, which made use of R&D capabilities of the Daedeok Research Complex. The Daedeok Research Complex was built in Daejeon Area in 1973, modeled after Japan's Tsukuba Science City as the Hongreung Research Complex in Seoul reached its limit. Currently, there are a total of 447 institutions, including twenty Government-funded Research Institutes (GRIs) and 369 venture companies with a total of 18,000 employees, including 5,000 researchers each with a Ph.D (this figure accounts for 10 per cent of the nation's total R&D human resources and researchers with doctorates).

Table 4.24 On-site organizations in Daedeok Research Complex

	Research Institutes			Educating Orgs	Public Orgs	Supporting Orgs	Venture Coms	Total
	GRIs	Private	Investing institutes					
2003.12	18	30	8	4	9	7	171	247
2004.06	19	30	9	5	11	7	170	251
2005.06	20	33	10	6	12	6	360	447

Source: Daedeok Research Complex basic statistics (Jun.2005)

Since the 1990s, spin-off companies and technology innovation-driven venture companies are established based upon the research and development infrastructure and research outcomes of the Daedeok Research Complex. Successful spin-off cases from the Daedeok Research Complex are the *Light and Electron* from ETRI, *KL Tech.* and *Havit Information*, which are technology innovation-driven SMEs in the fields of electronics, information and communication. The founders of these SMEs created their enterprises based upon their research outcomes accomplished while they were working for ETRI. They still work in collaboration with ETRI in R&D, and seek their growth through new product development.

The Daedeok Valley also produced successful business start-ups. The *Intekplus*, one of the innovation-driven SMEs in the area, utilized the area's innovation capabilities and succeeded in strengthening its technology capabilities. It specializes in measuring/testing technology development in the fields of semiconductor and display. It took part in a national R&D project and strengthened its technology capacity through joint technology development cooperated with universities and research institutes in the Daedeok area. With this experience and technology development, it succeeded in commercializing its technology. *Intekplus* was awarded Inno-Biz title by the Small and Medium Business Administration (SMBA) in 2001 and the most outstanding venture company by the Federation of Korean Industries in 2002. As such, it proved its technology capabilities through these awards and, in 2004, its sales volume amounted to more than US$ 873.6 billion.

The Government of the Republic of Korea designated the Daedeok Research Complex as a Research and Development Special Zone in 2005, in order to maximize the R&D potential of the Daedeok Research Complex, expedite commercialization, and foster it to become the mecca of technology innovation and new technology creation. To this end, the government is planning to develop R&D projects exclusive to a special R&D region for fusion and commercialization of technologies, to encourage joint research with enterprises, and to expand customer-oriented R&D projects through the establishment of R&D Business (R&DB) that reflects market demands. In addition, the government is introducing a "Technology Support System" so that research institutes and enterprises establish alliances in order to facilitate technology transfer, follow-up research, and technology guidance.

The government also plans to make the "Research Enterprise" system, where national research institutes and GRIs are able to commercialize their own R&D outcomes; institutes are allowed to contribute 20 per cent or more to financing out of their capital so that it is possible to establish private enterprises within the special zone and receive tax benefits (e.g. The Korea Atomic Research Institute in the Daedeok region and *Korea Kolmar* established a venture company through technology investment. Firms invest money while GRIs produce research outcomes by evaluating the technology value of research outcomes).

The government will establish a system where research/innovation and start-up/entrepreneurship are pre-cycled by rendering intensive support to specialized clusters with such growth potential as IT, BT and NT in order to support SMEs in the Daedeok Special Region. For instance, it will strengthen the networking related to R&D activities within the region by encouraging the joint use of large-high-price R&D facilities, which will be installed on the premises and by establishing cutting-edge R&D infrastructure that includes an ultra-high-speed telecommunication network and international conference rooms. In addition, the government will establish the Daedeok Special Fund (DSF) with the amount of 100 billion won by the year 2009 with a view towards rendering stable financial support to firms in the fields of state-of-the-art technology areas within the Daedeok Special Zone.

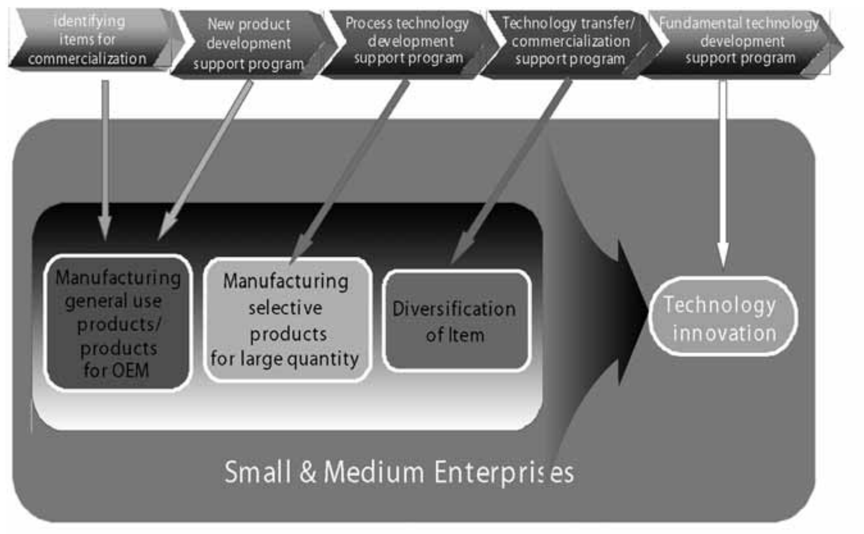
D. Future prospects

Korea's SMEs are diverse in size: 89.1 per cent (2.67 million) of the nation's SMEs are at the individual-size level, 8.1 per cent (240,000) are small-size, and medium-independent employing more than 50 persons 2.8 per cent (90,000). Among these figures, small and medium-sized manufacturers employing more than five persons account for 3.7 per cent, the number of which reaches 110,691. In order to strengthen the competitiveness of SMEs in the future, it is necessary to establish a differentiated support system based upon SME specialization, and support SME innovation capabilities with a customer-oriented integrated support programme. With regard to the promotion of regional SMEs, the government will establish a regional innovation system centred upon regional specialized industries that dovetails into the regional surroundings.

In providing support appropriate to the modes of firms, it is desirable to devise and implement separate a SME-support policy based on the modes of firms; namely, innovation-driven SMEs, middle-independent SMEs, and individual-sized SMEs. In case of innovation-driven SMEs, the policy should focus on technology development, human resources, and investment in order to foster them into becoming the engine for future growth and new employment. For middle-independent SMEs, a greater light should be shed on management and administration, such as accounting and law. For individual-sized SMEs, a policy effort should be made to nourish them to become the base for regional economy. Toward this end, the government should strengthen its support in financing, finding markets, and business administration through the establishment of a centre for individual-sized SMEs and a regional newspaper.

In the implementation of SMEs' technology support programme, it is important to take into consideration the types of business and technology innovation capabilities. For the SMEs lacking in technology or resources, development of a technology support programme is required: thus, providing more SMEs with an opportunity to participate. To take manufacturing SMEs an example, it is desirable to devise a support programme that zeroes in on improving such productivity as expanding cutting-edge manufacturing facilities and developing process technology. For SMEs with diverse products, diverse technology development support programmes that encompass technology transfer and commercialization might be more beneficial to them. The government's SME support policy should recognize SMEs as an "innovation entity" that is directly linked to regions, and should drop the protection policy of the past. It should change its policy direction to strengthening innovation capabilities of SMEs through selection and concentration.

Figure 4.11 Differentiated technology support programme for SMEs by type of firms



E. Conclusions

In the 21st century traditional production elements, like labour, capital and estates are becoming less important while knowledge and information are emerging as the core production elements that determine the competitive edge of industries. These changes transfer the economic structure into an innovation-driven economy where the creation and utilization of knowledge and information play a pivotal role. In this light, SMEs and venture companies that create high profitability and added value become core entities for the nation's economic growth and balanced development.

However, SMEs and venture companies in general are going through hardship insofar as they are small in size and short of funds and human resources, which make it difficult for them to secure the unique technologies that are indispensable for product innovation. Therefore, the role of clusters where research and development capabilities are accumulated is of great importance in strengthening the competitiveness of SMEs and venture companies and fostering technology innovation-driven SMEs. In particular, as is shown in the case of the Daedeok area, it is imperative that the government provide SMEs with the base for technology development for new products through collaboration with firms, regional universities, and research institutes at the beginning and growing stages. In summary, in order to put policies to foster SMEs into efficient implementation, above all things, the government should recognize SMEs and venture companies as an innovation entity that is linked to regions, drop protection policy and change its policy direction to strengthening the innovation capabilities of SMEs through selection and concentration.

REFERENCES

1. Daedeok Research Complex Basic Statistics, June 2005.
2. Korea Bank, Management Analysis of Businesses, each year.
3. Korea Federation of Small and Medium Business, Statistics of Small & Medium Enterprises for 2005, April 2005.
4. MOST/KISTEP, Report on the Survey of Research and Development in Science and Technology, 2005.
5. National Statistical Office, Statistical Information System (http://kosis.nso.go.kr)
6. National Statistical Office, 2003 Basic Statistical Survey Report for Businesses, December 2004.
7. National Statistical Office, Mining-manufacturing statistics survey report, each year's report.
8. Lee, Byonheon et al., The Study on the Analysis of the Korean SMEs and The Alternative Policy Directions, PACST, 2005.
9. OECD, Small and Medium-scale Enterprise Outlook 2002.
10. Presidential Commission on Small and Medium-scale Enterprises, Special Commission on SMEs Meeting, January 2005.

XI. THAILAND[12]

In the past, Thailand's SMEs have received very little government support. These SMEs are faced with similar problem. Handicapped by lack of opportunity, lack of access to low cost funding, lack of modern management skill, lack of modern technology, no innovative creation etc., these SMEs have not gained competitive edge. They were unable to capitalize on their smaller size and flexibility to compare with large scale enterprises. Fully realizing the important of SMEs as a vital economic engine of Thailand's economic development the government has made it one of top priority to under take the quantum leap in supporting the existing SMEs as well as promoting new SMEs for sustainable development.

Thailand's economic performance compare with others selected middle and lower income developing countries during 1995 to 2001 shows very weak and lower than average performance. Annual growth rate of real GDP after the Asian crisis are comparable to neighboring countries in the region. Thailand with around 1 per cent of world population makes contribution to about 1 per cent stagnated market share since 1991.

For a developing country like Thailand to move forward into the new knowledge-based economy world, she has to prepare herself in the strong globalization trends to be a learning society nation which means to reduce illiteracy from present 7 per cent to be well under 1 per cent. International language literacy, Technological language literacy and Mathematical language literacy are also needed for the transformation the nation into the knowledge based economy nation which almost automatically leads to the competitiveness of the nation.

For Thai SMEs competitiveness landscape needs both macro governmental S&T strategy for SMEs and micro firm strategy for each innovative SMEs. Close partnership between government SMEs promotion board [public sector], and the SMEs (private sector) themselves is essential. National Science and Technology strategy for innovative SMEs have duty to stabilize and confidently promote science and technology growth in the private sector. Each individual SMEs has duty to improve product, process, and innovation development lead to productivity growth which contributes to national economic growth.

In order to improve innovative SMEs competitiveness, fundamental development strategies using Porter's diamond model to visualize the problems and needs of local SMEs need to be developed. For factor/supply condition, the World trend is on learning society. Sustainability is needed to drive SMEs organization. Human Resource Development strategy using modern business management concept such as Continuous Improvement Concept, Knowledge Management, Technology & Innovation system etc. is needed. For structure of firm and rivalry, the World trend is on knowledge-based economy. Operational Excellent is needed to drive SMEs organization. S&T Institutional Infrastructure Strategy to help strengthen SMEs improvement. Also management improvement strategy using modern management concept such as Productivity Improvement tools, ABC Cost Cotrol, Benchmarking, Total Quality Management, Balance Score Card, Business Process Outsourcing etc. is needed.

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[12] *This paper was prepared and presented by Mr. Birasak Varasundharosoth, Advisor, the Office of Small and Medium-scale Enterprises Promotion, Ministry of Industry, Bangkok, Thailand.*

For related and supporting industries, the world trend is on cluster development. Networking & Partnership is needed to drive SMEs organization. Cluster Development Strategy for SMEs using modern management concept such as Supply and Value Chain Management, Collaborative e-Commerce etc. is needed. For demand conditions, the world trend is on globalization. Customer Intimacy is needed to drive SMEs organization. A public awareness strategy of science, technology and innovation for SMEs needs to be strengthened by using modern management concept such as Customer Relationship Management Concept, e-Commerce etc.

In order to establish Science, Technology and Innovation Intermediary Mechanism to promote and speed up the ST&I commercialization process, government-led special strategy is needed as follow: (1) Strengthen the government's guideline, promotion policy etc.; (2) Collaborative functional mechanism, technology infrastructure etc.; Innovative service system, such as fund/financial supports, marketing services, etc.; (3) Provide information network system; (4) Building and training of professional team, consulting and training service etc.; (5) Establish unified, open, and competitive system; and (6) International cooperation.

The fifth R&D generation for innovative SMEs

In dynamic global competitiveness, S&T intermediary mechanism play an important roll for successful development. Performance is largely based on intellectual capacity and impact. Cluster networking system is clearly visible. Self-managing knowledgeable employee plays key roll for development. The major process leans heavily on collaborative innovation system. In order to reach these objectives Thai SMEs have to adjust, adapt, and improve themselves significantly. This necessary long and painful process can be overcome only by strong right direction government policy to help local innovative SMEs products to reach commercialization stage and launch into competitive market successfully.

Box 4.2. Major fact-findings on Thailand's SIS policy and measures[13]

1. Overall Institutional and Policy Framework

In 2003 the Government of Thailand established the National Innovation Agency (NIA) as an autonomous organization to promote various model of cooperation at enterprise, sector and micro levels as well as to foster linkages between different actors in academic, technical, production, financial, investment, and management fronts. This institutional arrangement seems to show the Government's strong commitment to transform Thailand toward the country with knowledge-based economic and social system, recognizing the importance of innovation as a determinant of Thailand's future national competitiveness. NIA is supervised by the Ministry of Science and Technology (MOST) and operated under the policy guidance of the National Innovation Board.

In Thailand, there are many government organizations responsible for SME promotion. There have been various policies and programmes relating to SME promotion formulated and implemented by individual organizations, but there were no any significant efforts to coordinate and co-operate those policies and programmes. Against this background, in 1999, the Government of Thailand created the Office of Small and Medium-scale Enterprises Promotion

[13] *The Secretariat excerpted this information from the "report of the UNESCAP fact-finding mission on SIS and SME technology capacity-building (October 2005) as a reference material for understanding the SIS policy and SME technology capacity-building strategies in Thailand.*

to efficiently coordinate SME policies and programmes of relevant agencies and to implement some crucial policies.

In the Science and Technology Action Plan (2002-2006), the Government set five strategic industries needed to strengthen competitiveness through active innovation activities such as: automotive, food, tourism, fashion and software. The Plan introduced the concept of NIS and industrial cluster building as well as outlines several policy measures for strengthening technology capabilities of private firms. As basic policy directions, MOST also set the following policy directions: to accelerate the potential and innovation networking between relevant government agencies and private sectors to strengthen the capacity of the nation and to promote knowledge dissemination and technology transfer to SMEs, community business and the people.

In order to materialize these basic policy guidelines, NIA and the National Science and Technology Development Agency (NSTDA) prepared innovation strategies. It is noted that recently, NIA launched policy publication titled on "Thailand competitive innovation strategies", incorporating a strategic framework for technological capability development and some specific government initiatives. NSTDA has a range of initiatives and programmes to provide technological support to SMEs in line with facilities of the Thailand Science Park.

Regarding SME promotion policy, the government formulated "the Promotion Plan of SMEs of Thailand (2002-2006)" as a master plan. The Plan incorporated the national development directives of the 9th National Economic and Social Development Plan, the Small and Medium-scale Enterprise Promotion Act 2000, all relevant government policies, existing promotion and development plans, specific policy research results and opinions of all parties concerned, more importantly including inputs by numerous SMEs themselves. Among thrust areas incorporated in its action plan, noted for our studies might be:

- Develop SMEs in communities and regions, considering appropriate utilization of local resources;
- Promote R&D including the transfer of modern and appropriate technologies for SMEs as well as the application of modern technology and local know-how;
- Promote linkages and networking among SMEs and large-scale enterprises; and
- Promote SMEs cluster development and IPR support.

In Thailand, currently, science & technology and innovation (STI) policy including technology support activities for SMEs are exclusively initiated by the central Government. The Thai government is in the process of establishing their unique national innovation system (NIS) along with institutional arrangements. In this respect, there has been no explicit policy directly related to Subnational Innovation System (SIS) promotion or provincial level STI policies and promotion strategies. However it is noted that MOST, in partnership with local universities, has a plan to expand Thailand Science Park to the provincial level: Northeastern part (Chiangmai), Eastern part (Chonburi) and Southern part.

2. Programmes and measures

(1) Setting key areas for innovation capacity-building

NIA set three strategic areas needed to promote innovation capability as follows: bio-business including biotechnology, bio-based materials and natural products; energy and environment; and design and branding. To facilitate creation of start-ups in those areas, there has been implemented such supporting schemes as good innovation and zero interest and technology capitalization initiatives.

(2) Building NIS

NIA initiated this programme to promote a high degree of coordination and cooperation between the public and private sectors, as part of efforts to establish an enabling regulatory framework, capacity-building measures and market mechanism for stimulating innovation in the Thai society. One of initiatives is the University Business Incubator (UBI) programme to promote developments of commercialization of university R&D results and fostering young entrepreneurs. To facilitate networking of universities and institutions, the UBI Office was set up as a support hub to help promote UBIs and their interconnection.

(3) Innovative cluster building

The Thailand Science Park (TSP) is the country's first of its kind, established in 2003 as a comprehensive service centre for S&T and R&D activities, under NSTDA, MOST. The Park is focusing on: R&D activities with potential commercial applications; collaborating among industry, academic institutions and NSTDA; and providing technology incubation services in areas of electronics, material science and biotechnology. In order to attract private sector's R&D activities, TSP provides the following support schemes: joint investment, low interest loans and research grants for high-risk industrial R&D projects; industrial technology assistance programme (ITAP), technology acquisition and IPR related service; analytical testing service and quality management service, and pilot plant operation service. The Government has a vision to develop TSP as the innovation-led technology cluster in Thailand and has a plan to create several provincial science parks to promote local STI activities.

As a sector specific science park, there is Software Park Thailand in Nonthaburi Province to stimulate the Thai S/W industry development responding to a rapidly changing global digital economy. It houses over 50 companies with 17 companies having international business links, employing over 560 workers, collaborating with international software firms like IBM, SUN, HP, and Oracle as well as universities and Thai private sector.

(4) Industrial cluster building and networking

The National Economic and Social Development Board (NESDB) is currently mapping out industrial cluster development strategies including technology road mapping across the country and, as initial development stage, has been operating five pilot clusters in the selected strategic sectors as follows: Cluster of Thai Automotive Parts; Cluster of Motorcycle Parts (SMEs007+); Chaiyaphum Garment and Textile Cluster; Thai Food Cluster; and Thai Spa Product Cluster.

These clusters are networked among the following institutions: Public Offices and Institutions (DIP, MOI, NESDB, Chaiyaphum Province, Thailand Automotive Institute, Kenan Institute Asia); Associations such as Technology Promotion Association, Thailand Management Association, Thai Auto-Parts Manufacturers; Academic Institutes (Chulalongkorn University, King Mongkut's Institute of Technology); and Financial Institutes such as Thai Military Bank Plc., SME Development Bank of Thailand (SMEs Bank).

(5) Industrial Technology Assistance Programme (ITAP)

ITAP is one of the oldest SME technology support scheme, implemented quite successfully during the last 12 years. This scheme aims to assist SMEs in upgrading their products and processes through helping solve their technological problems, as well as provide financial support for the consultancy projects. During the last 12 years, about 4,000 firms were benefited and 60 firms were surveyed to have recorded the 6 times more growth performance in terms of direct tax, employment and standard. NSTDA is constructing ITAP national network programme and planning to expand ITAP scheme in the provincial level.

(6) Dual track approach for SME promotion

The Government of Thailand has adopted a dual track approach towards developing economy in Thailand. This relates to promoting both cash flow industries and SMEs grass roots sector simultaneously, so that the economy will not have to rely too heavily on the export-sector. Besides from gearing cash-cow industries towards embracing more innovation and new technology, the Government is distributing resources to promoting innovation among SMEs and grass root communities. "One subdistrict, One product project (OTOP)" is aiming to create innovation from indigenous wisdom. Cluster development, incubation centres, data networks of innovation, and manufacturing are some of the initiatives for networking innovative SMEs. Innovative SMEs production would be based on appropriate balance between new ICT and living breath of the indigenous intelligence.

XII. UZBEKISTAN[14]

A. Introduction

In the last decade of the 20th century, information and communication technologies (ICT) became one of the major factors influencing the development of society and the life of people. Many countries understand the enormous advantages brought about by the accelerated development and proliferation of information-communication technologies. The economic activities, associated with the manufacturing and the use of information technologies, have become a driving force of the steady economic growth of these countries. A new era of e-commerce based economy has begun. The e-commerce-based economy is not only the digital economy that comprises the manufacturing and use of computers and telecommunication equipments, but also the networked economy, whose elements are connected and operated through telecommunications.

There are various aspects of the e-commerce based economy:

- The e-commerce based economy is enabled and driven by powerful technology, ICT. A new ICT generation appears every three - four years. Today, ICT companies are in line with the largest corporations. The ICT sector is considered to be one of the most rapidly growing economic sectors.
- A telecommunication network, integrally connected with ICT growth, has spread its roots throughout all spheres of human activity, forcing them to change their methods of operation and the conditions under which they operate.
- Knowledge based on information and supported by cultural and spiritual values has become an independent force and decisive factor in a social, economic, technological and cultural transformation.
- A global information society has becoming a reality. The knowledge-based economy has allowed a fast integration of the huge intellectual resources of the transition countries into a global pool, stimulating the development of everyone.

[14] *This paper was prepared and presented by Mr. Sultan-Mukhamedov Nodir Ravshanovich, Specialist, Chamber of Commerce and Industry of Uzbekistan, Tashkent, Uzbekistan.*

- The e-commerce based economy continues to influence other spheres of public life of countries, including the institutional and innovation systems, development of human resources, etc.

Is the definition of what "New Economy" is really matters? The term itself is not very popular in Uzbekistan nor it is used widely by national media so far. There is no doubt that most of the people have no idea about its close meaning (with the except for students of economics, who have already managed to write a number of works dedicated to this phenomenon). Market economy itself seems to be pretty much "new" for average Uzbeks therefore the progressive technologies of all kinds (communicational, managerial or production) are always associated with free market economy or capitalism in general.

As it often appears to be, arguing about the close meaning of the term "new economy" is totally useless: picking out particular production sectors to name them "new" doesn't really help in any research. Every study, and the study of the "new economy" is not an exception, is carried out because there is some problem with the object of the study, or there is at least something interesting and unusual about it. Simple analysis of the modern society shows that a lot of political, economic, social and even behavioral problems connected to the introduction of the "new" things exist. Personal computers, mobile phones, the internet and automated teller machines (ATMs) are all new for people. It seems pretty much clear that the particular study should deal with these problems and not with definitions or rhetoric issues like is something "new" or not (if it is not a problem itself - as the widespread abuse of the term "new economy" in the Eastern countries (Woroniecki 2003)).

Some years ago introduction of the stationary telephony made great impact on the life of the society developing existing and providing possibilities for new forms of business to appear, creating goods and services unknown before. Together with the progress telephony brought a number of problems such as need for regulation (should it be state monopoly or regular service provided on the free market?) or soliciting-on-the-phone problem. The same process is happening right now with the dissemination of information and communication technologies (ICT). Our society faces not only opportunities but also problems connected to implementation of new technologies and some threats as well. Answering the earlier outlined question the idea should be pointed out that similarity of problems can reveal to us the object of the study or putting it the other way definition of an object should derive from alikeness of the problems connected to it. It's the problem anyway that really matters not the definition.

As it is going to be proved further in the text the same problems concern the whole Uzbekistan ICT sector beginning with data-generation (computer hard and software), data-transmission (e-mail, e-banking), data-storing (networked workplaces, Internet data-bases) and finishing with the voice-communication systems (mobile telephony).

Worldwide e-commerce development and penetration

Electronic commerce is not a new phenomenon. Electronic commerce, or "e-commerce" for short, may be generally defined as the performance of transactions (the buying, selling or negotiation of products and services) by electronic means over the Internet or via electronic networks. For many years, companies have exchanged business data over a variety of communication networks, but these were always proprietary. The Internet has allowed e-commerce to explode into a complex web of commercial activities transacted on a global scale between an ever-increasing number of participants, corporate and individual, known and unknown. For traditional electronic commerce, the network is a means to move data; for Internet electronic commerce, the network is the market.

E-commerce is not limited to business. It is also dramatically changing the way the Government carries out its functions. Many countries have allowed tax filings via the Internet for several years, but governments are now dramatically increasing their interaction with their citizens and broadening the services and information provided through the Internet. The spontaneous generation of communities on the Internet has reduced the gap between producer and consumer, thus making the economy more efficient. The Internet is not limited to borders; it brings people into contact with one another from all areas, provided there is access.

The results of a massive study in the United States performed by the University of Texas and Cisco Systems Inc. in 1999 estimated that the Internet economy in the United States in 1999 alone would produce US$ 507 billion and employ 2.3 million Americans. This study proves that while the Internet economy grew by 68 per cent from the first quarter of 1998 to the first quarter of 1999 in the United States, the amount of e-commerce business increased by 127 per cent during the same period.

Forms of e-commerce

Economic activity on the Internet falls roughly into four categories: Business to business (B2B), Business to consumer (B2C), Consumer to consumer (C2C) and Consumer to business (C2B). This paradigm allows for a more accurate understanding of the benefits and obstacles of e-commerce, while providing for more appropriate responses.

- **Business to business (B2B)**

B2B is when two businesses conduct transactions through the Internet. For example, a business can issue requests for proposals, receive quotations from their suppliers, conclude a contract, receive and pay invoices all through the Internet. This is perhaps the most promising area of e-commerce for Uzbekistan. Domestically, it can help to build new commercial links between Uzbekistan manufacturers and make it easier for them to buy from each other, rather than importing production materials and equipment from abroad. Internationally, it can enable Uzbekistan manufacturers to participate more actively in the global market.

- **Business to consumer (B2C)**

B2C, the most popular form of e-commerce today, is when a business sells directly to a consumer. One of the world's largest B2C examples is Amazon.com, the American book retailer, which has over 30 million customers worldwide. While expanding its business operation, Amazon.com's business model has created a new supply chain model that facilitates the delivery of products to consumers worldwide. B2C will be effective for equalizing differences between the major cities and remote regions for consumers' access to goods and services, provided that problems with regional public Internet access, delivery and payments systems are resolved.

- **Consumer to consumer (C2C)**

C2C is when consumers sell to other consumers. Consumers are easily able to set up their operations and develop an on-line presence with the support of a third party provider. A leading third party supplier in the United States is e-bay.com, which is revolutionizing the concept of C2C by hosting one-to-one trading in an auction format on the Internet. It allows people with constraints to conduct and operate a business when it is convenient for them, resulting in lower overhead costs, which in turn create a savings for the final consumer.

- **Consumer to business (C2B)**

C2B involves consumers naming their price for various products or services offered by businesses, and is the smallest and least-developed sector of e-commerce. The most visible example of C2B is the American company Priceline.com, which allows consumers to name a price at which they would be willing to buy a specific product or service. Priceline.com acts as the broker to find a supplier that is willing to sell a product at that price.

B. National strategy and action plan

1. Strategy and action plan

The ICT sector has become a major component of the economy of Uzbekistan and a force of its growth. The basic aspects and strategic goals of the country with respect to ICT and the internet are highlighted in the Statement by the President of Republic of Uzbekistan, May 2001. As of May 2003, several National Programmes targeted to ICT and internet network development in Uzbekistan have been developed:

(a) A National Programme of Reconstruction and Development of Telecommunication Network of the Republic of Uzbekistan for the Period up to 2010 *(Resolution of the Cabinet of Ministers No. 307, 1 August 1995)*

The purpose of the Programme is to create a National Telecommunication Network on the basis of digital transmission systems and digital switching equipment, stipulating a deep integration into the global telecommunication system and providing comprehensive satisfaction of the needs of the economy and the population in communication services.

The main objectives of the Programme are:

- Defining priority directions of the telecommunication development;
- Formulating the State principles for support of the telecommunication development;
- Attracting investment resources from non-governmental sources, including foreign investment, for telecommunication network development;
- Creating a material and technological basis of communication that meets international requirements, organization of production of telecommunication equipment, opticalfiber cable with the participation of foreign investors;

- Observance of sovereign rights of the country and the interests of regional structures in forming the technical basis of telecommunication and organization of their interaction during the creation and operational stages of development of the telecommunication system.

(b) Programme of Modernization and Development of National Data Transmission Network of the Republic of Uzbekistan for the Period 1999-2003 *(Resolution of the Cabinet of Ministers No. 193, 22 April 1999)*

The purpose of the Programme is to define basic organizational and technical measures to stimulate modernization and development of the National Data Transmission Network for the period 1999-2003 and a network expansion in Tashkent, Nukus and province centres within the period 1999-2001 and in the Regional Centres during 2000-2003.

The primary objectives of the Programme are:

- Basic technical requirements for the construction and organization of the National Data Transmission Network;
- Technical means, ways of perfection of communication basis for the creation of a single information space and expansion of the opportunity for integration of the Republic of Uzbekistan into a global information space;
- Measures on centralized connection of data transmission networks of the Country operators (providers) to global information networks, including the Internet, and long-distance networks of the Republic of Uzbekistan, as well as identifying directions and stages of network modernization and development;
- Identifying sources and mechanisms of financing network modernization and development, including utilization of the National Operator-UzPAK finances, attraction of foreign investments, and the utilization of budgetary resources.

(c) Programme of Computerization and Information Technologies Development for 2002-2010 *(Resolution of the Cabinet of Ministers No. 200, 6 June 2002)*

The main purpose of the Programme is satisfaction of information needs of society and raising the competitiveness of domestic producers on global markets.

The following are foreseen as goals:

- Accelerating the development of modern telecommunication infrastructure and digitalization of networks and the development of mobile networks;
- Development of an Internet National Segment;
- Creation of conditions stimulating the development of computerization, domestic industry and exports of software;
- Training of highly qualified personnel in ICT;
- Development of a competitive environment in the ICT sector;
- Further perfection of the normative and legislation base, standardization and certification.

2. International cooperation

The State programmes have the assistance of donor countries: the United Kingdom, Germany, the United States of America, Switzerland and Japan. These countries bring an essential contribution to the development of the Uzbekistan ICT sector by supporting scientific research institutes, educational establishments, small and medium-sized businesses, and non-governmental organizations.

The development of the Uzbekistan ICT sector also enjoys the support of the UNDP, World Bank, EBRD, ABD, European Union, USAID, IFC and other international donor organizations. In particular, the NATO Scientific Programme provides for ICT development in national academic establishments and the creation of Internet multiple access points in the national education and library system. USAID special programmes/projects bolster the ICT development in the governmental bodies. Some of these projects aim at promoting ICT development also in the private sector. The sustainability of international donor assistance is very important for the successful realization of the National Strategy for ICT Development in Uzbekistan.

C. Institutional mode

1. Government bodies

The following government bodies were set up to formulate and oversee the implementation of the National Strategy and Action Plan: *(1) Coordinating Council on Development of Computerization and Information; and (2) Communication Technologies.*

The Coordinating Council, lead by a Deputy Prime Minister of the Republic of Uzbekistan, is a supreme body on coordination of development of computerization and information, communication technologies. The basic functions of this body are:

- Formulating an ICT Development Strategy;
- Overseeing the development of ICT Programmes;
- Defining a policy aiming at the creation of favourable climate for ICT development;
- Coordination of training and re-training of qualified personnel in the ICT Sector;
- Facilitation of the creation of a competitive environment and support of innovative businesses in the ICT Sector;
- Facilitation of the development of international cooperation in ICT and extension of access of educational establishments to information networks.

(a) Communications and Information Agency of Uzbekistan (www.aci.uz)

The Communications and Information Agency of Uzbekistan is a special authorized body on the state regulation in the communications and ICT Sector. It is a working body of the Coordinating Council on Development of Computerization and Information Communication Technologies. The main goals of this body are:

- Organization of performance of communication and ICT development programmes;
- Deepening economic reforms in the communication and informatization sector;

- Regulating telecommunication infrastructure development, creation of a competitive environment, licensing and maintenance of certification in communication and ICT;
- Development and introduction of modern standards and requirements for ICT;
- Coordination of practical activities of ministries and agencies/committees on creation and use of information databases, networks, electronic government;
- Expertise of created electronic information networks;
- Realization of measures on protection of consumers' rights and provision of information security in communications and ICT;
- Development of draft legislative acts and standards in ICT.

(b) Press and Information Agency of Uzbekistan (www.uzapi.gov.uz)

The Press and Information Agency of Uzbekistan is a specially authorized body on State regulation of development of mass media, publishing and printing. The main goals of this body are:

- Monitoring of legislation in the area of mass media and maintenance of guarantees of freedom of speech and press;
- Realization of State policy in publishing and printing, mass media, distribution of periodicals, including realization of registration in the specified kinds of activity;
- Monitoring compliance with current legislative acts and regulation in the area of information;
- Maintenance of protection of the rights and interests of citizens and legal persons in the field of production, distributions and access to information.

(c) Computerization and Information Technologies Development Centre – UzInfoCom

The Computerization and Information Technologies Development Centre is established in accordance with the Decree of the President of the Republic of Uzbekistan as a non-governmental organization. The main goals of the Centre are:

- Development of draft programmes, normative acts in the sphere of information communication technologies;
- Participation in tenders on development of applied and adapted software, information databases, websites and other software products for branches of real economy, management spheres, business, public health services, science and education, and also on realization of the programme of electronic commerce;
- Rendering a wide spectrum of information and consulting services for controlling bodies, budgetary organizations and private business on issues of computerization and introduction of information-communication technologies;
- Preparation of quarterly reports and reviews on global and domestic trends in the development of information-communication technologies, modern international standards in this sector.

Moreover, *special structural divisions*, responsible for the creation and maintenance of information networks and databases and ICT development, *are established in each Ministry (Agency/Committee)*.

2. The Legislation

The current legislation provides a normative framework for ICT development, defines an order of establishment of firms on the telecommunications and information technologies market, sets up general principles of activity on this market, firm taxation, and measures of responsibility for infringement of legislation. Today, more than 15 Laws, including the Constitution, Civil and Tax Codes, Administrative Responsibility Code, regulate the activity in this economic sector.

Special Laws defining Uzbekistan' State policy in ICT are listed below:

- Telecommunication Law
- Communication Law
- Radio-Frequency Spectrum Law
- Mass Media Law
- Informatization Law
- Law on Guarantees and Freedom of Access to Information
- IPR, including Copyright
- Law on Licensing of Some Kinds of Activity
- Law on Protection of Right of Computers Software and Databases.

The majority of legislative blocks consist of the Presidential Decrees and Government Resolutions and normative acts regulating various aspects of ICT development. In particular, pecial tax and custom privileges, stimulating computerization process of society and ICT utilization, were granted by the Presidential Decree of 30 May 2002 (No. UP-3080), Government Decisions of 22 August 2002 (No. 296), and 23 September 2002 (No. 328). Taking into account the necessity of further perfection of the legislative base and the creation of a favourable environment for ICT development, the Government has prepared and submitted to the Parliament the following draft laws: "Informatization Law" (new edition) and "Electronic Digital Signature Law". Alongside these, the Cabinet of Ministers of the Republic has finalized the formulation of the draft "Electronic Document Circulation Law", "Electronic Commerce Law" and "Electronic Payments Law".

D. Present situation and tendencies in information systems development

1. Information and technical infrastructure

Secure, reliable connections to the Internet are a fundamental requirement for the growth of e-commerce. The greater the scale of the access, the greater will be the growth and benefits of e-commerce. Viewing the voice and data networks as national infrastructure, it is clear that the government has a role in its development. But these networks require large investments, which the government itself cannot afford. Therefore, the government should refine its role to ensure that it is proactive in supporting the conditions that will allow others to invest in the development of the national Internet infrastructure. If demand exists, investment will naturally flow into these areas, as has happened around the world, but only if there are no artificial barriers to investment. Wider investment into the network infrastructure will not simply provide more connections, but will also provide more options and competition, which will lower costs and allow a broader spectrum of the population to gain online access. The Internet also relies on innovation, and innovation is a product of competition.

Today, the Uzbek telecommunications industry is heavily regulated and tightly controlled. As a result, communication monopolies in the market are able to use the exclusivity of their position to stifle development and investment. For example:

(a) Leased Lines:

Data networks of most online service providers are constructed with leased lines that must be obtained from national telephone companies, often monopolies or governmental entities. In the absence of effective competition, telephone companies may impose artificially inflated leased line prices and usage restrictions that impede the provision of service by online service providers.

(b) Local Loops Pricing:

To reach their subscribers, online service providers often have no choice but to purchase local exchange services from monopoly- or government-owned telephone companies. These services also are often priced at excessively high rates, inflating the cost of data services to customers. For example, MGTS in Moscow makes it virtually impossible for independent Internet service providers (ISPs) to buy telephone lines to provide service. At the same time, the ISP owned by MGTS (MTU-Intel) has expanded to 1300 lines in 2 years to become the largest ISP in Moscow.

(c) Interconnection and Unbundling:

Online service providers must be able to interconnect with the networks of incumbent telecommunication companies so that information can pass seamlessly between all users of the network. Monopolies or dominant telephone companies often price interconnection well above cost, and refuse to interconnect because of alleged concerns about network compatibility or absence of need for other providers.

(d) Attaching Equipment to the Network:

Over the years, some telecommunication providers have used their monopoly power to restrict the connection of communication or technology devices to the network. Even when the monopoly has been broken, a host of unnecessary burdensome "type acceptance" practices have been used to retard competition and make it difficult for consumers to connect.

As a result of these barriers, Internet access is limit and more expensive. This restricts the growth and benefits of all types of e-commerce. Therefore, in the area of infrastructure development, the government should focus its efforts on opening the industry to allow greater investment and competition.

A positive tendency is developing right now on the in-country market of accounting and legal software. Due to the extreme complexity of national legislation it is almost impossible for any firm to get by without appropriate software. Unusually high demand provided national suppliers with strong incentives so now accounting and legal software used by Uzbekistan firms is 100 per cent domestically produced. It is interesting that in this case software suppliers find ways how to make sure that everybody who uses their products pays for them.

Telecommunication network

General long-distance channels of the telecommunication network of the country are based on fiber-optic and microwave (radio relay) communication lines (TAE FOCL, FOCL and radio relay lines), and they allow creation of high-speed data transmission lines (from 64 Kbps up to 2048 Kbps) between Tashkent, Nukus and the regional centres of Uzbekistan. Communication between the regional centres and areas essentially varies throughout the territory of Uzbekistan. A modern network is already established in the northern areas of the country: in Karakalpakstan Republic, Bukhara, Navoi, Khorezm and Syr-Darya provinces. Almost 40 per cent of these areas have digital channels. In other areas, the analogue channels connecting the regional centres with areas remain in place.

International telecommunication network

Construction of the Trans-Asian-Europe Fiber-Optical Communications Link (TAE FOCL) is complete, and a national segment of the fiber-optic communication backbone was launched in 1998. This line has connected China to Europe and allowed the creation of direct channels to China, Germany, Turkey, Uzbekistan , Kazakhstan, Turkmenistan, and also has given digital channels for connection of some regional centres of Uzbekistan. From a total bandwidth of 155 Mbps " east direction only 10 per cent are currently involved.

Trunk telecommunication network

At present, the trunk telecommunication network consists of fiber optic lines 1,913.35 km in length, and radio-relay lines (RRL) 1,028.83 km in length. The total extent of long-distance telephone channels is 7,867,917 thousands channel-km, where 73 per cent are digital channels. The length of international telephone channels is 3,025,75 thousands in channel km, where 84 per cent are digital.

Local telecommunication network

At present, there are 2,077 telephone exchanges (more than 9.67 per cent of them are digital) in the country, and total capacity makes up to 1.92 million numbers. Networks of Navoi Telecom (76 per cent), Bukhara Telecom (71 per cent), Khoresm Telecom (60 per cent) and Joint Venture Chirkom (66 per cent) have the biggest number of digital telephone exchanges. The extent of FOCL in the city telecommunications networks is 1,434,243 thousands channel-km that are used for communication between telephone exchanges. Communication between telephone exchanges allows data transmission with a speed of up to 155/622 Mbps.

Mobile communication networks

There are seven mobile operators on the mobile communication market, and three of them are using AMPS (DAMPS) and GSM standards, and are currently capable of covering the whole territory of the Republic. Another three of operators, using GSM and IS-95 (CDMA) standard, render services within and around of Tashkent, capital of

Uzbekistan. The Operator JV «UzbekTelecom» has launched a project on creating a cellular network in regions of the Republic, using CDMA-450. Of the above-mentioned operators, only two cellular operators perform international roaming with operators from more than 40 countries of the world.

General indicators of telecommunication development in 2001 – 2002

Number of phones, thousands	1,630	1,638
Density, number of phones per 100 person	6.65	6.68
Number of mobile phones, thousands	127	187
Density, number of mobile phones per 100 person	0.5	0.8

Satellite communication

About forty artificial satellites are accessible in Uzbekistan, and about fifteen of them cover the country. The majority of these satellites belong to INTELSAT, INMARSAT, CCC ASIASAT, TURKSAT, Uzbekistan n Federation, etc. It is expected that within the coming years the number of artificial satellites will be substantially increased, which will create a favourable opportunity for development of satellite communication networks (SCN) in Uzbekistan on the basis of satellite capacity.

2. Data transmission and internet

Data transmission networks in Uzbekistan are constructed on the currently existing telecommunication network. Leased circuits (mainly digital) are being used to organize data transmission long-distance and at central-office level. International connection (output) of networks with international information networks, including the Internet, is organized by direct communication, using satellite and terrestrial digital international channels. As of 1 January 2003, the number of subjects, rendering data transmission services, including the Internet, is 135. Of these, 64 render services through multiple access points (Internet-cafe, Internet-clubs, etc.).

Data on large providers are given in the table below:

Operator	International Capacity	Partners
UzPAK	7.5 Mbps	Sea Bone (Italia) TAE / China Telecom
Naytov	3.5 Mbps	Teleross, DeteSat (Uzbekistan) Satis (Germany)
Uzscinet (UNDP)	3.5 Mbps	KPN (Holland)
Sarkor Telecom	4 Mbps	TAE / China Telecom; Cable & Wireless
Intal Telekom	2.5 “bps	TAE / China Telecom
Sharq Taraqqiyoti	2 Mbps	Yamal / Sonera (Uzbekistan)
TPS	1 Mbps	TAE / China Telecom
Total:	**24 Mbps**	**(including other channels)**

UzPAK and Naytov ISPs provide Internet access on practically the whole territory of Uzbekistan. The majority of Internet providers operate mainly in Tashkent. Local Internet providers supply a full set of Internet services, including: dial-up connection, leased lines, e-mail and domain names (DNS) services, hosting, and web-design. Voice-over-IP (VoIP) services are officially not accessible on the territory of Uzbekistan although some companies and organizations are engaged in the development of this technology. Some companies use corporate IP-telephony.

The general capacity of modem pools in the country is estimated at 3,500 units (ports). The real average speed of access is about 19.2 kbps on analogue lines. An average speed up to 44.0–64.0 kbps is possible on digital lines. More and more regions of the country are receiving new digital equipment and fiber optic channels. There has therefore been a gradual improvement of quality and connection speed to Internet. Only four Internet providers provide round-the-clock service for end users (help-desk).

3. Internet availability

(a) Cost of services

Despite the existing Internet-services competitive market, prices for Internet access are high, relative to the average per capita income. Many providers carry out an aggressive policy to attract clients by granting various package deals, discounts, and privileges for local users. Discount connection to Internet at night is thus becoming more and more popular: if the average dial-up connection rate in Uzbekistan is US$ 1.6 per 1 hour in day time, at night this is US$ 0.7.

The cost of Internet-connection with a speed of 19.2 Kbps varies from US$ 400 up to US$ 600 per month, depending on marketing and traffic; with speed 1024 Kbps - from US$ 500 up to US$ 2,000 per month. Understandably, large corporate clients, banks or foreign representations can only get connected by a leased line. The majority of ISPs clients make the connection by dial-up (the average ratio of those who make dial-up connection, and those connected through leased lines, is approximately 1:100).

(b) Computer, telecommunication and related equipment

Manufacturing of computers in the country is barely established, although attempts to assemble computers have been undertaken. However, these attempts were not sustained due to the problems of converting local currency. The local ICT equipment market is still dominated by imported equipment. According to experts' estimates, the price of a PC, depending on configuration and brand, is from US$ 500 up to US$ 2,500. The annual growth of the number PCs is increasing by approximately 25,000–30,000 items.

(c) Purchasing capacity

For the majority of the population Internet access is limited, because of the low purchasing capacity. Average monthly salary in 2004, by the World Bank experts' estimation, was about US$ 90. In an attempt to widen access of the population to information technologies, in 1999 the project on "Creation of Potential for Development of Internet Technologies and their Distribution in Uzbekistan" was launched by UNDP and the Open Society Institute in cooperation with the NATO Scientific Programme. The project is oriented to Internet development in the country with a main emphasis on basic network development of free access to the Internet for scientific and educational institutions of the Republic of Uzbekistan.

4. Internet users

According to expert estimates, the total number of Internet users in Uzbekistan in 2002 reached almost 275,000 persons. As of 1 May 2003, their number was 310,000, more than twice the indicator of 2001 (137,000). About 73 per cent of the number of users is concentrated in Tashkent. The basic share of users (almost 70 per cent) falls to multiple access points, whose total number today exceeds 100. The smallest number of multiple access points is in the Autonomous Republic of Karakalpakstan and the Surkhandarya province. The number of Government bodies connected to the Internet, as of 1 January 2003, reached 286, and of their managing subjects – 5,123.

5. Internet resources

The number of registered domains in the **.uz** zone at the beginning of 2003 reached 650. Web sites in Uzbekistan n prevail among the resources of the **.uz** zone. About 70 per cent of local sites "broadcast" in this language. The number of sites in English and Uzbek is about the same. The Government is represented in the Internet by the official site www.gov.uz. At the same time, practically all Ministries, State Committees and Agencies have websites. Nine of 14 Governmental Bodies and State Management Organs have their Internet resources. Also, there are many sites of various companies – from providers to company offices – who have decided to open a homepage on the Internet.

The most popular local resources are the following information web sites:

- www.ferghana.ru – information and news site, one of the oldest and most authoritative information projects of UzNET, and has won several local Internet competitions.
- www.uzreport.com – information and news site
- www.uza.uz – information site
- www.uzland.uz – information directory of Uzbekistan
- www.UzDessert.uz – site about Uzbek culture and music
- www.show.uz – information and entertainment portal
- www.forum.uz – on-line forum of Uzbekistan
- www.choyhona.uz – Uzbek IRC Chat

Mail services are available on both providers' and large free-of-charge sites. Leaders in the provision of this service are www.mail.arbuz.com, www.assalom.uz, www.mail.uzpak.uz. There are several search engines like www.re.uz, www.vse.uz within the .uz zone. In April 2003, the popular world search engine Google (www.google.com) opened a site in the Uzbek language – www.google.uz. Free-of-charge hosting in Uzbekistan is represented by a small number. The most important providers are www.ferghana.ru, www.vip.uz and www.re.uz. Hosting of ISP www.assalom.com is considered to be the best among the paid hosting services. Similar services are also provided by www.billur.net. From other network services providers banner-exchange networks www.reklama.uz, www.banner.uz and Internet-statistics services www.top.arbuz.com and www.axiom.uz should be noted.

6. Electronic commerce

The number of companies in Uzbekistan which successfully use ICT in their activity is extremely low. At the same time, some positive experience in electronic commerce has already been gained in Uzbekistan. The introduction of e-commerce initiated by the Government of Uzbekistan (Resolution of the Cabinet of Ministers of 1 May 2001, No. 198), such as a uniform electronic system of exchange tenders at the Uzbek Republican Commodity-Raw Stock Exchange (UzRCRSE), has led to appreciable growth of trade as a whole (increase of 1.45 times from the level of a similar period of 2001). However, the increase of volume of wholesale trade for the same period as a whole was only 1 per cent.

For the first time in the history of the exchange movement of the Republic, the growth of turnover of exchange tenders in the regions of Uzbekistan outstripped the growth of turnover of exchange tenders in the capital of country (1.7 times against 1.3 times). The experience of UzRCRSE shows that the greatest benefits from the introduction of electronic commerce were gained by businesses in the regions of the Republic, whose access to material resources without the introduction of ICT in business practice would otherwise have remained problematic. As a whole, electronic commerce in Uzbekistan is in its initial stage of development. Several existing Internet-shops and trade platforms function on UzNET. An overwhelming majority of the companies use the network for publishing their price-lists only.

The Government of Uzbekistan pays significant attention to the development of electronic commerce. A Draft Programme of Development of Electronic Commerce, whose basic purpose is to develop an information infrastructure of the commodity market and services, establish and further perfect conditions for the development of electronic commerce, is formulated on the assumption of increasing efficiency of state support measures, integration and coordination of efforts of public and private (commercial) organizations. At the same time, the government is preparing a new legislative initiative on perfection of the legislation on electronic commerce.

E-commerce is still new and unfamiliar phenomenon to the majority of Uzbeks. We will try to find out the reason why a little bit later but in meanwhile a rapidly developing tendency worth mentioning. Recently quite many e-shops appeared, mostly based in Tashkent, representing business-to-consumer (B2C) e-commerce. Currently their number is couple of dozen offering wide range of the products beginning with groceries and ending with laundry machines. Firms keep on rotating on constant basis: when firms which did not make fortune leave the market new ones move in immediately.

The list of obstacles for e-commerce development in Uzbekistan includes technical and legal challenges such as lack of legal basis for e-commerce transactions, logistical problems with transport and shipping, vague financial and banking procedures, low number of credit card holders. In everyday life large number of transactions is executed in US dollars for Uzbekistan. Some is not very reliable legal tender because of high rate of inflation. Carrying out payments in foreign currency between residents is illegal. Validity of electronic signature is another issue, which has not been resolved yet.

Currently only physical signatures are legally valid. Thus in order to create friendly environment for e-commerce development in Government of Uzbekistan should at least develop appropriate legal framework. And still some time have to pass until currier and other logistical services are developed enough to physically execute all electronic transactions as well as means of electronic money transfer become more widespread.

Meanwhile national e-commerce is taking somewhat ridiculous and absurd forms such as "cashon-delivery" "e-shops" where physical delivery is carried out by an employee of such "e-shop" who also collects straight payment in cash (usually in US dollars). Web site happens to be not more than just a virtual window of a firm: transactions are not prosecuted online basically. Banner trade backed up by web-money circulation can be mentioned as an exception though not as important one yet. The same arguments apply for explaining B2B e-commerce underdevelopment though with some additional complications: it is considerably harder for two firms involved in B2B electronic transaction to escape revealing it in book-keeping documents than for just one as in case of B2C e-commerce.

E-banking

Most of commercial banks have their own web sites with rather dynamic content. Some banks offer interactive services to their clients such as information on the current state of client's account. The first bank that launched Internet service providing customers with possibility to transfer money to or from their accounts online was National Bank of Uzbekistan (www.nbu.com). Yet the service remains rather a "status thing" than a necessary tool to be used massively in everyday life.

7. Electronic government

The majority of State and Government bodies have established their own web sites. These sites contain information on the functions and responsibilities of the State body, its structure, field of activity, status and prospects of development of the sector, data and references on operational conditions for foreign investors, and news. A functioning Governmental Network – UzNET, provides access of various ministries and departments of the country to the Internet and e-mail services. A number of State organizations, including the Central Bank, Ministry of Internal Affairs, Ministry of Defence and the State Tax Committee, have their own corporate network. The corporate network of the Central Bank, connecting 920 branches of banks across all Uzbekistan, is the biggest data transmission network in the country.

The government is interested in easing the access of the population to the Government by providing public services online. It is also aiming to achieve a high degree of "electronization" of the economy. For this purpose, the Government of Uzbekistan has prepared a Draft Programme for the Introduction of Electronic Technologies into Government for the period 2003-2010.

***Recommendations of UCCI*:**

There are many well-known recommendations for encouraging competitiveness and investment in the telecommunications industry, which cover topics such as licensing, privatization, regulation, transparency, etc. Those aside, the following recommendations address the issues which are specific to developing the growth of the Internet and e-commerce:

- Prohibit monopoly service providers from providing direct Internet access or having any interest in Internet access providers. Such a restriction will force them to focus on providing interconnects and local-loops to third-party providers on a commercial basis.
- Ensure that regulations enforce "even-playing field" access to interconnect and local-loops of monopoly service providers. These regulations must ensure that all service providers have the same opportunities for access to public networks at the same price.

E. National innovation opportunities

1. Innovation

The development of an e-commerce based economy has been driven by innovation and the application of new technologies. The development therefore of a system that supports and encourages innovative activities is crucial for closing the gap between Uzbekistan and the advanced market economies in the area of R&D and, hence, of knowledge-intensive activities.

In 2002, 112 innovative projects were completed in Uzbekistan. The budgetary allocation for R&D to support these projects was US$ 600,000. In order to mobilize additional resources for financing innovative activities and the commercialization of their products, the Government of Uzbekistan has introduced a principle of participatory financing. The principle of participatory financing has become one of the most effective elements of the commercialization mechanism of such projects. It consists of a flexible combination of budgetary appropriations and finances of branches, regions, enterprises and organizations which have interests in solving the problems put before scientists. So, the volume of the off-budgetary finance mobilized for financing the above projects were US$ 200,000.

Since 2000, a steady growth of patents has been registered. If, in 2001, 651 patents were granted, where 485 patents were given for inventions, in 2002 the total number of patents amounted to 658, of which 515 patents were granted for inventions. The total number of copyright certificates, enforcing copyrights for computer programmes and databases, remain practically without change, 117-122 certificates a year.

2. Research and development

In order to further develop the scientific and technological potential of Uzbekistan, sustaining the development of the country and ensuring the efficiency of scientific research work and technological development, the Coordination Council on Scientific and Technical Development was established under the Cabinet of Ministers of the Republic Uzbekistan by the Decree of President of the Republic of Uzbekistan on 20 February 2002.

The primary goals of this body are:

- Defining priority directions for fundamental and applied scientific research work and technological development in coordination with the strategy of development of branches of the economic and social sphere;

- Organization of expertise and feasibility studies for large research programmes and technological projects;
- Annual preparation of the State Programme of Scientific Research Work and Technological Development; and
- Creation of a support system for talented scientists.

The Centre for Science and Technologies is an executive body of the Coordination Council on Scientific and Technical Development.

3. Science

The system of the Academy of Science of Uzbekistan consists of 187 Scientific–Research Institutes. In the sphere of the Academy of Science, about 6,000 researchers and scientists are employed, of whom more than 2,000 are directly involved in research. The main purpose of the Academy of Science of Uzbekistan is to promote the development of fundamental research in the field of economy, industrial and information development, and also studies on new opportunities for practical use of scientific achievements.

F. Major national initiatives

The main national initiatives of the Republic of Uzbekistan are elaborated in view of global tendencies, the existing level of ICT development in Uzbekistan and the importance of ICT for the country. The political desire of the government to pursue ICT development is expressed in the Programme for ICT Sector Development (Resolution of the Cabinet of Ministers of 6 June 2002 No. 200) and in the Programme for Telecommunication Development, introduction of electronic technologies in government management and development of electronic commerce for the period 2003-2010, but also in the aspiration to create a competitive environment for ICT development in the country (Resolutions of the Cabinet of Ministers dated 10 October 2002 No. 352, and 17 December 2001 No. 488).

ICT development is a process requiring large investments, which is rather difficult at the moment. In this connection, an accelerated ICT development is carried out mainly at the expense of the private sector returns, received by private firms from ICT. The government generally promotes ICT development through the creation of favourable investment, tax and customs modes, and stimulating public demand for ICT.

The implementation of the above-mentioned goals will require:

- Perfection of the normative-legal base in the field of ICT development and use.
- Perfection of the system of economic stimuli and other forms of state support for ICT development.
- Development of practical measures to implement the target programmes presented as follows: (1) Introduction of electronic technologies in the government for the period 2003-2010; (2) Development of electronic commerce for the period 2003-2010; (3) Development of telecommunications for the period up to 2010; and Training and retraining of specialists and teachers in ICT.
- Development and realization of specific programmes (health care, taxation, provision of pensions, social insurance, etc.) for the ICT sector.

G. Conclusion

Uzbekistan is entering a period of fast ICT modernization with a number of positive values, assisting the development of a new strategic focus on ICT and information services. Among the factors favouring this strategic course are:

- Strong political desire of the government to pursue ICT development;
- High level of existing human resources;
- Availability of the fiber-optic telecommunication network, connecting most cities and regions of the country;
- Sufficient capacity of international telecommunication networks;
- Plenty of higher educational institutions across Uzbekistan;
- Relative development of the banking system with plastic cards payment and inter-banking network of payments;
- Presence of the "UzNET" network for governmental organizations;
- Growth of public interest in ICT.

At the same time, it is necessary to note that Uzbekistan has only recently begun the application of modern ICT. It yet has not many components of an information society. The weak points of the domestic ICT sector are:

- High tariff rates on Internet services;
- Insufficient development of domestic data transmission network;
- Insufficient quantity of computers per students;
- Insufficient attention of local State management bodies to ICT development;
- Limited local resources offering online training;
- Low purchasing capacity of the population and high costs of modern equipment;
- Significant "digital gap" between Tashkent city and other regions of Uzbekistan;
- Backwardness of the Internet-payment system, telemedicine and software;
- Deficiencies of the existing legislation, constraining the development of a local ICT industry;
- Absence of competition on the local market of basic network services.

APPENDIX I

E-commerce and import regime

1. Optimal distribution conditions for the development of e-commerce key findings:

- E-commerce is currently a national market place; 92 per cent of orders are shipped within the country of purchase. By 2008, this picture is forecasted to change completely; 80 per cent of orders will be shipped cross-borders.
- With one in five orders reaching the customer late at today's relatively low volumes, and 86 per cent of companies predicting a rise in overall sales, distribution and logistics will rapidly be one of the key on-line differentiators.
- Uzbekistan has one of the lowest online sales versus total sales percentage (less than 0.5 per cent) but has one of the largest growth rates for online sales predicted for the next 5 years.

The primary distribution systems currently available worldwide are postal services and courier services. The optimal distribution system should be facilitated by consistent and eased Customs rules and regulations. The main focus should be on "E-Commerce Fulfillment", whereby a consumer has minimum involvement in the end-to-end goods delivery, except for ordering and payment. The supplier and distributor should take responsibility to ensure the safety, security and on-time delivery of goods ordered. Except for Customs-related matters, the same principles should apply to the distribution system within Uzbekistan (i.e. end-to-end fulfillment and the safety and security of goods ordered using e-commerce).

2. Current state of Uzbekistan n distribution system

Most of the barriers to the development of e-commerce in the Uzbekistan n distribution system stem from the lack of transparency of Uzbekistan Customs rules and regulations, as well as burdensome Uzbekistan n Customs paperwork requirements. It is often difficult to predict the Customs duties, necessary paperwork and the time necessary to clear goods through Customs. The fact that on-line ordering and payment methods conflict with the requirements of Uzbekistan n Customs discourages companies and private individuals from using e-commerce extensively. There is already an increase in the number of e-commerce activities in Uzbekistan, and unless the laws and regulations are clearly defined up-front, the distributor companies will be faced with the risk of dissatisfying consumers.

Business-to-Business: Although there is no significant problem with the actual transportation of goods, Customs procedures with regard to payment and paperwork requirements are complicated and difficult. On-line payments are not accepted methods by Uzbekistan n authorities. Every bank transfer should be registered with the contract of purchase of goods.

Business-to-Consumer: Although paperwork requirements are simpler in this case, the consumer should be involved with the customs clearance personally.

In both cases, there is the risk that the total distribution and clearance costs are not really recognized or appreciated by the receiver, and this results in a significant number of "unwanted" goods being refused by the consumers but being handled and delivered anyway. Historically, express carriers are more prepared than others to distribute goods purchased through e-commerce. This is because they have developed infrastructure in Uzbekistan and all over the world, they usually act as customs brokers, they are accustomed to handling a wide range of commodities and they can provide complex solutions (i.e. freight, storage, clearance, and distribution).

3. Current state of Uzbekistan import system

The current state of the Uzbekistan n import system is such that importing items is difficult, time-consuming, and too reliant on the physical transfer of paper and relevant material. What is necessary is that Customs rules and regulations are simplified to facilitate the movement of goods ordered through e-commerce. The particular focus should be on easing paperwork requirements and facilitating the acceptance of on-line payments. The progress and approval of electronic signatures play a vital role to achieve this.

The process of making the process e-commerce compatible will promote the consistent interpretation of rules and regulations across all Customs offices within Uzbekistan. In addition, it will help consumers to clear goods from Customs without personal involvement (i.e. through appointed brokers).

The increased demand for reliable logistics and delivery of domestic and international products and services will support the development and attract investment in the distribution infrastructure and transportation industries of Uzbekistan. Given the geographic expanse of the country, the most efficient delivery system would ultimately be air transport, but the railroads could develop a competitive advantage if the Ministry of Railroads took a proactive approach to providing a reliable and efficient solution for Business-to-Business and Business-to-Consumer activities. The opportunities exist, but an appropriate combination of government support and entrepreneurial energy is necessary to create the proper solution.

APPENDIX 2

Payment systems opportunities, requirements and obstacles

Although the Internet has become an everyday reality to more prosperous Uzbekistan, the development of e-commerce is still handicapped by the inadequacy of sufficient and secure payment mechanisms, lack of regulatory support and general distrust of cashless payment methods. Uzbekistan n e-businesses still have no access to effective e-payment methods. Although electronic ordering is available, payment is either on pre-payment terms or upon delivery (e.g. a computer ordered through the Internet is delivered to a person's home, but payment is in cash to the seller's representative, or through the postal clearing). Therefore, it is crucial development of legislation supporting payment instruments that can be effectively used in e-commerce is a crucial point in development of e-commerce in Uzbekistan.

1. Current Uzbekistan payment system

Like any generic payment system, the Uzbekistan system consists of payment instruments, intermediaries (usually banks), clearing system and customers (businesses and individuals). Payment instruments and their availability in Uzbekistan are depicted in Table 1. Besides the instruments listed in Table 1, vexels and barter are also used often in settlements, but they have been gradually losing their positions as means of payments since the ruble devaluation in August 2003.

Table 1

Instrument	Available in Uzbekistan		Comment
	B2B[15]	B2C[16]	
Cash	Y	Y	Transaction amount upper limit is US$ 150 for any single B2B settlement.
Funds transfer (postal)	N	Y	Individuals may send money via "pochtovy perevod" to another person, but not an entity. About 60 million such transactions carried out annually.
Electronic Funds Transfer (Domestic Clearing)	Y	Y	Most frequent means of payment.
Electronic Funds Transfer (Cross Border)	Y	Y	Seldom used by individuals.
Credit/Charge Card	Y	Y	Low penetration (about 5.5 million cards). Mostly debit cards. Individuals use them primarily for cash withdrawal.
Special cards (chip cards)	N	Y	Usage is restricted to designated terminals (e.g. telephones), and it is not possible to pay using these cards in retail outlets.
Vendor Card	N	Y	Several companies issue such cards that can be used for gasoline purchase at designated stations. Lack of mutual recognition.
Postal Clearing	Y	Y	Company mails order by post. Buyer pays to the postman and then the post office remits money to seller
Direct Debit	N	N	Direct debit in Uzbekistan is a draft. True direct debit is available only as an exception.
e-money	N	Y	Do not have any legal status.

[15] *Business-to-business transactions, also referred to as wholesale payments.*
[16] *Business-to-consumer transactions, also referred to as retail payments.*

Cashless payments in Uzbekistan, both wholesale and retail, are cleared via:

(1) Central Bank network (59 per cent of total transaction volume in 1998[17])

(2) Intrabank payment network (32 per cent)

(3) Correspondent banking relationship (9 per cent)

(4) Special institutions (clearing house) licensed by Central Bank (Less than 1 per cent)

The system still suffers from low penetration of electronic data interchange (EDI) and a significant share of transactions requires paper confirmation, which leads to longer processing times. Retail payments in Uzbekistan are dominated by cash transactions. The share of credit and charge cards, direct transfers, postal clearing, and electronic payments is very small.

The following obstacles handicap the development of retail payments using cards:

(1) Low penetration of credit and/or charge cards

(2) Poor Infrastructure

(3) Undermined credibility of banks

(4) Concerns about security of transactions, which have risen substantially after recent fraudulent usage of credit cards at ATMs in Moscow.

2. Internet-based payment systems (IBPS) in Uzbekistan

The following methods of making payments are applied in Internet-based payment systems:

(1) Remote authorization of credit/charge cards

(2) Remote authorization of bank transfer

(3) Digital cash

Having realized the benefits of leadership in this emerging business, several companies, including banks, tried to build their own IBPS. To date, there are about ten IBPS, with two leaders, CyberPlat, and Assist holding about 70 per cent of the Internet payments market. The role of IBPS in payments in Uzbekistan is insignificant due to small volume and limited number of customers.

The prospects for B2B Internet payments development seem to be more favourable than for retail, at least in the short run, because low penetration of Internet access devices (less than 1 per cent of population) makes it impossible for B2C payments to grow.

On the demand side, many Uzbekistan n businesses are already using the Internet for promotion and would likely welcome opportunity to turn it into a full-fledged distribution channel if IBPS were in place. On the supply side, further development of IBPS in Uzbekistan will be determined by two key factors: favourable treatment by the State and willingness of banks to develop a new segment of payment services. Although should lead in developing IBPS, to date, most large Uzbekistan n banks are laggards in the business.

[17] *Source: 2002 Annual Report of Central Bank of Uzbekistan.*

The main issue for IBPS in Uzbekistan is the absence of an acceptable e-payment method and the lack of payment instruments. In principle, cards and other e-payments are accepted, but this requires opening multiple accounts (each buyer needs a separate account or should already hold an account in the bank that supports a particular card). This leads to compartmentalization of Internet payment systems, since there is no mutual recognition of transactions initiated within different payment systems.

In modern, developed economies, credit cards play a crucial role in facilitating all commerce, especially business to consumer commerce. In Uzbekistan, until credit cards become a widespread payment mechanism, the direct debit system can be the most effective payment method in e-commerce.

3. Recommendations for improvement and preparedness of Uzbekistan payment systems:

(1) Introduce and promote new widely accepted payment instruments, such as credit cards

(2) Introduce direct debits and make their implementation easier

(3) Allow forms of e-payment to be determined by contractual parties.

Successful implementation of the recommendations is dependent on support of the Central Bank of Uzbekistan. On the other hand, usage of Internet based open systems raises new security concerns for the participants. In this regard, we believe the state regulators must be more aggressive in undertaking and enforcing fraud protection measures.

APPENDIX 3

E-commerce and advertising

Advertising and marketing on the Internet are still in the early stages of development in Uzbekistan. As the market grows and develops, so will the need for the appropriate level regulation develop accordingly. The questions that now face the Uzbekistan n Internet include the extent to which these regulations should be adopted in accordance with international norms and how to regulate advertising in a way that encourages growth while at the same time objectively regulates advertising and marketing on the Internet.

There are clear benefits of self-regulation in Uzbekistan. It is safe to assume that advertising will soon represent the primary revenue for the Internet. It is cost effective, reaches a wider audience and can be targeted more directly than advertising through traditional media vehicles. Advertisers should realize that it is in their own interest to take the first step and observe self-disciplinary guidelines specifically adapted for electronic advertising and marketing. Such guidelines will lead to an Internet environment that can be fully trusted by the consumer.

According to the International Chamber of Commerce, guidelines on advertising and marketing on the Internet should be globally adopted voluntarily by corporations worldwide in an effort to encourage global unanimity of Internet regulations. There is currently no global unanimous decision concerning whether the county of origin or country of destination applies to advertising and marketing on the Internet. Key issues such as identity disclosure of those who are advertising and marketing goods, responsibility of advertisers to inform consumers about the cost of accessing messages and services, data privacy, disclosure of data, unsolicited commercial messages and advertising to children are only some of the issues that are addressed by the ICC's recent Internet Advertising Guidelines (See below: ICC Guidelines on Advertising and Marketing on the Internet, 1998).

Further, in order to combat the misuse and abuse of the Internet, Uzbekistan n e-commerce should incorporate an educational element into its programming to educate consumers on how to recognize fraudulent advertisements and false claims. Additional issues, such as monopolies on Internet advertising companies, should be addressed and enforced by current anti-monopoly laws already in existence in Uzbekistan today. In fact, the same vigilance over standards and truth in advertising that currently guides advertising in mass media can also easily be adapted and applied to the Internet.

Recognizing and addressing these issues in Uzbekistan, whether through self-imposed regulation or state regulation, is the only way in which trust in the Internet can be maintained. As access grows and Uzbekistan's economy bounces back, the number of Internet users across Uzbekistan will increase. As consumer buying power grows stronger, the Uzbekistan n consumer will begin to look toward the Internet for cheaper, more easily accessible goods and services. Advertising and revenues will increase, ultimately benefiting everyone in the cycle--the advertiser, the consumer, and ultimately, the government itself will benefit from taxes and duties charged on those transactions.

The objective in addressing the issues of advertising and marketing on the Internet is to encourage self-regulation and global adoption of international guidelines for Internet advertisements. In doing this, Uzbekistan will allow e-commerce to grow in a way that will be comparable and compatible with the rest of the world.

Benefits for OIC countries on Uzbekistan example

In order to pursue economic development and any necessary changes in supporting legislation, it is necessary to evaluate the benefits that will be derived from the proposed development. The benefits of e-commerce are broad and range from the enhancement of social programmes to an increased tax base. This section will review the benefits and provide recommendations to achieve those benefits.

1. Expansion of the labour market and utilization of skilled labour force

The development of e-commerce will have a positive impact on the structure and operation of the Uzbekistan labour market. E-commerce has been a major impetus worldwide for the creation of new jobs. For example, in the United States, more than a million new jobs were created by the United States. high-tech industry since 1993.[18] Uzbekistan has a very scientifically oriented, highly technical labour force. As e-commerce develops, Uzbekistan's labour force will be able to adapt quickly and efficiently to necessary changes in how business is conducted. As more opportunities are created, the labour force will contribute to Uzbekistan's overall gross domestic product (GDP). Per-capital income will rise, the tax base will expand, and the potential for a "brain drain" from Uzbekistan will reduce.

Two areas of employment growth significantly improved by electronic commerce are technical programmers and customer service providers. Uzbekistan has a competitive advantage globally in programming and should aggressively support the development of these talents. The expansion of business opportunities created as a result of an e-commerce friendly environment will enable these talented people to remain in Uzbekistan, earn higher salaries, pay income taxes, spend their disposable income and invest in new business development in Uzbekistan, rather than exporting their talents and income abroad.

The necessity for customer service support created by e-commerce is another area of tremendous job creation potential in Uzbekistan. The pressure to increase such services might also provide the impetus to institutionalize these skills. Private and government-sponsored programmes to develop these services would provide Uzbekistan with both a technical and customer-oriented labour market.

2. Growth of export potential

The export potential of both manufactured items and services can develop exponentially given an environment that is not hindered by restrictive legislation. Since the August 1998 financial crisis, many Uzbekistan producers have developed a competitive advantage relative to foreign companies that are importing products. This advantage was first based on price, but the resulting inflows of cash have led to investment and improved quality, particularly in food processing. As domestic industry strengthens and product quality improves, Uzbekistan companies can look beyond the border to

[18] *American Electronics Association, 1999.*

other markets. E-commerce can play a crucial role in assisting Uzbek companies with marketing and selling their products abroad, thus resulting in the expansion of domestic enterprises, an increasing tax base, and higher government revenues from taxes and customs duties.

3. Expansion of business models

E-commerce assists small and medium-sized businesses in competing with larger enterprises by enabling businesses to reach a wider consumer market and helping them search more effectively for the lowest-cost inputs. In the United States, small businesses that use the Internet have grown 46 per cent faster than those that do not.[19] This, in turn, has spurred the development of small businesses. Economic development is self-reinforcing, thus creating economic growth, an expanding tax base, and demand for related services.

E-commerce is also useful to both producers and consumers because it helps to overcome the traditional barriers of distance and lack of information regarding market opportunities. Companies no longer need to support redundant labour or maintain many physical establishments requiring large capital outlays. Virtual shops and contact points on the Internet enable physical storage close to production sites, thus making distribution faster and more cost effective. The Internet and e-commerce increase advertising opportunities worldwide, making advertising easier and more global than before. This can be particularly helpful to businesses in Uzbekistan that traditionally find it difficult to reach customers abroad.

Another benefit for Uzbekistan is that e-commerce makes it possible for certain jobs, such as software development and technical services, to be carried out from where the consultants are located rather than in the country where the service is demanded. This should facilitate Uzbekistan sales of services which have lagged because of restrictions on the movement of natural persons. Uzbekistan citizens will consequently benefit from job creation and earned income, while the government will benefit from personal and corporate tax revenues and retained earnings.[20]

Aside from the specific value of e-commerce transactions (estimated to exceed US$6 million in Uzbekistan in 2001 based on current trends[21]), the Internet economy will create a substantial amount of related business for Uzbekistan. Business will develop because of the requirements for computer hardware and management services, including security, billing, accounting, and customer service.

The benefits of e-commerce are clear; there is much to be gained by the government, Uzbekistan businesses, and consumers from the promotion and development of e-commerce. However, it is important to note that e-commerce development is not without potential risks, including fraud, tax evasion, the invasion of privacy, and intellectual property right violations, though these risks are not specific to e-commerce alone.

Though the risks are real and could potentially develop as e-commerce expands, they are currently being addressed by companies and various national governments in a way that prevents them from disrupting e-commerce. Companies, governments and individuals are forming coalitions throughout the world to work together to find appropriate solutions to potential threats to e-commerce.

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[19] *American City Business Journals, 1999.*

[20] *IBID*

[21] *e-Business Forecasts – Deloitte & Touche Tohmatsu*

4. Government budget benefits (Revenue)

The reason to expand the economic structure of Uzbekistan is to develop a broadened base from which revenues can be collected. As Uzbekistan's participation in e-commerce continues to develop and flourish, increased revenues from tax collection can be one of the many benefits directly realized. To achieve this broadened tax base, there are many issues that have to be addressed by Uzbekistan. The first of which is how to maintain the delicate balance between preserving the tax base in the face of untraceable electronic transactions while concurrently encouraging e-commerce development on a local level.

The phenomenon of e-commerce has created one of the most internationally based sets of tax issues ever. Governments have quickly realized that doing business electronically presents numerous challenges for established tax administrations due to e-commerce's anonymity, the untraceable nature of transactions and the fact that borders are crossed through telephone lines. Many governments have taken action against a perceived potential for revenue loss, and many others are studying their needs. While the questions are far from being resolved, most have been identified, and organizations such as the OECD are developing global recommendations.

The OECD, the United States, the United Kingdom and the European Union have developed and agreed upon four primary principles. They are:

(1) The development of electronic commerce should be led primarily by the private sector in response to market forces.

(2) Government intervention, when required, should promote a stable, international legal environment, allow a fair allocation of scarce resources and protect public interest. Such intervention should be no more than is essential and should be clear, transparent, objective, non-discriminatory, proportional, flexible and technologically neutral.

(3) E-commerce is global by nature. Government policies that affecting it should be internationally coordinated, compatible and should facilitate inter-operability within an international, voluntary and consensus-based environment for standards setting.

(4) Transactions conducted using e-commerce should receive neutral tax treatment in comparison with transactions using non-electronic means. Taxation of e-commerce should be consistent with established, internationally accepted practices and administered in the least burdensome manner.[22]

Keeping these four principles in mind, the next step for Uzbekistan requires reviewing current taxes and taxation schemes to see how they affect e-commerce. Below is a review of the various taxes and some insight on proposed courses of action. At the end of this section, specific recommendations are provided.

[22] *OECD Conference, Paris, 2002.*

1. Profit taxes

(a) Domestic issues:

Characterization of income

From a purely domestic perspective, the questions regarding the taxation of e-commerce are limited. Where purchasers and sellers are both located in Uzbekistan, existing taxation principles should easily determine the amount of revenue and profit that is earned and taxable. One issue requiring some consideration is the classification of some transactions emerging in e-commerce, where taxation depends on such classification. For example, while many e-commerce transactions involve the purchase of physical goods, traditional services or identifiable software transferred over the Internet, new web sites are constantly being created that charge consumers for simply accessing information. Considering that most of the Uzbekistan tax system is based on "goods, works or services", it is unlikely that this issue will pose a significant problem.

Advertising

A sizeable part of the business-to-consumer industry on the Internet is based on advertising revenues. Due to the fact that the majority of individuals with Internet access simply "web browse" or "web surf" and do not actually buy anything on the Internet, many extremely successful web sites survive from advertising revenues alone. Such advertising is usually in the form of banners placed on their sites. However, in Uzbekistan, there is one additional issue that is fairly unique concerning the Internet economy. Existing restrictions on the deductibility of advertising expenses and additional taxation of advertising in Uzbekistan could severely hinder the development of some potential businesses. As the government is currently reviewing these rules based on suggestions from the business community, this issue should be included in these deliberations.

(b) International issues:

The international implications of profit taxes are by far the most important. E-commerce, with its global nature, virtually ignores international boundaries in many ways. Accordingly, there are a number of issues to be raised concerning the protection and growth of the Uzbekistan tax base.

Permanent establishments

One of the most important questions is whether or not a foreign company selling goods, works or services in Uzbekistan over the Internet will be taxable in Uzbekistan on the related profits. If the principles of Uzbekistan legislation[23] are applied, it is unlikely that this situation would be considered taxable for profit tax or turnover tax purposes. The question that follows is then: Should it be?

In the same manner as almost all other major countries in the world, Uzbekistan looks to its many international tax treaties to determine whether or not a foreign entity is taxable on its profits based on the existence of a permanent establishment ("PE"). Obviously, as the OECD's Model Tax Treaty was not previously updated with e-commerce in mind, it is difficult to make such a determination based on the wording

[23] *Instructions of the State Tax Service of the RF #34.*

in most of the world's tax treaties that are based on this model. In accordance with agreed-upon principles regarding e-commerce, the answer is to be found by fitting e-commerce within existing international tax rules. As a result, the OECD is currently devoting a great deal of attention to this issue and released a first draft of their comments in November 1999. The intention is to clarify the application of Article 5 of the Model Tax Treaty to e-commerce transactions through the related commentary sections; however, minor changes to the wording may be suggested if necessary. The following are the main principles contained in the November draft:

(a) In order to determine whether a PE exists, a distinction must be made between computer equipment versus data and software. According to the document, only computer equipment may constitute a fixed place of business. Data and software cannot be fixed places of business because they do not involve the presence of facilities such as premises, machinery or equipment. An example is given of a web site that cannot, in itself, constitute a fixed place of business, as tangible property is not involved.

(b) The document also points out that where company A carries on its business through a web site located on a server operated by company B, company A should not be deemed to have a PE in the state where the server is located because the server cannot be considered as being at its disposal.

(c) Equipment used for e-commerce may be considered a fixed place of business even where no personnel are physically present in the place where the equipment is located.

(d) Equipment used for e-commerce entails the presence of a PE only if it may be considered fixed within the meaning of Art. 5(1) of the Model Convention.

(e) Internet service providers and businesses hosting the web sites of other enterprises on their servers generally cannot be considered as agency PEs of the latter enterprises. However, the document admits that this could be the case in "very unusual circumstances". In particular, they cannot be considered either dependent agents, as they do not have the authority to conclude contracts in the name of the other enterprises, or independent agents, as they act in the ordinary course of their business.[24]

The OECD has been accepting comments on this first draft and will continue to revise the new commentary as necessary. While a number of uncertainties must still be clarified, the international community strongly believes that this issue is properly addressed by the OECD within its model treaty. In the same way that the taxation of traditional international business is governed by tax treaties, e-commerce should be taxed on a consistent basis worldwide in order to minimize specific country advantages and to avoid double taxation. Uzbekistan will be best served regarding PEs by following the recommendations of the OECD, which are expected to be finalized later this year.

Characterization of income

As stated previously, e-commerce creates an entirely new set of "products" that continues to expand and does not always allow for traditional classification. The most

[24] *Tax News Service (IBFD Issue 45, Volume 33) - 8 November 2003.*

difficult problem, from an international tax perspective, is where a payment may be considered a royalty as opposed to a purchase of products or services. Many e-commerce transactions are difficult to classify, such as regular payments for the use or access to information. As royalty payments are generally subject to withholding taxes and taxable to the recipient in most countries, double taxation is a significant problem. In European Union countries, withholding taxes on royalty payments have been nearly eliminated for transactions within the European Union. However, this is not likely in the near future for the rest of the world, which leaves e-commerce open to inconsistent tax treatments by different countries and therefore, the possibility of double taxation.

One particular classification issue arose before the e-commerce debate and received some clarification from the OECD in 1992 when the OECD expanded its commentary on the treatment of royalties to cover software. The primary distinction made was between the sale of software with a single or limited user license versus the sale of a license to copy and distribute the intellectual property that is considered software. The latter case is considered to be a royalty situation, whereas the former case was clarified to be a sale that would not be subject to withholding tax. This principle may be very useful in classifying many forms of e-commerce transactions, and Uzbekistan should consider adding some specific wording to its tax treaties as some other countries have already done. The ability to pass software between countries without unusual tax costs is extremely important for the development of the Internet economy in Uzbekistan because there are many skilled software designers in Uzbekistan that need global market access to become successful and profitable. The OECD is continuing to examine this issue as it relates to all e-commerce transactions and the international community is expected to follow future recommendations.

Tax havens and transfer pricing

The use of tax havens has been of particular concern to many governments. Because it is possible to establish an Internet business in a tax haven country and sell products or services to other countries without the creation of local PEs, there is a general concern that profit taxes will be avoided even for companies that are actually controlled by residents of countries with tax systems. While this is certainly a possibility, there are a number of obstacles already in place to minimize such occurrences.

The first and most important obstacle is the definition of a PE as discussed previously. Once the OECD's guidelines are finalized regarding PEs, the world will have a standard to create and maintain consistency. The difference is that most true tax havens do not have tax treaties with other countries, and their companies will be subject to the domestic laws of the countries in which they transact business. Due to the fact that the OECD will establish guidelines that will attempt to allocate taxation on the most equitable basis, applying these principles domestically would be reasonable for Uzbekistan and other countries. Whether a business is operated from a tax haven or not, its operations would be taxable if they fall into these equitable guidelines. Many of the other obstacles facing an offshore company involve the actual establishment and operation of a physical business in a small tax haven country.

Another important issue related to tax havens is the placement of intellectual property ("IP") rights in an offshore company. A common planning technique, where it is possible to own IP rights in a low tax jurisdiction, involves a large portion of the profits attributable to countries where the business is carried on to be extracted through royalty payments. However, as most tax havens do not have tax treaties with other countries, withholding tax on royalties is usually a major barrier to this structure. In addition, transfer pricing rules should regulate the level of royalties permitted. Where IP is developed in a country with transfer pricing rules, appropriate tax is usually collected on the sale of the IP if it is moved to a tax haven.

In general, the use of tax havens with e-commerce should not pose a significantly increased threat to Uzbekistan's tax system. As discussed in the section below, indirect taxes are likely the most important to protect and should not be affected by an offshore structure.

2. Indirect taxes (VAT)

While profit taxes of companies actively engaging in e-businesses in Uzbekistan is obviously important, it is not likely the mechanism that has the most direct potential. As e-commerce allows Uzbeks to access products and services from vendors around the world, there is a tremendous potential for the application of VAT on the final consumers. As the Uzbekistan system is very similar to the VAT rules throughout the European Union, Uzbekistan should be particularly interested in European Commission proposals. The European Commission supports the worldwide acceptance of VAT being applied only at the place of consumption.

While this system appears reasonable and is supported by other non-European Union countries and the OECD, there is a particular problem with administering it. In general, business-to-business transactions are not a problem, as most business registration requirements for VAT purposes and self-assessment could be relied upon and monitored. However, the application of VAT to individuals where they purchase goods or services from the Internet is a much more difficult problem with no simple answers. One of the leading proposals in the European Union is to require all non-European Union suppliers to register for VAT in at least one European Union country. The supplier would then be responsible for withholding and paying VAT to the European Union for all sales within its borders.

The OECD and the European Commission are continuing to research this issue, and a plan should be adopted that works from a global perspective. The primary guidelines in the European Union's proposed system are currently as follows:

(a) No new taxes should be introduced to deal with e-commerce, and existing taxes should be adapted;

(b) Supplies made via an electronic network should be treated as a supply of services for VAT purposes and should not be outside the scope of VAT;

(c) Only services supplied for consumption within the European Union should be subject to VAT. Input VAT should be deductible; and

(d) Supplies of goods and services should be similarly taxed regardless of the mode of commerce used or whether delivery is carried out on-line or off-line, or whether the goods or services were purchased inside or outside the European Union.[25]

[25] *Tax News Service (IBFD Issue 32, Volume 33) - 9 August 1999.*

The most likely result of the work by the EC and OECD is a common agreement on the principles. In order for Uzbekistan to maintain its tax base and continue encouraging the development of e-commerce, its laws should coincide with the new principles when they are finalized. Currently, new draft laws exist relating to the application of VAT to certain goods, such as music, which can be easily purchased in electronic form. In concept, these laws are not much different from those already existing in many countries. However, the enforcement methods of these laws will create challenges, and Uzbekistan would be best served by joining other countries in finding a solution.

3. Customs duties

As in most countries, when goods are physically delivered from a different country, they are generally subject to customs duties upon entering Uzbekistan. However, the Internet and e-commerce have made it possible to receive many products electronically such as music, books and software. Currently, no system exists to collect customs duties on electronically delivered goods where the same products would be subject to duty if delivered in a physical form. Uzbekistan law already defines the movement of goods over the "electronic border" to be subject to customs laws; however, there is no method available to even track this kind of importation. Meanwhile, the international community is adamant that no new taxes should be created to deal with e-commerce. How is this to be rationalized if the same governments and organizations believe that e-commerce should be treated fairly on the same basis as non-electronic transactions?

The Government of the United States has been one of the loudest voices advocating the elimination of customs duties and tariffs worldwide. Many other countries, including members of the OECD and the WTO, join the United States in their view that e-commerce should be free from new forms of taxation, including customs tariffs. In addition, there seems to be a consensus that the reduction or removal of trade tariffs will only help improve international trade and benefit all countries. However, there is dissent to this view, mostly from developing countries that feel their industries will be damaged if free trade is permitted before they become competitive in world markets.

The most reasonable first step might be to remove customs duties on physical products that may also be delivered over the Internet free of such charges. Attempting to track these electronically delivered goods would be extremely difficult and costly and would not coincide with the international community's consensus on this issue. Meanwhile, Uzbekistan likely would be viewed favourably by other countries and the business community if it were to eliminate the tariffs on similar physical goods. With the ability to choose a tariff-free method of delivery, it is likely that such tariffs will steadily decline anyway. In addition, the move would influence multinational businesses to look internationally for their e-commerce investments.

The OECD, WTO and the European Union will continue to research this area and will likely advocate further reductions of tariffs on all goods. This issue is much more specific to each country than most others involving e-commerce. However, Uzbekistan has an opportunity to take the lead the issue and lower tariffs, in accordance with international trends.

4. General principles

Taxation should not be a barrier to growth of electronic commerce. Rather, it should foster a climate in which e-commerce can grow more efficiently. The following are the basic principles of e-commerce taxation that have been adopted by many leading countries and organizations:

(a) The taxation of e-commerce should be neutral compared to the taxation of similar transactions using non-electronic means. It should neither distort nor hinder commerce. No tax system should discriminate among types of commerce, nor should it create incentives that will change the nature or location of transactions.

(b) No new taxes should be created or applied with respect to e-commerce or other forms of Internet transactions.

(c) An e-commerce taxation system should be simple and transparent. It should be capable of capturing the overwhelming majority of appropriate revenues, be easy to implement, and minimize burdensome record keeping and costs for all parties.

(d) The taxation of e-commerce should be consistent with established, internationally accepted practices.

As the majority of the world will use these principles to establish approaches to the taxation of e-commerce, Uzbekistan would benefit greatly from adhering to them in its own policies. It is widely agreed that e-commerce is a global phenomenon, and global consensus will decide its fate.

In order to achieve the benefits outlined above, the following is recommended:

- Review existing laws on characterization of income to ensure that e-commerce is treated fairly and correctly.
- Evaluate the deduction of advertising as a normal business expense.
- Review the utilization of the OECD Model Tax Treaty for treatment of e-commerce and recognition of Permanent Establishments (PE).
- Ensure that there are no double taxation issues that relate to software and royalties that support e-commerce.
- Continue to utilize indirect taxes (i.e. transfer pricing rules) to protect from any loss of revenues due to the operation of offshore tax havens.
- Join together with European Union countries to determine an effective way to collect VAT for transactions that occur or originate outside of Uzbekistan but are made or originated by Uzbekistan businesses or consumers.
- Review the elimination of customs duties on goods that can be imported/exported in either a physical or electronic medium, such as recorded music.
- Remove any potential taxation barrier that stifles the growth of e-commerce, and instead encourage taxation that will foster the growth of e-commerce.

REFERENCES

1. Woroniecki, Jan. "New Economy: Illusion or Reality? Doctrine, Practice and the OECD Perspective"
2. TIGER Working Paper Series, No. 5
3. "Uzbekistan Economic Outlook, 2003", IFC, 2003
4. "Uzbekistan and countries of the world", Ministry of statistics and Analysis, 2001
5. "Readiness for the Networked World –Uzbekistan", IMF, 2001
6. "Social-Economic Status of Households", Ministry of Statistics and analysis, 2004
7. "Statistical Yearbook", Ministry of Statistics and Analysis, 2004

XIII. VIET NAM[26]

A. SMES status in the Viet Nam economy

Vietnamese economic reform (Doi Moi), shifting in social and economic orientation, (Doi moi) started in 1986. In 1990, the "Private Enterprise Law and Company Law" were enacted with aims to create the foundation for the formation of formal private sector. As a result of this reform drive, there had been created 0.85 million household business and 100 private enterprises in 1990 (GTZ, 2005). In 2000, a substantial level of legal reform actions on the "Enterprise Law" was taken in favour of private enterprise promotion. According to the Government Decree on SME Development (2001), a SME is defined as the enterprise with registered capital of not more than VND 10 billion (US$ 625,000) or number of labour of not more than 300 people.

As of 2002, the number of SMEs in Viet Nam amounts to 59,831 enterprises, representing about 95 per cent of national total enterprises, among which State-owned SMEs comprise 6 per cent, non-State-owned 91 per cent and the rest foreign affiliated companies (see Table 4.25). Looking into the contribution of SMEs to the development of the economy, SMEs made contribution to 58.75 per cent of GDP in 2000: State-owned SMEs 10.98 per cent and private SMEs 47.77 per cent.

Table 4.25 Number of SMEs in total enterprises by sector and ownership

(by number of employees)

	2000			2001			2002		
	Total	**SMEs**	**%**	**Total**	**SMEs**	**%**	**Total**	**SMEs**	**%**
State-owned	5,759	4,194	72.83	5,355	3,752	70.07	5,364	3,631	67.69
Non-State-owned	35,004	34,490	98.53	44,314	43,664	98.53	55,236	54,400	98.49
FDI	1,525	1,213	79.54	2,011	1,646	81.85	2,308	1,800	77.99
Total	42,288	39,897	94.35	51,680	49,062	94.93	62,908	59,831	95.11

Source: GSO, 2005

Table 4.26 Number of SMEs by sector and ownership

(by number of employees)

	2000		2001		2002	
	Number	**%**	**Number**	**%**	**Number**	**%**
State-owned SMEs	4,194	10.51	3,752	7.65	3,631	6.07
Non-State-owned SMEs	34,490	86.45	43,664	89.00	54,400	90.92
FDI SMEs	1,213	3.04	1,646	3.35	1,800	3.01
Total	39,897	100.00	49,062	100.00	59,831	100.00

Source: GSO, 2005

Table 4.27 Number of SMEs in total enterprises by sector and ownership

(by registered capital)

	2000			2001			2002		
	Total	**SMEs**	**%**	**Total**	**SMEs**	**%**	**Total**	**SMEs**	**%**
State-owned	5,759	2,496	43.34	5,355	2,040	38.10	5,364	1,763	32.87
Non-State-owned	35,004	33,433	95.51	44,314	41,967	94.70	55,236	51,770	93.73
FDI	1,525	376	24.66	2,011	663	32.97	2,308	683	29.59
Total	42,288	36,305	85.85	51,680	44,670	86.44	62,908	54,216	86.18

Source: GSO, 2005

[26] *This paper was prepared and presented by Ms. Nguyen Thi Phuong Mai, Researcher, National Institute for Science and Technology Policy and Strategy (NISTPAS), Hanoi, Viet Nam.*

Table 4.28 Number of SMEs by sector and ownership

(by registered capital)

	2000		2001		2002	
	Number	**%**	**Number**	**%**	**Number**	**%**
State-owned SMEs	2,496	6.88	2,040	4.57	1,763	3.25
Non-State-owned SMEs	33,433	92.09	41,967	93.95	51,770	95.49
FDI SMEs	376	1.04	663	1.48	683	1.26
Total	36,305	100.00	44,670	100.00	54,216	100.00

Source: GSO, 2005

B. Innovation policies for SMEs

The economic reform packages launched in the 1980s and accelerated in the 1990s, included measures to make science and technology system alignment toward the needs of the productive sectors. Some of the main measures are included: (1) Granting authority to R&D institutions to directly contact industry; (2) increased feasibility of R&D institutions on industrial R&D; and (3) expanding technology support services for industry including technology transfer, consulting services, experimental and pilot manufacturing.

Currently, there are four types of technology innovation policies in Viet Nam: To create/innovate/master technology that is suitable with and required by SMEs; to promote the transfer of technology into SMEs; to provide technological assistance for SMEs in innovation; and to provide financial supports for SMEs in technological innovation. Table 4.29 shows the status of SMEs which are engaged in technological innovation activities.

Table 4.29 Percentage of SMEs conducting technological innovation activities

	By employee ranges (%)			All (%)
	Micro	**Small**	**Medium**	
Minor process innovation activities	84.6	82.8	73.3	**81.0**
Major process innovation activities	46.2	48.3	46.7	46.6
Minor product innovation activities	61.5	48.3	80.0	**60.3**
Market introduction of new products	53.8	41.4	53.3	48.3
Foreign technology acquisition with foreign services	23.1	24.1	66.7	34.5
Foreign technology acquisition with domestic services	30.8	41.4	33.3	36.2
Industrial design assimilation	53.8	31.0	40.0	37.9
Other innovation activities	7.7	20.7	20.0	17.2

Source: NISTPASS, 2005

Looking into characteristics of technological innovation of SMEs, most of innovation activities are related to minor or incremental changes in process and products. Many SMEs are engaged in innovation by imported technologies rather than in-house R&D or indigenous technologies. Therefore, necessary technologies are mostly transferred from MNCs or parent companies (see Table 4.29) and there have been weak cooperation linkage with R&D institutions and other enterprises.

Obstacles of SMEs in conducting innovation are:

- Lack of technology information
- Do not know how to evaluate technology
- Lack of knowledge to select appropriate forms of external technology acquisition
- No experience in negotiation of technology transfer agreements
- Difficulty to access capitals to implement technological innovation activities
- IPR issues

Box 3. NISPASS evaluation of technological level of firms in Viet Nam

- Low level linkage from manufacturing and industry to capital and intermediate goods
- Weak linkage between R&D institutions and the productive sectors
- Inefficient and ineffective role of the state in supporting enterprises in terms of information, consistent policy signals and credit guarantee, etc.·
- Constant shortage of appropriately trained and skilled technicians, engineers and labour· Lack of capable technical, engineering and management training institutions
- Lack of management capabilities to manage in a competitive market economy
- Other factors hindering technological change and upgrading: the relative lack of financing, including access to credit on reasonable terms; an unsuitable and exceedingly complex taxation system; an unstable policy climate and an inadequate legal framework.

Table 4.30 Sources of information for technological innovation activities

Source of information	All activities (%)
Emerge during the production processes	89.7
Follow other enterprise (domestic/foreign)	36.2
Suggestions/requirements of customers	48.3
Suggestions of suppliers/contractors	10.3
Information from professional associations	10.3
Cooperation with technological research institutes	6.9
Cooperation with technical colleges/universities	5.2
Investigate or survey aboard	34.5
Provided by domestic consulting agencies	13.8
Provided by foreign consulting agencies	3.4
Participate in fairs/exhibitions	39.7

Source: NISTPASS, 2005

C. Current status of subnational innovation system and technology capacity-building

Government policies and other institutions for SMEs technology capacity-building are currently available but could not be substantially implemented in every part of the country. Meanwhile, most of local governments do not have authorities and resources to implement incentive policies for local SMEs and in general research organizations do not meet requirements and needs of SMEs in conducting technology innovation.

With respect to subnational innovation system of Viet Nam, there have been a lot of challenges needed to be appropriately addressed:

- Lack of linkage between SMEs and R&D institutions and universities
- Lack of universities and training institutions to provide human resource for SMEs
- Problem in management of intellectual property owned by public research organizations
- Problem of IPR protection: tacit knowledge could not be codified
- Lack of networks of SMEs including industry associations
- Lack of technological information centre/consulting agencies
- Limited capital for innovation activities of SMEs
- Industry parks/zones only available for FDI and large enterprises

D. Best practices

From 2000, Ho Chi Minh City has implemented a special programme to encourage the linkage between enterprises, research organizations and local government in order to build technology capacity and enhance competitiveness of SMEs. The population of the City is 6 millions and its GDP per capita is US$ 2,000. There are 40 universities and colleges, and 60 research institutes and centres.

Major schemes of Ho Chi Minh City's Programme are:

- Provide fund for enterprises to conduct research or technological innovation together with the assistance of public research organizations (PROs)
- Request PROs to conduct research projects for addressing the need of SMEs
- Set up a design centre for developing new machine and equipment
- Assist enterprises and research organizations in facilitating technology transfer
- Provide training courses on evaluation of intellectual property
- Provide consultant services for enterprise relating to technological issues
- Provide training courses for enterprise managers
- Organize technology fair/exhibition every year
- Assist enterprises to follow international standards
- Assist enterprises in IPR issues
- Set up database of technology information
- Encourage investment in selected priority products among 37 types of machines/ equipments and technologies·
- Transfer of 250 machines/equipments to enterprises across the nation
- Export some of local developing products to other countries
- Initially establish the linkage between actors of the system of innovation.

However, there have been remained some problems and issues as follows:

- Benefit sharing between actors involved need to be clarified
- Still limited research activities to lack of equipments and capital
- Number of technology transferred still limited and slow.

E. Future plan

The Government of Viet Nam is requested to establish sectoral innovation system for promoting new and emerging technologies, as well as local/regional innovation systems to enhance competitiveness of local SMEs based on technology capacity-building. To this end, the following issues need to be addressed or taken into account.

- Promote existing R&D centres/institutes and universities
- Encourage transfer of technology from R&D institutes/universities to the SMEs
- Set up a fair benefit sharing mechanism for researchers and their institutes
- Establish technology transfer offices (TTOs) within PROs
- Create good infrastructure and special environment for facilitating start-ups such as: incubators, high-technology zones, science parks, etc.
- Establish SMEs groups/association within a certain location
- Develop programme to assist SMEs in technology management
- Improve and develop system of supporting centres and services agencies such as technology information centres, technology consulting agencies, etc.

PART FIVE

SPECIAL PRESENTATION OF KOREAN EXPERIENCES ON THE PROMOTION OF SIS AND SME TECHNOLOGICALCAPABILITY

I. ENHANCING THE COMPETITIVENESS OF SMES BY FOSTERING RIS: THE KOREAN CASE[1]

1. Why innovation system is required?

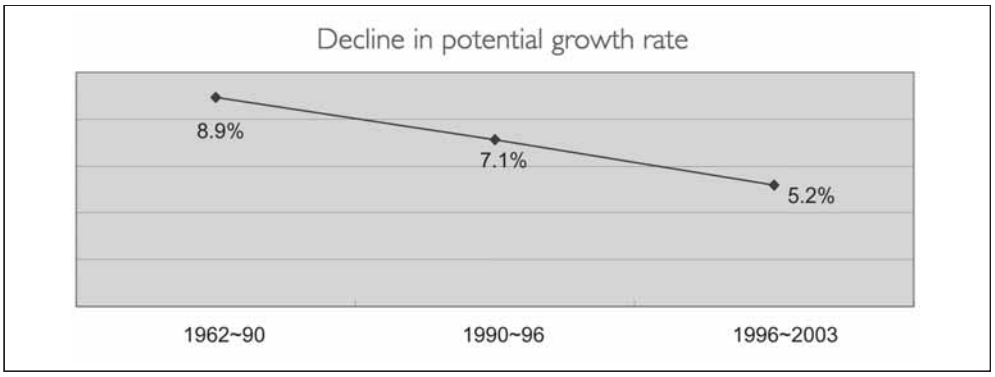
Rising demand for new growth model

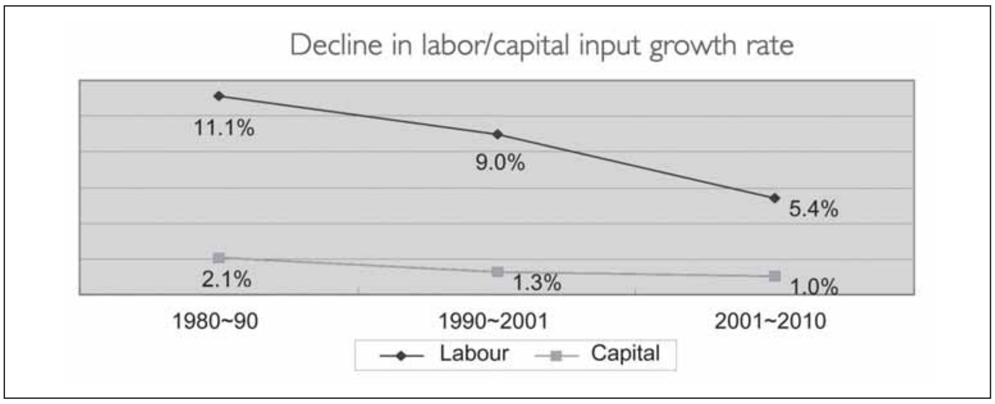
There is a rising demand for seeking a new growth model in the Korean economy as the traditional input-driven strategy faces its limit of growth due to the following changes: increased labour cost; emergence of new competitors with higher cost competitiveness like China, India and other ASEAN countries; and shortening of technology life cycle and lack of competitive fundamental technologies. Currently the productivity of the Korean economy remains just 50 per cent level of those of developed countries. For instance, the below comparison with respect to index of the Republic of Korea and the United States shows the gap of productivity and competitiveness remained.

Comparison of index of the Republic of Korea and the United States (Source: The Bank of Korea)

- Capital per capita: ('70) 20 per cent, ('90) 63 per cent, (2000) 93 per cent
- Average years of education: ('70) 52 per cent, ('90) 74 per cent, (2000) 83 per cent
- Productivity (Input/Output): ('70) 37 per cent, ('90) 47 per cent, (2000) 48 per cent

Figure 5.1 Limit of input-driven growth strategy





[1] *This paper was prepared and presented by Mr. Hyung-Young Kim, Director, the Presidential Committee on Balanced National Development, Seoul, the Republic of Korea.*

2. Why innovation system matters in the Republic of Korea?

In the current Korean society, there has been an increasing policy concern for unbalanced development between regions and communities. For instance, economic resources and infrastructure were extremely over concentrated in Seoul and Kyounggi region: 48 per cent of national population, 91 per cent of top 100 companies, 60 per cent of national tax revenue, 64 per cent of universities. This unbalanced development has to some extent impeded sustainable growth and thus the benefits from concentration have been overwhelmed by inefficiency due to overpopulation. In this context, the current government has put the issue of "regional balanced development" on a top policy priority.

It may be noted that balanced development does not mean equally spreading resources to each region and therefore the necessary policy approach is aiming to mitigating the negative aspects of overcrowded regions while facilitating and accelerating development of less-developed regions. Against this backdrop, the government is pursuing an innovation-driven strategy as a new growth model as well as a growth strategy by building strong regional innovation system (RIS) in which one of the major initiatives is innovation cluster building.

3. What is new growth model for the Korean economy?

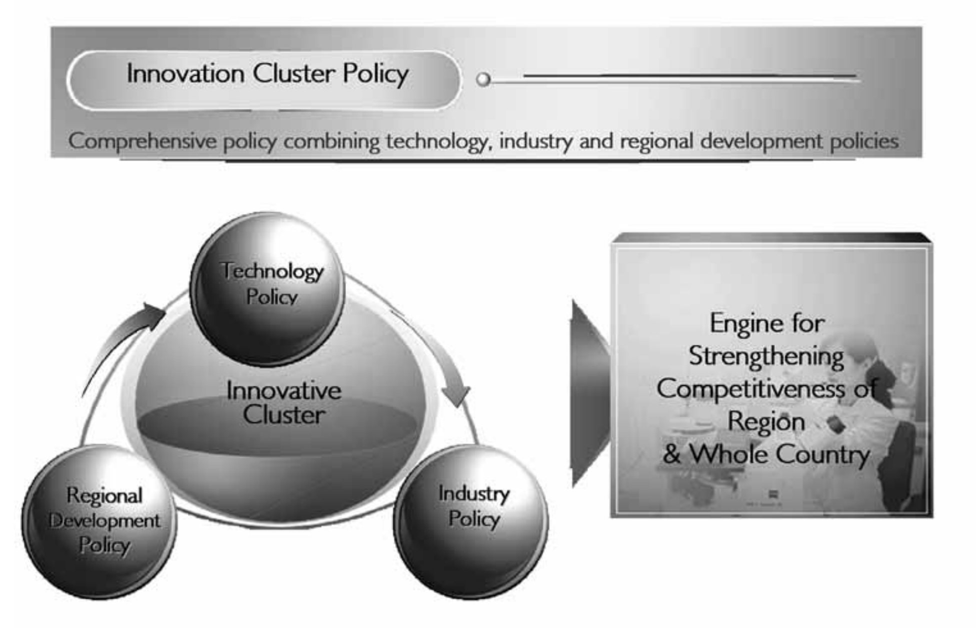
In the knowledge-based economy, the national competitiveness is determined by knowledge, information and technology: sources of national wealth have been shifted from comparative advantage based on capital and labour to competitive edge base on knowledge, technology and information. In this context, the government is initiating the innovation-driven strategy in which one of the policy priorities is to foster innovation cluster in selected regions.

Like clusters in other developing countries, most of the existing clusters are in the stage of simply making geographical proximity of businesses, research institutes, universities. The problems they are facing now include: lack of interaction and collaboration among businesses, research institutes and colleges; lack of venture capital and business service providers such as consulting, law, marketing, and technology management firms; and lack of commercialization of R&D results due to insufficient infrastructure for technology transfer and technology appraisal.

The innovation cluster is the key to growth strategy of the Korean economy through building RIS. A RIS in industry sector is an "innovation cluster." Then, what is the innovation cluster? An innovation cluster is an interactive cooperation system among innovation actors agglomerated in a certain space or area, designed to stimulate technology/business innovation activities through strong networks among industry, universities, research institutes and governments.

In general, an innovation cluster policy needs a comprehensive policy approach incorporating technology, industry and regional development policies. A sound innovation cluster may be a growth engine for enhancing competitiveness of a region as well as a whole country. Building an innovation cluster is a critical way to accelerate development of a particular region and to achieve balanced national development. A successful cluster therefore can facilitate development of other clusters, and lead to the development of the whole country. Through those cluster building initiatives, RIS can be successfully consolidated into NIS.

Figure 5.2 Innovation cluster policy framework



How to build innovative clusters?

Building an innovation cluster needs the preparation of various infrastructure including physical infrastructure, technology and knowledge infrastructure, needs to establish necessary institutions and governance system, and needs to support appropriate financial incentives including venture capital and public finance support. It also necessitates the existing of enterprises, clustering of enterprises and knowledge institutions as well as social and cultural capital. Building clusters from the scratch therefore might be extremely costly and ineffective and upgrading or revitalization of existing traditional clusters to innovative clusters is a wise alternative. Building and strengthening networks among industry, research institutes, universities and local governments is the key to cluster building, especially an important strategy for promoting start-up companies and technology-based SMEs.

It may be worth noting that the effort of simply copying and transplanting a successive cluster of other region to a region with different environment and resources (even in the same country) would surely go futile (e.g. San Diego vs. Florida/Baltimore, Maryland/ Loudon, Virginia). Scott Wallesten pointed out that "High-technology cluster bombs: On average, there was no evidence that building a research park made a difference to regional development" (Nature, 11 March 2004).

Focused clusters in the Republic of Korea

Across the country, there are several types of focused clusters as follows: Daedeok Innovative Cluster; 7 industrial complexes now being transformed into innovation clusters; Bio-technopolis in Osong; Cultural clusters; IT Complex (Seoul & Incheon); and agricultural clusters located 20 sites. In the following, further discussion is focused on the government initiative to converse seven existing industrial complexes into innovation clusters.

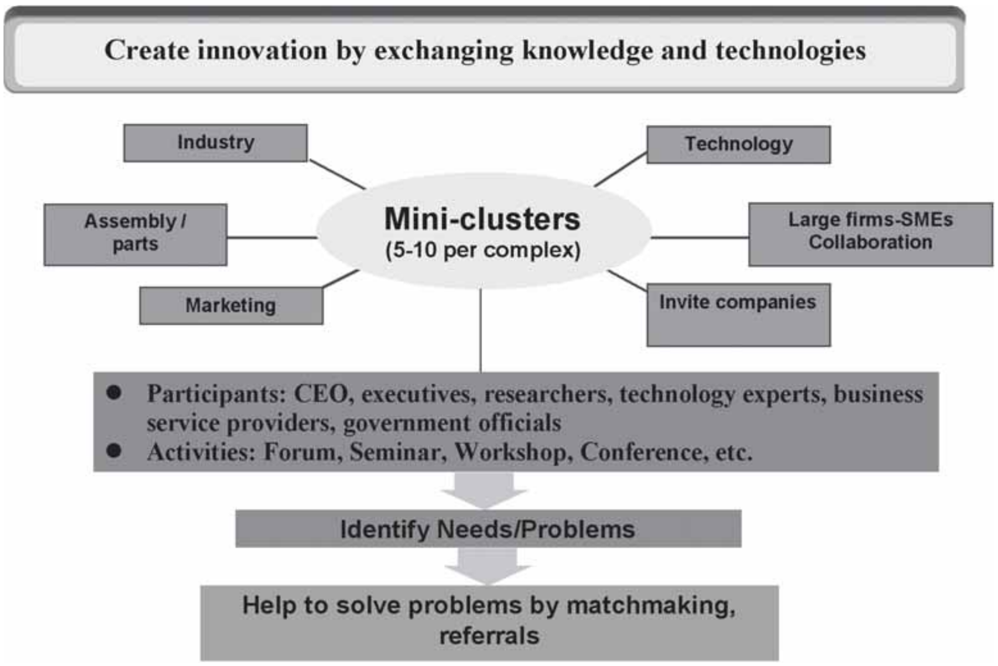
In recent years, the initiative to converse the existing seven industrial complexes into innovation clusters brings about a keen policy attention from central and local governments, as a prime strategy for achieving sustainable and balanced national development. The main actors of the existing industrial clusters are composed of manufacture/assembly-driven suppliers for large or foreign companies, which are generally lack of R&D competence, high-end technologies, and have weak interaction and cooperation among research institutes, university and other businesses.

Strategies to upgrade them towards innovation clusters are: (1) to build and promote formal/informal networks, namely building "Mini-cluster"; (2) to enhance R&D capabilities of concerned actors; (3) to improve business and residential environment conducive for innovation; and (4) to collaborate with advanced innovative clusters abroad.

(a) Strategy 1: Build networks

As can be shown in Figure 5.3, the objective of mini-cluster networking is to facilitate innovation through exchanging knowledge and technologies among actors. Mini-clusters are requested to be involved a variety of activities and entities such as industry, technology and knowledge, assembly and parts firms, value-chain between large firms and SMEs, marketing activities and external companies, etc. Main participants include CEOs, executives, researchers, technology experts, business service providers, and government officials. Needs and problems can be identified through forum, seminar, workshop and conference and actors of clusters can help to address SMEs' needs and problems by process of matchmaking and referrals.

Figure 5.3 Network framework for building innovation cluster



Services provided by mini-cluster's networking and referral are:

- Joint technology development and technology transfer
- Consultancy: Legal, business planning and technological problems
- Product designing, financing and marketing support
- Filing of patent and technology licensing, technology and business incubation
- Recruiting skilled-workforce, testing and standard facilities

(b) Strategy 2: Enhancing R&D capability

One of success factors for innovation cluster building is to combine R&D capabilities of knowledge institutions with firms' manufacturing competence. To this end, there is a need to create alliance among actors through synergizing the following three areas: existing R&D infrastructure (central/local government); innovative clusters (industrial complexes); and network among service providers. Based on this environment, an efficient technology transfer system needs to be set up to stimulate technology exchange and commercialization of patented technologies through strengthening local R&D capability by inviting branch of R&D institutes or establishing R&D organizations, and signing MOU on industry-business fund.

(c) Strategy 3: Improving residential/business environment

Creating an environment conducive for business activities is the key to attract diverse innovative actors into a cluster, including FDI. There are three areas in creating optimum environment for a sustainable cluster: (1) business environment comprising environment friendly complex and knowledge-based industry zone; (2) residential infrastructure for foreign experts including guest house, hospitals and educational institutions; and (3) building an innovative city.

(d) Strategy 4: Affiliating with other clusters

It is well recognized that there is no single optimum policy model on the innovation cluster building which can be applicable to all member countries and establishing an innovation cluster cannot be started from scratch. There are a lot of success cases of cluster building. In this respect, there is a need for collaboration and benchmarking towards building an open-door cluster. To this end, collaboration with universities and research institutes is necessary for sharing information and commercializing R&D results. Benchmarking from advanced clusters abroad must be also considered through inviting experts, exchanging information and conferences. Lastly, there is a need to expand FDI by providing favourable tax incentives.

II. INNOVATIVE SMES AND PROMOTION POLICIES IN THE REPUBLIC OF KOREA[2]

A. SMEs in the Korean economy

Small and Medium Enterprises (SMEs), like most countries in the Asian and Pacific region, play a leading role in creating employment jobs and adding value. As the Korean economy now shifts towards a knowledge-based economy, particularly the role of innovative SMEs became significant. They are able to maintain global competitiveness through continuing management innovation and creation of new products and services. The government recognized the importance of nurturing innovative SMEs. Today, there are 330,000 SMEs except microenterprises and 2 per cent of SMEs, 7,000 manufactures, are innovative SMEs.

1. The shares of SMEs in the Korean economy

In the Republic of Korea, SME is defined as an enterprise with less than 300 employees. As of 2003, the number of SMEs reaches about three million and they employ 12 million people, while 4,808 large firms offer only one and half million jobs. Since the financial crisis in 1997, SMEs have been the main source of creating new jobs in the Republic of Korea. As of 2002, total production of SMEs was 455 trillion Korean won, comprising 52 per cent of total industry production.

Table 5.1 Status of business entities in the Republic of Korea

		2001	2002	2003
Number of Business entities	Total	2,876,817	2,953,124	3,004,105
	SMEs	2,871,951	2,948,171	2,999,297
	[%]	[99.8]	[99.8]	[99.8]
	Large Firms	4,866	4,953	4,808
	[%]	[0.2]	[0.2]	[0.2]
Number of Employees	Total	11,650,034	11,975,672	12,041,387
	SMEs	9,969,797	10,385,020	10,474,630
	[%]	[85.6]	[86.7]	[87.0]
	Large Firms	1,680,237	1,590,652	1,566,757
	[%]	[14.4]	[13.3]	[13.0]

Source: www.stat2.smba.go.kr

2. The shares of SMEs in manufacturing sectors

In manufacturing industry sectors, as of 2003 there are about 110,000 manufacturing SMEs (employing 5,300 persons), sharing 99.4 per cent of total manufacturing firms. The share of SMEs in the employment and in the industry production has steadily increased over the last 10 years and SME share in exports is 42.2 per cent in 2003.

[2] *This paper was prepared and presented by Mr. Brian H. Lee, Professor, Kwangwoon University, Seoul, the Republic of Korea.*

Table 5.2 Shares of SMEs in manufacturing sectors

		2000	2001	2002	2003
Number of Business entities	Total	98,110	105,088	109,489	111,363
	SMEs	97,379	104,406	108,819	110,691
	[%]	[99.3]	[99.4]	[99.4]	[99.4]
	Large Firms	731	682	670	672
	[%]	[0.7]	[0.6]	[0.6]	[0.6]
Number of Employees	Total	2,652,590	2,627,250	2,675,292	2,716,752
	SMEs	1,962,908	1,990,688	2,057,816	2,090,216
	[%]	[74.0]	[75.8]	[76.9]	[76.9]
	Large Firms	689,682	636,562	617,476	626,536
	[%]	[26.0]	[24.2]	[23.1]	[23.1]
Production (A hundred million)	Total	5,648,341	5,750,923	6,282,853	6,720,605
	SMEs	2,675,619	2,822,854	3,189,619	3,402,313
	[%]	[47.4]	[49.1]	[50.8]	[50.6]
	Large Firms	2,972,722	2,928,070	3,093,234	3,318,292
	[%]	[52.6]	[50.9]	[49.2]	[49.4]

Source: www.stat2.smba.go.kr

3. International comparison

Compared to other OECD countries, the Republic of Korea has more relied their employments and production on SME business as shown in Table 5.3.

Table 5.3 International comparison of SMEs

	Republic of Korea	Japan	United States	Germany	Taiwan Province of China
Shares of manufacturing sectors in GDP (2002)	29.0	21.0	15.0	23.0	26.0
SMEs in total number of businesses (%)	99.5	98.9	98.5	99.2	96.7
The share of SME employments	74.7	72.1	41.1	56.8	79.9
The share of SME production	53.3	51.3	24.8	42.5	33.4

Source: OECD, Small and Medium Enterprise Outlook, 2002

4. Competitiveness gap between large firms and SMEs

There have been remained the widening gap between large firms and SMEs in terms of the productivity and competitiveness as shown in Table 5.4. With respect to R&D performance, as of 2003, large firms have lion's share, 76.4 per cent of total private R&D investment amounting to 14,509 billion Korean won. Also 57.8 per cent of total private sector R&D personnel (124,030) are engaged in large companies (see Table 5.6).

Table 5.4 Value-added per capita in manufacturing sectors

(Unit: million Korean won)

	1990	1995	1998	2000	2002
Large firms	31.7	93.3	133.8	158.4	188.3
SMEs (%)	16.5 (52.2)	36.3 (38.9)	51.8 (38.7)	56.1 (35.4)	60.5 (32.2)

Source: Korea Research Institute for Small and Medium Industries, 2004

Table 5.5 Operating income to sales (Unit: %)

	2000	2001	2002	2003	2004
Large firms	8.21	6.03	7.54	8.16	9.43
SMEs	5.83	4.54	5.29	4.64	4.11

Source: The Bank of Korea

Table 5.6 R&D expenses and R&D manpower

(Unit: 10 billion Korean won)

	R&D expenses 2001	R&D manpower 2001	R&D expenses 2002	R&D manpower 2002	R&D expenses 2003	R&D manpower 2003
Large firms	8,737	57,019	9,337	62,459	11,084	71,698
SMEs	3,537	54,280	3,683	55,701	3,425	52,332

Source: Korea Ministry of Science and Technology, 2004

5. The importance of SME innovation in the Korean economy

Innovative SMEs are expected to play a crucial role in driving the Korean economy with more knowledge-based, competitive one. In general, there are three imperatives and objectives for the government to achieve through promoting innovative SMEs as follows: (1) to enhance the overall competitiveness and technological capability of SMEs; (2) to reduce the gap between the large firms and SMEs in profitability and technological competitiveness – during 1998-2002, capital stock (book value of equipment per worker) in large firms had increased 16.5 per cent annually while that of SMEs had increased only 12.8 per cent annually; and (3) to create new jobs for the younger generation – for the period of 1998-2002, employees of large firms decreased 207,000 persons while those of SMEs increased 206,000 persons. Since the current estimated unemployment workers reach about one million, there is a need to create at least 400,000 new jobs by innovative SMEs to fulfill the demands of the unemployed.

B. Innovative SMEs in the Republic of Korea

Innovative SMEs are defined as SMEs with independent R&D capacity necessary for new product development, process innovation and business management abilities. According to the survey (2004) by the Small and Medium Business Administration (SMBA), they are estimated to represent two per cent (20,000 firms) of a total of 110,000 manufacturing SMEs with five or more employees. The ratio of innovating SMEs which make substantial investment for technology development has gradually increased from 8.3 per cent in 1995 to 12.0 per cent in 2000 to 19.6 per cent in 2003. Compared with other countries, the percentage of innovating firms in the Republic of Korea is still lower than in other OECD countries as below.

	Republic of Korea	Germany	France	Italy	Sweden
% of innovating SMEs	37	67	46	40	48

Source: STEPI, 2004

1. Trend of innovative SMEs

According to the Korea Industrial Technology Promotion Association (KITPA), there are about 9,000 SMEs which have in-house R&D departments. About 6,500 SMEs are officially certified to be entitles as "venture business" by the government agency: "Venture business" means the company spending more than 5 per cent of revenues in R&D activities and it is used to explain a special group of innovating firms which have somewhat a legal status based on "Venture Business Promotion Special Act (1997)." Up to date, the Government designated about 2,500 SMEs as an innovating SME, namely a venture company. Lee, et al. (2005) estimated that 2.5-3 per cent of SMEs have technological competence and achieves abnormal profitability.

Meanwhile, as of the year 2003 venture companies and innovative firms account for around 10 per cent of employment and production in manufacturing sector. A recent survey by KOTEF reports that the aggregated total revenue of 5,438 innovative SMEs amounts to 111 trillion Korean won in 2003 and the total amount of exports by 3,693 innovative SMEs is 14 trillion won. The figures in the below table also show that innovative SMEs account for a significant portion of production and exports in the Korean economy.

	Total	SMEs	Ventures	Inno-biz	Large firms
Number of firms	111,363	110,691	6,469	2,557	672
%	100.0	99.4	5.8	2.2	0.6
Employees	2,716,752	2,090,216	297,512	116,087	626,536
%	100.0	76.9	10.9	4.3	23.1
Production (billion Korean won)	672,060	340,231	58,026	20,992	331,829
%	100.0	50.6	8.6	3.1	49.4
Exports (million USD)	193,817	81,698	7,078	8,889	112,015
%	100.0	42.15	3.65	4.59	57.79

Source: National office of Statistics, SMBA, 2003

2. Venture business

Recognizing the increasing important role of venture companies which can achieve higher business performance and create more jobs than existing SMEs, in 1997 the government enacted the "Special Measures Act for the Promotion of Venture Business." Key policy measures to support innovative SMEs stipulated in the Act are:

- Implementing certification and registration scheme of "venture business" by the Government to identify and to support targeted innovative SMEs
- Increasing deregulation of KOSDAQ and IPO market for promoting venture business
- Easing limit level of foreign investor ownership
- Lowering the IPO requirement for venture business
- Lowering market entry barrier for start-up venture companies
- Providing public venture capitals/matching funds for private venture investment
- Providing credit loans for operating cash at a 2 per cent lower interest rate
- Promoting and supporting technology/business incubators operated by universities, public research institutes and local governments
- Providing tax benefits to the venture business and the investors
- Exempting military services for young entrepreneurs/engineers working for ventures

3. Status of venture business

The government set the official criteria to publicly recognize and certify venture businesses, and classified the following three types of different venture companies: (1) Venture capital investment firms: more than 10 per cent of equity should be invested and shared by venture investment companies or funds; (2) R&D investment firms: their annual R&D investment should exceed 5 per cent of total sales and total amount of R&D expenditure should be more than 50 million Korean won per year; and (3)

New technology development firms: firms whose main source sales are from patent rights or new technologies developed by the government support; or high-technology firms invested by foreign companies; or firms commercializing new technologies developed by universities or research institutes.

	Venture capital investment firms	R&D investment firms	New technology development firms	Total
Number of ventures as of July 2004 (%)	551 (6.6%)	1,567 (18.7%)	6,252 (74.7%)	8,370

Source: The Korea Venture Association, www.venturenet.or.kr

A venture business employs 40 persons on average: an average employment is about 12 persons at the first year of its operation and 20 persons at the second year. In general, it has small revenue, but high growth rate: average revenue is 7.3 billion Korean won in 2003; in about 70 per cent of ventures, the revenue was less than 5 billion Korean won. While the average annual growth rate represents 24 per cent. It may be noted that most of ventures have been founded in the high-technology industry sectors including IT and S/W (see Tables 5.7-5.10).

Table 5.7 Distribution of ventures by industry

	Manuftr	IT S/W	R&D service	Const./trans	Retail	Agrict.	Others	Total
Number	5,755	1,899	330	138	153	26	69	8,370
%	68.8	22.7	3.9	1.7	1.8	0.3	0.8	100.0

Source: SMBA, Korea Venture Research Institute, 2004

Table 5.8 Distribution of venture businesses by firms' age

Year	12 -	4 – 12	2-4	1-2	Total
Number	731	2,108	2,259	658	5,756
%	12.7	36.6	39.2	11.4	100.0

Source: SMBA, Korea Venture Research Institute, 2003

Table 5.9 Distribution of venture businesses by sales scale

(Unit: A hundred million won, %)

Less than 1	1-5	6-10	11-50	50-100	More than 100	Total
711 (15.5)	552 (12.0)	936 (20.4)	926 (20.2)	625 (13.6)	840 (18.3)	4,590 (100.0)

Source: SMBA, Korea Venture Research Institute, 2003

Table 5.10 Performance comparison by firms' types

Performance Items		Large firms	SMEs	Venture
Sales growth rates (%)	2002 year	7.2	10.2	16.4
	2003 year	6.6	5.4	25.3
Return on sales (%)	2002 year	7.5	5.4	19.7
	2003 year	8.2	4.6	8.3

Source: The Bank of Korea, Business management performance analysis (2003)

4. Inno-biz firms

"Inno-biz" firms are defined as innovative SMEs in the traditional manufacturing sectors, older and bigger than venture business. Inno-biz is another type of firm of innovative

SMEs which is supported by specially designed government policies and measures. Inno-biz certification programme started in 2001 in order to complement "Venture Business Promotion Programme." SMBA is the nodal government agency in charge of evaluating the innovativeness of SMEs and thus selecting highly innovative SMEs as "Inno-biz" firms.

Evaluation criteria and selection process of "Inno-biz" firms were made as follows:

- A multidimensional index was developed based on Olso Manual which was designed to evaluate and assess technological capabilities and innovativeness in SMEs.
- The criteria consist of 92 items representing technological innovation output, technological innovation capability, technology commercialization capability, and innovation management capability.
- Evaluation has been done by an independent government agency.
- A SME can be selected as "Inno-biz" when getting more than 700 points of total 1000 points and a selected "Inno-biz" is entitled to get low interest loans and funding, as well as preferential support by diverse government innovation support programmes.

Most of Inno-biz firms come from traditional manufacturing sectors and more than half of Inno-biz firms were founded before 1998. The average number of employees is 45.5 persons and the average revenue is 8.2 billion Korean won in 2003 (see Tables 5.11-5.14).

Table 5.11 Distribution of Inno-biz firms by industry and the year of registration

Year	Manufacturing	IT/ SW	Bio-industry	Service	Environment	Total
2001	730	177	-	-	-	907
2002	555	211	-	-	-	766
2003	364	116	15	12	12	519
2004	425	106	12	15	12	570
Total	2,074	610	27	27	24	2,762

Source: SMBA (www.smba.go.kr)

Table 5.12 Distribution of Inno-biz business by firms' ages

Year	1 below	1~3 below	3~5 below	5~10 below	10 over	Total
Total	29	636	798	712	587	2,762

Source: SMBA (www.smba.go.kr)

Table 5.13 Distribution of Inno-biz firms by sales volume
(Unit: million Korean won)

Year	0	Less than 100	100~ 500	500~ 1,000	1,000~ 2,500	2500~ 5,000	5,000~ 10,000	10,000~ 20,000	More than 20,000	Total
2001	12	44	111	126	170	155	145	83	61	907
2002	40	44	95	76	146	135	120	60	50	766
2003	2	13	35	45	99	124	101	61	39	519
2004	2	9	41	45	128	125	88	87	45	570
Total	56	110	282	292	543	539	454	291	195	2,762

Source: SMBA (www.smba.go.kr)

Table 5.14 Distribution of Inno-biz firms by employee size

Year	1~5	5 ~10	10 ~50	50 ~100	100~200	200 over	Total
2001	26	90	581	128	54	28	907
2002	3	72	534	106	35	16	766
2003	5	32	348	88	31	15	519
2004	3	45	370	97	44	11	570
Total	37	239	1,833	419	164	70	2,762

Source: SMBA (www.smba.go.kr)

C. The Government policies and promotion programmes

1. Historical evolution of SME innovation policy in the Republic of Korea

(a) Before 1990s

There was no explicit policy to promote innovative SMEs. The government enforced a number of rules and regulation to protect SMEs from direct competition with large firms and Chaebuls (e.g. the government procurement scheme for SME products, regulation prohibiting large firm's entry into specific industries for SMEs). In 1976, the Korea Credit Guarantee Fund (KCGF) was created to provide public policy funding for SMEs.

(b) In the early 1990s

Policies were implemented to enhance productivity of SMEs so as to meet rapid wage increase since the late 1980s. Restructuring efforts were progressing to transform labour intensive SMEs into capital intensive ones by making investment in the production equipments. Policy actions were taken to deregulate large firm's entry into SME business sectors. For instance, low interest loans and credit backing programme were introduced to assist SMEs in investing new facilities and the government began to provide credit guarantee to high-technology ventures by setting up the Korea Technology Credit Guarantee Fund (KOTEC) in 1989.

(c) In the late 1990s and the early 2000s

Promotion of venture business and venture IPOs at KOSDAQ market were initiated. The government implemented the SME innovation support programme to sponsor R&D projects done by SMEs and promoted public financing for private venture capital industry.

(d) Since 2003

The government formulated the integrated SME innovation policy as part of regional innovation policy: creating regional technology service centres for promoting local SMEs; facilitating cooperative R&D and technology transfer among SMEs, universities and public research institutes; concentrating support for boosting R&D activities of innovative SMEs.

2. Government programmes to promote innovative SMEs

A total of 230 programmes to support SMEs have been executed by fourteen government organizations including SMBA and the Ministry of Commerce, Industry and Energy (MOCIE). There are also 525 non-private organizations with 38,369 working staffs, which have involved in implementing the above-mentioned SME support programmes. The Presidential Commission on Small and Medium Enterprise was set up in 1998 to coordinate and integrate these multi-ministerial programmes and organizations.

Major government support programmes are:

- Business restructuring and production equipment support programme
- R&D and technological innovation support
- Entrepreneurship training programme
- Incubating programme
- Funding programme
- Human resource supply programme
- Sales and marketing support programme
- Information technology and e-commerce implementation support

3. Government budget for SME promotion

The total government expenditure to promote SME competitiveness and innovation amounts to around 6 trillion Korean won in 2004, some 5.5 per cent of the total government budget. Some 21 per cent (1.2 trillion won) of the total SME budget is used to support technology development programme and 37.6 per cent (2.3 trillion won) is loaned to SMEs which invest for new production equipment and facilities (see Table 5.15).

Table 5.15 The Government budget for SME promotion

(Unit: billion Korean won)

Categories	2001		2002		2003		2004	
	Amount	%	Amount	%	Amount	%	Amount	%
Production equipment	1,498	25.7	1,651	28.0	1,990	30.7	2,288	37.6
IT	43	0.7	118	2.0	137	2.1	147	2.4
Tech development	1,320	22.7	1,208	20.5	1,214	18.7	1,277	21.0
Incubation/venture	719	12.3	650	11.0	623	9.6	527	8.6
Sales/marketing	151	2.6	246	4.2	342	5.3	384	6.3
Mngmt consulting	693	11.9	598	10.1	739	11.4	133	2.2
Human resources	292	5.0	314	5.3	351	5.4	451	7.4
Local SMEs	1,111	19.1	1,119	19.0	1,086	16.8	886	14.5
Total	5,827	100.0	5,904	100.0	6,482	100.0	6,093	100.0

Looking at nature of the government budget, the amount of loans for SMEs reached 4.1 trillion Korean won in 2004, more than half of the total SME support budget, while around 1.7 trillion won was supported as subsidy or grant type, most of which went to R&D support projects and technology development activities of SMEs. The amount of equity investment is very small portion, only 1.2 per cent of total expenditures (see Table 5.16).

Table 5.16 Types of expenditure
(Unit: billion Korean won)

	2001		2002		2003		2004	
	Amount	%	Amount	%	Amount	%	Amount	%
Loans	4,175	71.6	4,026	68.2	4,501	69.4	4,120	67.6
Subsidy or grant	1,304	22.4	1,572	26.6	1,740	26.8	1,758	28.9
Equity investment	307	5.3	269	4.6	211	3.3	138	2.3
Others	41	0.7	38	0.6	31	0.5	76	1.2
Total	5,827	100.0	5,905	100.0	6,483	100.0	6,092	100.0

4. Funding for SMEs innovation

According to the Korean Federation of Small and Medium Business (KFSMB, 2004), sources of capital for SMEs are: loans from commercial banks (72.7 per cent); government funding (19.8 per cent); and equity financing (0.3 per cent).

Table 5.17 Types of government funding for SMEs: international comparison

Types of funding	Republic of Korea (2004)	United States (2004)	France (2002)
Credit guarantee	94.6% (0.2)	66.0% (26.0)	78.0% (52.0)
Direct loan	5.2%	0.1%	21.7%
Equity Investment	0.2%	33.9%	0.3%

Source: Korea Ministry of Finance and Economy, 2004

Table 5.18 The volume of credit guarantees
(Unit: trillion Korean won)

	2003		2004	
	No. of guarantees	Amount	No. of guarantees	Amount
Korea Technology Credit Guarantee Fund	100,258	13.4	66,000	11.6
Korea Credit Guarantee Fund	315,584	32.9	329,010	30.9

Source: Korea Technology Credit Guarantee Fund, Korea Credit Guarantee Fund

5. Venture capitals

The Korean venture capital industry had grown rapidly from 1998 to 2000, at the time of internet venture boom. In recent years, however the amount of funding and investment has significantly decreased and most of funds have been mobilized by the government funding. Particularly, as can be shown at Table 5.20, the venture capital investment has been sharply decreased. Looking into credit- guaranteed loans for SMEs, the amount of venture capital investment accounts for very small portion of the total SME innovation funding. In order to increase equity-type investment for innovative SMEs, venture capital industries and investment banking firms need to be more promoted by providing various kinds of the government support measures including tax incentives.

Table 5.19 Venture capital industry statistics (Unit: billion Korean won)

	1999	2001	2004
Number of investment companies	97	145	105
Total capitalization of investment Co.	1,240	2,2194	1,652
Number of funds	149	395	422
Total amount of funds raised	488	791	527
The amount of government funding	27(5.4%)	122(14.4%)	158(30%)
Number of invested venture businesses	1,457	1,117	510
Total amount of funds invested	950	889	564

Source: SMBA, 2005

6. Start-up venture incubation programme

Over the last 10 years, a total of 291 venture incubators have been established by universities, public R&D institutes and local governments. Through public supported business incubation system, some 4,000 ventures had been incubated and currently 4,217 start-up companies are being incubated. According to the SMBA survey in 2004, the incubated companies produced total sales of 1.3 trillion Korean won and employed 45,000 persons. With respect to the government financial support for incubators, SMBA grants 50 per cent of total construction costs and grants 50-100 million won per year for incubator's operating costs.

Table 5.20 Number of incubators and incubated companies

No. of incubators	No. of start-ups by incubators	No. of venture incubated
291	4,217	3,925

Source: www.bi.go.kr

A variety of services are provided to facilitate start-ups and enhance entrepreneurship by the government and business service intermediaries. Major services are:

- Incubation services for the tenants: Providing office space at a low rate; linking outside investors with tenant ventures; and business consulting and management service.
- Technology business incubation programme of MOICE: Seed money funding programme (provide interest-free loans - 100 million won per a start up, during 1995-2003, supported a total of 130 billion won to 1,500 start-ups)
- Techno-park construction programme: Started in 1999 to set up regional innovation clusters by networking local universities, innovative SMEs and start up companies; invested 400 billion won for 14 Techno-parks across the nation; provide office space, R&D facilities and opportunities to cooperate with university research teams.
- Performances and challenges: The government-led venture incubation programmes stimulate many start up ventures, however, these programmes have faced some limits in providing professional incubation services and thus resulted in the high failure rate.

7. SME technology development programme

Many government agencies are involved: SMBA, the Ministry of Science and Technology (MOST), the Ministry of Commerce, Industry and Energy (MOCIE), the Ministry of Information and Communication (MIC) (see Table 5.21). There are two types of support programmes: building physical infrastructures for technology development; and supporting R&D projects and technology development activities.

Table 5.21 Technology development support programmes for SMEs

Programmes	2003	2004
Industrial Technology Infrastructure Building Programme (MOICE) - Providing grants to universities and research institutes for building research facilities, R&D centres and engineer education centres for SMEs	363	375
Parts and raw material development programme (MOICE) - Providing subsidies for new product commercialization as a part of matching funds to SMEs in material and parts manufacturing sectors	132	172
IT commercial technology development programme (MIC) - IT industry-oriented R&D subsidies	128	210
New product development pogramme (SMBA) - Providing grants to SMEs in commercializing new patents	55	75
SME technology innovation and development programme (SMBA) - Providing grants to various types of innovation activities in SMEs	110	130

8. Infrastructures for SME innovation

Since the end of 1960s, 20 Government-supported Research Institutes (GRIs) have been founded for industrial technology development. In 2004, the total annual budget of GRIs amounted to 2.1 trillion won, and the total number of R&D professionals is 12,000. One of the key missions of those institutes is to support SME's technology development as shown in Table 5.22. However, SMEs are not satisfied with the GRIs' supporting activities due to the mismatch problem between the technology supporting services of GRIs and the demands of SMEs. In this regard, there is a need to design new policies and programmes by incorporating SMEs' demands and needs to further strengthen R&D cooperation between GRIs and SMEs.

Table 5.22 GRI supporting activities for SMEs

Types of Supports	2003	2004
Number of GRI-SME joint R&D projects	855	990
Number of contract R&D for SMEs	529	468
Number of technology transfer to SMEs	628	471
Number of technology consulting and advice	1,186	1,345
Number of SME engineers educated and trained by GRIs	3,274	3,338

Source: B. H. Lee, et al (2005)

Meanwhile, the government has installed a number of R&D centres in the universities to facilitate joint R&D activities between universities and SMEs.

- Technology innovation centres (TICs) to provide R&D equipment and facilities for SME-university joint R&D (45 TICs)
- Regional technology development centres to support regional specific industrial technology development (52 RTDCs)
- 13 local universities with special mandates to support local SME innovation

Key roles of the university R&D centres for SME innovation are:

- Providing research equipment and facilities to SMEs
- Joint R&D to develop technologies that can be commercialized by SMEs
- Education and training of SME engineers
- Providing university graduate R&D personnel to SMEs

With respect to outcomes and challenges of the "University R&D centre" programme, over the last five years, physical research infrastructure was well-established to support SME's technological innovation activities on the supply side, however, most of the cooperative activities between universities and SMEs were driven by the university researchers and technology suppliers. Furthermore, most of the R&D centres continue to be dependent on the government financial support. Another issue is that so many R&D centres are distributed across the nation, which leads to lack of sufficient operating resources and strategic focus in each R&D centres.

9. Government granted SME innovation programme

(i) National R&D programmes to support SME innovation: In 2004, a total of 757 billion Korean won supported, accounted for 12.7 per cent of total government R&D expenditure.

(ii) SME technology innovation and development programme (SMBA): A direct financial subsidy given to innovative SMEs; providing 100 million won for research grant at maximum as a matching fund (1,500-2,000 SMEs annually granted).

(iii) National R&D programme for SME-university-GRI joint R&D: In implementing national R&D programmes, a priority given to cooperation R&D projects among industry-academy-research; for the last 10 years, more than 20,000 cooperative R&D projects funded.

(iv) KSBIR: A Korean version of SBIR which requests all public organizations to reserve 5 per cent of their R&D funds for supporting SMEs.

(v) Outcomes and challenges: A number of SMEs in manufacturing sectors as well as in IT and BT sectors have been reported to succeed in technology development with the help of the national R&D programme, however, a series of recent surveys done by SBMA and other government agencies revealed that only 10-30 per cent of SME technology development projects funded by the government made successful commercialization; this low rate of commercial success seems to be due to the insufficient project selection process and the lack of complementary resources for market entry.

10. R&D cooperation between SME- university-research institutes

According to a recent survey on the cooperative R&D activities for SMEs, about 6,200 SMEs, 5 per cent of the total manufacturing SMEs are estimated to be participated in various kinds of cooperative R&D activities initiated by the government. Therefore, in order to raise the rate of successful commercialization of cooperative R&D projects, the more active commitment of SMEs and partners needs to be required (see Table 5.23).

Table 5.23 Survey results on cooperative R&D for SMEs

		Cooperative R&D with research institutes			
		None	**Less than one in a year**	**More than one in a year**	**Total**
No. of cooperative R&D with university	None	850 (78.9%)	96 (8.9%)	13 (1.2%)	959 (89.0%)
	Less than one in a year	55 (5.1%)	23 (2.1%)	10 (0.9%)	88 (8.2%)
	More than one in a year	14 (1.3%)	11 (1.0%)	5 (0.5%)	30 (2.8%)
	Total	919 (85.3%)	130 (12.1%)	28 (2.6%)	1077 (100%)

Source: Lee, et. Al (2005)

11. Human resource supply programme

Appropriate supply of well skilled human resources is one of the key SME innovation policies. In the Republic of Korea, most of innovative SMEs and technology ventures are facing the shortage of competent R&D personnel and sales & marketing managers. This is due to the employment trend that most of competent and young professionals prefer large firms, while most of SMEs are not afford to pay the qualified personnel or to train young employees.

Some of incentives and schemes to attract young engineers and university graduates for SMEs are as follows: Exempt from 2 years military service; refund the half of salaries for the first 6 months; subsidy of training costs for the SME workers and the employers; operating technology education centres with financial support of the government; and government funded internship programmes for university students.

12. Sales and marketing support programme

(a) Types of sales and marketing support programmes

- Preferential treatment in public procurement contacts: "SME Innovation Promotion Act" requesting public organizations to purchase new technology products of innovative SMEs.
- Supporting the development of the shared brands among SMEs
- Supporting SME product advertisement in cooperation with CATVs
- Providing export incubators and overseas market information
- Supporting on-line sales through e-commerce portal

(b) Outcomes and challenges

There is no substantial means to make public organization to purchase SME's new products and thus these products accounted for only 0.06 per cent of total public procurements during 2000-2003. Most of the programmes seem to be unsuccessful. Therefore, innovative SMEs need more diverse resources in marketing & sales stage than ones supplied by public sectors. There is a need to develop more market-oriented policies for assisting market entry of SME's innovative new products and services.

D. Recent initiatives for promoting SME innovation

1. Expanding the pool of innovative SMEs

(a) Objectives: to increase the number of innovative SMEs to 30,000 firms by 2008 - 20,000 SMEs in manufacturing sectors and 10,000 SMEs in service sectors.

(b) Strategies

- Lowering entry barriers for start-up ventures by abolishing the minimum capital requirement for registering incorporation entity
- Facilitating process/management innovation for traditional manufacturing SMEs
- Strengthening government support for university spin-off ventures
- Identifying and supporting new types of innovators in service sectors such areas as R&D, design, specialized sales and marketing, IT contents producers, etc.
- More focus of government support on pre-innovation stage SMEs

2. Increasing equity financing for early stage ventures and SME innovation

The government has attempted to expand both public and private investments in the area of SMEs innovation through deregulation on the venture capital industry and private equity market, and expanding the government funding for early stage venture and innovative SMEs. For instance, the Korea Fund of Fund (KFOF) was established in 2005 to increase the government investment for ventures: KFOF is a 100 per cent government-owned fund to invest in the private venture capital funds to effectively leverage the government funding for early stage ventures; currently US$ 170 million, expanded to US$ 1 billion in the next three years.

3. Strengthening collaborative innovation networks

(a) Fostering SME's demand driven collaborative R&D activities: introducing new type of collaboration mechanism to increase the commitments of R&D partners.

(b) SMEs-universities-research institutes networking: (1) government funding for joint R&D ventures for developing and commercializing advanced technologies: (2) building regional collaborative R&D centres to develop production technologies and to provide technical services to SMEs; (3) hosting SMEs' R&D centres to university-based R&D complexes; and (4) customizing university education programmes to meet needs of SMEs.

(c) Networking between SMEs and large firms: (1) increasing financial support for the joint R&D between suppliers and customers in the supply chains; (2) extending tax incentives for large firms investing in joint R&D with SMEs; and (3) fostering large firms' direct investments in the innovative SMEs.

(d) Global cooperation between domestic SMEs and global companies such as MNCs and TNCs.

4. Restructuring government support programme and organizations

The Presidential Commission on Small and Medium Enterprises (PCSME) has the authority and the responsibility to coordinate the government support programmes implemented by diverse government agencies. Efficiency and effectiveness of these government programmes need to be enhanced through transforming a variety of functional support programmes into customer-based integrated support programme and providing a so-called package service – "money + technology + professional manpower." There is a need to consolidate venture business incubators and regional R&D centres to achieve economy of scale in their operation.

III. REGIONAL INNOVATION SYSTEM AND TECHNO-PARK POLICY IN THE REPUBLIC OF KOREA: THE KYEONGBUK TECHNO-PARK CASE[3]

A. Preface

In the Republic of Korea, regional imbalance is a chronic issue, despite implementation of a large number of regional development programmes. Since the national industrial structure has been characterized by a polarized and metropolitan focused platform, industries and universities in the regions are too disconnected, and thus too weak to create the regional innovation systems required to be competitive and attract enterprises for sustainable development.

Against this backdrop, the central government, in cooperation with the local governments and industry, initiated the Techno-Park (TP) programme in December 1997 and the Ministry of Commerce, Industry, and Energy (MOCIE) nominated six TP candidates – Gyounggi, Daegu, Kyeongbuk, Songdo, Gwangju and Junnam, and Chungnam – as pilot TPs. Subsequently, other eight candidates were approved as TPs from 1999 to 2004.

The present government, in order to rectify the regional imbalance issue and to develop more techno-parks, formed the "Committee on Balanced National Development" in 2003. Also in 2003, the "Balanced National Development Special Law" was enacted so as to implement coherently the regional development policies. In addition, the government established the first "Five-Year Plan for Balanced National Development", while sixteen regional and metropolitan governments replicated that framework plan for designing their respective regional development strategies. Both levels of planning aimed to improve regional competitiveness based on a regional innovation system in order to rejuvenate the nation's overall economic health.

In this paper, there will be a brief general description of the developments of TPs in the Republic of Korea, with a special focus on the Kyongbuk Techno-Park in Gyeongsan City. Attempts were made to draw up some policy implications and issues mainly focusing on Kyongbuk TP, but worth being taken into account in other regions.

B. Regional innovation system and techno-park policy

1. Regional innovation system

In the Republic of Korea, regional imbalance is chronic, despite the large number of regional development programmes. Because the national industrial structure consists of a polarized and metropolitan focused platform, industries and universities in the regions are too disconnected and weak to create the regional innovation systems required to be competitive and attract enterprises for sustainable development.

The current government has made efforts to correct this drag on development by creating the "Committee on Balanced National Development" in 2003. In the same

[3] *This paper was prepared and presented by Mr. Seong-Keun Lee, Professor, Yeungnam University, Gyeongsangbuk-do, the Republic of Korea.*

year, the government enacted the "Balanced National Development Special Law" to implement systematically and comprehensively regional development policies and set up the first "Five-Year Plan for Balanced National Development", while sixteen regional and metropolitan governments replicated that plan for developing their regional innovation strategies. Both levels of planning aimed to improve regional competitiveness based on a regional innovation system in order to rejuvenate the nation's overall economic health.

There are eleven core programmes for the establishment of a regional innovation system as a whole which may be categorized in the following four types: technology development, techno-pole, innovation support, and industrial enhancement (Table 5.24). Among these programmes, TPs of the techno-pole type have most influenced the regional innovation system and regional development. Total TP programme investment amounted to 930 billion won (approximately US$ 809 million) from 1997 to 2003. The number of TPs doubled from 6 in 1998 to 12 in 2004.

Table 5.24 Regional innovation system core programmes in the Republic of Korea

Target	Single Function	Multiple Function
Infrastructure-Building	▪ **Technology development type:** Regional Technology Innovation Centre (RTIC)/ Regional Cooperation Research Centre (RCRC)/ Regional Environment Tech Development Centre (RETDC)	▪ **Techno-pole type:** Techno-park (TP)/ Venture Business Development Area (VBDA)/ Software Enhancement Area (SEA)
Non-Infrastructure Building	▪ **Innovation support type:** Specialized Research Information Centre (SRIC)/ Brain Korea 21 (BK21)	▪ **Industrial enhancement type:** Regional Specialized and Technology Development (RSTD)/Regional Industrial Enhancement (RIE)/Industry, University, Research Institute Consortium

Source: Lee S.K

2. Techno-park policy

The central government in cooperation with local governments and industry initiated the TP programme in December 1997 and the Ministry of Commerce, Industry, and Energy (MOCIE) designated six TP candidates - Gyounggi, Daegu, Gyoungbuk, Songdo, Gwangju and Junnam, and Chungnam – as model TPs. Six other candidates were approved from 1999 to 2003. In addition, in 2004, the central government established two more TPs which are Kyeongnam Techno-Park and Ulsan Techno-Park.

The central government provided 150 billion Korean won (about US$ 130 million) from 1998 to 2003 for building basic infrastructure and facilities, and local governments and industry provided over 227 billion won (about US$ 260 million) and 88 billion won (about US$ 77 million) respectively (Tables 5.25 and 5.26). The TP programme is to a great extent a third-sector oriented approach, despite the deep central government involvement.

Table 5.25 Capital investment for setting-up model TPs as of March 2004
(Unit: 100 million won)

Investors	Songdo	Gyounggi	Daegu	Gyoungbk	Kwangju/ Junnam	Chungnm
Central Govt.	250	244	250	254	248	254
Local Govt.	885	635	170	153	190	239
Industry	105	8	258	403	69	41
Others	477	159	355	126	176	450
Total	1,717	1,046	1,033	936	683	984
Establishment	06.18.98	09.17.98	12.07.98	08.27.98	12.07.98	12.17.98

Source: MOCIE, Department of Industrial Technology Policy, Activities of Techno-parks (2004)

Table 5.26 Capital investment in second-tier TPs as of March 2004
(Unit: 100 Million Won)

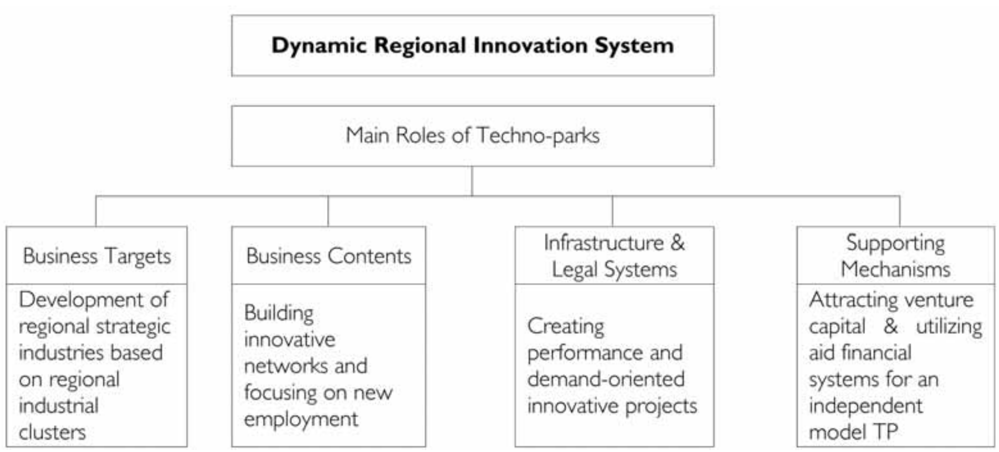
Investors	Busan	Pohang	Junbuk	Chung-buk	Junnam	Gangwon
Central Govt.	250	250	125	125	125	125
Local Govt.	150	214	300	201	195	302
Industry	260	253	113	65	42	30
Others	125	-	-	24	119	8
Total	785	717	538	415	481	465
Establishment	12.18.99	02.28.00	12.22.03	12.22.03	12.22.03	12.22.03

Source: MOCIE, Department of Industrial Technology Policy, Activities of Techno-parks (2004)
Note: Data for Gyeongnam TP and Ulsan TP are not included in this table as they were established in late 2004

The main purpose of TPs is to promote a regional innovation system, which is widely regarded as a growth engine for regional and national development. Moreover, as the first effort of the government to strengthen R&D and the functions of Technology and Business Incubators (TBIs) at local universities, the TP programme was adopted as the first comprehensive government approach to fortify independent regions by strengthening cooperation among local innovative actors at the regional level (Lee et. al., 2004).

Since its inception in 1997, Techno-parks have made considerable contribution to strengthening of a regional innovation system by focusing on developing regional strategic businesses and specialized regional networks. This programme has been focused on four agendas: to develop regional strategic industries, build innovative networks, create an innovative milieu, and generate independent TP models (see Figure 5.26).

Figure 5.26 TP roles in building the regional innovation system



Source: Lee S.K

The 6 model TPs established their self-reliance base in order to achieve their goals of acquiring specialized knowledge and maintaining a consistent and focused direction for development. The Pohang TP and the Busan TP had completed their facilities by 2002 and 2004 respectively, while the Junbuk, Chungbuk, Junnam, and Gangwon TPs had chosen construction sites at the beginning of 2004 and are now under construction.

An analysis of 6 variables below indicates that, among the 11 core programmes in the RIS initiative, TPs successfully achieved most of their comprehensive goals, ranking the first in disseminating technology innovation; the second in R&D, commercialization, and collaboration; and the third in manpower education and organizational management sector (see Table 5.27).

Table 5.27 Evaluation of the six pilot TPs

Fields	Average score of 11 programmes	Average score of the six model TPs	Rank of TPs among 11 core programmes
R&D	1.92	2.69	2
Commercialization	2.23	2.79	2
Education for manpower	3.19	3.65	3
Dissemination of technological innovation	2.47	3.65	1
Organizational management	2.87	3.08	3
Collaboration	3.23	3.80	2

Source: Lee S.K.

C. The Kyeongbuk Techno-Park case

1. Overview of KTP

In order for Kyeongbuk Techno-Park (KTP) to be successfully established, there were two key steps that had to be undertaken. The first was the formation of an organizing committee in July 1996. The second critical step was the establishment of the KTP Foundation in August 1998. The Kyeongbuk Techno-Park has been in operation for seven years. The principal aims of KTP are: to build RIS through the cooperation of industry, university, research institutes, and national and local governments; to foster start-ups and incubation; to support technological commercialization; to implement national industrial policies; and to enhance regional economic development. KTP is a university-initiated techno-park. One of its principal objectives therefore is to foster cooperation among industries, university research centres, and governments. The second objective is to provide one-roof services to support start-ups and incubated enterprises. KTP's role is to be a hub of RIS. The third objective is to promote new technology spin-off enterprises. The fourth objective is for KTP to assume a kind of brokerage role in order to facilitate linkage and coordination between start-up and spin-off enterprises and existing, established, dominant companies.

KTP is located in the campus of Yeungnam University in Gyeongsan. The land area allotted to KTP is 150,000 square-meters. Of that area, 66,300 square-meters have been developed to this date. Apart from the main KTP centre at Yeungnam University, there are four other specialized centres on four other regional university campuses. The main facilities at KTP include the Comprehensive Information Centre, the Pilot Production Plant, the Specialized Research Centre, and the Incubation Centre and Facilities. KTP has specialties in the fields of mechanical technology, ICT, and textiles technologies.

2. The Gyeongsan region

Location factors are some of the key elements in the successful promotion of regional technology innovation. Generally, the required locational features are: an abundant workforce, well-equipped research facilities, ease of access, the concentration of allied-industries, advantages from a neighboring large city, and a pleasant environment (Berry, et. al., 1997). According to these preconditions, the locational features of the Gyeongsan region which were investigated are as follows:

First, there are 11 universities and colleges, and a variety of research centres in this region. For this study, Gyeongsan City was deemed as a university city, which has sufficient capacity to be able to produce a large number of high-quality workforces with the potential to contribute to regional technological innovation.

Second, the techno-park branches in the five participating universities, the regional research centres, and the consortium between industry, universities, and the research centres are located in this region. Each university has good research facilities which can be used for utilizing up-to-date technology. However, the formation of networks (i.e. information, facilities, workforce, etc.) should be developed in order to promote continuing regional innovation.

Third, the location is accessible to the regional airport, a harbor (at Pohang), train stations, and highways. Thus, logistics, information, and the workforce for regional innovation can be transferred and expanded into this region easily.

Fourth, Chinryang and Ja-in industrial complexes have already been established in the region. Furthermore, Kumi, Pohang, Ulsan, Changwon, which are major industrial cities, are located an hour's distance from this region. And as of 1999, around 1,850 smaller businesses commanded an overwhelming majority of allied-industries. Most of the companies which were moved to Gyeongsan from Daegu (due to a policy of industry dispersion) are labour intensive, not high-technology (Lee, Seong-Keun, 1999).

Fifth, the Gyeongsan region is adjacent to a metropolitan city, Daegu, which has a population of 2.5 million. Thus, although Gyeongsan City has a population of 230,000 people, it naturally acquires the advantages of the metropolitan city, including an enormous population of consumers, an abundance of finance and information facilities, and growth potential.

Sixth, the Gyeongsan region tries to preserve or create a pleasant environment through well-planned urban development programme. In addition, the community has been very much concerned about regional development. In fact, the local government had already developed some plans to transform the Gyeongsan region into a techno-park-centred region.

3. Cooperative process of KTP

Kyeongbuk Techno-park had been developed through a cooperative process. The major participants in this process were Yeungnam University as the lead organization, four other regional universities, the local governments, and the Gyongsan Chamber of Commerce & Industry, and a number of SMEs. In order to further elaborate the developmental process of the KTP, the following five elements were taken into account: first, motivation, interest and cooperation; second, leadership; third, establishing the foundation; fourth, creation of a basic plan and programmes; and fifth, role divisions and organizations.

(1) Motivation, interest & cooperation

Three levels of cooperative regional development were necessary to create the KTP: national, regional, and individual organizational levels. At the national level, the central government should formulate a plan to cope with the pressure of globalization and for the open-door policy. At the regional level, the local government needs a development policy in order to promote regional technology. At the individual organization level, each university or enterprise in the region needs to overcome existing difficulties. To overcome difficulties, all participants must cooperate with all organizations in the region and, consequently, they have come to accept cooperative regional development concept as a problem-solving mechanism.

(2) Leadership

Yeungnam University assumed a major role in the process of establishing the KTP. The origin of the techno-park project in this region is based on one of the central government-supported projects for the engineering college of Yeungnam University in 1994. During the initial meetings for KTP creation, some problems arose, such as disagreement about fund-raising among the participants, the organization's structure, and selection of the specialized business of each participant. But the KTP Planning Committee made recommendations that were acceptable to all the participating organizations, and the Promotion Conference for TKT (the Chairman: the President of Yeungnam University) was established. Its general affairs bureau was placed in the Gyeongsan City Office in July, 1996.

(3) Establishing the Foundation

In 1995, MOCIE enacted a law supporting industry and energy technology base to meet rapid changes in the Korean economy and technological developments. Based on the Law, MOCIE had formulated a 5-year plan for expanding the industrial technology infrastructure. As a part of the Plan, MOCIE was planning to choose and support two or three techno-parks, after deliberation and assessment on the validity of the submitted techno-park plans which regional universities in consultation with local governments had made and proposed. Right after MOCIE selected Gyeongsan Region (Yeungnam University) as a model techno-park site in December 1996, five participating universities made cooperation agreements with about 170 private companies and "KTP" was set up as a corporate foundation with legal and financial autonomy.

(4) Creation of a basic plan & programmes

KTP as a CRD process is characterized by the principle of joint participation and investment. The business programme plan for KTP consists of two parts: the main plan governs the general business programmes, and the specialized centre plan handles the specialized programmes which will be implemented by five participating universities. According to these two plans of action, the planning committee is responsible for performing general business programmes by taking the different views of the participants into consideration, while each participating university is in charge of devising and implementing its own programmes and has also an opportunity for joint participation of programme execution.

(5) Role divisions of participating organizations

An appropriate division of role between stakeholders is the key to achieve a common vision for the techno-park development in the following. Firstly, the universities should keep close contact with the industries concerned, while focusing on the facilitation of creative ideas, human resources development, promotion of applied science and technology transfer. Secondly, regional industries should introduce innovative and value-added technologies, make active efforts to receive available services from the universities, and retain continuous cooperative relations with consumers. Thirdly, the regional communities need to provide suitable cultural support for realizing the vision of the techno-park. Finally, the local and central governments should provide proper legal frameworks, including various policy support measures and incentives based on the coherent policy enforcement, financial support and favourable tax system.

KTP is a network, namely a network type of organization with its spatial allocation emphasizing cooperation among the participants. To maximize its merit, the Secretary of the Foundation and its main complex are located at Yeungnam University, while the other specialized centres are located at the other universities. This type of organization is relatively well functioned with the effective and efficient linkage of the Foundation with each specialized centre. The existing research facilities, administrative network, libraries, and researchers in each university can be used as a base network for regional innovation.

4. Activity and performance of KTP

(1) Organization & revenues

The KTP Foundation has a decision-making committee and an operational committee. The organization KTP is structured as follows: two co-presidents (the Governor of North Gyeongsang Province and the President of Yeungnam University); the director who is in charge of overseeing two divisions (Planning and Operation; Enterprise Support); an administrative support division; two specialized centres (RIC and TIC) operating under the direction of KTP; and five specialized centres in the participating universities. The KTP Foundation also works together with two affiliated agencies - the Kyeongbuk Strategic Industrial Planning Agency (KSIPA) and the Gyeongbuk Marine, Bio, and Environmental Industrial Centre (GMBEIC).

There are 50 staff members working for KTP: among them 32 staffs belong to the KTP main centre, 11 staffs to KSIPA, and seven staffs to GMBEIC. For the efficient and transparent operation of the KTP, the KTP Foundation enacted 42 regulations.

Funding for the establishment of KTP was mobilized from government and private sources. Total funding amounted to nearly US$ 110 million, of which the central government provided about US$ 25.6 million, North Kyeongbuk Province about US$10.15 million, and local governments about US$ 17.15 respectively. Private funding came from universities in two forms: monetary and real estate contributions (land and structures), of which the monetary funding reached about US$ 26.7 million. The land and physical properties donated by the universities are valued about US$ 30 million.

(2) Enterprises support projects

In order to encourage or support the promotion of enterprises tenanted at KTP, the KTP has initiated diverse support projects, including promotion of start-up enterprises – providing rental space, management consultation, a manpower pool for supplying necessary skilled employees, venture capital access, marketing, etc. KTP is also implementing technology incubation projects for venture capital enterprises. Certain enterprises with great potential for success are entitled to be provided incentives such as financial aid and marketing/PR/advertising services. From October 2002 to June 2004, eleven such star venture enterprises were selected.

According to the evaluation on the KTP performance from 2002 to 2004, 12 BI and TBI projects were highly successful. In terms of information consultation, 58 enterprises had been supported from 2004 to 2005. KTP established a limited company called "GBTech" which specializes in IT education and training sector. For the period of 2004~2006, it is prospected that around 120 people per year be trained for IT related skills.

KTP has also promoted technology transfer, trade enhancement, technology forums and conventions, and established a technomart. Meanwhile, KTP has focused on increasing exchange and networking with China, in particular, with regard to the Beijing-Hanggju City-Gyeongsan City trade and information exchange relationship.

(3) Fostering RIS

The RIS centre of KTP was established in 2003, sponsored by the MOCIE. In order to promote R&D activities, KTP has coordinated factions and programmes of innovative agencies such as Technology Innovation Centre (TIC) and Regional Research Centre (RRC) both of which are supported by the central government, local governments, and participating universities. In order for KTP to facilitate R&DB activities of actors, it has implemented RIS projects, incorporating such functions as networking, marketing support, technology development and transfer, financing, education and training, public relation and advertising, and industrial commercialization of R&D. All of the above embedded systems are funded jointly by central and local governments as well as private enterprises.

The MOCIE and the Korean Industrial Technology Foundation (KITF) launched the initiate to foster skilled workforce necessary for regional innovation in 2004. The Industrial-University Research Linkage Project was initiated by the Industrial Technology

Evaluation and Planning (ITEP) under MOCIE in 2004. KTP is implementing the "Innovation Café" project as a main centre of the RIS where personnel from the various enterprises can meet informally and exchange information, expertise, and discuss problems and numerous topics and issues on regional innovation. The KTP Innovation Café was founded in 2004.

KTP was providing a field training programme targeted for unemployed engineering graduates for one year (2005), with a focus on embedded mobile manpower. Successive training programmes will be focusing on other topics and issues regarding regional strategic industries. KTP organized a PC utilization competition event in 2005, participated by local civil servants, and also held a software exposition in which a variety of IT related industries, universities, and corporations participated.

(4) Outcome and performance of KTP

During the period of 1998~2005, KTP incubated a total of 473 start-up enterprises, of which 202 were incubated at the main KTP centre and the rest at five specialized centres. During the same period, these centres employed a total of 2382 personnel and generated total sales of about US$ 134 million, of which about US$ 26 million was the amount of exports.

KTP and its specialized centres had financially supported 99 R&D projects with around US$ 3.8 million funded from 1998 to 2005. KTP provided 103 items of equipment utilization service to the enterprises, reaching a total cost of about US$ 2.5 million. Frequency of use of this equipment totaled 5,525 usages by 228 enterprises from 1998 to July 2005. KTP provided 293 classes of formal training to about 9,531 participants during the period of 1998~2005. Also, 191 special seminars were organized and attended by 8,792 participants.

KTP made available both online and offline information service to the enterprises: online service included such support as a web site (nearly 2 million visitors through 2005) containing a wide-range of useful information (7,374 individual items). KTP also publishes a bi-monthly offline newsletter, issuing 71,500 copies up to July 2005, as well as had published 209 special offline publications.

KTP provides a test area or pilot project plant in order for the enterprises to test and develop new products. The enterprises can utilize the space and equipment in the testing phase of production. Eleven pieces of equipment have been installed for this purpose at a cost of about US$ 1.2 million. This facility has been utilized 577 times for testing pilot projects from 1998 to 2005 by a total of 259 enterprises. Through this testing and pilot service, 30 new products were successfully developed, valuing about US$ 1.7 million.

(5) Two cases of successful strategic subsidiary enterprises

There have been many successful cases of strategic subsidiary enterprises assisted by KTP programmes. One of the most successful cases is SL LCD, Inc. which was founded in January 2001 at KTP prefecture as a start-up company. There were three important reasons why SL LCD located itself at KTP: firstly, it was nominated to be a TBI participant by MOCIE; secondly, the company wanted to take advantage of a university locale and its available technology; and thirdly, it wanted to have access to the pilot production plant at KTP. SL LCD, Inc. manufactures LCD backlights and frontlights for automobiles and hand-held PCs. At the beginning in 2001, SL LCD had only 6 employees and sales amounted to only US$ 220,000. However, by 2005, the firm had grown to 60 employees and sales had skyrocketed to US$ 61,000,000.

The second case is Upsan, Inc., a subsidiary of KTP, founded in July 1999 at Sihwa Industrial Estate in the capital region. This company specializes in manufacturing CCM and CCK which are both integral to textile manufacturing. Upsan, Inc. moved to KTP in 2001 for the following reasons: Located at Yeungnam University campus are two research centres specializing in textiles – the Textile Machinery Resource Centre and the Hi-Sensitive Polyester RRC, both sponsored by the central government; and the Daegu area has an excellent textile industry environment. Upsan, Inc. has developed many types of new technology in the field of textile manufacturing. Upsan, Inc. has been declared an "excellent enterprise" in the field of textile production by several government departments.

D. Conclusions and the way forward

Conclusions

Kyongbuk Techno-park has been very successful in many respects. However, we have seen a number of problems and challenges needed to be addressed by concerned stakeholders in the process of implementing future TP programme.

First of all, although the central government set it one of the strategies of the TP programme to implement the programme over the whole stages from the outset in close cooperation with the local governments, industry and other institutions, until now the TP programme has been entirely driven by the central government. Secondly, the TP initiative with much focus putting on hard infrastructure such as facilities, R&D equipment, communications, services, and roads, has consequently starved soft infrastructure such as technology and management support, and financial and legal assistance. Thirdly, collaborative networks among the major innovative actors at KTP still remain weak. Collaboration or networking in general occurs only in the execution of certain projects targeting a specific purpose, but so not in the case of general operational tasks. Fourthly, there has been no clear role of division among major actors in developing KTP. With no clear division of tasks, activities among institutions and actors have been frequently overlapped or in some areas were redundant, resulting in reducing opportunities of synergy. Last but not least, the KTP revenues primarily depend on rent cost paid by tenants, which is unstable and requires high maintenance and management costs. Such simple financial management without other sources of finance mobilization for sustainable operation of TP may make KTP financially vulnerable and reduce flexibility in generating optimum profit.

The Way Forward

In order for KTP to achieve even greater success, it should make strenuous efforts to improve in a number of areas. Firstly, KTP should put more focus on becoming more of a hub of RIS. With respect to this aspect, the MOCIE is planning to promote KTP as a hub for regional innovation governance agent.

Secondly, networking among the participating organizations needs to be greatly improved. A complex node-type network combining a horizontal node along with a vertical one should be developed and strengthened. The horizontal node-type network between each specialized centre is undeveloped, while the vertical node-type network between the foundation and each specialized centre is stable. This unbalanced networking may cause a disruption of technology transfer and diffusion. A network involving each enterprise in KTP should be also developed. High-technology enterprises are requested to facilitate information exchange in order to continuously make innovation from their technological activities. An administrative instrument for constructing such network among all the enterprises needs to be set up.

Thirdly, the software infrastructure building, including information exchange and inter-firm cooperation network must be emphasized more than the hardware. It must be focused on the existing specialized businesses in developing KTP. An innovative network of CRD capable of producing successful results should be developed.

The final task that KTP should consider is to develop demand-oriented R&D projects and to develop a comprehensive enterprise support system.

REFERENCES

Berry, B. J. R. et. al., (1997), The Global Economy in Transition, New Jersey: Prentice Hall

Cooke, P., "Economic Globalization and Its Future Challenges for Regional Development," *International Journal of Technology Management*, Vol. 26, No. 2, 3, 4 (2003).

Gregersen, B. and B. Johnson, "Learning Economies, Innovation Systems and European Integration," *Regional Studies*, Vol. 31 (1997).

Lee, Seong-Keun (1995), "Developing Strategies of Yeungnam Techno-Park as Technopole in Taegu-Kyongbuk Province," *The Proceeding of International Symposium on Techno-Park and Regional Development*, Yeungnam University.

Lee, Seong-Keun (1999a), "The Establishing of the Kyongbuk Techno-Park and Innovating Kyongsan Region," *Journal of the Korean Regional Development Association*, KRDA, Vol. 11, No. 3.

Lee, Seong-Keun (1999b), "The Capacities and Strategy of Industries in Kyongsan", *The Studies of City Policy for Kyongsan Development in 21st*, Kyongsan City Hall.

Lee, Seong-Keun (1999c), "The Characteristics and Policy Directions for the Government Supported Techno-Park in Korea", *Journal of the Korean Regional Development Association*, KRDA, Vol. 11, No. 2.

Lee, Seong-Keun (1999d), "Characteristics and Strategy of University-Initiated Kyongbuk Techno-park, *the Proceeding of International Symposium on City Planning 1999*, Chinese Institute of Urban Planning.

Lee, Seong-Keun (1999e), "Policy Directions for the Government Supported Techno-parks in Korea", *the Proceeding of International Symposium on Techno-Parks and Regional Development*, Korean Regional Development Association etc.

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Lee, Seong-Keun, Sang-Chul Park, and Kwan-Ryul Lee, "The Roles of Techno-Parks for Building Regional Innovation System," *Journal of National Planning*, Vol. 39, No. 2 (2004).

Lundvall, Bengt-Ake, "Why Study National Systems and National Styles of Innovation," *Technology Analysis and Strategic Management*, No. 10 (1998).

Meyer-Kramer, F., "Industrial Innovation and Sustainability-Conflicts and Coherence," in Daniele Archibugi and Bengt-Ake Lundvall (eds.), *the Globalizing Economy* (Oxford: Oxford University Press, 2001).

OECD, *Technology and the Economy: The Key Relationships* (Paris: OECD, 1992).

Park, Sang-Chul, Seong-Keun Lee, and Kwan-Ryul Lee, "A Comparative Study on the Regional Innovation Systems in Sweden and South Korea," *Korea Observer*, Vol. 34, No.1.

ANNEXES

I. INAUGURAL STATEMENTS

A. OPENING STATEMENT

Mr. Xuan Zengpei
Director, Trade and Investment Division
UNESCAP

It is my great pleasure to welcome all of you to this Regional Consultative Meeting on "Subnational Innovation Systems and Technology Capacity-Building Policies to Enhance Competitiveness of SMEs" organized by UNESCAP, in cooperation with the Science and Technology Policy Institute (STEPI) and Daedeok Innopolis with the generous financial support from the Government of the Republic of Korea.

First of all, I would like to express my deep gratitude to Honourable Dr. Seung-Hee Han, Director-General, Science and Technology Policy Bureau, the Ministry of Science and Technology, for delivering the inaugural statement this morning despite his busy schedule. I would also like to extend my deep appreciation to STEPI, in particular its president, Dr. Sung-Chul Chung as well as Daedeok Innopolis, especially its President, Dr. In-Chul Park for their cooperation and contribution in organizing this important event. I would also like to extend my heartfelt thanks to all speakers who have generously given their time to be here with us.

As you well know, in the global and knowledge-based economy, competitiveness, innovation, and technological capabilities are becoming increasingly important for meeting emerging challenges and opportunities. They are essential to the economy as a whole and especially important for the sustainable growth of small and medium-sized enterprises (SMEs). In this highly competitive environment, the competitiveness of SMEs largely depends on their ability to harness and exploit knowledge, information and technology. In particular, innovation is the prime driving force that creates and promotes dynamic and competitive SMEs in both developing and developed economies.

Meanwhile, the provincial or regional level is where innovation happens, where knowledge or research results are translated into economic value. Innovation is a continuous process and occurs in an extremely complex milieu where various elements and actors are involved. They include policymakers, entrepreneurs, researchers, large firms and SMEs, and consumers. Their mutual interaction and interdependence are at the core of a system that promotes innovation activities. It is why so many countries in the world are concerned about a national innovation system (NIS) and a subnational innovation system (SIS) as a strategic policy framework for their economic development.

Innovation policy is a horizontal issue and comprises many different policy aspects: research and technological development; economic development; promotion of entrepreneurship; creation of technology-based start-ups; firms' networking; public-private partnerships; and innovative financing mechanisms. Therefore, provincial governments and authorities must be the catalyst in bringing all these factors together, in structuring a favourable business environment by removing the barriers; by providing incentives; by encouraging R&D activities; by supporting networks and clusters. Good local conditions to set up a sound innovation system are indispensable for a successful innovation strategy.

In this connection, I would like to briefly point out why we should focus on a Subnational Innovation System for sustainable economic development of a nation. Nowadays, a SIS is widely recognized and in some countries adopted it as an important policy mechanism for the sustainable growth of the economy at the provincial level as well as overall national economic development. However, compared with NIS concept, this SIS is a relatively new concept which is still an evolving framework and currently only limited countries in Asian and Pacific region reflected SIS initiatives in their science and technology system or socio-economic development plan. It mainly focuses on industrial development and enhancing the competitiveness of the local or provincial enterprises, especially SMEs through the overall system restructuring and upgrading, including technology and innovation to support them.

Against this background, UNESCAP has been implementing a technical cooperation project entitled "Subnational Innovation Systems and Technology Capacity-Building Policies to Enhance Competitiveness of SMEs" since June 2005. This project aims to assist its member countries in developing their unique subnational innovation system policies and SME strategies to strengthen their technology and innovation capability, responding effectively to fast paced globalization and technological change. This Regional Meeting constitutes a final component of the project activities, and as such its main objectives are to bring together key prayers in this field to discuss recent developments and important issues associated with the promotion of SIS, to share good practices and to strengthen technical cooperation among countries in the region.

I wish to highlight that the recent Summit outcome (2005) of the United Nations also has put more emphasis on the role of science and technology in meeting the Millennium Development Goals (MDGs). The World Summit held in New York in 2005 reaffirmed the vital role of science and technology in achieving the MDGs. At the eighth session of Commission on Science and Technology for Development held in May 2005 stressed the necessity of reorienting science, technology and innovation policy mechanisms at the national level to ensure that they effectively and coherently serve the needs of development.

Particularly, the Commission Session recognized that achieving the MDGs requires the building of a solid S&T base to enable the creation, utilization and diffusion of knowledge and placing science and technology at the centre of national development strategies. The Commission also underscored that public and private partnerships are essential for building strong scientific and technological capabilities, and that building a national capacity to acquire and harness the potential of science and technology matters more for developing countries in meeting the MDGs.

I understand that in recent years the Government of the Republic of Korea has ambitiously initiated subnational innovation system policies to realize so-called endogenous subnational development as well as to promote innovative SMEs by implementing various policies designed to increase investments in high-tech industries; to raise funds to foster venture businesses; and to develop human capital for supporting sustainable growth of SMEs. In addition, most recently the Government of Republic of Korea restructured its science and technology administrative system and is implementing policy initiatives towards setting up of a new national innovation system to drive innovation-led economic growth in all sectors of society including government, corporate, education, finance, labour, science and technology.

As you remembered that the "Regional Consultative Meeting on Strengthening Technology Incubation System for Creating High Technology-based Enterprises" was held in Seoul in 2000. Technology incubation system is one of the key elements to promote enterprises' innovation capacity and to enhance technology capability for the competitiveness of SMEs. Today, we are gathering again in Seoul, where innovation activities in all areas have been actively taking place.

In conclusion, individual countries should make every effort to develop a sound national and subnational innovation system to maximize the benefits brought from the potential offered by knowledge and technology flows and innovation. UNESCAP will not only facilitate national initiatives of individual countries towards developing an enabling policy framework to promote a subnational innovation system, but is also committed to strengthen regional cooperation and networking for enhancing SME technological capabilities of 62 member countries of UNESCAP.

I believe this Meeting will provide a unique opportunity for policymakers and experts to discuss and exchange ideas, experiences and best practices on a subnational innovation system and SME technology capacity-building. This meeting will contribute to paving the way for more active regional cooperation and strengthen partnership and networking. Once again, I would like to express my heartfelt thank to all speakers and participants, and convey my best wishes to you all for the successful outcomes of this Regional Meeting.

Thank you.

B. CONGRATULATORY REMARKS

Mr. Seung-Hee Han
Director-General
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Ministry of Science and Technology

Honourable Director Xuan Zengpei of UNESCAP,

President Chung Sung-Chul of the Science and Technology Policy Institute,

President Pak In-Chul of the Daedeok Innopolis,

Country representatives and experts:

I am very pleased to address here today at the regional consultative meeting being hosted by UNESCAP.

Of late, we see small and medium businesses are increasingly assuming critical roles in national economic growth and balanced development. In doing so, I think it is opportune to explore ways to establish subnational innovation system for small and medium businesses to gain the competitive edge.

In this 21^{st} century defined as a knowledge-based society and global economy, the national and industrial competitiveness highly depends on the creation and transfer of knowledge. Acquiring differentiated knowledge and unique technological innovation to generate high value-added technology development will lead in the future competition and enhance the national and industrial brand value.

In particular, the role of small and medium businesses with technological edge should be highlighted in terms of regional economic development and creation of new jobs. Given the role of small and medium businesses in strengthening technological competitiveness, subnational innovation system needs to be established for cooperation among the industry, academia, and research institutes to further work with regional universities and research institutes.

It is also noteworthy that the Government of Republic of Korea directed its policy on small and medium enterprise to strengthen technological innovation capacities in tandem with the subnational innovation system. We pursue the joint technology development programme among industry, academia and research institutes for small and medium businesses lacking in skilled human resources and research facilities.

In addition, production-based industrial parks are transformed into innovation clusters with the R&D function newly added acting as a clearinghouse of new technology and advanced industries. The Government of Republic of Korea last year designated the "Daedeok Science Town" as a special research and development region, and is nurturing it as a Mecca of technological innovation and new industry creation. The Daedeok Science Town has been widely known as a flagship and integrated R&D base. It has made significant contribution to starting and nurturing technologically innovated small and medium enterprises through cooperation among industry, academia, and research.

Ladies and gentlemen,

I am very much looking forward to the insights and expert views that this meeting will yield.

Let me propose that we build a new model of regional innovation system to strengthen competitiveness of small and medium businesses through the mutual cooperation of UNESCAP and its 16 member nations. Then, I firmly believe that Asian and Pacific region can be developed into the central axis of the world economy. And I also hope the Republic of Korea will keep contributing to the efforts of UNESCAP.

Last but not least, I would like to thank all the staffs for their time and efforts in bringing this meeting together.

Thank you.

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III. PROGRAMME

Wednesday, 18 January 2006

0830 - 0900	Registration
0900 - 0930	**Inaugural Session** (Moderator: Mr. Xuan Zengpei, Director, TID, ESCAP) • Welcome Address by Mr. Sung-Chul Chung, President, STEPI • Inaugural Statement by Mr. Seung-Hee Han, Director-General, MOST • Opening Remarks by Mr. In-Chul Park, President, Daedeok Innopolis • Opening Statement by Mr. Xuan Zengpei, Director, TID, ESCAP
0930 - 0950	Coffee break
0950 - 1220	**Session I: SIS Policy Mechanism for Enhancing Competitiveness of SMEs: Its Policy Implications and Prospects in the Asian and Pacific Region** (Moderator: Mr. Sung-Chul Chung, President, STEPI) • Keynote Speech by Mr. Young-Rak Choi, Chairman, KORP • Keynote Speech by Mr. Lak-Kyoung Song, Executive Director, Daedeok Innopolis • Subnational Innovation Systems Policy to Enhance Local SME Competitiveness by Mr. Deok-Soon Yim, ESCAP consultant • Strategy for Strengthening Local SMEs Competitiveness Focusing on Technology Capacity-Building by Mr. S.P. Agarwal, ESCAP consultant Discussion
1220 - 1240	Photo Session
1240 - 1330	Lunch
1330-1600	**Session II: Benchmarking from Successful Countries and Regions: Experiences, Lessons and Best Practices on SIS** (Moderator: Mr. Joong-Wan Cho, Economic Affairs Officer, IEDS, TID, UNESCAP) • Japan Case: SIS Policy and Industry-Academy Partnership by Mr. Takaaki Matsuzawa, Director, NISTEP, Japan • Germany Case: SIS and Technology Capacity-Building Policies by Mr. Thomas Stahlecker, FhG/ISI, Germany • Malaysia Case: Promotion Strategy for Technology-based Innovative SMEs by Mr. Avvari V. Mohan, Multimedia University Malaysia

- Technology Outsourcing and Policy Instruments for SME Technology Capacity-Building in Developing Countries in Asia-Pacific Region by Mr. Se-Joon Yoon, Director, APCTT, New Delhi

Discussion

1600 - 1610 Coffee break

1610 - 1800 Session III: Country Presentation on SIS and Technology Capacity-Building Policies to Enhance Competitiveness of SMEs: Its Current Status and Future Prospects
(Moderator: Mr. S.P. Agarwal, UNESCAP consultant)

- Enhancing Competitiveness of SMEs through Fostering RIS by Mr. Hyung-Young Kim, Director, Presidential Committee on Balanced National Development, Republic of Korea
- Bangladesh case, presented by Mr. Mohammed Ibrahim Khalil, Deputy Secretary, Ministry of Commerce
- Cambodia case, presented by Mr. Nou Thara, Director, Department of Small and Medium Enterprises, Ministry of Industry, Mines and Energy
- China case, presented by Mr. Zhang Wei, Assistant Consultant, Department of Small and Medium-sized Enterprises, NDRC

Discussion

1800 - 1930 Dinner (Hosted by STEPI & MOST)

Thursday, 19 January 2006

0900 - 1100 Session III (Moderator: Mr. S.P. Agarwal, UNESCAP consultant)

- Daedeok Innopolis Development by Mr. Yoo-Sook Kim, Team Manager, Planning Communications Team, Daedeok Innopolis, Republic of Korea
- India case, presented by Mr. Aynampudi Subbarao, Advisor, Department of Scientific and Industrial Research, Technology, MOST
- Indonesia case, presented by Mr. Andi Eka Sakya, Assistant to the Deputy Minister for Priority and Strategic Research Programme, the State Ministry of Research and Technology
- Lao PDR case, presented by Mr. Somdy Inmixay, Director, Small and Medium Enterprise Promotion Development Office, Ministry of Industry and Handicraft

Discussion

1100 - 1110 Coffee break

1110 - 1300	**Session III** (Moderator: Mr. Avvari V. Mohan, Professor, MUM)
	• Innovative SMEs Promotion Policies in Republic of Korea by Mr. Brian H. Lee, Professor, Kwangwoon University, Republic of Korea
	• Malaysia case, presented by Mr. Yeoh Beng Keat, Principal Assistant Director, Policy and Planning Unit, MOSTI
	• Mongolia case, presented by Mr. Sh. Mungunbat, Head, Small and Medium Enterprises and Technological Development Division, MOIT
	• Myanmar case, presented by Mr. Than Myint, President, Myanmar Engineering Society
1300 - 1400	Lunch
1400 - 1520	**Session III** (Moderator: Mr. Thomas Stahlecker, Researcher, FhG/ISI)
	• Regional Innovation System and Technopark Policy in Republic of Korea: the Case of Kyungbuk Technopark by Mr. Seong-Keun Lee, Professor, Yeongnam University, Republic of Korea
	• Nepal case, presented by Mr. Tej Raj Shakya, Director-General, Department of Cottage and Small Industries, MOICS
	• Korea case, presented by Mr. Tae-Min Bae, Director, S&T Innovation System Division, Office of Science and Technology Innovation, MOST
	Discussion
1520 - 1530	Coffee break
1530 - 1700	**Session III** (Moderator: Mr. Deok-Soon Yim, UNESCAP consultant)
	• Thailand case, presented by Mr. Birasak Varasundharosoth, Advisor, Office of Small and Medium Enterprises Promotion, MOI
	• Uzbekistan case, presented by Mr. Sultan-Mukhamedov Nodir Ravshanovich, Specialist, Chamber of Commerce and Industry
	• Viet Nam case, presented by Ms. Nguyen Thi Phuong Mai, Researcher, National Institute for Science and Technology Policy and Strategy
	Discussion
1730 - 1900	Dinner (Hosted by Daedeok Innoplis)

Friday, 20 January 2006

0900 - 1130	**Session IV: Comprehensive Discussion and Conclusion** (Moderator: Mr. Xuan Zengpei, Director, TID, ESCAP) • Comprehensive Discussion: Toward A Policy Framework for SIS Establishment and SME Technology Capacity-Building • Conclusion and Recommendations • Closing Remarks (UNESCAP and STEPI)
1130 - 1300	Lunch
1300 - 1700	Technical Tour (Kyunggi Techno-Park)