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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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Dear Reader,

Since we adopted a new graphic format coupled with efforts to maintain quality in the materials and information published, we have been receiving very encouraging feedback on the ***TIES Newsletter****. These are gestures very well appreciated as they manifest on the usefulness and value of our product to our clients.*

With this, we continue to bring to you information on technology and investment related fields at the level of international and national concerns; the article on the global scenario on international technology transfer which finishes the series in this issue; and experiences and opportunities available in India, Indonesia and Pakistan.

We have also been using the ***TIES Newsletter*** *to keep you abreast with UNIDO's programmes and initiatives in the fields of technology and investments. In November 1994, UNIDO organized Techmart Hanoi, which was again another success in terms of participation and interest generated. In this issue, we have extracted information on technology offers as they were made by companies from various countries, notably Italy, Germany, Poland and the United Kingdom, for this technology market. While made for this specific event, these offers reflect availability for potential users in general, which might have a need for technologies in the indicated fields. Another similar event for which preparations are now in high gear, is the forthcoming Intechmart in India in March 1995. Information is accordingly provided in this issue together with the current context of the Indian economy against which this event is taking place.*

Once again, we thank our contributors to the ***TIES Newsletter*** *to whom we owe much of the positive responses we have been receiving. We hope for your continued support.*

Technology Acquisition Section
Technology Service

MEETING ON TECHNOLOGY MONITORING

Cooperation in Technology Monitoring in Developing Countries was the highlight of a meeting organized by UNIDO in New Delhi, India on 22 to 25 November 1994. Attended by some 40 participants representing regional and national institutions from Asia, Latin America and Africa, the meeting succeeded in deriving the main elements of a plan of action that will promote cooperation among developing countries in the field of technology monitoring and related areas.

Technology monitoring is seen as an increasingly essential input for decision making by policy makers and enterprise managers in the context of the rapidly changing global environment. Monitoring is to watch, check and keep up with developments. It entails the systematic accumulation and analysis of data from which forecasts are made. The sources of information are identified and then information is gathered, filtered and structured for use in forecasting.

The meeting focused on the need for developing country governments and industry, to monitor technologies, especially new and emerging technologies, and to build the capacity to analyze the implications of technology trends. The Indian experience in technology monitoring through its Technology Information, Forecasting and Assessment Council (TIFAC) provided the meeting with an example of a systematic approach and how this has served industry's need for forward planning in technology through close interaction between TIFAC and the Confederation of Indian Industries (CII).

A biennial review of technology trends to be coordinated by TIFAC in cooperation with interested institutions from other developing contries is planned to be undertaken and published by January 1996. International networking will be established among institutions to be involved in the biennial review. In addition, capacity-building and human resource development including the development of a manual in the field of technology monitoring are envisaged.

Co-sponsoring the meeting were TIFAC, CII and the Asian and Pacific Centre for Transfer of Technology (APCTT).

UNIDO AT ECA MEETING ON TECHNOLOGY ACQUISITION

The importance of securing technology policies based on both technology acquisition from foreign sources and locally adapted and generated technologies was once again highlighted in the meeting of experts on technology transfer, negotiation and acquisition convened by the Economic Commission for Africa on 18 to 23 September 1994.

Five important thrusts of technology policy requirements for Africa were identified as follows:

- the development and application of domestic technical research capabilities for meeting basic needs;
- the development of technical training at all levels of educational systems to respond to the needs of technological development based on local demand in the various economic sectors;
- the selective development and production of industrial equipment and of machines and tools which foster the generation and diffusion of technologies within these sectors;
- the national capacity to effectively handle the technology transfer process in so far as it concerns the selection, evaluation, adaptation and negotiation of imported technologies;
- the use of locally developed technologies as well as intra-regional cooperation in technology transfer.

The experts meeting was attended by 28 participants representing institutions and consultancy organizations in Africa dealing with technology transfer and other international organizations. UNIDO was represented by the Chief of the Technology Acquisition Section.

NEW IMPULSE TO UNIDO/ESCAP COOPERATION

UNIDO and ESCAP forged cooperation anew with recent agreements on mechanisms of cooperation and an identification of overall areas of mutual interest as well as specific projects of potential cooperation. These agreements were reached as a result of intensive discussions and exchange of ideas held between UNIDO management and staff and the Officer-in-Charge of ESCAP's Industry and Technology Division during the latter's visit to UNIDO in August this year.

Among the areas identified for potential collaboration between the two agencies are technology transfer and investment promotion together with new and emerging technologies and reorientation of industrial and technology policies and strategies. Both agencies agreed to exchange information on planned studies, meetings and projects; contribute to each others projects and meetings in the form of substantive papers, resource persons or other inputs; and conduct joint programmes and projects as appropriate. These moves augur well with the overall effort within the UN system to achieve coordination and complementation among the various agencies dealing with related subjects or common issues.

ANOTHER SUCCESS IN VIET NAM TECHMART

A total of 450 participants, 200 representing Vietnamese companies and R&D institutes and the other 250 representing various companies and institutes from the Czech Republic, France, India, Italy, Germany, Mongolia, Pakistan, the Republic of Korea, Russia, Thailand, Ukraine and the United Kingdom, took part in VIET NAM TECHMART held on 1 to 4 November 1994 in Hanoi. Over 200 business meetings were arranged involving preliminary discussions on potential collaboration arrangements as a result of which 25 Memoranda of Understanding to pursue further collaboration were signed.

The event was a joint undertaking of UNIDO and the Ministry of Science, Technology and Environment (MOSTE)and the National Centre of Science and Technology Information and Documentation (NACESTID).

A forty-member delegation from the Republic of Korea, led by Daewoo Corporation and the Korea Institute of Industry and Technology Information (KINITI) was in active search of technology transfer opportunities even as expression of interest to participate in TECHMART events to take place in India and Brazil were given.

As is a usual feature of similar TECHMART events, four seminars on topics of technology laws and regulations, information support services to small and medium enterprises, partnership opportunities available from Italy and experience in innovation of technology in the Republic of Korea were organized.

TECHMART is a meeting place for technology developers, owners and buyers to explore possible business opportunities. It provides a setting for the conclusion of practical business arrangements focusing on technologies. To facilitate the process of matching technologies with needs, UNIDO compiles and publishes a technology compendiu m that describes thousands of technologies currently available for transfer to developing countries.

For VIET NAM TECHMART, a technology compendium containing 744 technology offers and 275 technology requests was prepared to facilitate and stimulate contacts between those interested in buying technology and those owning or having access to it.

UNIDO/LES Video Film Project

"Acquiring Technology through Licensing" is a film which brings a viewer through the essential steps of searching, locating, evaluating and selecting, negotiating and eventually acquiring a technology under a license agreement. Basic success factors in the acquisition process is highlighted in the film.

The video film is a joint UNIDO/LES (Licensing Executives Society) production again under the aegis of UNIDO/LES collaboration in promoting global technology transactions and flows.

Spearheading the production of the film are the UNIDO Public Information Section and the LES Educational Committee. The film, which will be the joint property of UNIDO and LES, will become an important part of the training kits of both organizations for use in their educational programmes on technology acquisition and negotiation.

The film was shot in an industrial plant in Ternitz, Austria and in various locations in Vienna, including the Vienna International Centre in May 1994.

INDIA INTECH-MART IN 1995

With an investments and technology thrust, India Intechmart takes place in New Delhi from 24 to 27 March 1995 under the joint auspices of the Government of India and UNIDO. Taking place at the New Exhibition Hall of Special Display (hall No. 10), Pragati Maidan, New Delhi, the event aims at bringing together potential foreign and Indian investors to explore opportunities for joint collaboration, technology sellers and buyers on the basis of the requests for technology from Indian companies and offers of technology from foreign companies.

A comprehensive indexed compendium of the technologies needed by companies in India and offers of technology by foreign companies will be compiled and distributed among potential partners and interested persons. The compendium will contain information on specific products or processes, clearly describing the technology being offered, the potential uses and advantages. With this information, participants will be able to identify the technologies they will pursue at the level of individual business discussions. At the same time, arrangements will also be made to display technologies by means of sample products, drawings, process flow diagrams, photographs and product catalogues. Companies and organizations offering license opportunities may reserve one or more booths at Intechmart.

The project proposals and technology acquisitions will be primarily concentrated in the following sectors of industry:

- Food processing
- Leather and leather goods
- Chemicals and allied products
- Packaging industry
- Textiles and ready-made garments
- Auto components
- Electronics, including telecommunications equipment

During the Intechmart, technology experts in the above seven sectors will be available for advice and guidance. Relevant ministries, industry associations, financial institutions and banks will be available to render support services. A legel expert from UNIDO will also be available for consultations and advice.

The main lines of collaboration to be promoted are joint venture investment, acquisition of technology, international marketing arrangements and subcontracting/buy-back arrangements.

For further information on India Intechmart, please contact the following:

The Joint Secretary
Department of Industrial Development
Ministry of Industry
Udyog Bhawan, Room No. 160
New Delhi 110 011
India

Tel.: 91-11-301 2655 or 301 2651
Fax: 91-11-301 1339 or 301 1770

or

The Managing Director
Investment and Technology Promotion Division
United Nations Industrial Development Organization
P.O. Box 300
A-1400 Vienna
Austria

Tel.: 43-1-21131, ext. 3693 or 3729
Fax: 43-1-232156 (general) or 2095332 (direct)
Tlx: 135612 UNO A

TECHNOLOGY OFFERS & REQUESTS

PRODUCTION LINE FOR HIGH QUALITY COOKIE TYPE BISCUITS Up to two tonnes per shift of bonbons and candy. Each line to consist of sugar dissolving, cooking, forming, cooling and wrapping machines. Raw ingredients required – sugar, glucose, water, colours and flavours. Services required: steam, water, electricity three phase supply and compressed air. **Contact:**

Mr. David Lines
Kelly Marketing International Ltd.
Sheraton House
Brooklands Close
Sunbury-on-Thames
Middlesex TW16 7DX
UK

Tel: 44-1932 821501
Fax: 44-1932 780620

Status: *Commercialized*
Offer: *Production equipment/Training/Designs, formulation & technical assistance*

FERTILIZER PRODUCTION The technology allows production of calcourea, an innovative fertilizer, an adduct of urea and calcium nitrate, which are its raw materials. The fertilizer has the advantage, with respect to urea, of limiting the N_2 losses to very low values (about 5 per cent for calcourea against about 50 per cent of urea, as average values). The agronomic capacity of calcourea is 30 per cent higher than that of urea. An economic plant may be built with a production capacity greater than 10,000 t/year. **Contact:**

Mr. Antonio Naviglio
President
SRS - Servizi di Ricerche
Vicolo delle Palle
25-25/B e Sviluppo Srl
00186 Rome
Italy

Tel: 39-6-68300047
Fax: 39-6-6868662

Status: *Commercialized*
Offer: *Joint venture offer/Production equipment/Training*

IONIC ACCELERATOR Water anti-scale treatment system, with no chemicals and low energy consumption. Solves the problem of industrial and civil use of hard water. **Contact:**

Mr. Rastrelli Roberto
Export Manager
ETD Srl
Corso Giovanni Lanza 88
10133 Turin
Italy

Tel: 39-11-6602057
Fax: 39-11-6603044

Status: *In current production*
Offer: *Manufacture under licence/Patent for sale*

LIVEX TECHNOLOGY Production of fresh livexes from the blood of any animal, based on a biotechnological method. Livexes are characterized by a high technological usability and a high biological nutritive value for man and animals and some of them show very positive prophylactic and therapeutic qualities. **Contact:**

Mr. Maciej Grzegrzoika
Licence Department Manager
"POLSERVICE"Foreign Trade Enterprise
8 Chalubinskiego Street
00-613 Warsaw
Poland

Tel: 48-22-301515
Fax: 48-22-300076

Status: *Commercialized*
Offer: *Manufacture under licence/Training/Designs, formulations & technical assistance*

AGRICULTURAL DISTILLERY Capacity: 200 lt. of 100° spirit per one hour and spirit rectification division capacity: 1,500 lt.100° soirit per 24 hours. Delivery: machines and devices, technical documentation and technical services. **Contact:**

Mr. Maciej Grzegrzoika
Licence Department Manager
"POLSERVICE"Foreign Trade Enterprise
8 Chalubinskiego Street
00-613 Warsaw
Poland

Tel: 48-22-301515
Fax: 48-22-300076

Status: *Commercialized*
Offer: *Manufacture under license/Turnkey operation/Training/Designs, formulations & technical assistance*

BLISTER PACKING LINE consisting of automatic tablet feeder with tray, automatic cartoner with leaflet folder and inserter plus overwrapping machine. Line is also fitted with print registration, perforation station infra-red "no tablet" detection system and emboss coder manufactured in 1991 by a reputable German company and has only run for 1300 hours. Installation and commissioning assistance available. **Contact:**

Mr. David Lines
Kelly Marketing International Ltd.
Sheraton House
Brooklands Close
Sunbury-on-Thames
Middlesex TW16 7DX
UK

Tel: 44-1932 821501
Fax: 44-1932 780620

Status: *Commercialized*
Offer: *Production equipment/Training/Designs, formulations & technical assistance*

STAINLESS STEEL 316 CLOSED TOP MIXING TANK with stainless steel mixing head to prepare solutions. Pumped under vacuum to ampoule filling and sealing machine the completed ampoules are collected in wire cages and placed in autoclave for final sterilization and subsequent printing. Available: ultrasonic washing machine, sterilizing tunnel, ampoule filler, laminar flow above filler. Sizes available 2, 5 and 10 ml ampoules at an output of up to 10,000 ampoules an hour. Line manufactured by Strunck in 1978. Assistance with installation and commissioning is possible. **Contact:**

Mr. David Lines
Kelly Marketing International Ltd.
Sheraton House
Brooklands Close
Sunbury-on-Thames
Middlesex TW16 7DX
UK

Tel: 44-1932 821501
Fax: 44-1932 780620

Status: *Commercialized*
Offer: *Production equipment/Training/Designs, formulations & technical assistance*

WEIGH PACK FILLING LINE consisting of automatic weighing machine set on the count you require, i.e. 100 up to 10,000 into mini grip bags. Infeed conveyor, outfeed on to turntable plastic bag packs placed into cardboard outer trayed and overwrapped. Many lengths of suitable conveyor are available; also stainless turntables and shrink wrapping facilities as well as training of staff is available. **Contact:**

Mr. David Lines
Kelly Marketing International Ltd.
Sheraton House
Brooklands Close
Sunbury-on-Thames
Middlesex TW16 7DX
UK

Tel: 44-1932 821501
Fax: 44-1932 780620

Status: *Commercialized*
Offer: *Production equipment/Training/Designs, formulations & technical assistance*

MODULAR PRE-FABRICATED BUILDINGS Technology for the production and the assembly of pre-fabricated buildings for domestic or industrial use. The system is flexible and quickly implemented at low cost and produces a good quality finished product. **Contact:**

Mr. Gianni Serena
President
Serena Prefabrication Srl
Viale Stazione 84
31030 Albaredo (Trenso) Italy
Tel: 39-423-401367
Fax: 39-423-401359

Status: *Commercialized*
Offer: *Patent for sale/Joint venture offer/Production equipment/Training*

TRAINING COLLEGE FOR THE FOOTWEAR INDUSTRY Objective – to assist in setting up a footwear training college to international standards and to assist in teachers training and assessment techniques and syllabus preparation. Potential teachers would learn all aspects of practical shoe making, design, pattern cutting, design, marketing, export opportunities, quality control and process control systems. Duration 6-12 weeks. **Contact:**

Mr. Roger T. Beeby
Overseas Coordinator
Leicester South Fields College
Faculty of Art, Design and Technology
Aylestone Road
Leicester
LE2 7LW
UK

Tel: 44-1533-541818
Fax: 44-1533-653147

Status: *Commercialized*
Offer: *Training/Designs, formulations & technical assistance*

STARTING A SMALL SHOE FACTORY Objective – to teach technical, design and business skills to start a small shoemaking company. Course includes practical shoemaking, cutting leather, serving uppers, lasting to shape, sole attachment, finishing, design, pattern cutting, marketing, export opportunities, costing, small business financial controls, English language, quality control, and production planning. Duration 6-12 weeks. Consultancy advice on selection of equipment and appropriate low cost machines. Negotiable to suit client. Course as provided for UNIDO. **Contact:**

Mr. Roger T. Beeby
Overseas Coordinator
Leicester South Fields College
Faculty of Art, Design and Technology
Aylestone Road
Leicester
LE2 7LW
UK

Tel: 44-1533-541818
Fax: 44-1533-653147

Status: *Commercialized*
Offer: *Training/Designs, formulations & technical assistance*

STARTING A SMALL FASHION CLOTHING FACTORY Objective – to teach fashion, design, technical and business skills to start a new clothing company. Course includes: fashion for western markets, design, pattern cutting, design and construction of woven and knitted fabrics, garment construction and making up, costing, small business financial controls, English language, production control, quality control. Duration 6-12 weeks. Negotiable to suit client consultancy advice on setting up a new business. **Contact:**

Mr. Roger T. Beeby
Overseas Coordinator
Leicester South Fields College
Faculty of Art, Design and Technology
Aylestone Road

Leicester
LE2 7LV
UK

Tel: 44-1533-541818
Fax: 44-1533-653147

Status: *Commercialized*
Offer: *Training/Designs, formulations & technical assistance*

TANNERY-LEATHER PROCESSING Complete tannery plant. Full range of machines, tanning chemical products and technical assistance to produce leather at international standards. The technology comes from a long experience achieved in the leather industry. Applications include cow, buffalo, pig, sheep, goat hides and skins from raw to finished leather with special emphasis to minimize the environmental impact. **Contact:**

Mr. Luca Bussani
General Manager
LETCO - Leather Technology Group
Via Nazario Sauro 32-56024
Ponte a Egola-Pisa
Italy

Tel: 39-571-49013
Fax: 39-571-49637

Status: *In current production*
Offer: *Turnkey operation/Production equipment/Training/Designs, formulations & technical assistance*

GLASS, PLASTIC AND RUBBERWARE Design, engineering, supply, commissioning and start-up of glass, plastic and rubberware production plants. Includes: market analysis; plant selection; specification of raw materials and sources; design, supply and commissioning of plant; training of personnel; maintenance procedures and operation instructions; and miscellaneous technical assistance. **Contact:**

Mr. Roberto Catella
Administrator Unico
Saico Srl - Impianti Industriali
Via Santa Teresa 8
20025 Legnano (MI)
Italy

Tel: 39-331-453613
Fax: 39-331-453855

Status: *Commercialized*
Offer: *Production equipment/Training/Designs, formulations & technical assistance*

MACHINERY FOR PLASTIC RECYLCING Simple and compact systems for reprocessing plastic scraps from industry and consumers in order to prepare the plastic for new production. Output from 60 to 1000 kg/h. **Contact:**

Mr. Maurizio Burini
Sales Engineer
Gamma Meccanica Srl.
Via Sacco E Vanzetti 13
42021 Bibbiano
Reggio Emilia
Italy

Tel: 39-522-881504
Fax: 39-522-883490

Status: *Commercialized*
Offer: *Manufacture under license/Joint venture offer/Production equipment*

FACING BRICKS AND ROOFING TILES Realization of complete plants for the production of facing bricks and roofing tiles; specific solutions to modernize and upgrade existing installations offering an advanced technology which increases work quality and reduces labour costs. **Contact:**

Mr. Francesco De Sabato
Managing Director
Alpina Industriale Srl
Via del Lavoro 126
14100 Asti
Italy

Tel: 39-141-476969
Fax: 39-141-477136

Status: *In current production*
Offer: *Manufacture under license/Joint venture offer/Production equipment/Designs, formulations & technical assistance*

LASER MASTERING SYSTEM FOR CD PRODUCTION All CD formats including new high density CD's. A straight sale is offered, including a clean room, of this environmentally low input system. **Contact:**

Mr. Philip Moss
Head of Communications
NIMBUS Technology and Engineering
Wyastone Leys
Monmouth
Gwent
NP5 3SR
UK

Tel: 44-1600-890682
Fax: 44-1600-890137

Status: *Commercialized*
Offer: *Manufacture under license*

AUTOMATION AND MEASURING INSTRUMENTS Production of instruments for industrial automation and measurement, to control and measure pressure, flow, levels in chemical, petrochemical and industrial plants. Production of industrial accessories: flanges, valves, filters, etc. **Contact:**

Ms. Adriana Zuccon
Export Manager
SAMI snc
Via Marconi 16
30033 Noale VE
Italy

Tel: 39-41-5800611
Fax: 39-41-440336

Status: *In current production*
Offer: *Patent for sale*

THE NEW SCENARIO FOR INTERNATIONAL TRANSFER OF TECHNOLOGY

(last of a series)

by Carlos Correa,
UNIDO Consultant

(continued from issue No. 51)

II. NEW REGULATORY FRAMEWORK

1. Changes in the intellectual property system[27]

(a) Protection and enforcement of intellectual property rights within GATT

After almost five years of negotiations, a draft Agreement on Trade-Related Intellectual Property Rights (TRIPs) has been submitted by GATT's Director General in December 1991 as part of a proposed "Final Agreement" of the Uruguay Round. If finally adopted, the TRIPs Agreement will be one of the most far reaching international instruments ever subscribed on intellectual property rights (IPRs). It covers all types of IPRs, with the sole exception of breeders' rights (only incidentally referred to) and of utility models (or "petty patents").

The TRIPs Agreement will establish minimum universal standards on patents, copyrights, trademarks, industrial designs, geographical indications, integrated circuits and undisclosed information (know-how). It will supplement with additional obligations the Paris, Berne and Washington Conventions in their respective fields. Though freedom shall still remain to legislate on various aspects at the national level, the Agreement shall harmonize to a great extent the substantive (and some procedural) rules on IPRs.

In addition to the well established principle of "national treatment", the commented draft extends to IPRs the "most-favoured-nation-clause". These principles tend to ensure non-discrimination, on the one side, between foreigners and nationals and, on the other, between nationals from different countries. This latter type of discrimination has arisen as a result of unilateral actions that led to concessions only benefitting the nationals of the country that pressed for the reforms.

In the copyright area, the Agreement explicitly stipulates the protection of software as a literary creation and provides – for the first time in an international agreement – for rental rights in respect of phonograms, films and computer programs as well as for the protection of compilations of data. It establishes a minimum term of protection for works not belonging to natural persons: fifty years from publication or from creation (if publication was not made within fifty years from the making of the work)[28]. Enforcement rules are considerably strengthened by the obligation to establish criminal procedures and penalties against copyright piracy on a commercial scale.

Trademarks protection is also harmonized and reinforced by establishing a minimum permissible period of non-use and the possibility of justifying it by "valid reasons based on the existence of obstacles" (article 19). It also supplements the Paris Convention with regard to the protection of "well-known" trademarks, among other norms.

A crucial chapter of the TRIPs draft Agreement relates to patents. It neatly reflects the above-mentioned trends relating to patentability, limitation of working obligations and extension of duration. Patents should be granted without discrimination as to the place of the invention and the field of technology. The draft Agreement thus settles the so far conflicting issue of pharmaceutical product patents, which under the TRIPs Agreement should be fully recognized. For biotechnological inventions, however, and as a reflection of the complexity and still unresolved differences on the issue, the draft only provides for a transitional solution (to be reviewed within four years)[29].

The draft text states the rights to be conferred under a patent, including the protection of a product directly made with a patented process, and an exclusive right to produce, sell and import the protected product. Though no explicit rule was finally introduced, article 6 allows member countries to legislate on exhaustion of rights and, therefore, to admit parallel imports if they wish to do so. The reversal of bur-

den of proof is stipulated for process patents in order to strengthen the patentee's position in case of infringement. The minimum patent lifetime is determined as twenty years counted from the filing date.

Additionally, detailed norms are provided for to limit the conditions under which compulsory licenses may be granted. National laws could not discriminate in this regard on the basis of whether the patented product is locally produced or imported. Compulsory licenses should be non-exclusive and terminate when the circumstances that originated their granting cease to exist. There is no specification on the grounds under which such licenses can be granted, but particular reference is made to the cases of dependency of patents, licenses for governmental non-commercial use and to remedy anti-competitive practices. The text is also open on the rights that can be exercised by the licensee, which may hence include production or importation.

In the area of "undisclosed information", trade secrets are deemed protectable under the rules of unfair competition and article 6 bis of the Paris Convention. In addition, obligations are imposed in relation to test results and other data submitted to governments to obtain approvals of pharmaceutical or agrochemical products. Such tests and data should be protected against disclosure and unfair commercial use.

As far as integrated circuits are concerned, the TRIPs draft Agreement requires compliance with the still unratified Washington Convention on the Protection of Intellectual Property in respect of Integrated Circuits, with a few – but important – additional obligations in connection with the protection of industrial products containing chips, innocent infringement, compulsory licenses and the term of protection.

The GATT proposal on TRIPs also contains detailed provisions on judicial and administrative procedures and other measures related to the enforcement of rights, as well as specific rules to combat counterfeiting.

The draft Agreement includes transitional provisions that would allow developing countries to delay its implementation up to ten years. However, GATT member countries would be obliged to recognize "exclusive marketing rights" during that transitional period in relation to pharmaceutical and agrochemical products that have been patented and approved for commercialization abroad and in the country in question.

Non-compliance with the new rules, once adopted, can be the basis of a dispute settlement procedure under the GATT rules and, eventually, of commercial retaliatory measures in any field (and not only in IPRs) by the country whose nationals are affected by such non-compliance. Since the respect for the new universal standards becomes within GATT a *quid pro quo* in the commercial arena, the likelihood of deviations from those standards is drastically reduced, unless a country is prepared to absorb the costs of trade restrictions that may be imposed against it.

(b) Restrictive practices in licensing agreements

i. General Principle

Section 8 of the draft Agreement contains a set of rules aimed at the control of "anti-competitive practices" in voluntary licenses. These rules may be regarded as one of the concrete applications in the said Agreement of the general principle stated in article 8.2, according to which "appropriate measures, provided that they are consistent with the provisions of this Agreement, may be needed to prevent the abuse of intellectual property rights by right holders or the result to practices which unreasonably restrain trade or adversely affect the international transfer of technology".

The text in article 40.1 recognizes that some licensing practices pertaining to intellectual property rights which restrain competition "may have adverse effects on trade and impede the transfer and dissemination of technology".

ii. National legislation

Article 40.2 expressly allows countries to adopt measures to control or prevent certain licensing practices, but while doing so establishes limits for national action. The test to judge the practices to be controlled or prevented should be based on three elements:

a. the judgement of practices should be made in particular cases;
b. practices should constitute an "abuse" of intellectual property rights, a concept which will probably vary among different countries;
c. they should have an "adverse effect on competition in the relevant market". What the "relevant market" is remains open to interpretation. Thus, while applying this provision, Parties may look at the market of the products or services produced with a licensed technology, but also to the market of the technology itself.

Based on the referred elements, article 40.2 clearly adopts the competition test and the rule of reason to assess anti-competitiveness, and thus settles a debate that divided developed and developing countries during the long and unsuccessful negotiations on an International Code of Conduct on Transfer of Technology. For many participants and observers, this clause would achieve what the proposed Code attempted to obtain, and even more. In one sense this is correct. If the draft Agreement is adopted, for the first time there will be some rules on restrictive practices in licensing contracts in a binding international instrument, as compared to the Code of Conduct, which had been conceived based on merely voluntary compliance. Article 40.2 of the TRIPs draft Agreement, however, falls short in respect of the Code objectives in many aspects. Most important among them are, on the one side, the fact that the said article only allows national legislation to adopt measures, but (with the exception of a few examples considered below) does

not contain internationally agreed rules on the practices that may be deemed anti-competitive. On the other, the proposed Code included other substantive chapters on obligations and responsibilities of parties engaged in technology transfer transactions, international cooperation and settlement of disputes. The GATT draft Agreement is silent on these issues.

iii. Practices that may be deemed abusive

Article 40.2 provides a few examples of practices which may be deemed restrictive. They include:

a. exclusive grant back provisions, i.e. those that oblige the licensee to transfer the improvements made on the licensed technology exclusively to the licensor;
b. obligations imposed on the licensee not to challenge the validity of licensed rights;
c. coercive package licensing, i.e. the obligation for the licensee to acquire from the licensor other technologies or inputs he does not need or desire.

It would be interesting to clarify the reasons that the drafters of the commented proposal had to select the three mentioned examples. Previous versions of the document included a significantly longer list where restrictions on research and on use of personnel, price fixing, exclusive sales or representation agreements, tying agreements, exports restrictions and other practices were mentioned[30]. One possible explanation is that there may exist some consensus to consider the clauses used as examples, subject to certain conditions, as anti-competitive. One problem is, however, that section 8 applies to all types of intellectual property and certain practices which may be generally deemed as condemnable for some titles may not be equally viewed when related to other types of intellectual property[31]. In any case, an advantage of the provision is that any restrictive clause could be subject to scrutiny, provided of course, that the stipulated test is applied.

iv. Consultation system

One peculiar feature of section 8 is that it establishes a consultation system applicable for cases where a Party (Party A) considers that a national or domiciliary of the other Party (Party B) is undertaking practices in violation of the former's laws and regulations on anti-competitive practices. In this situation, Party A may request for consultations with Party B and the latter "shall accord full and sympathetic consideration to, and shall afford adequate opportunity" for such consultations. In addition Party B is obliged to cooperate "through the supply of publicly available non-confidential information of relevance to the matter in question and of other information available to the Party, subject to domestic law and to the conclusion of mutually satisfactory agreements concerning the safeguarding of its confidentiality by the requesting Party" (article 40.4).

In other words, Party B may be requested to supply publicly available as well as confidential information, but in the case of the latter its supply only refers to information which is "available to that Party", which would exclude trade secrets except if in possession of the government (for instance, as a result of a submission for marketing approval of a product). The transfer of such information, in addition, is conditional upon national legislation of Party B and the establishment of confidentiality agreements with Party A. It may be expected that under these conditions, the actual access to confidential information will be quite limited, if at all possible.

Consultations may also be requested by a Party whose nationals or domiciliaries are subject to proceedings in another Party concerning alleged violations of the latter's legislation on anti-competitive practices. In this case, the requesting Party "shall be granted an opportunity for consultations" (article 40.4) with the other Party under the same conditions as in the case presented above.

In the two referred situations, consultations will be without prejudice to any action under the relevant national law and "to the full freedom of an ultimate decision of either Party" (article 40.3), that is, judicial or administrative authorities will be free to decide in accordance with their own judgement of facts under the applicable law.

(c) Developments within WIPO and UPOV

Various negotiations have taken place in the framework of the World Intellectual Property Organization (WIPO) during the last decade, in addition to the work of expert groups on several important issues such as counterfeiting and biotechnological inventions[32]. Such negotiations have included the revision of the Paris Convention, the harmonization of patent law and the establishment of a treaty on layout designs of integrated circuits.

The negotiations for the revision of the Paris Convention were prompted by developing countries during the 1970's and in a completely different international scenario. After more than a decade, those countries' efforts proved unsuccessful and were bound to failure since intellectual property was incorporated into the Uruguay Round in 1986 as one of the "new issues". Developing countries' demands for special treatment and other measures to strengthen compulsory licenses were completely overridden by changes, precisely in the opposite direction, more effectively articulated by industrialized countries within GATT.

The far-reaching proposal to harmonize patent legislation launched by WIPO has still an uncertain outcome[33]. The proposal – as contained in the WIPO's Director General draft text to The Hague Diplomatic Conference-touches upon various technical and procedural aspects (disclosure, claims, unity of invention, filing date, right to a patent, amendment and publication of applications). Among these issues, one has been (and continues to be) particularly controversial: while almost all countries in the world confer patents on the "first to file" principle, the USA does it according to the "first to invent" rule.

The patent harmonization proposal also refers to several substantive issues such as the rights conferred under a patent, the duration and the fields of technology where patents should be granted. These issues have not yet been tackled by the Diplomatic Conference; in exchange, they have been addressed within TRIPs negotiations in GATT, as indicated above.

A third area where WIPO has been active in the development of international rules, is the protection of the layout designs of integrated circuits. Based on the *sui generis* approach first adopted by the US legislation in 1984, a Treaty was negotiated and finally adopted by a Diplomatic Conference held in Washington in 1990. The Treaty provides for minimum standards relating to such designs, whether fixed or not, for at least eight years. It authorizes reverse engineering and the granting of compulsory licenses.

The Washington Treaty has not yet entered into force. Paradoxically, the USA, the country originally most interested in its adoption rejected the text finally adopted by the Conference. Japan also joined this position. Nevertheless, the TRIPs Agreement would supplement the Washington Treaty precisely in respect of the points that caused the US reluctance to sign and ratify the latter.

WIPO has also launched an initiative to negotiate an additional protocol to the Berne Convention, in order to supplement its provisions particularly in connection with computer programs, databases, works made with a computer, and phonograms. It is unclear yet whether this initiative will find enough support, in view of the agreements already reached on those matters in TRIPs negotiations.

The contents of plant varieties protection is, as noted before, one of the few areas not specifically dealt with in the TRIPs draft Agreement, which would only oblige member countries to protect such varieties via breeders' rights, patents or a combination of both.

While TRIPs negotiations were in course, the Union for the Protection of Plant Varieties (UPOV) convened, after thorough preparatory work, a diplomatic conference to revise the UPOV Convention. The new version, finally adopted in 1991, introduces a number of significant changes with respect to the 1978 text (Correa, 1992).

(d) Implications for technology transfer

The just described changes are likely to have implications on different aspects of the creation, diffusion and transfer of technology in and to developing countries. Those implications, however, will considerably vary in accordance with the level of development of the countries concerned and with the firms and sectors involved. A stronger or wider protection of IPRs may stimulate local innovation, provided that a certain level of technological development has been achieved. Transfer of technology may be affected in several ways.

On the one side, the existence or reinforcement of protection may be perceived by potential technology suppliers as a condition for transferring certain technologies. On the other, such a protection is likely to reinforce their bargaining power to determine royalty rates and other contractual conditions. If – as proposed in TRIPs – the working obligation of patents is diluted or eliminated, foreign patents may be exploited just by importing the respective product into the country of registration. Given the globalization of the economy, the continued importance of economies of scale in various sectors and the reduction of tariff protection in many developing countries, it is likely that innovating firms in the North tend to increasingly exploit their inventions through trade – rather that through licenses or FDI – in the South. This explains why GATT – a trade related negotiating forum– has played such a significant role in the development of international rules on IPRs.

2. International rules on the environment and biodiversity

The review of environment-related conventions indicates a trend towards increasingly precise commitments regarding technical assistance and technology transfer in certain well defined areas. The Long-Range Transboundary Air Pollution (LTRAP) Convention (1979), called for technical cooperation in general terms among signatory countries. Its Protocol on nitrous oxide (1988) required parties to "facilitate the exchange of technology to reduce emissions" (on a commercial basis). The Basel Convention (1989) went a little farther and obliged parties to "employ appropriate means to cooperate in order to assist developing countries in the implementation" of the Convention and to "cooperate in developing the technical capacity among Parties, especially those which may need and request technical assistance in this field". Far more concrete was the Montreal Protocol on Substances that Deplete the Ozone Layer (as amended in London, in June 1990). It established a multilateral fund to meet, on a concessional basis, incremental costs of developing countries's compliance with the Protocol obligations and to finance "clearing-house" functions. In particular, article 10.A states that:

"Each party shall take every practicable step, consistent with the programmes supported by the financial mechanism, to ensure:

a. that the best available, environmentally safe substitutes and related technologies are expeditiously transferred to [developing country] Parties ...; and,
b. that the transfers referred to in subparagraph (a) occur under fair and most favourable conditions".

An interesting example of international cooperation in the transfer of technology, has taken place with the setting up of an association of large industrial users of chlorofluorocarbons CFCs, the Industry Cooperative for Ozone Layer Protection (ICOLP). ICOLP, as an intermediary institution has participated, for instance, jointly with Northern Telecom, the US Environmental Protection Agency and the Mexican State Environmental Agency, in a training and demonstration project on CFC solvent conservation and elimination in the Mexican electronics industry. Northern Telecom supplied a spray misting technology proven to be environmentally sound as well as feasible

and efficient.

A major effort to set out an international framework for the transfer of environmentally sound technology reflected itself in the negotiation of Chapter 34 of Agenda 21 at the UNCED Plenary in Rio de Janeiro, in June 1992. The adopted text recognizes the need of a favourable access to and transfer of environmentally sound technologies, in particular to developing countries (art. 34.4) and that "proprietary technology is available through commercial channels, and international business is an important vehicle for technology transfer" (article 34.11). Among the Objectives, the Plenary proposed

"To promote, facilitate, and finance, as appropriate, the access to and the transfer of environmentally sound technologies and corresponding know-how, in particular to developing countries, on favourable terms, including on concessional and preferential terms, as mutually agreed, taking into account the need to protect intellectual property rights as well as the special needs of developing countries for the implementation of Agenda 21" (article 34.14).

The referred Chapter also contains a detailed provision on activities for the "support and promotion of access to transfer of technology", including measures to prevent the abuse of intellectual property rights and compulsory licenses. The relevant text reads as follows:

"Governments and international organizations should promote, and encourage the private sector to promote, effective modalities for the access and transfer in particular to developing countries of environmentally sound technologies by activities, including the following:

a. Formulation of policies and programmes for the effective transfer of environmentally sound technologies that are publicly owned or in the public domain;
b. Creation of favourable conditions to encourage the private and public sectors to innovate, market and use environmentally sound technologies;
c. Examination by governments and, where appropriate, by relevant organizations of existing policies, including subsidies and tax policies, and regulations to determine whether they encourage or impede the access to, transfer of and introduction of environmentally sound technology;
d. Addressing, in a framework which fully integrates environment and development, barriers to the transfer of privately owned environmentally sound technologies and adoption of appropriate general measures to reduce such barriers while creating specific incentives, fiscal or otherwise, for the transfer of such technologies;
e. In compliance with and under the specific circumstances recognized by the relevant international conventions adhered to by States, undertaking measures to prevent the abuse of intellectual property rights, including rules with respect to their acquisition through compulsory licensing, with the provision of equitable and adequate compensation;
f. Develop mechanisms for the access to and transfer of environmentally sound technologies, in particular to developing countries, while taking into account developments in the process of negotiating an international code of conduct on transfer of technology, as decided by UNCTAD at its eighth session in Cartagena" (article 34.18).

Discussions and recent studies on the transfer of environmentally sound technology have helped to clarify various issues.

First, as in the case of the transfer of other technologies, the capability of the recipient party to select and effectively absorb the concerned technology is a decisive factor. Therefore, the building up of "institutional capacity within developing countries is of crucial importance (e.g. technical training, increased awareness of existing environmental problems, access to information about preferable alternatives)" (World Resources Institute, 1993, p.3).

Second, shifting away from old, environmentally unfriendly technologies, may not only have positive environmental effects but increase at the same time efficiency in production.

Third, the problems of access to environmentally sound technology is not necessarily a purely supply problem: a major constraint is likely to rely on the demand side, due to the lack of economic incentives to introduce changes and improvements (which often are costly), limited information on available alternatives and absence of effective public policies. In order to encourage, hence, the transfer and adoption of environmentally sound technologies new instruments may need to be devised such as taxes and incentives, financial mechanisms and improved information systems.

The Biological Biodiversity Convention is another outcome of the Rio Conference which contains significant provisions on technology transfer. Article 16 of the Convention states that each Party undertakes to provide and/or facilitate the other Parties' access to technologies relevant to the conservation and sustainable use of biodiversity or which make use of genetic resources and do not cause significant harm to the environment. Such an access shall be provided and/or facilitated under fair and most favourable terms, including mutually agreed preferential and concessional conditions. The adequate protection of intellectual property rights should be taken into account, wherever protected technology is involved.

Two other important provisions in article 16 establish that each Party shall take measures (a) to ensure other Parties, particularly developing countries, that provide genetic resources, access to the technologies that use such resources and the transfer of said technologies on mutually agreed conditions; and (b) for the private sector to facilitate access to technology, its joint development and its transfer to governments and the private sector of developing countries. Finally, a financial mechanism, eventually applicable

to technology transfer transactions, will be established (articles 20 and 21).

The referred provisions represent a considerable step forward to the extent that they set out basic principles and define some obligations of the signatory countries. They need, however, to be implemented adequately and to be further developed in order to deal with particularly complex cases[34]. The USA, while ratifying the Convention, has announced an interpretive statement in order to make clear that agreements concerning access to and transfer of technology must be voluntary and consistent with an adequate protection of IPRs, thus excluding the eventual application of compulsory licenses.

Environmental concerns as well as the new international rules on biodiversity may, in sum, constitute a new and important factor influencing the transfer of technology, both in terms of the contents of the technological "packages" transferred as well as of the new initiatives that, at the national and international level, may be adopted to stimulate the demand and implementation of environmentally sound technologies.

III. CONCLUSIONS AND POLICY OPTIONS

The previous sections have described a number of trends which have changed the scenario for cooperation in the field of transfer of technology. Of course, the analysis is not exhaustive, but it provides some elements that may be helpful for policy formulation at the government and firm level. The main conclusions of the said analysis are summarized below.

Technology today plays a key role in the development process and in the creation of competitive advantages. Intangible investments are growing in industrialized countries as a proportion of total investment. R&D, which accounts for a growing share of GNP, is highly concentrated in said countries, despite recent trends towards decentralization of R&D activities by large firms. The increased costs of R&D – which significantly differ by industry- have given raise to new modalities of cooperation, both government supported (e.g. European research programmes) and directly established by interested enterprises.

The main implications for developing countries of the aforementioned trends are twofold:

a. entry barriers posed by intangible investments and, in particular, R&D costs continue to grow and further consolidate the market power of the major firms of industrialized countries;
b. changes in the access to and transfer of technology are likely to occur, given the strategic character of innovation and its increasing cost. As discussed below, the impact of these trends is accentuated by the shortening of the life-cycle of products and by the globalization of the economy.

Pari passu with the described trends, the globalization of the world economy, the liberalization of developing countries' economies, the shortening of the product life-cycle and the exacerbation of competition, are modifying the patterns of technology transfer. Potential technology recipients that cannot enjoy any more compensating advantages to apply mature technologies in sheltered markets, need to become more efficient and qualified in order to obtain and exploit licensed technologies.

A general problem is, however, that in the new international scenario, strong pressures exist towards the privatization of scientific knowledge and protection of technology. This trend may not only affect scientific international cooperation – essential for the development of science worldwide – but also limit the access to the most modern and competitive technologies. Signs of the said protectionism have been evident in the most advanced developing countries and also manifest themselves in the present initiatives for strengthening IPRs.

Environmental issues still receive little attention in terms of R&D resources devoted by industrialized countries, but are likely to constitute an important factor in innovation and technology transfer. Notwithstanding marked North-South differences on these issues, progress has been made in concrete cases of transfer of environmentally sound technologies as well as in the development of a number of international conventions and principles.

Technology demands change as a country reaches different levels of technological and economic development. Formal channels of technology transfer prevail as the industrialization process advances, where FDI and licenses become more important than the purchase of machinery and other informal modalities of transfer. FDI inflows to developing countries have grown during 1985-1990 – attracted by a few fast growing developing countries, mainly in Asia – but the said countries' participation in total FDI inflows has fallen 8 per cent during the last decade.

FDI does play an important role as a means of technology transfer at early stages of technological development, when domestic absorptive capabilities are weak. Given the key importance of technology as a competitive asset and the protectionist trend pointed out above, it is also likely to increasingly become a substitute for unbundled licensing whenever state-of-the-art technologies are involved.

While joint-ventures have not yet fully delivered their promise as appropriate vehicles for technology transfer, new forms of technological cooperation have emerged. The latter – most notably strategic alliances – offer new ways of accessing to technologies, but are mostly confined to enterprises from industrialized countries or from the most advanced developing countries.

The bargaining power of technology recipients has not been substantially improved, according to the available evidence, by regulations on technology transfer applied in many developing countries. The bargaining power seems to improve as the recipient's technological capabilities increase, either in-house or based on cooperation with public laboratories

and research centres. The new global scenario and the reluctance of innovative firms to part with their technology suggest that trade in technology may be subject in the future to increasingly hard terms and conditions for the recipient party.

Finally, the study has reviewed in some detail a number of regulatory trends at the international level. Most relevant for technology transfer issues are the developments within GATT and other fora, which tend to increase the levels of IPRs protection. It is too early to assess the likely impact of these changes, particularly on IPRs, but they are undoubtedly giving potential technology suppliers more freedom to select the ways of internationalization of their operations and, in particular, to use trade as a main means of exploitation of innovations

Based on the precedent analysis, a number of policy options may be indicated:

Technology and development policy

The growing importance of intangible investments, including R&D, is a clear indicator of the key role played by technology in global competition and economic growth. Access to and mastery of technology are to be viewed today as a main target of any development policy.

A new focus for transfer of technology

Evidence referred to above indicates that the regulation of contractual aspects of technology transfer transactions may improve the negotiating position of potential recipients. The building up of absorptive capabilities seems however to be the essential strategy at the country and firm level. This is a complex and time-consuming process, which requires supplier cooperation but, above all, an innovation-inducive environment and deliberate efforts by recipient firms. Technology transfer policy should strongly focus on the creation of conditions for such a process to take place.

On the other side, the opening of previously sheltered economies is forcing firms in many developing countries to compete with more technologically advanced firms. Lacking factors that may compensate the age of technologies acquired and other comparative disadvantages, recipient firms need to become more efficient in the process of selecting and absorbing transferred technologies. Policies should assist recipients to meet these new requirements.

The role of foreign direct investment

In the current competitive scenario, as mentioned, FDI is likely to play an increasingly important role as a channel for technology transfer both for mature technologies where the recipient's technological capabilities are low and for high technologies that innovating firms are reluctant to license to unrelated parties. Since FDI may be, in this new scenario, a substitute for licensing in many situations, technology transfer policies should be adequately integrated with investment policies, taking into account the changes brought about by the globalization of the world market in respect of FDI patterns.

New and old approaches to technology transfer

Strategic alliances as well as the acquisition of technology-intensive firms in industrialized countries, offer the most advanced developing countries new approaches to get access to modern technologies, but are not available to most firms in developing countries. The latter may, however, expand the utilization of modalities that have been extensively used in some Asian countries, such as subcontracting and OEM arrangements. These may lead to a substantial technological learning and job creation. Rather than a single channel of technology transfer, developing countries should endeavour to combine new and old modalities, depending on their degree of development and the sectors involved.

Technology and competition

The possession of technological advantages, particularly if protected by intellectual property rights, creates a considerable market power. Adequate measures are necessary at the national level in order to avoid abuses that unreasonably affect competition. Technology policy should therefore be associated to a sound competition policy able to stimulate innovation and fair deals in technology transfer. Action aiming at reinforcing legislation on anti-competitive practices should be encouraged.

Technology and the environment

The development of environmentally sound technologies may be in the years to come one important source of technological change. Developing countries' access to such technologies (as well as to those that preserve biodiversity) should be stimulated, acting on the supply as well as on the demand side. Policies should eventually incorporate incentives and compensations for firms adopting technologies better suited to the environment.

Research on technology transfer issues

Notwithstanding the extensive literature on technology transfer produced since the 1970s, a fragmented theory and little evidence are available on various issues referred to in this paper. Further research is needed, in particular, on the impact of intellectual property rights on technology flows, and on the implications of the emerging scientific and technological protectionism for the access to and pricing of technology.

Action by international organizations

Programmes on technology transfer of international organizations should take the new realities and trends in developed and developing countries into account. Specific issues to be addressed at the policy level may include:

- linkages between technology transfer and building up of absorptive and innovative capabilities at different stages of development;
- relationship between transfer of technology and competition policies and legislation;
- the role of investments, particularly, of FDI, in the transfer of high-technologies;
- implications of subcontracting and OEM arrangements for technological learning.
- implementation of the Biodiversity Convention and of UNCED Agenda 21 in respect of transfer of technology issues.

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NOTES

27. This section is partially based on Correa, 1993.
28. One of the main areas of application of this minimum term will be computer programs for which Brazil and France have established a shorter term of protection (the same applicable to works of applied arts)
29. The draft Agreement authorizes Parties to exclude patentability of plants and animals other than microorganisms and of essentially biological processes for their production (other than non-biological and microbiological processes). However, plant varieties should be protected under patents, a *sui generis* regime or any combination thereof.
30. See the text of 22 November 1990, which was discussed at the Montreal Mid-Term Review of December 1990. See also the list of practices as negotiated by the UN Conference on a Code of Conduct on Transfer of Technolgy (UNCTAD TD/CODE TOT/47)
31. This may the case of example (b) which has been commonly accepted for the patents but not for trademarks.
32. Although these groups do not enter into actual negotiations, their conclusions are often influential. One example are the suggestions on the extent and modalities of protection of biotechnological inventions.
33. A "First Part" of a Diplomatic Conference for the Conclusion of a Treaty Supplementing the Paris Convention as far as Patents are Concerned was held in The Hague in June 1991. The dates for the second part of the Conference, where the most substantive issues should be dealt with, have not yet been determined.
34. See in this regard Menon, 1992.

INDIA: Opportunities for Investment of Technology Transfer

(The following are excerpts from an information booklet on India, issued in connection with the India Intechmart, 24 to 27 March 1995)

OVERVIEW

India is the seventh largest country in the world and the second largest in Asia. With a land mass of 3.29 million square kms and a population of over 870 million, it possesses a richness and diversity in culture, people, language, geographic and climatic conditions and natural and mineral resources that are matched by few other countries in the world.

A new spirit of economic freedom is stirring in India, bringing sweeping changes in its wake. A series of ambitious economic reforms aimed at deregulating the economy and stimulating foreign investment, has moved India firmly into the front ranks of the rapidly growing Asia Pacific region and unleashed the latent strengths of a complex and fast changing nation.

India's time tested institutions offer foreign investors a transparent environment for the security of their long term investments. These include a free and vibrant press, a judiciary can and does overrule the government, a sophisticated legal and accounting system and a user-friendly infrastructure, most evident in the widespread use of English as the principal language of commerce and administration.

India's dynamic and highly competitive private sector has long been the backbone of its economic activity. It accounts for over 75 per cent of its Gross Domestic Product and offers considerable scope for joint ventures and collaborations.

India's process of economic reforms is firmly rooted in a political consensus that spans its diverse political parties.Its democracy is a known and stable factor which has taken deep roots over nearly half a century. Importantly, India has no fundamental conflict between its political and economic systems.

THE INDIAN ECONOMY

The Indian economy is characterized by steady GNP growth, moderate levels of inflation and a comfortable foreign exchange reserves position. GNP has been growing at 5.4 per cent per annum over the last decade. Per capita incomes have registered an annual growth rate of 2.7 per cent despite population rising at over 2 per cent per annum

India is the fifth largest economy in the world and the second largest amongst emerging developing economies, based on purchasing power parity. In 1992-93, the GDP was Rs 6.279 billion at current prices.

In July 1991, India initiated a wide ranging programme of economic reform. Far reaching changes were carried out in policies relating to virtually every sector of the economy - trade, industry, foreign investment, finance, taxation and the public sector. The measures then introduced and progressively strengthened thereafter have transformed the business environment and opened up the economy to foreign investment.

The reforms came after a decade of sustained economic and industrial growth of 5.5 per cent and over 7 per cent per year respectively, but with growing fiscal and external imbalances. The reforms sought to achieve macro-economic stabilization and build on the strengths that the economy had acquired, such as high domestic savings and investment rates, a strong and mature private sector, a vibrant capital market, a large and diversified industry and self-sufficiency in agriculture. The reforms aimed at global integration, accelerating growth, improving productive efficiency, innovation and international competitiveness and focusing government resources on rural development and the social sector.

Regulation of investment and production were substantially relaxed. Private participation is now permitted in virtually all industries. Foreign investment is welcome and is generally treated at par with domestic investments. A phased programme of public sector divestment and restructuring has begun. Import barriers have been brought down radically and tariffs reduced. Capital markets have been opened for foreign investment and measures to further strengthen and develop the markets have been launched. Banking sector controls have been eased and private investments encouraged. The tax structure has been simplified and rates reduced. The new economic policies have also substantially relaxed foreign exchange controls.

RECENT PERFORMANCE

The economy has responded remarkably well to the stabilization and reform measures of the past three years and has been on the path of recovery from the economic crisis of 1991. GDP growth which fell to 1.1 per cent in 1991-92, reached 4 per cent in 1992-93.

Industrial production and investment, which initially showed a hesitant

recovery from the deflationary effect of the initial stabilization measures, are now looking more buoyant. Having registered a growth rate of 3 per cent in 1993-94, it is expected to grow by 7 per cent in 1994-95. Real GDP growth is expected to be 5 per cent or higher.

Fiscal deficit came down from 8.4 per cent of GDP in 1990-91 to 5.7 per cent in 1992-93: growth in money supply dropped from 15.5 per cent per annum to 1990-91 to 14.2 per cent in 1992-93. The inflation rate slowed down from 16.7 per cent per annum in August 1991 to less than 7 per cent per annum in March 1993. While it went up again to slightly above 10 per cent in April 1994, it was back to single digits in August.

The improvement in India's external accounts, both current and capital, has been remarkable. With export growth of 20 per cent in dollar terms in 1993-94, the current account deficit has declined to 0.3 of GDP from 3.3 per cent of GDP in 1990-91. Foreign investment has surged to record levels and foreign exchange reserves increased to US$ 19.5 billion by October 1994 from a low of US$ 1 billion three years ago.

CONSUMER MARKET

One of the most striking features of the Indian economy is the sheer size of the consumer market. Private consumption expenditure grew at 13 per cent per annum (at current prices) through the 1980s and was estimated at Rs 3,418 billion (US$ 110 billion) in 1990-91. The overall growth of 13 per cent is composed of widely differing growth rates in the various sectors. Expenditure on transport and communication is increasing by as high as 21 per cent per annum and consumer electronics at 30 per cent. This reflects a perceptible shift in consumer spending from primary products to manufactured goods and services, which is also borne out by the increasing share of manufactured goods and services in the country's GDP.

The class of consumers that constitutes the major market for consumer goods is estimated to be between 100 million and 300 million, depending on the type of consumer good. Recent years have seen a boom in consumer spending.

THE RESPONSE

The rate at which approved direct foreign investment is growing, is a positive indication of the growing global interest in India and the ease of entry.

The USA has traditionally been the largest foreign investor, accounting for nearly 40 per cent of the foreign direct investments approved during the period 1991 to 1993. The global network of expatriate Indians (NRIs) has accounted for the second largest category of investments approved during this period. Other leading investor countries are the UK, Switzerland, Germany, Japan and France. An interesting development in recent months has been the increasing investor interest from South East Asian countries such as Thailand and Singapore as well as other non-traditional investors such as Australia, Oman, UAE and Mexico.

These investment commitments have been backed by an increasing inflow of funds, with several investors having already set up or being in the process of setting up production facilities in the country.

REGULATORY ENVIRONMENT

INDUSTRIAL POLICY

The Industrial Policy Resolution of 1956 and the Statement on Industrial Policy of 1991 provide the basic framework for the overall industrial policy of the government.

In the initial stages of the country's developmental process, growth of industry was regulated through grant of industrial licenses and other industrial approvals. The system of obtaining government approvals in a large segment of industrial activity was progressively liberalized over the 1980s. This process culminated in the watershed changes in industrial policy announced on 24 July 1991 which substantially abolished industrial licensing, announced measures facilitating foreign investment and technology transfers, and threw open the areas hitherto reserved for the public sector.

AREAS FOR THE PUBLIC SECTOR

The private sector can operate in all areas except those of strategic concern such as defence, railway transport and atomic energy. The list of industries reserved for the public sector has been reduced to six. Private participation is permitted in some specific areas in this list as well, such as mining; oil exploration, refining and marketing; and parts of the railway transport sectors.

Areas where an industrial license is required:

The requirement of obtaining an industrial license for manufacturing activity is limited to:

- Industries reserved for the public sector;
- 15 industries of strategic, social or environmental concern;
- Industries reserved for the small scale sector.

All other industries are exempt from licensing, subject primarily to locational restrictions in metropolitan areas.

FOREIGN EXCHANGE CONTROLS

India's foreign exchange control regime is governed by the Foreign Exchange Regulation Act (FERA), a legislation enacted in 1973. Comprehensive amendments to FERA, especially with respect to foreign investment, have been undertaken in order to give effect to the liberalizations announced in the economic policies.

Foreign exchange controls have been substantially relaxed. Effective from August 20, 1994, India announced its movement to Article VIII status in the IMF: the Indian Rupee is now convertible on the current account. For foreign investors, the Indian Rupee is already convertible on the capital account.

TRADE POLICY

An outward looking trade policy is one of the main features of India's programme of economic reform. Changes in trade policies have included a significant scaling down of tariff barriers, virtual dismantling of the system of

import and export licenses and simplification of procedures.

IMPORTS

Goods can be imported freely except for a small Negative List of Imports.

Quantitative restrictions on imports of capital goods and intermediates have been almost completely removed. The import of second hand capital goods is allowed, provided they have a residual life of five years. Import of capital goods, either new or second hand is also permitted at a concessional customs duty rate of 15 per cent under the Export Promotion Capital Goods (EPCG) scheme, subject to the fulfillment of specified export obligations.

REDUCED TARIFFS

The government has clearly stated its commitment to bringing tariff rates down to international levels in a phased manner.

Prior to the reforms, India's tariff rates were very high indeed. There has been a consistent decline in these rates over the past three years from peak rates of 300 per cent in June 1991 to 65 per cent at present. Capital goods imports which were earlier subject to tariff rates of around 100 per cent, now attract duties in the range of 20-40 per cent, with the basic import duty on general capital goods at 25 per cent. Import duties on equipment are even lower for projects in specific sectors and nil for export oriented projects.

EXPORTS

Export of goods is allowed freely, except for a few items in the Negative List of Exports.

SPECIAL INCENTIVES FOR EXPORTS

Exports are the major focus of India's trade policy. The export promotion package compares favourably with incentives offered elsewhere in the world. It makes a special effort to attract foreign investors to set up export oriented units in India.

Export profits are exempt from income tax.

Higher royalty payments of 8 per cent (net of taxes) are permitted on export sales as compared to 5 per cent on domestic sales.

Export oriented Units (EOUs) and Export Processing Zones (EPZs) enjoy special incentives such as duty free imports of capital goods and raw materials for the purpose of export production.

INTELLECTUAL PROPERTY RIGHTS

The concept of the importance of Intellectual Property in India is established soundly at all levels: statutory, administrative and judicial. The four main aspects of India's Intellectual Property Rights regime are:

- Copyrights,
- Trade Marks,
- Patents, and
- Industrial Designs.

Copyrights

India's copyright law, laid down in the Indian Copyright Act, 1957, fully reflects the Berne Convention on Copyright, to which India is a party. It has been amended periodically to keep pace with changing requirements. The most recent amendment was effected in 1994, which ushered in comprehensive changes and brought the Copyright Law in line with the new developments in satellite broadcasting, computer software and digital technology. Indian copyright law is now at par with the most modern laws in the field.

Trade Marks

India affords full protection to Trade Marks under the Trade Marks and Merchandise Act. Service Marks are not specifically included in the Trade Marks and Merchandise Act. However, they have been protected in judicial decisions by the Courts. Government has introduced a Bill in Parliament seeking to amend the earlier Trade Marks and Merchandise Act and provide for statutory protection of Service Marks.

Patents

Under the Patent Act, 1970, India recognizes product patents under a 14 year period of protection for patents. However, it provides an exception in three areas: food, chemicals and pharmaceuticals, where it recognizes only a process patent for a period of seven years.

Industrial Designs

Industrial Designs are governed by the Designs Act of 1911. The registration of a design confers on the registered proprietor the right to take action against third parties who apply the registered design without license or consent. The duration of protection afforded to a design registered under the Act is five years initially, with renewals for two further periods of five years each.

INDIA AND GATT

India, along with 110 other countries, authenticated the results of the Uruguay round by signing the Final Act at Marrakech on 15 April 1994. India intends to abide by the obligations arising out of the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS), which form part of the Uruguay Round Agreements.

FOREIGN INVESTMENT

WELCOMING FOREIGN INVESTMENT

The policy changes initiated in July 1991 are designed to attract significant capital inflows into India on a sustained basis and to encourage technology collaboration agreements between Indian and foreign firms. Today, India welcomes direct foreign investment in virtually every sector of the economy except those of strategic concern such as defence, railway transport and atomic energy. Salient features of the new policies towards foreign investment are:

- Foreign equity up to 100 per cent is allowed, subject to certain conditions.

- Automatic approval for foreign equity participation up to 51 per cent is granted in several key areas. These approvals are normally granted within two weeks by the Reserve

Bank of India (RBI).

- The Foreign Investment Promotion Board (FIPB), a specifically empowered board, has been set up in the office of the Prime Minister to speed up the approval process. Clearance of proposals by the FIPB takes around six weeks on an average.
- Foreign investors need not have a local partner.
- Free repatriation of profits and capital investment is permitted, except for a short specified list of consumer goods industries where it is subject to dividend balancing against export earnings.
- Use of foreign brand names/trade marks for sale of goods in India is permitted.
- Indian capital markets are now open to foreign institutional investors.
- Indian companies have been permitted to raise funds from international capital markets.
- India has become a member of MIGA and is also willing to sign Bilateral Investment Protection Agreements with investing countries.
- Corporate taxes have been reduced by 5-10 per cent. Further progressive reductions are planned.
- Special investment and tax incentives are given for exports and certain sectors such as power, electronics and food processing.
- Foreign capital invested in India is allowed to be repatriated, along with capital appreciation, if any, after the payment of taxes due on them. The disinvestment is permitted in accordance with the terms of the letter of approval granted at the time of approving the foreign collaboration.

INDONESIA: Characteristics and Features of Technology Flows

by Djoko Pitono
Centre for Analysis of Science and Technology Development
Indonesian Institute of Sciences
(PAPIPTEK-LIPI)

INTRODUCTION

Indonesia's record of economic growth and diversification is among the most successful in the developing world. Prudent economic policies, political and social stability, pursued for more than 20 years, have created an environment well-suited to long-term business and investment.

Indonesia's economic growth since independence (1945) has taken the country through several successive phases, beginning with agricultural stabilization during the 1950s and 1960s, followed by replacement of imports with domestic products during the 1970s, and later, the re-investment of revenues from oil and gas during the 1970's and early 1980s. In the 1990s, Indonesia entered a new phase of economic maturity, based on opening its trade sectors to world markets, broadening its manufacturing base, extending the scope of its banking and capital markets and stepping up its export drive.

During the fourth year of the fifth Five-Year Development Plan (Repelita V), Indonesia's economic development has attained quite a high rate of growth. In 1992, the economic growth rate reached 6.3 per cent, making the average growth rate during the four-year period reach almost 7 per cent annually. This means that the targeted 5 per cent annual growth of Repelita V had been surpassed.

The rapid growth was also due to the increasing contribution made each year by the industrial sector, the share of which to national productionhas surpassed that of the agricultural sector since 1991. The dependence of the economy on oil has gradually decreased, while exports continue to play a more important role. In development activities, the business community and business world continue to play a greater role as well.[1]

The role of foreign and domestic investment is considered to be very important for economic growth. Foreign investment is regulated by Act. No. 1 of 1967, and later amended by Act No. 11 of 1970, while domestic investment is regulated by Act No. 6 of 1968 and amended by Act No. 12 of 1970. The foreign investment act stipulates that foreign companies may invest and operate in Indonesia independently as well as in the form of joint-venture with Indonesian partners with the approval from the Government of Indonesia for a maximum period of 30 years. However, since January 1974, all foreign investment – in some specific areas the investments were totally for export business – had been in the form of joint-ventures with Indonesian partners.

For administrative and accounting reasons, foreign direct investment is divided into three categories namely: general; financial services; oil and gas. In the case of oil and gas, for example,

foreign participation is considered part of "production sharing" and is not regarded as "direct investment". Foreign participation in Indonesia's oil, gas and financial sectors is approximately of the same magnitude as all general investments combined.

The Investment Coordinating Board (BKPM) was established in 1977 to evaluate investment proposals under the Foreign Investment Act of 1967 as well as the Domestic Investment of 1968. With the exception of oil and gas and the financial sector, BKPM is the sole body the foreign investors have to consult when seeking to invest in Indonesia. Once the investment has been approved, BKPM will require operational reports periodically.

Meanwhile, measures have been adopted to create a more favourable climate of investment. In 1984, the government had made tax reforms to simplify the tax rate and tax procedures. In 1985, import procedures were simplified so as to accelerate the in and out flow of goods and to lower the cost. The "6 May 1986" Package, a newly-revised policy, was introduced to promote non-oil and gas exports and investment. This was followed by the "25 October 1986" Package, which allowed foreign investments in those fields under the domestic investment scheme on condition that they should increase exports of their products; the "24 December 1987" Package to enhance foreign and domestic investment, and the "21 November 1988" Package to smoothen, among others, the way for foreign investment in joint-venture companies in the marine transportation business. Not less important is the issuance of the 1989 Investment Negative List (DNI), replacing the former Investment Priority List (DSP).[2]

TECHNOLOGY TRANSFER[3]

The term technology transfer gives the impression of the existence of a donor and a recipient instead of a seller and a buyer. It may be clarified that technology transfer simply means importation of technology based on mutuality of interest. Furthermore, it is known that useful technology is not given away free – it has to be paid for in one way or the other. It is also sometimes thought that technology transfer simply means purchase of *Technoware*. Thus considerable effort is spent on trying to secure *Technoware* and the *Inforware* to operate and maintain it at the best possible prices. It is, however, important to view technology transfer considering all four components of technology to ensure that adequate steps are taken locally to effectively transfer and assimilate imported technologies. The following points regarding the four components may be worth noting:

Technoware

Technoware, other than the state-of-the-art, can normally be bought internationally for a price determined by the relative bargaining position of buyers and sellers. Less sophisticated imported Technoware may very often require sophisticated Humanware to operate and maintain it.

Humanware

Humanware can be imported temporarily, and success in acquiring this ability depends primarily on local learning capability. When Humanware is well developed in any particular area of technology, importing Technoware can be a very effective option for reducing the technology gap.

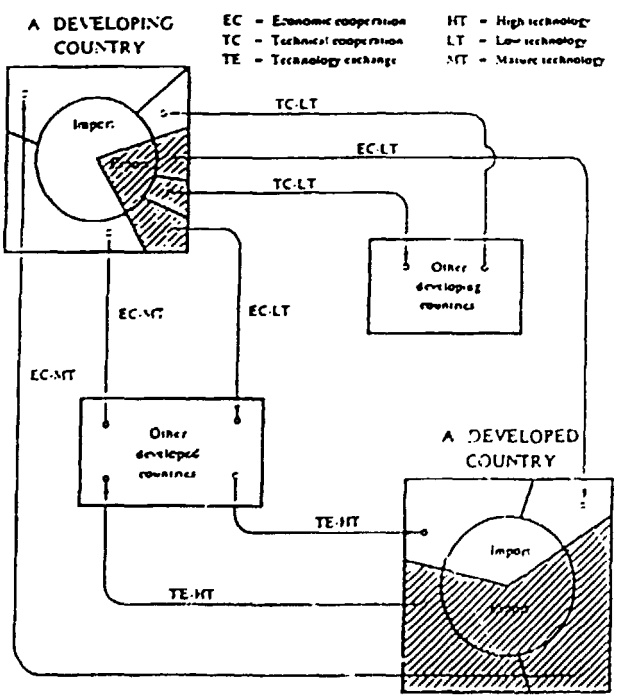

Fig. 1: General Pattern of Flow of Intrnational Technology

Inforware

Inforware, beyond the level of simple operating instructions, is usually not given to the ordinary Technoware importer. Since Technoware production costs money and involves risks, critical information (particularly comprehending, generalizing and assessing facts) is closely guarded for cost recovery and profit making. Thus, importing Inforware may be more expensive than the cost of Technoware import.

Orgaware

Orgaware from abroad cannot be easily transplanted in the local environment and needs considerable adaptation to suit local working conditions. Many public sector enterprises in developing countries are established through external financing and managed by transnational corporations (TNCs). As the TNCs use very sophisticated Orgaware, the host organization in the developing countries (which did not have the opportunity to gradually evolve its Orgaware through various degrees of sophistication), becomes dependent on foreign experts and the linkages of the external organizations, such as TNCs.

The aforementioned aspects may explain why mere importation of machinery and plants will not automatically lead to technology transfer. Effective utilization of imported Technoware requires considerable investment in the development of the other three components of technology. This implies that local research and development expenditures are needed for the development of: suitable Humanware, protected Inforware and compatible Orgaware. Unfortunately, at times, commercial interest and political leverage act as constraints against harnessing the fullest benefits from technology transfer. (See figure 1).

TECHNOLOGY FLOW IN MANUFACTURING INDUSTRY THROUGH FOREIGN AND DOMESTIC INVESTMENT

The information contained in investment approval documents of the Investment Coordinating Board (BKPM) can be used to construct statis-

Table 1: Foreign Investment Approval by BKPM

Industries Producing Products with a:	Billion of Current Rupiah									
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
High-tech	4874	5252	1391	1305	283	246	893	1220	2481	4343
Medium-tech	5738	3678	1647	4466	3246	2478	15865	27132	23114	14071
Low-tech	465	13115	6859	1079	2310	6075	21091	14109	30884	21289
Total	11077	22045	9897	6850	5839	8799	37849	42461	56479	39703

Table 2: Domestic Investment Approval by BKPM

Industries Producing Products with a:	Billion of Current Rupiah									
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
High-tech	399	7226	1601	596	1057	1831	912	1820	3592	2338
Medium-tech	5480	7775	2451	13285	9421	22983	32811	44513	138154	91208
Low-tech	15943	32556	11272	5645	10117	39821	63146	82980	290649	171099
Total	21822	47557	15324	19526	20595	64635	96889	129313	432395	264645

tics describing a prerequisite to increase manufacturing production. To the extent that these investments are in sectors that intensively use technology or technical skills, these statistics can also be used as leading indicators of the growth of technology intensity in Indonesian manufacturing industries

Every industry uses varying degrees of technology in its operations. Two approaches to identifying the potential use of technology by industry are available. The first is to use one of the lists of high technology or technology intensive industries developed elsewhere (for example, in the USA or by OECD/Organization for Economic Cooperation and Development). Those industries in which the relative R&D efforts are greatest are likely to be those whose products have the highest technology content. This approach has the advantage of identifying those industries in highly industrialized countries in which changes in products and in production technology are most likely. Even though a large part of technology transfered into Indonesia may have been developed in other countries, this technology was still included in the products assembled or produced by Indonesian manufacturing industries. Thus, comparison of high – medium – low technology in Indonesia are still valid.

Low technology intensive still dominated foreign as well as domestic investment in Indonesia.[4]

TRADE BALANCE OF MANUFACTURING INDUSTRIES

Trade statistics of Indonesian export performance, particularly for products with a high – medium – low technology content, serve at least two purposes in an indicators report. First, they provide additional evidence of the evolution of a nation's economy, as increasing exports and decreasing imports reflect the growth of specific products. Second, the ability to export, in particular, is proof of international competitiveness. Information about the international competitiveness of products that are the target of industrial policy can be helpful in the evaluation of those policies (see figure 2).[5]

The value of Indonesian imports of manufactured goods has increased steadily since 1985 at an average annual rate of over 17 per cent before inflation (8 per cent in real term). The increase in imports of manufactured products has been concentrated in products with relatively high or medium technology content (see figure 3).[6] Imports of low technology-intensive products have followed a similar path, but at somewhat lower rates. Between 1985 and 1991, for example, imports of these products grew at a real annual average rate of 7 per cent.

The high level of imports of manufactured products is tangible evidence that domestic production has not been able to keep pace with the aggregate demand for manufactured products. As a consequence, there has been a subtantial trade deficit in manufactured products: the value of total imports substantially exceeds the value of total exports (see figure 4).

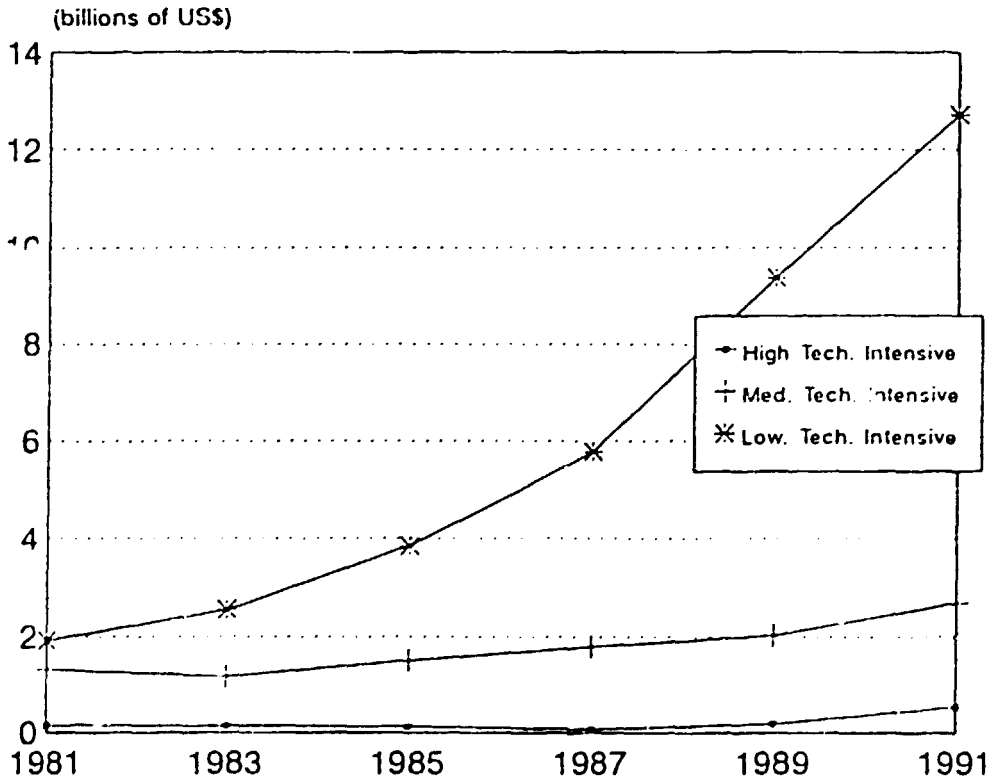

Fig. 2. Exports of Manufactured Products, 1989-1991

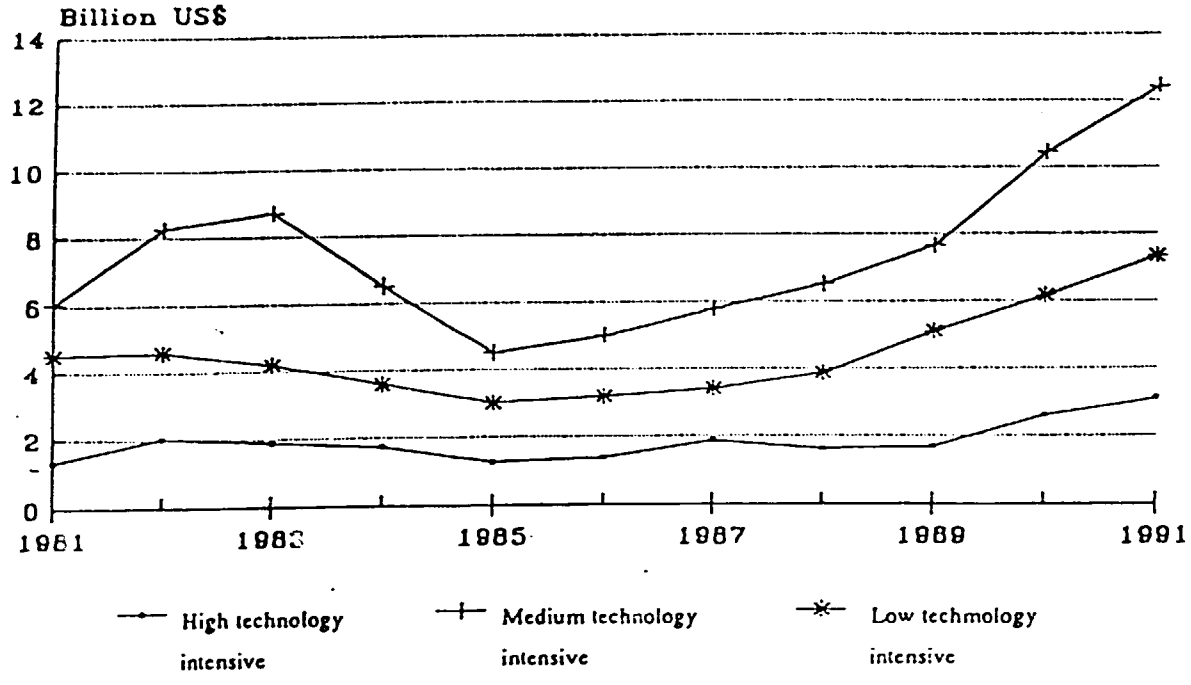

Fig.3. Imports of Manufactured Products, 1981-1991

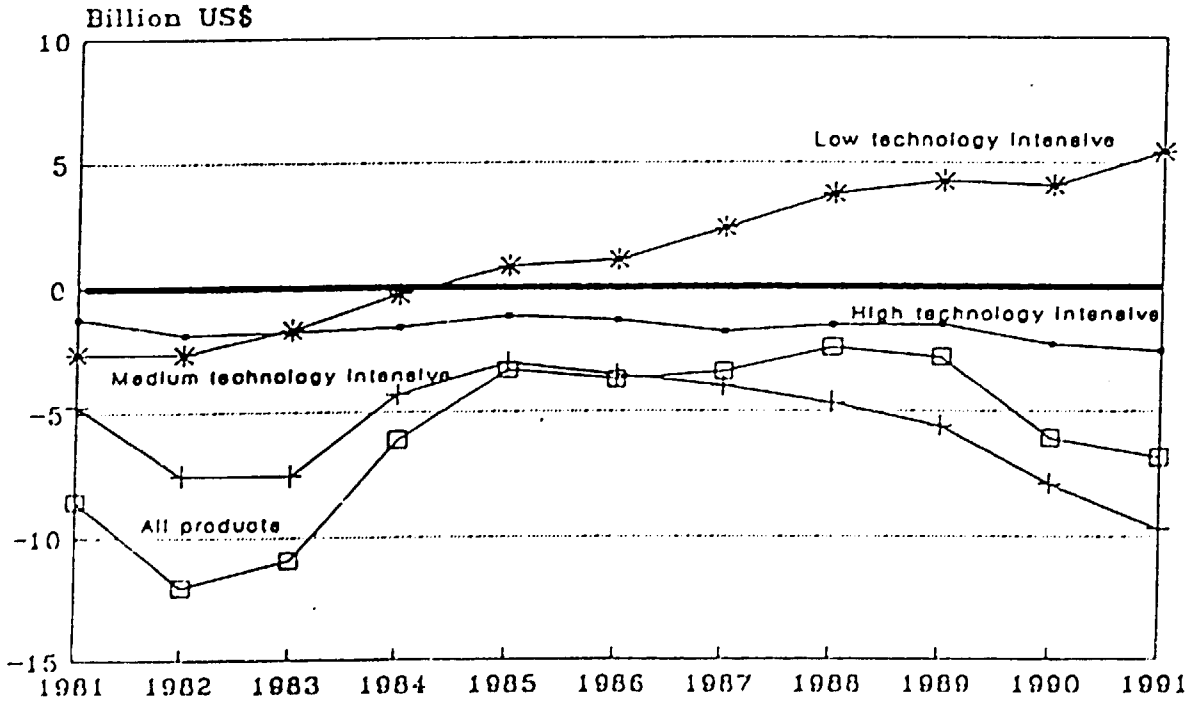

Fig.4. Balance of Trade in Manufactured Products, 1981-1991

HUMAN RESOURCES WITHIN MANUFACTURING INDUSTRIES

The Central Bureau of Statistics (BPS) has reported that over 70 per cent of manufacturing work force in Indonesia has been educated at the primary school level or lower. Only 1.2 per cent of all manufacturing employees have a D3 (three years after high school level) or higher (S1, S2, S3), and they are concentrated in a relatively small number of establishments. In 1990, only 21 per cent of Indonesia's large and medium scale manufacturing establishments employed one or more natural scientist and engineer or technicia:i. The basic metal industry had the highest proportion of establishments (58 per cent) employing Natural Scientists and Engineers (NS&E) and the non-metallic mineral products industry had the lowest (12 per cent), see Table 3.[7]

EXPERIENCE FROM TEN STRATEGIC INDUSTRIES

Company level studies of ten strategic industries (Barata/construction, Boma Bisma Indra/Heavy equipment, Dahana/explosive, INKA/railway, INTI/telecommunication, IPTN/aircraft, Krakatau Steel, LEN/electro-technique, PAL/shipbuilding, PINDAD/light weapon) give much better picture about their human resources, see Table 4.[8]

If large and medium scale manufacturing industries in Indonesia would like to increase their scientists and engineers employees (D3, S1, S2, S3 level) up to 10 per cent from their total number of 2.662.000 within five years, then local universities should be able to supply at least 53,040 graduates annually, which is beyond the production capability of local universities.

Furthermore, since 1984, the strategy of the application of science and technology is directed to accelerate the technology transformation and industrialization. The strategy includes transformation process and the selection of means which will act as the vehicle for the transformation process. The strategy of the transformation process consists of four steps:

- application of existing world technologies in the value added process;
- integration of the imported technology into new design and production process;
- development of available technology; and
- basic research which leads to invention of new technology.

Table 3: Large and Medium Manufacturing Establishment Employing NS&E, Dec. 1990

Industry	Number of Establishments	Number of Establishments Employed NS&E	Percent of Establishments with NS&E	Number of NS&E
Food	4.616	625	14%	4.350
Textiles	3.958	575	15%	4.000
Wood	1.946	450	23%	2.500
Paper	702	180	26%	1.700
Chemical & Petroleum	2.059	750	36%	6.950
Nonmetallic mineral	1.323	160	12%	1.500
Basic metals	95	55	58%	700
Fabricated metals	1.595	685	43%	10.750
Other manufacturing	242	40	17%	150
Total	16.536	3.520	21%	*32.600

* Total number of employees 2.662.000

Table 4: Percentage of ten Strategic Industries Manpower

Education Level	BI	BBI	DHN	INKA	INTI	IPTN	KS	LEN	PAL	PIN
D3,S1,S2,S3	9,2	15,1	17,3	13,6	18	24,3	13,3	24	16,6	14,9
High School	7	50,1	8,0	23,6	47	57,4	64,6	51	44,9	45,9
Secondary	7	34,8	5,4	19,4	30	4,9	15,4	13	38,4	18,6
Primary	7	-	69,3	43,4	5	13,4	6,7	11	0,1	21,6
Total	100	100	100	100	100	100	100	100	100	100

This strategy is based on the philosophy that in order to succeed in transferring technology, it is necessary to carry out real activities that will use technologies which are competitive technically and economically in the process of design and production of goods. The choice of means should consider the four principles above where the identification of these steps to start with is based on the evaluation of the level of existing indigenous technology available in the country.

The focus of the transformation process cover nine types, namely:

- Aircraft industry
- Shipbuilding and maritime industry
- Land transportation industry
- Telecommunication and electronics industry
- Energy industry
- Engineering industry
- Agriculture machinery industry
- Defence industry, and
- Other fields which relate directly or the spin-off of those eight types of industry.

The implementation of those strategies in short can be demonstrated in Figure 5 for ten strategic industries and Figure 6 for Nusantara Aircraft Industry.

TECHNOLOGY FORECASTING[9]

There appears to be a general misconception regarding the need and usefulness of Technology Forecasting (TF) in developing countries. This may be due to two commonly held beliefs: (i) TF is essentially a planning tool for the existing Research and Development (R&D) organizations of the developed world; and (ii) R&D activities are very expensive, and hence a luxury which poor developing countries cannot afford. Thus, it is concluded by many that TF has no relevance in developing countries. This may not necessarily be true for the following reasons:

INTEGRATION OF BUSINESS STRATEGY AND TECHNOLOGY STRATEGY			BUSINESS STRATEGY			
			Price Leadership	Quality Leadership	Niche Leadership	Green Leadership
			Price Minimization	Value Maximization	Feature Specialization	Environment Conservation
			Compulsive Strategy for Profit and Survival	Protective Strategy for Customer Satisfaction	Reactive Strategy for Segment Superiority	Proactive Strategy for Image Building
TECHNOLOGY STRATEGY	Technology Leader (Stage IV)	Production State-of-the Art Technology				
	Technology Follower (Stage III)	Adaptation of Advanced Technology			IPTN, PAL.	
	Technology Exploiter (Stage II)	Utilization of Standardized Technology		IPTN PAL.		
	Technology Extender (Stage I)	Salvation of Obsolete Technology	BI,BBI,Dahana,INKA, INTI,IPTN, KS,LEN, PAL, PINDAD			

Fig.5. Ten Strategic Industries

INTEGRATION OF BUSINESS STRATEGY AND TECHNOLOGY STRATEGY			BUSINESS STRATEGY			
			Price Leadership	Quality Leadership	Niche Leadership	Green Leadership
			Price Minimization	Value Maximization	Feature Specialization	Environment Conservation
			Compulsive Strategy for Profit and Survival	Protective Strategy for Customer Satisfaction	Reactive Strategy for Segment Superiority	Proactive Strategy for Image Building
TECHNOLOGY STRATEGY	Technology Leader (Stage IV)	Production State-of-the Art Technology				
	Technology Follower (Stage III)	Adaptation of Advanced Technology			N-250, Fin CN250, CN-250, Platform, Fly by Wire.	
	Technology Exploiter (Stage II)	Utilization of Standardized Technology		CN-235, NC-212, RainMakerN BEL412, Gunship.		
	Technology Extender (Stage I)	Salvation of Obsolete Technology	NC-212, NBO-105, NSA-330, NAS-332, FFAR-2, 75SUT Torpedo Compnents: F16,B737, B767.			

Fig.6. PT.IPTN (Nusantara Aircraft Industry)

° We live in a man-made technological world, where technology is the prime mover for national development. Thus, until we are in a position to produce our own technologies, we have to import technologies from developed countries. However, in the absence of TF, it is highly likely that we will import obsolete technologies.

° Technology is very much surroundings-specific (socio-cultural, economic, environmental, etc.). Hence, for technology transfer from developed to developing countries to be effective, it needs to be adapted for local conditions. Proper adaptation, however, requires technology evaluation and assessment, for which TF is an essential tool.

- Beside adapting imported technologies to make them appropriate to local conditions, developing countries also engage in producing their own appropriate technologies. Here again, TF is essential for project planning.
- In order to pay for the imported technologies, developing countrie. have to export something. Some countries sell their natural resources, as long as they have some! But for long-term viability, they have to produce some technologies which they can export. TF is essential for the development of exportable technologies.
- The single most important resource for producing new technology is the human resource. Developing countries have plenty of people. Through proper TF and planned education, they can be transformed into an enormous human resource for the development of exportable technologies.

Different forecasting techniques are used either for projecting on the basis of known trends, or fixing a target objective and time, and working back to see that the objective can be achieved. Intuitive thinking, unless based on available and up-to-date knowledge, may not lead to informed judgements about setting the right priorities. Therefore, technology forecasting based on well developed and rigorous techniques, is essential even for developing countries. Forecasting in the national and global context may not be confined to the technological field alone. Social and economic forecasting is also necessary to determine priority areas.

TECHNOLOGY ASSESSMENT[10]

Technology assessment is a form of analysis which provides the decision-maker with a comprehensive evaluation of a technology. In developing countries where one can take advantage of the late-starter situation, technology assessment is simply a step towards the disciplining of technological progress to maximize the positive effects (gains or opportunities) while minimizing the negative effects (losses or degradation) to the surroundings. It has been observed that in the early-starter (already developed) countries, technological advancements have been associated with the degradation of the environmental system. As the reasons for the deterioration of the physical environment (land, water, air) have become known, with the development of corrective measures, developing countries can avoid the mistakes of its predecessors.

It is observed that in the late-starter (not developed) countries, lack of technological advancement is associated with the low level of economic well-being, unplanned population growth, wastage of valuable resources, increased social disorder and political instability. Moreover, poverty and unrest are immediate problems while population is a long-term problem for the masses in developing countries. For developing countries, a proper strategy may be to use technology to solve both the short and long term problems.

The following may be considered as the major purposes of technology assessment in the context of developing countries:

- Evaluation of appropriateness of technologies for transfer and adaptation. This involves the identification of existing technologies available in developed countries, that are somewhat compatible, and have scope for adaptation within the surroundings in the developing country.
- Selection of technologies for development. This involves the identification of those existing indigenous technologies or other existing exogenous technologies that are consistent with national goals.
- Control of inappropriate technologies for the protection of the environment. This involves the identifications of corrective measures for both local and imported technologies.
- One very important consideration for developing countries is to institutionalize the use of technology assessment in development planning. The common practice in development planning is the selection of projects with only implicit attention being paid to technological aspects. What may be more beneficial in the long run would be to incorporate technological considerations explicitly. This will require making technology assessment part of the entire process of decision-making.

- Technology assessment is a prer. quisite for developing countries if technology-based development planning is to be made a reality.

NOTES

1. Indonesia, 1994, An Official Handbook, p.105.
2. Indonesia, 1994, An Official Handbook, pp. 118-119.
3. Technology for Development, APCTT, UN-ESCAP, 1989, pp. 44-45.
4. Science and Technology Indicator of Indonesia, BPPT-RISTEK-PAPIPTEK/LIPI 1993, pp. 94 and 163-164.
5. Ibid., p. 58.
6. Ibid., p. 62.
7. Ibid., pp. 66 and 140.
8. Science and Technology Management Information SyProject Report, PAPIPTEK/LIPI-UNESCO/UNDP, Vols. 1-16, Jakarta, 1993.
9. Technology for Development, APCTT, UN-ESCAP, 1989, p. 48.
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PAKISTAN: AN OVERVIEW OF TECHNOLOGY POLICY PLANNING AND IMPLEMENTATION MECHANISM

by Dr. J. Zaidi, UNIDO consultant

INTRODUCTION

In the last forty six years, the development process in Pakistan has brought about fundamental changes in the structure of the economy. In the process, labour has shifted from low productive areas such as agriculture to high productivity areas such as manufacturing. Trade pattern has also undergone structural transformation.

During the four and a half decades, the efforts at planning and development of the economy have yielded rich dividends in a few sectors, while there have been cases of failures in some others. It is a typical dual economy, where the GNP and GDP have grown in real terms at the rate of 5.4 per cent and 5.3 per cent per annum respectively, but the social sectors reckoned in terms of Quality of Life Indices e.g. literacy rates, drinking water facilities, medicare, rural electrification, etc. have consistently trailed behind as lagging sectors.

At the time of Independence in 1947, Pakistan started with a very narrow industrial base as well as an almost negligible scientific and technological infrastructure. Since then, notable progress has been made in the S&T development. An independent, separate Ministry of Science and Technology (MOST) has been established in the Federal Government with the sole responsibility of looking after S&T activities in the country. The MOST develops and monitors S&T programmes in the country. There are twelve R&D organizations under the umbrella of MOST. The number of R&D organizations and the number of universities in the country has also increased.

INDUSTRIAL POLICIES AND GUIDELINES

Pakistan's first Industrial Policy Statement was issued in 1948. This underscored the objectives and outlined the strategy of industrialization appropriate for a newly independent nation determined to change the predominantly agricultural character of its economy.

The revised Industrial Policy Statement issued in 1959 was based upon the experience of more than a decade of actual progress and the emerging pattern of industrialization in the country.

The period of a quarter century from 1959 to 1984 witnessed a remarkable growth, expansion and diversification of the industrial structure in the country. This period has also been characterized by extremely sharp turns in government policy towards the ownership of industrial assets.

The private sector was the main vehicle for industrial investment during the 1950's and 1960's. An Economic Reforms Order was issued in 1972 taking over the management of a number of industrial units, and in 1975 there was another round of nationalization of rather small agro-processing activities. The sudden shift towards nationalization of private sector industrial assets shattered private sector confidence. At the same time there was also a great acceleration in direct investment by the public sector in setting up new industries ranging from basic manufacture of steel to the production of garments and bread. This left the public sector to carry the entire burden of industrialization virtually alone.

The Industrial Policy Statement (IPS) issued in 1984 attached high priority to the development of steel based engineering goods, agro-based industries for the processing of agricultural surpluses for the home and export markets, defence-oriented industries, fertilizer, basic chemicals, electronics and mineral-based industries. The IPS also laid special emphasis on providing gainful employment through accelerated industrial development and balanced regional growth through various fiscal and monetary incentives.

The new Industrial Policy Package formulated by the Government in 1989 was in the context of its various commitments to the nation. The emphasis was on the following:

- Provision of physical and social infrastructure facilities in the industrial estates as well as backward areas.
- Development of key industries viz. biotechnology, fibre optics, solar energy equipment, computers and software, other electronic equipment and fertilizers.
- Creation of employment opportunities by encouraging labour intensive projects as well as small-scale industries.
- Balanced regional growth through dispersal of industries in the less developed areas.

SALIENT FEATURES OF PRESENT INDUSTRIAL POLICY

Realizing the importance of involving the private sector in the speedy industrial development of the country, measures have recently been taken for deregulation of the economy. Rules governing foreign currency were relaxed and steps have been taken to privatize the national industrial units. All the areas which were previously held by the Government to install, operate and manage the industrial units have been left open for the private sector.

As a sequel to the new policy initiatives, new objectives were identified and urgent steps taken to achieve them.

The present industrial policy aims at attaining the following objectives:

- Self-reliance
- Development of value-added exports
- Development of skills which help in improving efficiency, productivity, and quality
- Encouragement of labour intensive industries
- Development of infrastructure facilities with active cooperation of the private sector
- Increasing power generation capacity in the country to eliminate existing power shortage and to provide additional capacity for ensuring unrestricted growth of industrial, agricultural, commercial and domestic consumers
- Dispersal of industries in the backward and rural areas.

In order to spread the fruits of prosperity and to provide employment opportunities for the rural masses in the non-farming sector, the Government has provided a set of incentives to industrialists to attract them to invest in the rural areas.

The Government has come to the conclusion that it should not run industrial units or undertake trading activities. It should better concentrate on the provision of infrastructure and other services required for industrial development. For this purpose, steps are being taken to hand over public sector units to the private entrepreneurs for efficient management, for instance, privatization in a phased programme of WAPDA's thermal power plants and Area Electricity.

The Government has set up the National Investment Council (NIC) under the chairmanship of the Prime Minister, which replaced the Industrial Promotion Board earlier constituted. This Council is in charge of investment matters in all sectors and is the highest policy and coordination-making forum both for foreign and local investment. It meets periodically to review the scale and nature of private investment in the country and consider incentives and schemes to accelerate the pace of investment, particularly foreign investment in value added industries and other key sectors of the economy. The Pakistan Investment Board (PIB) is its Secretariat.

The Government has also established the PIB under the Chairmanship of the Minister for Industries. The Terms of Reference of the Board include the following:

- to take steps for image building of Pakistan as a safe and attractive place for investment;
- to make policy recommendations to the Government and to take all necessary steps aimed at generation of investment locally and from abroad;
- to provide in appropriate manner efficient and effective services to prospective investors at home and abroad.

The Board is a part of the Ministry of Industries but it has an independent and autonomous status.

THE NATIONAL SCIENCE AND TECHNOLOGY POLICY

The Government of Pakistan formulated a comprehensive National Science and Technology Policy in 1984. This policy document provides broad guidelines for remedying the deficiencies and speedily building up adequate S&T capability in the nation. It outlines the main aims and objectives of the science and technology policy, defines the major priorities, and indicates the measures necessary for the full utilization of science and technology as a productive force. An Action Plan has also been prepared to put the policy proposals into effect.

Some of the main features of the policy proposals are:

- the S&T system will be restructured to fill the existing gaps in the formulation, implementation and evaluation of coordinated action plans based on S&T policy;
- greater autonomy and intellectual freedom will be allowed to S&T organizations and workers to provide full scope for the creative faculties of the best minds in science;
- R&D centres will be created in industry for achieving increased productivity and improved quality of products;
- requisite S&T structures will be set up at the provincial and local government levels in order to ensure maximum participation and direct involvement of the people at large in the evaluation and application of site-specific technologies;
- working conditions of scientists will be improved and they will be given a career structure commensurate with their intellectual attainments;
- international cooperation in S&T fields will be promoted in order to break the isolation of Pakistani scientists with regard to the acquisition of technology from the active centres of research in the world;
- steps will be taken to achieve greater self-reliance in the development of technological capability as an integral part of the national strategy for self-reliant growth;
- an effective process of accountability at all levels will be evolved in order to ensure that the nation gets a satisfactory return on its S&T investment in terms of greater insight into national problems and improved technologies for their solution.

HIGHLIGHTS OF PROPOSED NATIONAL TECHNOLOGY POLICY

The Ministry of Science and Technology has formulated a National

Technology Policy. It has been submitted to the Government for approval. The National Technology Policy was approved in November 1993 and is under implementation along with the NTP. The Government has also approved the Technology Development Action Plan (TDAP). The National Technology Policy envisages that Pakistan would join the world economic community as a member of the group of Newly Industrialized Countries before the current century closes. The goal of the National Technology Policy is to help attain this vision by promoting the best use of international and indigenous technology in various sectors of the economy and thereby accelerating economic growth and improving the quality of life of all Pakistanis.

The National Technology Policy realizes that sustainable economic prosperity necessitates well-directed investment in the nurturing of a technological capability which can meet current and future demands of industry. The Policy aims that Pakistan would initially be an intelligent consumer of international technology, but by the end of the century it would be expected to become a contributor to the international stock of technology. The National Technology Policy aims to affect all institutions engaged in acquiring, diffusing and upgrading technology and in developing technical human capital.

There are four main objectives of the Policy:

i. **Bridge the gap between the best local and the best international practices in industrial technology:**

Attaining the state-of-the-art in production technology in certain key industrial areas is necessary if Pakistan is to compete internationally. Closing this gap depends upon the formulation of policies promoting exports, direct foreign investment, quality assurance, and purchase of the best technologies and capital goods.

ii. **Bridge the gap between the best and sub-standard local practices in industrial technology:**

Narrowing this gap will increase competitive pressures on leading firms to improve productivity in order to stay in the lead. Closing this gap provides the strongest motivation for firms to continually strive for the acquisition of improved technology. In Pakistan, this internal gap is known to be large. There is scope for significant improvements in technology information dissemination and industrial extension.

iii. **Improve and develop technology to enhance international competitiveness in the long run:**

Improvement and development of technology is crucial to keep abreast of, and ultimately to contribute to, technological innovation. A primary feature of the science and technology system in Pakistan is its orientation toward farmland unproductive – rather than commercial – research and development. Other problematic issues are the negligible private sector role in R&D, high administrative overheads in government R&D institutes, and the absence of linkages between components of the R&D system. A strong partnership between the research community and the productive sectors of the economy is required to correct these trends.

iv. **Technical manpower development:**

It is those societies that have invested in the skills of their people that are today global economic leaders. In the decades to come, as industry becomes more knowledge intensive, the return on investment in technical manpower development will increase. In Pakistan, human capital must be developed through proper education and formal and informal training.

A sound policy in any sector has to bear full relevance to the prevailing conditions of society at large and it can be deemed to be successful only if and as long as it meets the challenges of the times. Since rapid change is a characteristic feature of the present age, a technology policy can prove purposeful only if it is dynamic and flexible enough to respond appropriately to the requirements of changing conditions. Periodical in-depth evaluation of the proposed technology policy and programmes would, therefore, be absolutely necessary, and, since development plans of the country are formulated on a five-year basis, such reviews should logically be synchronized with development plan preparations.

MINISTRY OF SCIENCE AND TECHNOLOGY

The forerunner of the present Ministry of Science and Technology was created in 1964 as the Scientific and Technology Research Division under the direct charge of the President of Pakistan. In 1969, the S&T Division was attached to the Ministry of Education which was renamed as the Ministry of Education and Scientific Research. Subsequently, in recognition of the importance of Science and Technology in overall national development, an independent Ministry of Science and Technology was created in 1972. With this reorganization, some research councils and scientific organizations, which were functioning under other Ministries, were also transferred to the charge of the Ministry of Science and Technology. While organizations such as PAEC and SUPARCO were taken away.

The following S&T Organizations are working under the administrative control of the Ministry of Science and Technology.

- Pakistan Council for Science & Technology
- Pakistan Science Foundation
  - Pakistan Scientific & Technological Information Centre and its Sub-centres in provinces
  - Pakistan Museum of Natural History
- Pakistan Medical Research Council
  - Medical Research Centres located in various medical colleges and National Institute of Health
- Pakistan Council of Scientific & Industrial Research
  - Multi-functional PCSIR Laboratories, Lahore, Karachi and Peshawar

National Physical & Standards laboratory, Islamabad
- Pak Swiss Training Centre, Karachi
- Leather Research Centre, Karachi
- Fuel Research Centre, Karachi
- PCSIR Nucleus Office, Quetta
- Solar Energy Centre, Hyderabad
- Scientific & Technological Development Corporation Pakistan - a subsidiary of PCSIR

° Pakistan Council of Research in Water Resources
- Drainage & Reclamation Institute of Pakistan, Tandojam
- Pakistan Decertification & Monitoring Unit, Bahawalpur
- Water Resources Research Centres
- National Documentation and Library Information Service (NADLIN) in Water Resources Sector

° Council for Works and Housing Research
- National Building Research Institute, Karachi

° Pakistan Council for Appropriate Technology
- Four sub-centres in the provinces

° National Institute of Electronics
° National Institute of Silicon Technology
° National Institute of Oceanography
° National Institute of Power
° National Centre for Technology Transfer

RESEARCH AND DEVELOPMENT IN THE COUNTRY

When Pakistan gained independence in 1947, it inherited an almost negligible infrastructure for imparting science or for conducting research. Almost all the universities and research organizations established by the British remained in the Indian territory. Pakistan had to start virtually from scratch.

In the first 20 years, that is 1947 to 1967, a number of R&D institutes were established including PCSIR, PAEC, SUPARCO, DESTO, PARC, etc. During the period 1967-88, further progress was made in the development of science and technology as the number of R&D institutions grew from 75 in 1967 to 166 in 1988.

Almost 33 per cent of the R&D organizations are in the agricultural sector. In the field of education, there are 22 universities, this includes four engineering universities, one private medical university, three fully-fledged agricultural universities and nine centres of excellence. The existing infrastructure in most of the universities as well as centres of excellence is too weak to carry out productive research.

STANDARD AND TESTING INSTITUTES

Metrology, Standards, Testing and Quality System (MSTQ) is a key instrument for narrowing intra-industry productivity and quality gaps between and worst performing Pakistani firms, thereby raising average productivity. The present system may be adequate to meet the level of industrial demand today, the weaknesses will begin to show as policy changes encourage more competition and greater export orientation. Each product should meet the stringent quality requirements of the export markets.

A number of institutions are working in the country in the area of scientific testing, quality control and standards services, namely:

° National Physical and Standards Laboratory (NPSL)
° Pakistan Standards Institute (PSI)
° Pak-Swiss Training Centre (PSTC)
° Central Testing Laboratories (CTL)
° Pakistan Industrial and Technical Advisory Centre (PITAC)
° Metal Industry Research Development Centre (MIRDC)
° Pakistan Council of Scientific and Industrial Research (PCSIR)
° Provincial Testing Laboratories
° Pakistan Cotton Committee Laboratories, etc.

DEVELOPMENT OF S&T MANPOWER IN HIGH-TECH FIELDS

Trained scientists, technicians and skilled workers constitute invaluable national resources, which is of vital importance to the successful application of modern science and technology to the development process. This national resource must, therefore, be produced according to the requirements of national development, and has to be carefully planned in order to ensure sufficient availability of the requisite manpower for each sector of economic development.

The slow advancement of science and technology in Pakistan has been mainly due to the shortage of adequately qualified skilled manpower. To overcome this deficiency, in September 1985, the Ministry of Science and Technology launched a programme for the development of S&T manpower in high technology fields. The main objectives of the programme are:

° to create a critical mass of highly qualified scientific and technical manpower in new and emerging technologies;
° to improve the R&D potential of the research institutions and the training potential of the universities;
° to provide highly trained manpower for the industrial sector (public as well as private).

Under this programme, scholarships are awarded to young scientist engineers and doctors to pursue post-graduate studies leading to MS/M.Phil/Ph.D degree in selected high-tech fields such as lasers, fibre optics, genetic engineering and biotechnology, oceanography, material science, computers, nuclear science and engineering, etc.

Another serious weakness of the R&D system in Pakistan is the dearth of trained and competent technical administrators to manage S&T programmes and projects. In Pakistan, there is no systematic training programme in S&T management. Persons working in S&T establishment do not undergo any formal training.

Administrators of S&T establishments must possess not only technological competence and administrative skills but also a clear vision and keen awareness of the large aims of society and its capacity to respond to rapid change. The senior officers and administrators of S&T institutions need to be trained in modern management techniques, especially applicable to S&T institutions, to enable them to organize the work programme of their institutions in accordance with the latest concepts and

techniques on efficient lines.

The senior research officers also need training in project formulation, implementation and management, technology transfer and development, market surveys and systems analysis. The personnel freshly recruited and those already working in R&D institutions should be given courses on the latest knowledge, research techniques and methodology for upgrading their skills. Besides, such training programmes are needed to familiarize them with the government's S&T policy and development programmes, research management and use of computers and mathematic skills.

CONCLUSION

A number of steps have been taken by the Government of Pakistan to liberalize the economy which could facilitate transfer and development of modern technology. The recently issued investment guidelines and the approval of the National Technology Policy would accelerate the process. It will now all depend on the infrastructure created so far how it would respond to the needs and demands of the industrial enterprises. At this stage, there is a need to develop an effective mechanism for coordinating and monitoring all the technology promotion and development programmes.

In Pakistan, little efforts have been made so far towards technological forecasting. There is no organization in the country, neither in the public nor in the private sector, neither at the macro- nor micro level, neither at the national nor at the sectoral level, which is performing this function. Perhaps its need was not felt. But in the present environment of industrialization, it is the need of the day. It is hoped that the policy makers will realize the importance of such an agency, and take appropriate steps to set up an institute of technology monitoring, assessment and forecasting.

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