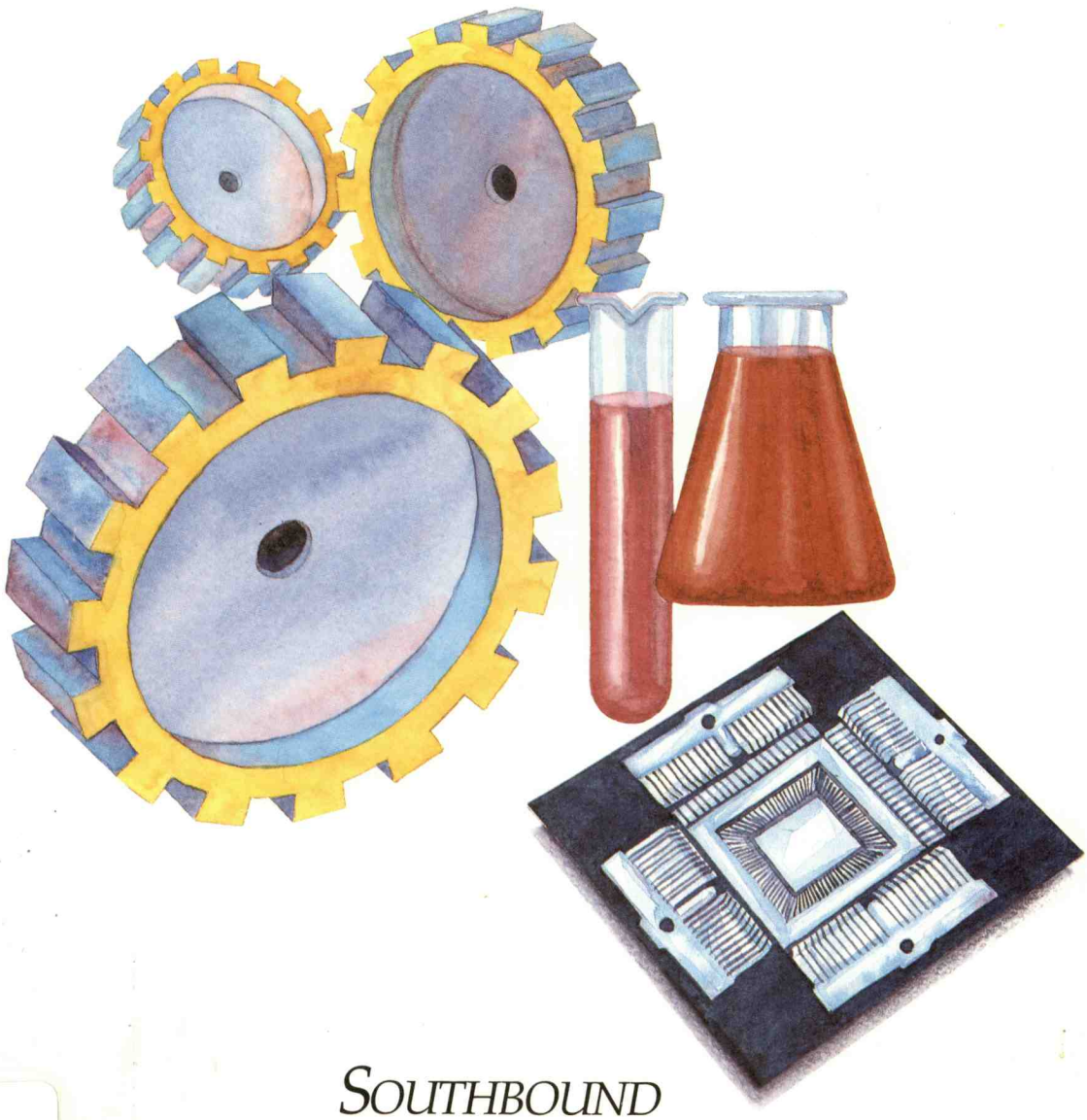
TECHNOLOGY, INNOVATION & COMMERCIALIZATION SERIES

Technology Financing for Competitiveness

Arjan J. Advani



SOUTHBOUND
INTERNATIONAL DEVELOPMENT RESEARCH CENTRE

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Arjan J. Advani

Series Editor
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Contents

A Development Bank with a Difference

The Industrial Credit and Investment Corporation of India Limited (ICICI) is a Development Finance Institution (DFI) set up in 1955 with the assistance of the World Bank, to encourage and assist industrial development and investment in India. Its main objectives are to:

1. provide assistance in the creation, expansion and modernization of industrial enterprises,
2. encourage and promote participation of private capital, both internal and external, in such enterprises; and
3. encourage and promote industrial investment and the development of capital markets.

Project Finance

Project financing is the ICICI's principal line of business. For project financing, ICICI endeavours to evolve products tailored to meet the varied requirements of Indian industry's capital investment programmes. As a development bank, ICICI counsels new entrepreneurs at an early stage and offers advice to existing entrepreneurs on optimizing the finance-mix to work out options ideally suited for their requirements. Some forms of assistance include:

- Long-term rupee and foreign currency loans
- Margin money for working capital
- Direct subscription to and underwriting of shares and debentures
- Guaranteeing payment to suppliers of equipment.
- Soft funding of projects located in backward and growth areas for infrastructure development and modernization.
- Funding of exports, including grants for productivity improvement; and
- Lines of credit to manufacturers as well as buyers of capital goods.

Innovation has been a tradition in ICICI. Apart from providing project finance, it has pioneered and achieved leadership in diverse fields from merchant banking to technology development and commercialization. Outlined below are some activities that distinguish the ICICI from other institutions.

Merchant Banking and Leasing

Close association with industry, often reaching beyond the role of lender or financier, has provided ICICI with an insight into industry's problems. Realizing the need for organized merchant banking services for its clientele, ICICI started its Merchant Banking Division (MBD) in 1973. The MBD is well known for both the number and size of assignments handled, and for the quality of its service. The Division owes its pre-eminence largely to its appreciation of the requirements of its clientele and its innovative problem-solving approach. The major MBD products are -

- Management of capital issue,
- Syndication of long-term rupee and foreign currency finance,
- Mergers and amalgamation,
- Financial restructuring,
- Financial consulting services,
- Feasibility studies and Short-term fund syndication.

Since 1973, the Merchant Banking Division has assisted clients in raising total amount of Rs278 billion (equivalent to US$9.27 billion) including Rs206 billion (equivalent to US$6.87 billion) from the capital market.

Growth in volume and complexity of business and sophistication in financial management techniques in India especially during the 1980s, generated a demand for new financial instruments. ICICI was the first financial institution to establish leasing as a financial product. A fledgling unit in 1983, ICICI's Leasing Division is an industry leader today. As of March 1992, total approvals under leasing have been for Rs96 billion (US$3.2 billion).

Export Development

The ICICI has helped Indian companies in their export development programmes. Since 1986, this assistance has been in the form of term loans and grants under two lines of credit mobilized from a World Bank Export Project.

ICICI has provided foreign currency loans of US$300 million to over 250 export-oriented projects under the World Bank Export Project. In addition to this, under the Productivity Fund, grant finance of US$10 million has been provided to 150 export development programmes. The following services have evolved:

- *The Export Development Fund (EDF)* which provides grant finance of up to 50% of the expenditure in

developing and implementing a strategic export development programme. The programme can be related to manufacturing operations including productivity improvement and /or export marketing;

- *Export Advisory Service* for development and implementation of long-term export strategies; and
- *Export Breakthrough Service* in collaboration with DeCTA (a British Trade Development Agency based in London). This service provides advice and grant finance for overseas market research in the target countries.

Project Advisory Services

Aimed mainly at foreign investors interested in undertaking project investments in India, ICICI acts as a focal point to enable them to forge relationships with Indian industry. This could be in the form of a technology collaboration, joint venture with an Indian partner, or an independent project investment. The range of services offered provide a 'turnkey solution' to foreign investors by handling all preliminary arrangements prior to setting up a project. This includes preparing industry prospectii, identifying / evaluating joint venture partner(s), undertaking market studies, obtaining statutory approvals, arranging legal advice and arranging recruitment services.

Technology Finance

In its primary function of providing development finance to Indian industry, ICICI has constantly endeavoured to evolve new schemes especially to bridge the technology gap. To become, and remain internationally competitive, industries require funds for R&D and technology development, for product and process innovations as well as for productivity improvements and technology upgrading. ICICI has designed ways of financing the needs of Indian industry, from prefeasibility and laboratory studies to pilot plant and scale-up operations leading to eventual commercialization. These include :

- The Programme for Advancement of Commercial Technology (PACT), with the United States Agency for International Development (USAID), under which ICICI administers a fund of US$15.5 million for financing joint Indo-American R&D projects for development of innovative products and processes.

- The Programme for Acceleration of Commercial Energy Research (PACER), is an innovative project to encourage consortium and contract research in the energy sector, funded by USAID with a grant of US$20 million, executed by ICICI under the direction of the Indian Department of Non-conventional Energy Sources (DNES).
- The Sponsored Research and Development (SPREAD) Programme, is designed to encourage industrial firms to step up their R&D activities by sponsoring projects with technology institutions. The programme, with funding of US$15 million from the World Bank, envisages R & D cooperation between industrial firms and technology institutions in a cost effective manner.
- The Technology Institutions (TI) Programme aims to strengthen the capacity of selected technology institutions for accelerated development of indigenous technologies. The TI programme, with a funding of US$40 million from the World Bank, helps the institutions in upgrading their facilities and enhancing their expertise so that the R&D needs of the industry are served more effectively.
- Agricultural Commercialization and Enterprise (ACE) Programme is managed by ICICI for investment in horticulture, focusing on post-farm operations including : handling, transport, cold storage, processing, packaging and marketing, with funding of US$20 million from USAID. It also involves technical assistance in the state-of-the-art technology, management and marketing information.
- Trade in Environmental Services and Technology (TEST), is a new programme with a fund of US$25 million from UNSAID, implemented by ICICI, with a view to enhance the productivity of Indian Industry on a sustainable basis by adapting "cleaner" technologies.
- The Centre for Technology Development (CTD), is a society with broad objectives of technology development, promotion of R&D, assistance to scientific research institutions, promotion of venture capital, human resource development and technology information exchanges.
- A Venture Financing programme for commercialization of high- technology projects through the Technology Development and Information Company of India Limited.

Details of these programmes on technology financing and commercialization are provided in the sections to follow.

Other Services

The very concept of development banking has been enlarged by ICICI, primarily through institutional development to strengthen the financial infrastructure of the country. Among these institutions are:

- Indian Investment Centre, New Delhi.
- Institute for Financial Management and Research, Madras.
- Housing Development Finance Corporation Limited, Bombay.
- Indian Institute for Foremen Training, Kansbahal.
- Credit Rating and Information Service Company of India Limited, Bombay.
- The Shipping Credit and Investment Company of India Limited, Bombay.
- Technology Development and Information Company of India Limited, Bangalore.
- Academy for Management Excellence, Madras.
- Over The Counter Exchange of India.

Organisation

ICICI has a Board of Directors comprising persons of eminence from industry, government and professions. The management team is ably supported by inter-disciplinary professionals (about 400) - engineers, finance and management experts, economists, lawyers and chartered accountants. The organization of ICICI is characterized by a high degree of professionalism, effective delegation of authority and decentralization, computerized database and accounting procedures and a good communications network for effective client- servicing. ICICI's total staff strength is about 1,000 persons. With a Head Office in Bombay, it also has Regional Offices in Calcutta, Delhi and Madras and Branch Offices in Baroda and Bangalore.

Operations

ICICI operates at the national level and has assisted about 4200 companies for 9900 projects relating to agribusiness, petrochemicals, fertilizers, steel, cement, textiles, chemicals, automobiles, machine tools, electronics and electrical products. As of March 31, 1993 ICICI's share capital amounted to Rs24.1 billion

(equivalent to US$0.8 billion) and reserves Rs96.5 billion (US$3.22 billion). ICICI's cumulative sanctions up to March 31, 1993 amounted to Rs293 billion (US$9.77 billion). During 1991 - 1993 its sanctions amounted to Rs59 billion (US$1.97) and income Rs14.4 billion (US$0.48). ICICI had a net profit of Rs2.3 billion (US$0.8 billion) in 1992 - 1993 and declared a dividend of 26% for its shareholders - who now number close to one-half million.

Sharing Experience

ICICI shares experience through training, conferences and seminars, industry studies and publications. Since 1979, ICICI has offered consultancy services to overseas development finance institutions for upgrading their procedures and operations. Such institutional assistance has been provided to development banks in Bhutan, Ghana, Jamaica, Nepal, Uganda and Sri Lanka.

Technology Financing

It is a well known fact that the developing countries spend much less on Research and Development than those of the advanced industrial countries. India is no exception. Latest data available indicate that the amount spent on Research and Development in India was 0.89 % of GNP. Some of the developed countries are spending 2% - 3% of their GNP on R&D. India's per capita R&D expenditure is only US$3 - as against US$100 - 600 for most of the developed countries.

Research and Development has a relatively long gestation period, and also requires high levels of education and skills. A developing country has many demands on its resources. Most of the resources are spent on immediate consumption and development of industry to harness the local resources. Many of the products that the country requires are available from abroad, or could be manufactured with borrowed technology. Hence, development of indigenous research and development occupies secondary place in the order of priorities in many developing countries.

In spite of these factors, development of indigenous know- how is essential ; first, the new processes and products available from other countries may not be always suitable for a developing country. Second, the consumer tastes, preferences and requirements could be substantially different. The labour saving technologies developed in countries with scarce and costly labour are not relevant to developing countries where unemployment is a major problem. Moreover, there is also an obsolescence factor for imported technologies. By the time projects based on these technologies commence production these technologies are already about ten years old. Technologies being developed by industrial nations in high-tech areas of space, super conductivity and artificial intelligence are of not much use to developing countries where basic needs are to be met in the first instance. What is required in such circumstances is development of appropriate technology - as per the local needs and available resources.

Countries borrow technology from each other. However, in order to learn from borrowed technology and build on it simultaneously, a technological infrastructure has to be created. Japan's achievements in this regard are commendable. Starting with technology acquisition, then adaptation, modification and finally, its innovations, Japan has reached the highest level of technology achievements in many fields. Japan was able to do so by purposeful planning in creating an excellent technological base.

India is among the few developing countries which realised the importance of indigenous research and development and set-up an elaborate infrastructure comprised of national laboratories, institutes of technologies, institutes of science, universities, polytechnics, etc. However, most of these institutions either have been established directly by the government or public sector undertakings. Their attention has been more towards scientific research than industry related / market oriented technology development. Out of the total R&D outlay in India of Rs532 billion, (US$17.73billion) the Central Government accounted for 69%, public sector companies 11%, State Governments 8% and private industry 12%. The total R&D expenditure by the industrial sector was Rs123 billion (US$4.1 billion) in 1990 -91. Industry spends about 0.66% of its sales turnover on its R&D activities in India. The ratio for most of the developed countries is 3% - 4%.

Study of the newly industrialised countries shows that the technology investment should be led by private enterprise and the development carried out on a voluntary basis. When this happens, technology development is closely linked to the market needs and results in development of practical technologies which can be commercialized quickly. It is also necessary that the investment in technology development is uniform, through all sizes of industry - small, medium and large. It is therefore necessary that the private sector in the country devotes its resources to research and technology development. In this connection, it may be mentioned within a period of one decade (1961-1970), research and development expenditure in the private sector in Japan increased five-fold, while over the same period the Gross National Product (GNP) increased only 3.8 times. In Japan, the investment by private industry is 2 times higher than that of the government.

ICICI, as early as 1970, called a "Conference On R&D In Industry" to focus on development of indigenous technologies and setting up of R&D centres by private sector companies. The conference also discussed the incentives that may be provided by the government to motivate industrial units to set-up R&D centres. Today, there are about 250 specialised institutions and research laboratories established by different science and technology departments and other agencies of the government. There are also about 1200 in-house R&D units set-up by industry in both the private and public sectors. ICICI provided financial assistance to some of the units in the private sector. Apart from in-house R&D centres, ICICI also financed some independent units for undertaking commercial R&D work.

In the mid-seventies, ICICI set up the Development Department with a view to support activities relating to entrepreneurship

development with emphasis on technical entrepreneurs. Jointly with other institutions it has financed 1250 Entrepreneurship Development Programmes (EDP) in various parts of the country. Of these programmes 240 EDP's were specially tailored for Science and Technology Graduates. ICICI's share for entrepreneurship development amounts to Rs17 million.

ICICI also participated in setting up of 17 Technology Consultancy Organizations (TCO) in different states to provide consultancy services to small and medium scale enterprises. ICICI's assistance to various TCOs amounts to Rs11 million in the form of equity capital and loans. TCOs have provided valuable services to entrepreneurs in the preparation of project feasibility studies, industrial potential surveys, special studies on development of industrial estates, engineering designs etc. ICICI has been the lead institution for TCOs in three states. These TCOs have been profitable endeavors.

ICICI has also assisted several non-government organizations engaged in rural development to improve the skills and employment potential of rural population, particularly to adapt rural technologies. Forty five diversified schemes ranging from polytechnics for rural women, to mobile education programmes on environment protection in rural areas have received a total assistance of Rs23 million (US$0.77 million). Some schemes are meant to assist blind and other physically handicapped persons to acquire technical skills for gainful employment.

ICICI has also provided assistance in setting up Science and Technology Entrepreneurs Parks (STEP) in seven states. These parks provide opportunities to new technical graduates to channelise their knowledge into setting up an industry thus resulting in self-employment. These parks endeavour to increase interaction between technical institutions and industrial enterprises. STEPS provide a productive and innovative environment with the necessary infrastructure for budding entrepreneurs to experiment with their innovative ideas. Recently, ICICI has also financed schemes for Incubators where young technical persons would receive hands-on support for technology, management and marketing. These incubators are designed to nurture enterprises in the initial stage. ICICI's cumulative assistance to 8 STEPS is about Rs20 million.

The "Programme for Advancement of Commercial Technology" (PACT) supports the financing of joint ventures for the development of technologies with commercial potential. This programme has been financed principally by the USAID. Details of the PACT Programme follow.

Programme for Advancement of Commercial Technology

The Programme for Advancement of Commercial Technology (PACT) has several innovative features. Instead of transfer of know-how, it offers to develop know-how jointly by an Indian Company with a U.S. firm. The know-how is to be developed for technologies which have immediate prospects of commercialization. PACT involves development of an innovative product or process. Another innovative feature of the scheme is that assistance is provided in the form of a Conditional Grant. In case of failure at the development or commercialization stage, the assistance could be written-off. Thus the risk in the development of innovative technologies is mitigated. Anxiety regarding timely payment on interest on a quarterly basis during the developmental stage, and instalment payment of commercialization, in case of failure, is removed. It is stipulated that, on successful commercialization of technology, a royalty on sales would be paid back to the PACT fund until the amount reaches a level of two and half times the original grant. Design of the PACT programme provides for the acceleration of the pace and quality of technological innovations for products and processes having applications in industry, agriculture, health, energy and other areas beneficial to the development process in India. The focus being the "development end" of R & D means substantial savings in cost, time and risks in carrying out commercially successful innovations. The primary thrust is on market oriented R & D activities, aimed at catalysing technological advancement in India.

Since PACT envisages technological development (not just technology transfer) through joint ventures in R & D, it means introduction of new ideas and an opportunity for the Indian partner to acquire R&D management techniques in particular.

Details regarding the nature and scope of co-operation under PACT programme, eligibility of projects and Applicants, form of assistance, scale of financing, disbursement of conditional grant, payments to ICICI, project proposal evaluation criteria and technical evaluation are given on the following page:

Nature and Scope of Cooperation

Due to the diverse range of projects and joint ventures that may qualify for PACT support, there are no specific rules for the detailed nature of the cooperation between partners. They are expected to reach an understanding with respect to the division of activities as they relate to the technical and commercial goals of the project. For example, if the bulk of the R & D is to be performed by one partner typically in India, the contribution of the other partner may emphasise marketing and hence detailed product specifications, sales, service, etc. and joint supervision of the R & D effort. Manufacturing may be by either or both partners, or by subcontractors, or by their licensees. Institutions or non-manufacturing companies may act as subcontractors in the R & D or testing phases of the project.

Eligible Projects

Projects eligible for PACT assistance should:

1. Involve the development, through R&D, of an innovative product or process which promises tangible direct benefits for the Indian economy;
2. Envisage financial exposure and projected returns from commercialization which are commensurate with the risks;
3. Be proposed by an Indian company and US company as a team, with each member having a specified role and capability in the development and commercialization;
4. Involve a project cost typically not exceeding US$1.0 million;
5. Envisage a PACT contribution up to US$500,000;
6. Have capability of significant commercial potential;
7. Be capable of completion within a period of three years;
8. Not relate to defence/armament, surveillance, weather modification or abortion related equipment and services.

Eligible Applicants

The typical applicant would be a company having access to R&D and manufacturing facilities and a demonstrated capability in selling its product, developed in response to specifically identified market needs or opportunities. Eligible applicants, one from each

country, apply as a team on the basis of an agreement that permits them to obligate themselves singly and jointly in a contract with ICICI for the project. Participants based either in India or the US, approach ICICI with expectation of receiving assistance in finding suitable partners in the other country. ICICI endeavours to assist innovations originating with individual entrepreneurs or new companies which may otherwise have difficulty in the development stages of research and development.

Form of Assistance and Scale of Financing

The financial assistance envisaged is typically be in the form of a Conditional Grant which is beneficial and practical to operate for all the parties concerned and specifically relevant to the ends in view.

Any pair or operating entities, submits a Proposal for joint development and commercialization of any innovative technology based product or process that has the potential of yielding returns commensurate with the investment and risks. If the proposal is convincing in the context of the proposing team, PACT typically shares 50:50 with each of the participants in the total cost of bringing the proposed product or process to the point of commercial "readiness". The PACT assistance is normally limited to US$500,000 or 50% of the total estimated cost, whichever is less.

Based on the amount and nature of expenditure, financial assistance is provided for :

- Project Proposals; and
- Prefeasibility expenses.

Project Proposals

Project Proposals are submitted to the ICICI, PACT Division and scrutinized using a two-tier evaluation process.

The proposal is initially reviewed by the PACT Division and technical specialists from a particular skill area. Thereafter, acceptable/qualifying projects are placed before the decision-making body for approval. Upon approval by the Screening Committee, a cooperation and financing agreement is entered into by the proposer and ICICI. This agreement will describe the work plan, project budget, payments due to the proposer, payments due from the proposer, from sales or other income resulting from the project, reporting requirements, preconditions for disbursements such as satisfactory progress and a continuing good market forecast for the proposed product/process.

Project expenditure includes salaries and wages, materials and utilities, cost of consulting services, subcontracts and data processing, necessary travel and administrative expenses, outlays to meet regulatory requirements, pre-marketing expenses, special purpose equipment but not standard catalogue equipment and facilities used for production purposes which the proposer is expected to own or provide.

Normally expenditure incurred prior to the effective date of the cooperation and financing agreement is not included in the project cost.

Prefeasibility Expenses

In cases where preliminary investigations are necessary to determine the technical prefeasibility or market acceptability of a new product or process or where two potential participants face considerable expense in preparing a proposal by nature of the need to visit each other specifically and such expenditure is likely to be burdensome at that stage, ICICI grants up to US$25,000 as 50% of PACT share of the cost of carrying out the feasibility study. Such approvals are made on an understanding that a formal proposal will be submitted by the proposer for consideration if the feasibility results are promising.

Should this effort lead to a PACT-supported project, the amount provided for the prefeasibility expense is added to the conditional grant for the project.

If such a prefeasibility study suggests a viable project, however which the participants choose to abandon or discontinue, the participant will be obliged to refund the full amount of the prefeasibility grant.

Disbursement of Conditional Grant

Conditional grants approved under PACT are disbursed to proposers on the basis of their needs and in consultation with them. A first disbursement of up to 40% of the amount approved is considered on signing the agreement and the balance is disbursed on the basis of the technical and fiscal reports. If the work is unsatisfactory, ICICI reviews the project with the proposers and determines a suitable course of action with respect to further payments against the conditional grant, if any.

Payments to ICICI by Proposer

The PACT shares typically 50% of the total project cost, in the form of a conditional grant (in dollars and/or rupees) provided that :

1. The proposer agrees to make payments to ICICI at a negotiated percentage of revenues arising from the project on commercialization ;
2. Such negotiated payments are limited to a maximum of 200% of the PACT share in the project; and
3. ICICI assumes its share of risk, no revenues-no payments.

Project Proposal Evaluation Criteria

Listed below are the indicative criteria for evaluating project proposals for PACT assistance:

1. The nature and degree of technological innovation of the product/process;
2. The extent of benefits accruing to the partnership;
3. The prospects for commercialization based on clear definition of the market;
4. A satisfactory return on capital employed;
5. Proven strength of the participants in terms of availability of financial resources, marketing capability, manufacturing capability, technology base and skills;
6. Special factors that merit consideration, such as policy, legislation, energy conservation and location; and
7. The extent of the catalytic effect if the project is a success in relation to the goals of PACT.

Technical Evaluation of Project Proposals

Technical evaluation of project proposals is carried out by ICICI as appropriate with the assistance of Industry experts/consultants (India/US). In evaluating a proposal, consideration is given to the extension of the state of the art in relation to other products and processes that have been developed by the participants and by other enterprises. The innovation must be technically credible. Initial feasibility must justify incremental investment for significant commercial returns. Activity schedules and benchmarks necessary to attain project goals are evaluated.

PACT Achievements

The PACT programme was established in late 1986 with an initial fund of US$10 million from USAID under an agreement with Government of India. The fund was subsequently increased to US$15.5 million in 1990.

To date, about 43 projects with a total assistance of US$15million have been approved by ICICI. The major sectors covered by the projects are information technology, software development, biotechnology, energy, engineering, environment, health care and pharmaceuticals. Of these, 8 projects have commenced repayment to the PACT fund on commercialization, 9 projects have completed the development phase and are about to start commercialization, 8 projects have made substantial progress, 5 are mid-way, 9 projects have commenced implementation recently and two have been discontinued.

Some notable projects under PACT include:

1. development of a process package for high yielding prime button mushrooms using Indian compost and raw materials leading to the export of hybrid strains,
2. a permanent magnet alternator with electronic controls for mobile applications,
3. a component library management system and component data base which enables electronic designers to select the best available device reducing cost and time-to-market,
4. bio-pesticides,
5. birth control devices,
6. computer aided garment production system,
7. bio-drugs for Parkinson's disease and
8. infection free catheter system for post-operation health care.

Two independent evaluations of PACT programme have been made; one by a team of consultants appointed by USAID and a second by the well-known international consultancy firm Price-Waterhouse. The team also included Director of Bi-National Industrial Research and Development (BIRD) Foundation, Israel which supports a programme, along similar lines as the PACT. The evaluation reports have confirmed that PACT has fulfilled its objectives. It has also demonstrated that benefits can flow to both the countries. It should be mentioned that 19 projects under PACT cater to the markets in the USA in the fields of software and biotechnology, and generated revenue of about US$40 million in 1994-95. Other projects cater to the markets in India in the fields of energy, environment and biotechnology, having generated a revenue of US$20 million.

Some of the start-up companies under PACT have established important partnerships and tie-ups with large American firms/ agencies. Such tie-ups have been made with Mentor Graphics, Hewlett Packard, Hughes, Tektronix and NCR as customers and Network General as strategic partners. PACT has 10 proposals and 27 profiles under formulation. It has received 12 new profiles.

A large number of projects cater to the niche markets in USA and provide an advantage to U.S. companies to compete in the international market. Some of the PACT projects create additional employment and revenues to both the Governments. PACT has helped in the export earnings of India.

Significantly there have been no major failures under the PACT Programme. A significant contribution has been to catalyse a Venture Capital movement in India, as well as strenghten ICICI's involvement in technology finance through other innovative schemes such as their Programme for Advancement of Commercial Energy Research (PACER), Sponsored Research and Development (SPREAD), Technology Institutions Programme (TIP), Centre for Technology Development (CTD), Agriculture Commercialization and Enterprise (ACE) and the most recent, Trade in Environmental Services and Technology (TEST). Salient features of these schemes are discussed further in the text.

Programme for Acceleration of Commercial Energy Research

The Programme for Acceleration of Commercial Energy Research (PACER) supports technology innovation and development in the Indian energy sector. It is being implemented by ICICI in cooperation with the Department of Non-Conventional Energy Sources (DNES), India.

PACER aims at promoting the development of goal-oriented and market responsive technological innovations in the Indian energy sector through financial assistance to consortia of manufacturer(s), research institution(s) and/or end-user(s) from the public and private sectors in India.

Promotional assistance and finance takes the form of a conditional grant to meet part of the project cost, which addresses the risk inherent in technology development. Liability for payment towards the conditional grant arises when the technology is commercialized. In addition, PACER provides grants for pursuing research in support of technology development projects.

It is envisaged that proposers for projects to be financed under PACER will normally be Indian. However, in cases where US participation is necessary in technology development efforts, suitable provision could be made for the purpose.

Priority Areas

PACER's thrust is mainly on the development of innovative products and/or processes for the officially identified priority areas of the Indian energy sector. For example, the Five Year Plan documents include acceleration of exploration of coal and hydropower resources, intensification of exploration of oil and gas, energy conservation and exploitation of renewable energy resources as the priority areas. Keeping these in view, an illustrative list of some technologies has been prepared.

Commercially attractive technologies to tap biomass or solar energy :

- biomass fired power unit
- wind and photovoltaics
- small-scale hydel
- solar thermal electric power generation

Coal conversion technologies for low-grade Indian coals :

- fluidized bed combustion
- slagging combustion
- oil and water coal slurry techniques
- coal beneficiation

Technologies to improve efficiency of major end-use electrical equipment in industry, agriculture and the commercial sector :

- variable speed drives
- motors lighting effective agricultural pump-sets

Technologies to make better use of available generating capacity :

- load levelling and load management control systems
- energy storage (e.g. off-peak storage of chilled water for air conditioning)
- power plant instrumentation, monitoring and advanced diagnostics
- cogeneration systems

Eligible Projects

PACER supports proposals for technology development in any of the priority areas of energy research and development. The main criteria for project eligibility are that:

1. It envisages development of new or innovative product/ process relevant to the Indian energy sector.
2. It indicates significant potential for commercialization within a period of five years
3. It envisages PACER assistance of up to US$3 million or 65% of the estimated cost, whichever is less.

Eligible Applicants

Eligible proposers for PACER assistance are those who:-

1. have formed a consortium of existing profit-making business organisation(s), research institution(s) and/or end-users(s) agreeing to work jointly towards accomplishing the project goals;
2. have demonstrated capability in the successful marketing of products developed in response to opportunities;
3. are ready to enter into an agreement with ICICI, which includes an obligation for the profit-making participants to repay the financial assistance to PACER on mutually acceptable terms;

4. agree that profit-making participants would contribute at least 35% of the cost of the R&D project.

Forms and Terms of Assistance

PACER provides conditional grants to consortia for developing innovative products/processes:

1. Assistance in the form of conditional grant (in US dollars or rupees as may be necessary) involves liability to repay the amount if the technology commercialization is successful.
2. assistance is provided up to US$3 million or 65% of the estimated project cost, whichever is less, while the balance amount is contributed by the proposer.
3. Payments to PACER are in the form of :
   (i) a negotiated percentage of revenues arising from the project on commercialization; and
   (ii) are limited to 200% of the PACER contribution towards the project cost.
4. No technology patents or participation in equity at the commercialization stage are required by PACER.

In the case of certain consortium R&D projects eligible for conditional grant, a part/component of the development project might involve more intensive research work which could be undertaken by a research institution/scientist/technocrat. Such a research assignment which supports the main consortium R&D project could be considered on its merits for a research award in the form of a grant not exceeding US$400,000 or 80% of the estimated cost of the research work, whichever is less.

PACER also provides assistance in the form of a grant towards research projects of relevance to the energy sector in India as well as for formulating consortium R&D proposals in deserving cases.

PACER Experiences

Up to 23 consortium projects and 8 research projects have been approved under PACER. The assistance sanctioned is Rs414 million (US$13.8 million). Since PACER involves an innovative concept of Consortium R&D, involving more than two parties, considerable efforts were required to propagate the same. Moreover, energy projects being mainly in the public sector, bringing together various partners, defining their roles and responsibilities and sharing of benefits between them has been a

difficult task. Normally projects in the energy sector have large capital outlays (average PACER assistance Rs13million, or US$0.43 million, for consortium projects), have longer gestation periods and also high risk elements. The programme involves large organisations, and Government Departments where decision making processes are usually slow.

After initial "teething" problems, the PACER programme is now gathering momentum. A new approach of Request for Proposal (RFP) has been introduced, inviting proposals from parties on specified subjects, where gaps in technology have been identified and where technology development has promising commercial potential.

Although the financial stakes in technology development in the energy sector are high, some of the projects approved under the PACER programme would have far-reaching impact as far as the new sources of energy and environmental aspects are considered. For example, one of the projects aims at hydrogenation of large grey stone deposits, found in the north eastern sector, into a liquid stream. This would help in extraction of middle order distillates i.e. diesel oil, kerosene, etc. and reduce the import bill for petroleum products substantially. Some projects under PACER relate to the development of clean coal technologies. These would reduce pollution problems from thermal power plants and steam boilers.

Sponsored Research and Development Programme

The Government of India has setup an elaborate chain of 41 National Laboratories covering a wide range of fields such as chemicals, glass and ceramics, fuel, building materials, food, pharmaceuticals, biotechnology, electronics, scientific instruments, leather, petroleum, environment, aeronautics, metallurgy and toxicology.

Although these laboratories have some of the most sophisticated facilities, talented man-power, information database and other infrastructure, their research efforts have been directed mainly towards scientific research. Their financial requirements being met by annual budgets allocations from the Government, they had not strongly felt the need to interact with the industry, particularly the private sector. Moreover, working under Government departments, they had elaborate procedures to deal with relating to their own work and dealing with external clients. They developed a number of technologies at the laboratory and pilot plant scale, but could not provide guarantees for successful working on a commercial scale. Although fees were low because of cumbersome procedures, lack of interest and absence of guarantees, the private sector could not take advantage of their presence for a long time. The lack of interaction and cooperation between industry and the research institutions led to large scale import of technologies from foreign countries.

Some forward-looking companies set up their own R&D facilities with the incentives provided by the Government in the form of tax relief on R&D expenditure, easier import facilities and preferential treatment in licensing. About 1200 in-house R&D facilities have been established. However, their main efforts have been in the adaptation of technology, minor modifications, import substitution and solving day-to-day problems. Due to lack of sophisticated facilities, skills and data bases, their efforts in the development of new technologies have been costly and time consuming.

To address these concerns, the Sponsored Research and Development (SPREAD) was developed in 1989 for which the World Bank provided funds of US$15 million on soft terms, and appointed ICICI as the managing agency.

The SPREAD Programme aims at encouraging Indian industrial firms to strengthen their R&D activities. The Programme envisages utilization of the extensive facilities available with the national laboratories and other independent technology institutions in the country. Each project under the SPREAD Programme, therefore, involves cooperation between an industrial firm and a technology institution.

Objectives of the SPREAD Programme

- To encourage industrial firms to increase their R&D activities;
- To foster closer links between industry and technology institutions;
- To utilize the existing infrastructure in technology institutions to the fullest extent possible,
- To assist industrial firms in improving the cost-effectiveness of R&D projects; and
- To assist industrial firms in shortening the R&D project cycle.

Benefits to Industry

The SPREAD Programme is designed to offer the following benefits:

- Support for projects at all the stages of the R&D cycle, from laboratory and prefeasibility studies to prototyping and pilot plant operations;
- Facilitating access to the large infrastructure of scientific talent and laboratory facilities of the technology institutions in the country;
- Help in obtaining greater mileage out of a company's R&D budget through substantial savings in capital investments in major facilities and employment of personnel;
- Encouraging small-scale industries to undertake R&D programmes which they would not be in a position to do on their own; and
- Help in establishing a continuing relationship with technology institutions which can significantly expand the scope of the company's R&D activities.

Eligible Projects

Each project under the SPREAD Programme involves cooperation between an industrial firm and an autonomous, independent technology institution in the country.

Projects eligible for financial assistance under the SPREAD Programme involve :

- Development of a new product or process;
- Significant improvements in an existing product or process; and
- Scaling up of a technology developed by a technology institution.

Eligible Activities

Industrial firms can take up the following activities as part of their R&D projects :

- Prefeasibility studies;
- Laboratory trials; and
- Prototype building/Pilot plant operations.

The long-term R&D programmes are to be taken up in phases and projects based on successful completion of earlier phases are encouraged.

Project Characteristics

Projects undertaken for financial assistance under the SPREAD Programme are normally those which :

- Have feasible and quantifiable objectives;
- Do not take longer than 18 months to 2 years to complete; and
- Envisage division of major activities between the industrial firms and the technology institution.

Eligible Companies

All companies - whether existing or new, private sector or public sector - are eligible for assistance.

Eligible Technology Institutions

All independent, autonomous technology institutions in the country are eligible. These include :

- National laboratories;
- Universities and other educational institutes;
- Laboratories set up by industry associations; and
- Research foundations.

The technology institution with which a project is being sponsored should possess adequate facilities and requisite expertise for successful execution of the proposed project.

The industrial firm and the technology institution with which the project is being sponsored enter into a Memorandum of Understanding spelling out the division of activities, responsibility for execution of individual activity and the implementation schedule.

Eligible Expenditure

Project-specific expenses in respect of any or all of the following items are eligible for financing :

- Equipment and facilities;
- Materials and consumables;
- Payments to consultants and experts;
- Fees payable to technology institutions; and
- Project related travel and overhead expenses.

All expenses are to be documented and audited annually.

Contribution to the Industrial Firm

An industrial firm has to contribute at least 50% of the total cost of the project.

Maximum Assistance per Industrial Firm

The maximum assistance to an industrial firm would not exceed Rs15 million (US$0.5 million). Since the SPREAD Programme seeks to encourage industry to increase its R&D efforts, assistance under the Programme is not to substitute ongoing R&D outlays.

Terms and Conditions

- Interest at 6% during the implementation period of the R&D project;
- At the conclusion of the R&D project, interest increased to 15%; alternatively ICICI to negotiate royalty payments on commercialization of the R&D project
- Repayment period of up to 10 years with a suitable provision for a grace period, considering the duration of R&D project.

Project Monitoring

Projects funded by ICICI are closely monitored. ICICI identifies and assigns, wherever necessary, a resource person to monitor the progress of the project. In addition, ICICI forms a tripartite review committee with representatives from the industrial firm, technology institution and ICICI to review the progress of the project in meeting the technical and economic benchmarks formalized in the proposal and outlined in the agreement. Disbursement of funds are coordinated with the successful achievements of these benchmarks.

If the sponsoring firm establishes with convincing evidence that the project is not successful, ICICI considers writing off the loan. Such recourse is taken under exceptional circumstances.

The SPREAD Programme which became operational in mid-1990 has been well received by the industry. The response from technology institutions, which are required by government to generate one third of their funds from external sources-through know-how fees, royalties, consultancy services etc, was also encouraging.

To date 41 proposals involving an R&D outlay of Rs450 million have been approved by ICICI. SPREAD assistance for these proposals amounts to Rs222 million (US$7.4 million). The proposals relate to development of technologies relating to drugs, pharmaceuticals, bio-chemicals, machine tools, electronics, environment, polymers etc.

A few notable projects relate to development of technologies for bio pulping, bleaching and decolorisation of effluents in paper industry by means of microbial treatment, production of environmentally-friendly detergents using zeolites and recovery of precious metals from slags by use of plasma furnace.

The SPREAD programme is helping individual companies in implementing R&D projects with significant savings in cost and time. For ICICI, the SPREAD programme is attracting the attention of new, high-tech and fast growing companies. At the national level, it is bringing extensive network of Technology Institutions in the industrial mainstream and acting as a catalyst in the development of innovative technologies.

Technology Institutions Programme

While the SPREAD programme has the objective of enhanced interaction and co-operation between industrial firms and technology institutions, it has been considered necessary by the World Bank to have a scheme to enhance the capability of technology institutions so that they could serve the industrial sector more effectively and also on their own, to take up market-oriented technology development projects. The Technology Institutions Programme (TIP) has been designed with a fund of US$40 million from the World Bank. Details of this programme are as follows :

Objectives

- To *foster closer links* between technology institutions and industry;
- To help technology institutions in *upgrading their existing facilities*;
- To help technology institutions in setting up *new facilities for emerging technologies*; and
- To help technology institutions in *marketing their services* to industry.

Eligible Technology Institutions

Independent, autonomous institutions or agencies including:

- National laboratories;
- Laboratories set up by industry associations; or
- Research foundations.

Eligible Activities

Technology institutions could undertake these activities as part of their programmes:

- Setting up of pilot plant facilities and testing equipment;
- Upgrading management systems and safety procedures;

- Technical collaborations;
- Training and exchange programmes; or
- Strengthening marketing capabilities.

Programme Characteristics

Programmes undertaken by the technology institutions must:

- reflect the need of a specific sector in an industry;
- be completed in no longer than 2 to 3 years; and
- have significant potential for generating revenues from industry through sponsored projects, consultancy services and testing fees.

Eligible Expenditure

Programme-specific expenses in respect of the following items are eligible for financing :

- Equipment and facilities;
- Materials and special samples;
- Technology collaboration fees; and
- Training and exchange programmes with industry and foreign collaborators.

Terms of Assistance

- Programme undertaken by the technology institutions should include:
- An annual service charge at 1%;
- A front-end fee at 0.25%; and
- A repayment period of up to 15 years with suitable provision for a grace period considering the time required for implementation of the programme.

Contribution of the Technology Institution and Industry

Since the TIP aims at helping the institutions to set up facilities that will be useful to the industry, especially in the generation of external revenues, the technology institution and industry are expected to make appropriate contributions towards the cost of the programme which is decided on a case-to-case basis.

Under this programme, "first-time" Technology Institutions must take a loan, which is to be repaid out of their own earnings. This is a major change in their culture, thinking and approach, since they have been accustomed to receive only grants from various agencies to carry on their work. The initial response for TIP was slow, but because of the directives to increase their earnings from external sources, increasing number of institutions are formulating proposals to obtain assistance under this scheme. ICICI has sanctioned assistance to 8 institutions for an aggregate amount of Rs425 million (US$14.17 million).

Recently, the Government of India suggested further reductions in the budgetary support to technology institutions, urging them to take up more industry and market-oriented developmental work, and generate income from external sources. This is likely to bring about a major change in the working of the technology institutions and bring them closer to industry.

Management of Technology

Although a large number of persons are employed in R&D institutions in India, there is no programme available in the country which could upgrade their knowledge about Management of Technology (MOT). This has become a complex subject and at the same time is considered to be very important if the companies have to face competition - both local as well as international. Only those companies that pay attention to this subject can expect to achieve and maintain their leadership in industry. Industry awareness is on the rise, and progressive companies are looking for suitable programmes to train their personnel in the management of technology.

A survey conducted by ICICI, supplemented by a series of workshops involving industry, universities, IITs and management experts, focused on the content and duration of programmes for technology / engineering graduates, R&D managers and technologists engaged in R&D activities. It proposed several modules of short, medium and long term duration so that persons at different levels could participate in such programmes. The Science Policy Research Unit (SPRU) at the University of Sussex, U.K. is assisting ICICI in the design of these programmes, which would be implemented by different organizations such as IITs, Institute of Management, technical universities and industry organisations.

ICICI Technology Information Centre

The ICICI Technology Information Centre (I-TIC), cater to varied information needs of clients, institutions and agencies engaged in technology-based projects. ITIC will provide on-line access to a number of scientific, technological and commercial databases worldwide. It will offer in-depth information in the field of agroprocessing and environmental protection under the cooperative arrangements with leading US Agencies.

Centre for Technology Development

The Centre for Technology Development (CTD), a non-profit-making society, has been registered at Bangalore-Karnataka State in 1988 with broad objectives of Technology Development, Promotion of R&D, Garnering of Assistance for Technology Development in support of hi-tech industries, promotion of

Venture Capital Schemes, Human Resource Development in the technology sphere and provision of Information on technology.

The main activities of CTD are carried out through Focus Groups comprised of representatives from scientific and academic institutions, industry, financial circles and Government. Focus Groups formulate schemes which are implemented with 50% support from industry. CTD has set up Focus Groups for Informatics, Food Processing, New Materials and Dryland Development and commenced action towards setting up centres for applied technology relating to food processing, manufacturing engineering and tree crops in collaboration with Centre for Advanced Food Technology at Rutgers University and Carnegie Mellon University for programme in Robotics.

The CTD has also set up a National Venture Capital Forum to provide training and advise to entrepreneurs on Venture Capital proposals. Assistance is also extended to various agencies in human resource development, use of computers and computer aided designs. It is planning to extend activities in other states.

Funds for the Centre are being provided by USAID ($10m), Indian State Governments and user agencies. The Centre is managed by an autonomous Board of Governors. ICICI is a channelising agency for USAID funds in the implementation of CTD programmes.

Financing Commercialization of Technology

Term lending institutions in India have traditionally financed projects which have proven source of technology and commercial potential. Occasionally they receive requests from entrepreneurs for setting up projects based on locally-developed technologies with no proven track record. Generally institutions have been weary of backing up such projects and only in few cases have they financed projects after taking such safeguards as the setting up of pilot plant of a capacity where scale-up would not be a major problem or where the projects were being set-up by large industrial houses who could mobilize resources to solve problems. Many projects conceived by young entrepreneurs, particularly those belonging to the scientific community, could not be implemented as no institution was ready to to take risk.

By 1988, ICICI became involved in the financing of the development of indigenous technology through its various schemes. However, there was no mechanism available to bring these technologies to the market place since they were new and unproven. Financial institutions and banks were not inclined to finance such projects as the risk factors were high. Several young persons with bright ideas, but no adequate financial support, and most of them working in technology institutions, were looking for schemes which could turn their dreams into reality.

The ICICI was aware that Venture Capital Finance (VCF) played an important role during the past 2 to 3 decades as a "lubricant" which made high technology enterprises and innovative services run smoothly. In the USA, it created billion dollar products and services such as Apple Personal Computer and the Federal Express Service. VCF also played an important role in Japan, Europe and even in some developing countries in bringing out technologies from research laboratories to the market place.

Through its earlier experiences with the conditional grant and conditional loans, ICICI was aware of the potential. It was also familiar with the evaluation of risks and returns from such proposals. This represented a major gap in the Indian financial system. As one of the institutions which had pioneered many new concepts and institutions, ICICI decided to provide Venture

Capital Finance for projects with high risks but also high returns on successful commercialization. Some of the projects from the existing portfolio of ICICI meeting the above criteria were identified for transfer to venture capital. It was also realized that handling of such proposals needed a new kind of approach and an attitude different from the approach of traditional banking. Hence, a new institution was created, the Technology Development and Information Company of India Limited (TDICI), with its Headquarters at Bangalore. Here a number of high-tech projects in telecommunication, aeronautics, computers etc. are located, which employ a high number of scientists and technicians.

TDICI was started with a Venture Capital Fund of Rs200 million, subscribed equally by ICICI and the Unit Trust of India, with the aim of accelerating the pace of Indian technological development by offering venture capital and support services to industry and service sectors. Operations commenced in March 1989. Response to the fund has been good, and within less than one year, 38 high-tech projects received funds. These projects cover a wide range of industries : computer hardware /software, electronics and telecommunications, chemicals, polymers and special materials, biotechnology, environmental engineering, renewable energy sources, drugs, pharmaceuticals, diagnosis and vaccines, food and feed technology, electrical and mechanical equipment and new services.

Assistance from TDICI is provided to first generation entrepreneurs / technocrats for projects /services in view of four factors; innovation, growth, risk and reward. The assistance is extended in the form of equity participation up to a maximum of 49%, and a flexible instrument-conditional loan working on the principle of "payment according to the earning capacity". Both equity and conditional loans are risk and reward-sharing instruments. In addition, the conditional grant has features of equity but no voting rights which is preferred by entrepreneurs to have control on the Company. The payment in the form of royalties on sale is fixed depending on the profitability of the company and estimate of a reasonable yield. The overall performance of the first fund has been satisfactory. An annual dividend of 15% to the investors has been declared by TDICI since inception.

In 1990 TDICI constituted a second fund amounting to Rs1 billion which received contribution from ICICI, UTI, IFC - Washington, Commonwealth Development Corporation, Indian Banks and Corporate Sector. About 70 new projects with an assistance of Rs988 million have been financed from the second

fund. Apart from high-tech areas, projects requiring innovative marketing approaches and new services have been included under this fund.

Industry break-up of the TDICI's support to industry is as follows:

INDUSTRY	NO. OF COMPANIES	AMT. RS MILLION	%
Computers HW/SW/CAM/ Systems	26	167.87	19
Chemicals/Polymers/Spl materials	24	131.87	15
Drugs/Diagnostics/Vaccines	14	83.60	9
Services/Others	24	178.91	20
Food/Feed/Fisheries	12	98.99	11
Electrical/Electronics/Telecom	14	84.62	10
Engineering/Non-Conv. Energy	16	62.60	7
Consumer Products	3	29.44	3
Bio-Technology	4	32.67	4
Mechanical Equipment/Systems	3	17.70	2
TOTAL	**140**	**888.27**	**100**
		US$29.61	

Some of the proposals supported under Venture Capital relate to; treatment of spent wash from distilleries, manufacture of fuel pellets from agricultural and municipal solid waste, development of hybrid seeds, development of speciality and medicinal gum products, miniature sensitive relays for telecom industry, paints and coatings based on engineering polymers, rubberwood mouldings and components, home computers and intelligent note pads, seismic data acquisition for the Oil and Natural Gas Commission.

TDICI is India's first, fastest growing and largest technology venture capital corporation. It has played an important role in meeting the venture capital requirements of new and expanding companies in the early stage of their life cycle.

Venture capital in its institutionalized form has been in India for 5 years. The Government of India, announced investment guidelines for the venture capital industry in 1989, along with certain capital gains tax incentives. Since then, the industry has grown gradually. Today, there are eleven companies / financial institutions in the venture capital area. While some of them have been constituted as venture capital companies which have raised equity capital for investing, the more popular form of organization has been a *fund management company* similar to an asset management company as in the case of mutual funds. During the last five years, the venture capital companies/funds (VCCs/VCFs) have invested about Rs1 billion in over 200 enterprises.

The performance of the venture capital industry may at best be considered moderate, considering the fact that the annual rate of lending to the industrial sector by various financial institution is in excess of Rs15 billion.

Some of the problems faced by the venture capital industry are :

- Restrictive nature of present investment guidelines; and
- Inadequate tax concessions for the industry.

The present set of guidelines stipulate that 75% of the venture funds should be invested in companies set up by relatively unknown entrepreneurs and/or in businesses that commercialize unproven technologies. The guidelines may be interpreted as permitting investment only in manufacturing companies attempting new technologies. They deny investments in service sectors, and in areas that may not be technology-oriented. Given the present level of technology development activity in the corporate sector, there are not many investment opportunities for the VCCs/VCFs under the present guidelines.

The present Income Tax Rules in India allow a 50% concession to a venture capital industry or capital gains tax. However, the industry is taxed normally on any other form of income. Due to several restrictions on the issue of capital and pricing of equity that were in force historically, the venture capital industry had to consider, non-equity financing in order to lend effective support to their investee companies. The income derived on such non-equity financing is subject to tax at normal rates. The fiscal incentives provided so far are inadequate and need to be re-examined.

In this regard, it may be mentioned that the Government has recently granted a total tax exemption to mutual funds. The venture capital industry takes a much greater degree of business risk by investing in start-up and young companies for a long-term period. There is, therefore, a need to place the venture capital industry on par with mutual funds by providing total tax exemptions.

If an appropriate environment is created through the above changes, the venture capital industry can play a far greater role in the industrial development of the country by providing equity capital to new businesses. It is expected that the loan support from financial institutions will be increasingly difficult for new companies, given their resource constraints. Besides, with liberalized norms for equity pricing and consequent decline in investor returns, public support for equity issues of new companies would also decline. The venture capital industry would be in a position to bridge this emerging gap in the financial sector.

Agricultural Commercialization and Enterprise

Apart from the goal of commercialization of technologies through the Venture Capital Finance route, ICICI has recently implemented two more schemes which are related to specific sectors; Horticulture and Environment.

The Agricultural Commercialization and Enterprise (ACE) Project relates to the commercialization of technologies in post-harvest horticulture activities. The genesis of this scheme is that India, with more than 8.7 million hectares devoted to fruit and vegetable cultivation, is one of the world's largest producer of vegetables—next only to China; and the third largest producer of fruits - next to Brazil and USA. In spite of large production, due to lack of proper technologies and modern support services in the post harvest activities, nearly 30% of the production, amounting to Rs30 billion is wasted every year between the farm- gate and consumer. Inadequate processing facilities hamper India's share in the world market of horticulture produce,— less than 1%.

The ACE programme has been designed to address the critical areas of deficiency in the post-farm horticulture sector. The programme provides technical and financial assistance to acquire state-of-the-art technologies required for post-harvest operations for horticulture produce i.e. fruits, vegetables and flowers.

The major emphasis of the ACE project is on minimizing post-harvest losses and increasing the shelf life by using new technologies such as Mobile Pre-cooling, Individual Quick Freezing, Freeze Drying and other techniques. The other emphasis of ACE is on high value addition through setting up of processing units with modern facilities for sorting, grading, processing and packaging. With these facilities, the availability period for fruits and vegetables could be extended enabling farmers to realise higher prices for their produce.

Apart from providing loans to support these activities, the programme envisages Technical Assistance (TA) for obtaining state-of-the-art technology, equipment, market information and tie-up support for joint ventures and exports. One more component of the ACE programme is Trade and Investment Tours (TI) by Indian horticultural entrepreneurs and organizations to visit foreign firms and participate in exhibitions and seminars to

get acquainted with latest technologies, equipment, processes and farm practices. They also avail of the services of foreign experts for improvements in their operations. Whereas loans are provided on market terms, TA and TI are provided as grants to the extent of 75% of the cost.

The programme also supports sectoral studies to examine gaps in the technology, and healthy development of various sectors, policy studies to reduce bottle-necks, enhance prospects of commercialization and export earnings. Training programmes for institutional officers and entrepreneurs in India and abroad are also envisaged.

The ICICI has constituted an Advisory Council comprised of representatives of industry, government, commercial banks, management institutions, scientists, agricultural universities etc. to provide guidance for the programme. ACE has a panel of experts to assist in the evaluation and monitoring of proposals. ICICI has access to a firm of agro-business international consultants for advice and sourcing of technologies, experts, equipment and market information.

The ACE programme with a fund of US$20 million from USAID (US$10 million to be provided as loans and US$10 million to be used in providing Technical Assistance) has just commenced operations, in one of the states in India. About 80 proposals/ enquiries have been received for obtaining latest technologies, market tie-ups and value addition for mango, banana, grapes, guava, pomegranate, cashew, berries, orange and citrus fruits, papaya, pineapple, onion, mushroom, cabbage, carrot, bitter gourd, baby corn etc.

Trade in Environmental Services and Technology Centre

The rapid industrialization of the country has created major pollution problems relating to the atmosphere, water and land mass. Due to limited resources and large investments required in controlling pollution, without significant returns, Industry did not give adequate attention. Only with the creation of legislation and its increasing enforcement resulting in penalties and closure notices, has industry started vigorous action to solve their pollution problems.

ICICI is paying increasing attention to the environmental problems of Industry and providing modest amounts for treatment and disposal of effluents for individual units. However, ICICI's involvement has been mainly with medium and large scale plants in the private sector. There are innumerable units in the small scale and other sectors that have not been assisted by ICICI and are facing serious pollution problems due to out-dated technologies and poor management of these problems. In the metropolitan context, a large concentration of automobiles with very poor combustion efficiencies have created serious problems of emissions, affecting the health of citizens.

In 1990, the World Bank provided a special line of credit of US$50 million to the ICICI for advancing assistance to the industry on softer terms in solving their pollution problems. However, it has been found that there are large gaps in technology in certain areas and there is a need to have information not only on the state-of-the-art technologies for various sectors, but also about consulting agencies and experts who could bring developers/ suppliers of technology, equipment, engineering designs etc. to the users and arrange for know-how development, adaptation, transfer, etc. The parties could also set up joint ventures in India to provide "clean" technologies to the various sectors of Indian industry.

A new programme, Trade in Environmental Services and Technology Centre (TEST), is being introduced by ICICI with a fund of US$25 million from USAID. The innovative features of this programme are networking of institutions involved in solving environmental problems, access to latest information through satellite communication with various databases and specialized

agencies, and quick dissemination of information to various organisations. TEST also envisages involvement of consultancy firms and experts in the environmental field to provide services in solving problems of highly polluting process industries such as leather, paper, dyes, pesticides, distilleries, chemicals etc. on individual unit as well as sectorial basis.

A major objective of the TEST programme is to enhance the productivity of Indian industry on a sustainable basis i.e. by adapting affordable technologies, which provide recoveries of products/by-products of economic value, or alternate technologies which are relatively clean, involving reuse/recycle of waste streams, efficient firing of boilers to reduce exhaust emissions and reduction of noise pollution by better design.

Apart from financial assistance, Technical Assistance under the TEST programme is also available for exchange visits, workshops and conferences, assessment of specific pollution abatement needs and access to updated information from networks and databases on environmental services and technologies.

ICICI has started on the formation of TEST Advisory Board, expert panels and TEST group to implement the project. Under this new programme, ICICI, through its own personnel stationed in the USA, would have direct interaction with organizations involved in the solution of environmental problems. ICICI has provided assistance amounting to Rs64 million (US$2.2 million) to 2 projects in metallurgical and cement processing industries.

Conclusion

The ICICI emerged as a development finance institution in the mid-fifties, and has since diversified its operations from project finance to merchant banking and advisory services. For more than one decade it has strengthened its role in the field of Technology Finance and Commercialization.

Managed by professionals of high calibre and commitment - from the level of Chairman to Officers, the ICICI promotes an atmosphere of efficiency and competitiveness together with courtesy to its clients. With a decentralized delegation of authority, simplified procedures and quick communication, decision making process in ICICI are relatively expedient.

With a large contact base throughout Indian Industry, and a satisfactory financial record, the ICICI has received support from organizations such as the World Bank, the International Development Research Centre - IDRC (Canada), KFW, Asian Development Bank, USAID, CDFC, European Community, DANIDA, Swiss, French, Swedish Governments, commercial banks and financial institutions in the U.S.A., Germany, Japan, U.K., France, Canada and Switzerland. Several joint schemes and ventures are under implementation with these agencies.

As far as *Technology Finance and Commercialization* are concerned, major support to ICICI has come from USAID and the World Bank. In many of these programmes, ICICI is playing the role of an implementing agency. The ICICI does not make any profit from implementing these programmes, save cost recovering. All the reflows are ploughed back to revolving funds, which are used for the same purpose - for which different funds were created. An important feature of these schemes is cost of their implementation by ICICI is about US$100,000 scheme per year, which could be considered quite economical.

The amounts provided for various programmes are quite modest, considering the size and requirements of a country of the size of India. However, these programmes are playing a catalytic role and have created an strong awareness in the industry about the role technology development can play in the improvement of quality, productivity and competitiveness, which are important in the process of globalization. These programmes serve as "path-finders," and many organisations in India and abroad are developing programmes on similar lines.

Inspite of several regulatory and administrative bottle-necks and initial teething difficulties, the experience of the ICICI in implementing these programmes has been satisfactory. Persons and organizations who are associated with the implementation of these programmes have developed a sense of pride - in playing their role in the technological development. ICICI is ready to share its experiences with developing and developed countries and join them in the design and implementation of similar programmes.