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**THE FINANCING OF INDUSTRIAL  
TECHNOLOGY DEVELOPMENT**  
*(Sub-Program Proposal)*

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## 1) INTRODUCTION

The present report discusses the financing of Industrial Technology Development, and draws recommendations on how UNIDO could assist Third World countries on this matter.

Modern societies are in the process of revising the traditional roles played by governments, specially with respect to policies related to Industrial Technology Development. The formulation of a new set of policies became necessary as a consequence of major changes in the technological environment.

An independent approach is used while discussing financial policy instruments, as a consequence of their importance and the exclusive role they play. Traditional schemes of financial support are briefly reviewed, with the objective of setting up a framework for the discussion. The economical, political and technological environment is analyzed with regard to their influence on the formulation of policies, and the impact on industrial technology.

It is pointed out that, in a developing country, government needs to play a much more active role to offset known deficiencies of the less developed private sector. It is emphasized the need for UNIDO to act on behalf of these countries, and assist them in organizing their financial schemes for promotion and support of local industrial technology development.

An attempt is made to take into consideration the differences among developing countries, according to the stage of development of their economy.

Finally, the proposed actions, which are distinct from those inherent to the financial agents, are organized within four classes: budgeting at governmental level, financing of technological activities in industry, promotion of venture capital, and personnel training.

## 2) THE FINANCIAL SUPPORT TO THE INNOVATION PROCESS

Governments in all modern industrialized countries employ a variety of techniques to promote and shape technological development. Each has concluded that the free action of the market is not sufficient to achieve the desired long term goals of technological strength and independence. For many different reasons, governments may choose to intervene where market forces are clearly incapable of achieving defined national objectives (1).

While orienting their large purchase power, they can play an inductive role with respect to the generation of new technology. This can be done by adequate specification of performance requirements of procured products, processes, services and systems, or by directly contracting the development of those with industries and R&D institutions. Very often, the innovations and the acquired skills have technological byproducts, i.e., they find applications in different fields. Additionally, governments may intervene via regulatory capacity, by providing incentives and, finally, by carrying out R&D activities themselves.

Industry is usually the dominant source of commercially significant technology, however, governments have been much more important and direct influence on the orientation and rate of technological innovation than usually supposed (2). Governments have been sources of the so called "generic" technology, whereas industry is responsible for "proprietary" technology which greatly benefits from the former.

Unlike developed countries, in a developing country government needs to play a much more active role in order to foster sufficient scientific and technological capabilities and to utilize them efficiently. In other words, responsibilities of governments in developing countries are even broader than in developed ones.

Table 1 exemplifies common policy instruments employed for promotion of technology. Some instruments explicitly deal with S&T, directly impacting over technological development and, therefore, are said to be explicit. Other instruments influence the technological development in an indirect fashion, and are called implicit.

TABLE 1- Policy Instruments

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Instruments to build up a S&T infrastructure

S&T planning (explicit)  
Financing of S&T activities (explicit)  
Manpower training (explicit)

Instruments to regulate technology imports

Registries of technology transfer (explicit)  
Import controls (implicit)  
Foreign investment controls (implicit)  
Joint venture (implicit)

Instruments to define the pattern of demand for technologies

Industrial programming (implicit)  
Industrial managing (implicit)  
Price controls (implicit)  
Fiscal measures (implicit)  
Incentives (explicit)

Instruments to promote performance of S&T activities in enterprises

Special credit lines (explicit)  
Fiscal measures (explicit)

Instruments to support the performance of S&T activities

Consulting and engineering design firms.  
(explicit)  
Technical norms and standards (explicit)  
Technical information systems (explicit)

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Source: (2)

Many of these instruments are associated to direct financing or, at some stage of their implementation, are operated via allocation of funds. Therefore, the meaning of the word "financing" can be taken in a broad sense.

Illustration of a set of traditional financing schemes can be obtained from the following examples.

Table 2 shows the credit lines of the Brazilian Government preinvestment financing agent, FINEP-Financiadora de Estudos e Projetos.

Additionally to these lines of action FINEP has experienced special contracts under risk, participating in the capital of innovative firms, participating in the profit/cost of a particular project, contracting

differentiated interest rates and payout time depending on the performance of the project, etc. However, these can be understood as pilot cases.

TABLE 2- Credit Lines of FINEP

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<b>FNDCT</b>	Supports research projects of nonprofit organizations such as universities, foundations, governmental research institutes, etc. It is a nonreturn credit which, in many cases, has been used to provide complementary institutional support to such organizations.
<b>ADTEN</b>	Subsidized reimbursable credit line oriented toward supporting R&D activities in industry: such as: <ul style="list-style-type: none"><li>.development of new products and processes;</li><li>.adaptation of imported technology to local conditions;</li><li>.acquisition of technological packages;</li><li>.building capabilities of R &amp; D teams;</li><li>.creating entities with the objective of marketing products, processes or services of technological nature;</li><li>.introducing innovation at plant scale;</li><li>.establishing quality assurance systems;</li><li>.establishing research facilities;</li><li>.studies and development of technical systems and routines.</li></ul>
<b>ACN</b>	Reimbursable credit oriented toward building technical capability at engineering consulting firms, according to the following types of projects: <ul style="list-style-type: none"><li>.technical training of personnel;</li><li>.purchase or development of technical files, data base, project management systems, etc.</li><li>.purchase of information processing equipment;</li><li>.purchase of technical measuring instruments of all kinds;</li><li>.purchase of drawing and reproduction equipment (office furniture and equipment, real estate and civil construction are excluded);</li><li>.working capital for facing large contracts;</li><li>.export of consulting services: market survey and preparation of proposals.</li></ul>
<b>AUSC</b>	Reimbursable credit oriented toward the users (or clients) of engineering consulting services, applicable to most types of engineering consulting projects. These credit lines will only be made available for those companies under control of Brazilian citizens. Such criterion requires analyzing the firm's capital composition, the existing agreement among the shareholders and technological agreements.

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Source: (3)

In Perú the financial institutions and the Development Banks have not played a very important role in technological development (11), because return rates and pay-out time have always been the leading criteria for project appraisal; very little was done on technological evaluation.

Peruvian credits for Industrial Technology Development have two origins:

a-2% of net industrial income that can be used by industries or by R&D institutes and universities to support technological research and development; and

b-state funds.

Special funds have been operate by COFIDE, such as "FDSE-Fondo de Desarrollo del Sector Energetico" and "FPD-Fondo de Promoción y Desarrollo". These funds have the objectives of contributing to the development of the energy sector through the encouragement of the use of nonconventional energy sources and substitution, savings and conservation of energy. They also provide financial support to technological innovation and development of equipment prototypes and pilot plants. Allocation of funds can be made in the form of no-return grants, regular loans or venture credits with flexible pay-out arrangements.

Agriculture research has the financial support of "Fondo de Apoyo a la Investigación Agraria" del "Banco Agrario del Perú", that finances research activities of individuals and public or private organizations, both under reimbursable or nonreimbursable credits.

The Mexican experience is related to FONEI-"Fondo de Equipamiento Industrial" of Bank of Mexico. For ten years they have granted up to US\$ 20 million of soft credits for technological development (12).

The program has had a significant impact on the technological development of the country. Technological goals have been achieved in 72% of the projects and 46% of them have gone into industrial production.

The credit line called TDP-Technology Development Program provides a coverage for 80% of the R&D project value. FONEI operates through the commercial banks by assuming 90% of the total contract value; they can subsidize up to 30% of the project value when a university or a research institute participate in collaboration with industry or in the case of specially selected projects. It is possible that FONEI writes off up to 75% of the debt, if the project does not succeed technically.



Venture capital-financed innovation, as practiced in the United States and in other developed countries, has proved to be a powerful policy instrument in promoting technological development to the market (4). It constitutes a "new model" of innovation which goes beyond both classical entrepreneurship and corporate-based innovation. Venture capitalists forge important linkages among a variety of actors that play important roles in the innovation process (5).

Many other developed countries have followed the steps of the United States. In all cases emphasis have been placed on the innovative potential of small firms, which are said to enjoy certain inherent advantages in innovation (6). Additionally, a second point of interest has been the impressive job generation capacity. Within a ten-year period, the one thousand largest corporations in the US have not generated a single additional job position. Contrarily, the small and medium size firms have absorbed the net amount of 3.5 millions new employees, in the same period. The group of small and medium size firm represented 43% of the GNP and 55% of private job opportunities (7). These two attributes, i.e., innovativeness and job generation ability, seem to correlate to each other: in France, the innovative small and medium size industries have contributed to 59% of job creation and only to 5% of job reduction (8).

The growing interest on the subject, as shown by some developing countries, motivated IFC-International Finance Corporation to invest in Venture Capital Companies in Developing Countries (8).

### 3) OBJECTIVES

The general objective of the present program is to assist government and industry in developing countries to organize financial schemes for promotion and support of local industrial technology development. Such assistance should be oriented toward the following specific goals:

- Organize Planning and Budgeting Systems at National Level;
- Design Industrial Credit Lines for Technological Development;
- Establish Equity Capital Funds for Technological Innovations.

#### 4) JUSTIFICATION

Only a few of the instruments shown on Table 1 are not directly linked to the financing activity. Moreover, UNIDO has traditionally worked on most of these fields, and thereby built a unique expertise, that is not usually found in developing countries. Consequently, the proposed UNIDO engagement on financing of industrial technology development will both contribute to strengthen its current activities and, at the same time, benefit from its exposure to complementary subject matters.

Additionally, this power of UNIDO enhances its corresponding responsibility to assist developing countries in performing the necessary corrections of course, in adjusting their policies, in organizing their financial schemes, and in designing instruments and structures for promotion of technology, according to the new pace of the international scene.

##### **a-Organize Planning and Budgeting Systems at National Level**

Planning and budgeting technological development at national level is a common practice in most developed countries. Governmental agencies usually propose S&T activities in the form of national programs together with other major actions of their responsibility. Examples of these are known in areas such as space, telecommunications, health, agriculture, military, etc. This practice makes it possible to assess impacts or make benefit/cost analysis of investments, while budget preparation process is open for discussion and participation of the various segments of society.

It is a misleading concept that rich economies have surplus money to invest in S&T. Actually, S&T proposals compete for funds as in any other area, and they receive allocations according to their priority.

This common managerial tool, of transparent planning, budgeting, and evaluation is used for funding S&T infrastructure and governmental activities. Nevertheless, developing countries have very little experience in this field, and will greatly benefit from organizing their decision making process.

The degree of openness should comply with the needs of each particular society, nevertheless budgeting and planning process should be sufficiently open to stimulate discussion of S&T themes on local press as well as among common people. In the long run, this will be the only legitimate way of educating people and improving budgets for S&T.

At least one should consider improving budgeting methods and follow-up systems for R&D infrastructure, personnel training, and governmental programs. Planning and budgeting is the adequate means of implementing important policies such as contracting R&D or technology transfer from industry, promoting cooperation among industries, research institutes and universities, promoting international cooperation, etc.

#### **b-Design Industrial Credit Lines for Technological Development**

Development banks have traditionally dedicated themselves to providing financial support to new investment projects. Very few of them have developed expertise on promotion and evaluation of technology based projects. Global and economical changes, as discussed earlier in previous section, have introduced the need for differentiated criteria of project appraisal and selection.

On the other hand, although the degree of maturity of developing countries can vary widely from one another, the prevailing political and economic conditions are such that the traditional subsidized industrial credit lines, almost solely supplied by governmental funds, do not find local support any more, and need to be revised. It is also commonly expected among development agents that private capitals should play a more active role on technology promotion and financing (8).

It is important that development agents become familiar with projects both of imported know-how or local ideas. In general technology can come from:

- a. licenses;
- b. joint-ventures;
- c. endogenous sources.

To promote effective financing for industrial technology development one has to create financial intermediaries equipped with risk-sharing instruments, including conditional loans repaid through royalties if the project succeeds and several other forms of venture capital on equity basis.

In cases "a" and "b" above, the financing agent has to play the important role of maximizing technology transfer as a means to build endogenous capability.

The extent to which these changes will be practical is unpredictable, however UNIDO assistance to developing countries on reorganizing their industrial technology financing lines is important.

### **c-Establish Equity Capital Funds for Technological Innovations**

Generally speaking, there are many differences between the climate for entrepreneurial development in developing countries as compared to that of a developed country. IFD (9) lists the following:

-lack of entrepreneurial tradition, or if it exists, it is family-based and characterized by deep mistrust of external investors;

-lack of attractive investment opportunities, as a result of the nonexistence of Silicon Valley-style centers of technological innovation, capable of spawning large numbers of "high tech" companies;

-lack of divestment avenues, given undeveloped local securities market, and nonexistence of an over-the-counter market, specializing in the trading of securities of small, growth-oriented firms;

-risk-averse mentality of investors, as a result of unfavorable tax treatment of returns on equity investment, the high opportunity cost of funds, given attractive yields available from low risk debt investment, and lack of credibility in the financial information of small companies, given the lack of proper accounting and auditing standards;

-lack of tradition of disclosing financial information to outsiders, combined with the incentives for closely-held firms to keep information to themselves, caused by tax and disclosure policies, which are not conducive to "above-board" entrepreneurship;

-lack of experienced venture capitalists;

-lack of cultural or social acceptance of profit participating remuneration schemes for employees/managers."

Other experiences can be cited such as the Jordan Technology Group - GTJ (13), a private shareholding limited liability company. The concept of the company calls for the transfer of technology by bringing in joint-ventures with high-tech firms that have a limited access to export market in Middle East. In the U.K., the National Research Development Corporation - NRDC has accumulated experience with government venture capital schemes since 1948 (4.6).

There is much that UNIDO can do, in terms of designing appropriate regulatory environment that stimulates venture capital in developing countries.

In order to accomplish the necessary change on such environment, countries have devised a wide variety of policies and instruments. The explicit instruments and policies can be grouped in four types:

- fiscal incentives;
- financial incentives;
- compulsory private investment;
- public investment.

The fiscal incentive is usually implemented through the reduction of the Venture Capital Company income tax and that of their share holders. This is done by avoiding taxation on reinvested profit and by allowing tax deduction due to capital losses. As financial incentive, long term loans are made available to these companies, if they comply with pre-established rules.

In some countries, governments may operate investment companies or participate in joint venture with private capital. Pension funds, mutual funds, and financing agents, in other countries, are required by law or by regulatory measures to make compulsory investment in venture capital companies.

Besides the technical assistance and advisory service on studies, formulation of policies and regulation, UNIDO can play a very important role in the identification of investment opportunities, in the formulation of business proposals, in identification of potential foreign partners, in finding alternative suppliers of technology, etc.

### 5) RECOMMENDED ACTIONS

Recommended UNIDO actions in the financing of industrial technology development in Third World countries should not be misinterpreted as if they were equivalent to those of regular financial institutions. Conversely, they should aim at assisting government and industry in organizing their financial schemes, designing adequate policies, instruments and structures, training local officials on related duties, and other actions of the kind.

Such assistance should also be extended to the negotiations of international funds, and will greatly facilitate the establishment of joint-ventures, and other businesses. Furthermore, technology procurement, technical cooperation, and the entire portfolio of other UNIDO activities can be much more effectively oriented to supporting developing countries on industrial technology, if projects and plans are born within a financial institution. The role to be played by UNIDO herewith should be that of

management expertise on financing of industrial technology development, rather than banking of projects.

The major UNIDO input to this program should be in consultants, lecturers, fellowships, and study tours. Eventually, direct support to specific technology projects may be necessary, in which case other components should be present.

The following is a list of recommendations that should help implementation of the subprogram.

**a. Preparing project document.**

When selecting the countries for cooperation UNIDO has to take into account the possibility of extending individual experiences in other countries. Therefore, it is important to consider the stage of economic development and other characteristics of each nation (see discussion on strategies in document Industrial Technology Management Capability in Developing Country).

A recommended approach would be to work with groups of countries, with a regional or multilateral organization.

Before work plans are prepared a diagnostic phase has to be carried out to determine the nature of national needs, specific objectives, degree of complexity of intended systems, etc..

An introductory seminars would serve the purpose of bringing together the main collaborating agencies, homogenizing the background knowledge, by presenting an overview on the subject.

When selecting local collaborating and executing agencies, it is important to make shure that they have the adequate authority. Natural partners would be Development Banks, Industrial Banks, Ministries of Planning, of Science and Technology or equivalent, etc..

The initial stage may require carrying out a survey study of the world's experiences in a particular field, as well as a general training of local staff on related matters.

In addition to national staff, this planning phase should be assisted by local and international consultants.

### **b-Consulting**

International experts should be made available to assist on identification of areas of comparative advantages, investment opportunities, project evaluation, technology assessment, technology transfer, policy making, income tax regulation, securities market, public administration, legislation and budgeting, management and organization of credit, contracting, etc.

### **c- Financial and technological intermediation**

UNIDO should intermediate technology transfer negotiations for key project. In general, such assistance will improve licensing conditions and facilitate joint-ventures, mainly in cases where financial and political support are essential. This activity will play important role when acquiring technology from large corporations, from governmental entities and from other developing countries, particularly from the NIC's (Newly Industrialized Countries) and from East European Countries, which can be good alternative sources of technology.

Intermediation will also facilitate local development agents in contracting international funds, such as The World Bank, Interamerican Development Bank, International Finance Corporation, and others, both for venture capital or for regular loans.

**d- Seminar on Planning, Budgeting and Follow-up of Large R&D Programs.**

**Objectives:**

1) To review the international experience in national planning and budgeting systems for S&T:

2) To train selected decision makers of developing countries on planning, budgeting and follow-up of large R&D programs.

3) To develop a training package, with teaching material and literature, which then could be used in other developing countries.

4) To train adequate number of instructors and consultants from selected countries.

**Means:**

1) Assign to selected Reference Center the task of preparation of:

-a survey of existing international experience and skill on subjects:

-a course program, the teaching material and the selection and training of instructors.

2) Collaborate with a Training Center in the implementation and coordination of:

-a team fellowship aimed at training adequate number of instructors and consultants from selected countries;

-a pilot program and its evaluation.

Activities will consist of lectures to be presented by specialist, case studies and group discussion. Duration will be three days, full time.

**Justification:**

In modern societies budgets and plans on S&T have to be discussed and approved by congressmen and representatives, if they are to be legitimate public expenditures.

While implementing these plans, societies claim for transparent follow-up procedures in which government and industry have to show to payers and legislators the social and economic benefits resulting from these activities.



Therefore, the techniques and skill of elaborating plans and following up their execution will greatly influence investment on technological development.

**Location:**

The main activities should be held at "CINDA-Centro Interuniversitario de Desarrollo", Santiago (Chile), at headquarters of selected Reference Center and elsewhere, if necessary.

**e- Seminar on Financing of Industrial R&D Projects.**

**Objectives:**

1) To discuss the role of financing industrial technology projects and review the international experience in this field;

2) To review concepts and techniques of technological project appraisal and selection;

3) To study alternative systems of project follow-up and Promotion into the market, given present day needs.

4) To review techniques of risk evaluation of a project;

5) To discuss means of attracting private financial capital to technological projects.

**Means:**

1) Assign to selected Reference Center the task of preparation of:

-a survey of general needs of potential clients for such a seminar;

-a survey of existing international experience and skill on subject;

-the seminar program, the teaching material, the recommended bibliography, the development of case studies which take into consideration the financing of endogenous technology, as well as, that resulting from joint-ventures or licencing.

-the selection and training of instructors.

2) Collaborate with a Training Center in the implementation and coordination of:

-a team fellowship aimed at training adequate number of instructors and consultants from selected countries;

-a pilot program and its evaluation.

Activities will consist of lectures to be presented by specialist, case studies and group discussion. Duration will be three days, full time.

**Justification:**

The present importance of technology and related matters in the success of an industrial project became dominant. A more competitive economy calls for greater innovative capability and consequently this brings in the need for a new attitude of the development agents with regard to project evaluation and policies. This seminar aims at introducing the theme of direction and trends of such a change.

#### f- Seminar on Venture Capital Companies

##### Objectives:

1) To organize an international seminar with the objective of discussing and evaluating existing international experiences in the promotion of new technology projects via venture capital in developing countries.

2) To disseminate among selected decision makers of developing countries existing international experiences of the use of venture capital in the promotion of new technologies.

3) To discuss the applicability of such experience to the particular situation of each Developing Country.

##### Means:

Same as in the Seminar on Financing of Industrial R&D Projects.

##### Justification

Venture Capital Companies -VCCs have proved to be very effective means of promotion of high tech industry in the U.S. and other developed countries.

IFC - International Finance Corporation (14) took equity participation in seven VCCs in developing countries starting in 1978. Other private or government VCCs exist in these countries, which experiences have to be evaluated and shared.

##### Location:

In principle, UNIDO should promote regional seminars in collaboration with regional, international, or multilateral agents concerned with industrial/technological development. Sites and dates should then be chosen in accordance with specific conveniences.

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