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Session 3

POLICIES AND THEIR IMPLEMENTATION REGARDING SMALL AND MEDIUM SIZED COMPANIES AND PRIVATE INVENTORS

Chairman : Prof.C.E. Carlson
SITRA

PREFACE

NRDO-80 at Munich was the 5th in a series of International Conferences of National Research Development Organizations. Earlier events were held in London (1973), Milano (1974), Paris (1976) and Seattle (1978). The Conference, organized by the Fraunhofer-Gesellschaft (e.V.)-FhG, took place from May 27-29 th, 1980, with participants from most European countries, the USA, Japan, Latinamerica and Australia. With 2 days of presentations by NRDO members it followed the successful arrangements of the preceeding meetings. The Program had been selected from a large number of submitted contributions by a Program-Committee, consisting of G.Bedouet (ANVAR-Paris), W. Hauf (FhG-Munich), D.N. King (NRDC-London), G.O. Krause, Program-Chairman, (FhG-Karlsruhe) and W. Marcy (Research Corporation-New York).
It's topics this time centered upon the complete range of aspects influencing the work of NRDO's, dealing with national innovation policies,institutional approaches, their implementation especially regarding small and medium sized companies, plus practical experiences from case studies. A new feature was the inclusion of a keynote contribution by an invited Specialist.

The participants left Munich with the feeling, that by now the techniques of licencing patents and know-how have been well established and that the personal relationships, formed at the NRDO-Conferences are invaluable for the transfer of ideas and experiences, that on the other hand the context, in which our work takes place, has become rather complex requiring additional efforts and considerations, for instance regarding financial, organizational and structural aspects. Sharing informations and experiences in these areas has become an even greater necessity. Here could be an additional important field for contributions in future Conferences.

As a final note I like to take this opportunity to acknowledge the contribution of the staff-people from FhG, who assisted in the preparation of the program and the proceedings. Of course the program could not have been put together without the time and effort devoted by the fellow members of the Program Committee and last not least by all speakers. To those I extend my sincerest thanks and appreciation.

July 1980 Dr.G.O. Krause

OFFICIAL OPENING OF THE CONFERENCE

by H. Grunau

Dept. Research & Technology

Ladies and Gentlemen,

it is my pleasure to wish you a successful conference in the name of Dr. Hauff, the Federal Minister for Research and Technology, sponsor of this meeting.

It is an honor that you have chosen the Federal Republic of Germany as host country for the 5th International Conference of the National Research and Development Organizations. I hope that our foreign guests will enjoy their stay here in Munich and will have the opportunity to get to know the attractive surroundings.

After the initial meeting in London in 1973 and the following ones in Milan, Paris and Seattle, this is your 5th conference. This shows how important the exchange of experience aimed at by these meetings is for your organization, as is also indicated by the great number of participants, among which are representatives from 18 nations, including 6 from overseas.

Presently in many countries considerable endeavors are undertaken in the areas of research and development. The success of these measures depends on the degree to which it is possible to quickly transfer the achieved results into new products and processes in the economy.

For this reason various countries have in the last few years increasingly introduced measures labelled with such catchwords as "technology transfer" and "innovation promotion". It seems important to me that an intense international exchange of experience takes place in this still rather open field. It is therefore a welcome fact that your organizations, which are engaged in the exploitation of research results are at this conference. This meeting presents the possibility to become acquainted with the measures introduced in the respective countries and to exchange the results and experiences. Thus, incentives are stimulated and possible mistakes can be prevented.

In the four sessions of this conference, topics will be taken up that have been intensely discussed in the Federal Republic of Germany for years. This applies particularly to the complex of questions relating to the promotion of small and medium-sized enterprises. This group of enterprises plays a very important role in the economy of the Federal Republik with regard to the number of employees and the turnover. In 1978 the Federal Government presented a general concept for the promotion of research and development for small and medium-sized enterprises. That concept summarizes the measures of the Federal Government to support small and medium-sized enterprises. Within the framework of the overall concept, great importance is attached to the measures for transferring technological know-how. Here organizations, such as those represented at this conference, have an important function. Regarding the Federal Republic of Germany, I would like to mention here above all the big research institutes as well as the Fraunhofer-Gesellschaft, engaged in practice-oriented research and development.

I will discuss the essential measures of the "general concept" later on. However, I don't want to fail to mention, that the individual states of the Federal Republic increased their support of small and medium-sized enterprises.

I want to close with the best wishes for a successful exchange of experiences. I am hoping for lively and fruitful discussions.
As chairman of the first session, which I would like now to open, I have the honor of first asking Dr.J.Staehelin, Vice President of the European Patent Office, to speak on "European Patent Policy".

EUROPEAN PATENT POLICY

European Patent Office

J. Staehelin

E U R O P E A N   P A T E N T   P O L I C Y

LECTURE BY MR J C STAEHELIN

AT THE FIFTH INTERNATIONAL

CONFERENCE OF THE NATIONAL

RESEARCH AND DEVELOPMENT

ORGANISATIONS (NRDO)

MUNICH, 28 MAY 1980

I GENERAL INTRODUCTION

It is with pleasure that I have accepted your kind invitation to speak about "European Patent Policy" at your fifth international conference. As representative of the European Patent Office which was established in November 1977 in this beautiful city of Munich which you chose for this conference I indeed regard it as a great honour to have this opportunity to address such a competent audience.

As Vice-President of the European Patent Office I am a member of the organisation representing the main achievement of European patent policy so far. The development leading to this concrete achievement goes back some thirty years now and still has not yet reached its end. This process - the gradual building up of a European patent system - is a good example of "European policy" in a special field. I think I should give you an impression of how this "European Patent Policy" gradually developed, what the present status is - in this context I shall give you a description of the activities of the European Patent Office - and how the prospects for the future look.

II HISTORY OF THE EUROPEAN PATENT SYSTEM

The history of the European patent system goes back to a time much earlier than that of the establishment of the Common Market - the time shortly after 1945. As the very first step towards the now existing system one must regard the creation of the International Patent Institute (IIB) by the Hague Agreement of 1947 which was to provide common facilities for searching patent applications for a few European states including France and the Benelux countries.

Two years later, in 1949, France took the first initiative in the direction of a centralised European procedure for the grant of patents. The reason for this was that, in view of increasing economic relations between European countries, the deficiencies of the traditional system of patent protection had become obvious. This system was characterised by the principle of territoriality, i.e. patents were granted by national authorities, and these national patents therefore had a scope restricted to the territory of the state which granted them. This was contrary to practical needs: as a consequence of the increasing industrialisation and development of commercial interest, companies needed patent protection in more and more countries. Thus for the same invention national applications had to be filed in each of these countries. Furthermore, the national patent laws differed both in the procedure for obtaining a patent and in the requirements for patentability. All this meant that each national application had to be differently drafted and prosecuted. Apart from this complication, the different systems led to patents differing in scope for the same invention in the different countries. For the applicant this was in no way a satisfactory situation.

Difficulties, however, did not only lie on the side of the applicant: Patent Offices in the various states had to cope with multiple examination of these applications for the same invention. Moreover, with technical knowledge all over the world growing more and more rapidly, the amount of technical literature to be kept and dealt with by the various national patent offices grew to such an extent that the states were faced with increasing administrative and financial problems. The results were backlogs and ever increasing delays in the grant of patents.

It was a French Senator, Longchambon, who therefore presented a plan concerning the establishment of a European patent office to the Council of Europe on 6 September 1949.

The plan gave rise to widespread discussions and led to the institution of a group of patent experts which met for the first time in January 1951 in Strasbourg. It was decided to proceed step by step and to tackle first the problem of formalities required for patent applications. The task was completed in December 1953, when the "European Convention relating to the formalities required for patent applications" was signed in Paris. The aim of the Convention was not a complete harmonisation of patent formalities but the establishment of a list of maximum requirements which Contracting States were entitled to adopt in their national laws.

The next step followed in December 1954, when the "European Convention on the international classification of patents" was signed in Paris. This Convention, which had been elaborated on the basis of a Swedish initiative, was followed in November 1963 by the "Convention on the unification of certain points of substantive law on patents for invention" which was signed by eleven States. The Convention has not yet entered into force but has nevertheless achieved its aim to a large extent: the new national patents acts introduced by several European countries during the last few years (Federal Republic of Germany) 1976, United Kingdom 1977, France & Switzerland 1978) and also the European Patent Convention are based on the Strasbourg Convention of 1963.

Each of these Conventions represented a further step in the right direction, and the results achieved by the Council of Europe in the field of Europeanising patent law cannot be esteemed too highly. On the other hand, the principle of territoriality still remained unchanged: for the same invention, national patent applications had to be filed and prosecuted in each of the countries in which patent protection was required, and the results of the different procedures differed widely.

More aggravating still was the fact that this system of national patents which in effect were restricted to the territory of the State which granted them built up "patent walls" between the European countries: a patentee possessing a set of parallel national patents for the same invention could prohibit a free flow of goods between countries. When the Treaty of Rome came into effect in January 1958, it was clear from the start that precisely this could not be tolerated as it was in contradiction to the very aim of the Treaty - to establish a free flow of goods between Member States. The logical consequence was that the principle of territoriality had to be overcome. A centralised patent granting procedure had to be created which would have to lead to a unitary common market patent having the same effect throughout the territories of the Member States, with clearly defined rights of the patentee regarding sale of the goods covered by the patent and the subsequent circulation of these goods within the common market.

On the initiative of the EEC-Commission, a working party on "patents" was therefore established which published the first preliminary draft of the European Patent Convention in 1962 and a second preliminary draft after intensive consultation with the interested circles in 1965. Because of political difficulties however, the negotiations came to a standstill - the question of the participation of non-EEC States could not be settled.

Following a French initiative, in January 1969 the negotiations started again - this time within the framework of the EEC-Council. In order to give non-EEC States the possibility of participating in this system too, it was decided to separate the provisions concerning the centralised granting procedure and conditions of patentability on the one hand from those governing the granted unitary common market patent on the other. Two Conventions were accordingly envisaged: the first one, a "European Patent Convention", in which all European countries should be entitled to participate, whether or not they were members of the common market, and a second one, a "Common Market Patent Convention", which was to be restricted to Common Market Member States.

For the elaboration of the first Convention, an intergovernmental conference for the setting up of a European patent system for the grant of patents was set up in May 1969. The Conference held its meetings in Luxembourg and published a first preliminary draft of the Convention in 1970 and a second in 1971. The Conference terminated its meetings in June 1972 with the presentation of a draft of the Convention establishing a European system for the grant of patents (the so-called "Munich Convention") and of implementing Regulations. This draft was the basis for the Munich Diplomatic Conference in September/October 1973. Of the 21 European States which took part in this conference, 14 signed the Convention on 5 October 1973: Belgium, Denmark, Federal Republic of Germany, Greece, France, Ireland, Italy, Liechtenstein, Luxembourg, Netherlands, Norway, Switzerland, Sweden and the United Kingdom. Austria and Monaco signed in 1974 and brought the total of the Contracting States to 16.

For the preparation of the opening of the European Patent Office, the Munich Diplomatic Conference had established an Interim Committee which - together with seven working parties and a planning group - worked for nearly four years (from 1974 onwards) and produced in 165 meetings about 1500 documents relating to the different proceedings of the future office as well as to organisational, financial, personal and legal questions. Finally, on 7 October 1977, the Convention entered into force and the European Patent Office in Munich was established on 1 November of the same year with about 80 employees.

With this event the first phase of the Europeanising of the patent system had been successfully completed. A centralised procedure for the grant of European patents by one office had been created. This was not only an achievement in the field of rationalisation, it was also a remarkable political achievement: a group of European States, comprising Common Market Member States as well as States outside the Common

Market, have transferred their sovereign right to grant patents or exclusive rights on inventions for their territory to a common international organisation. In this organisation an examiner, for instance a French examiner, is responsible for the grant of a patent not only in his own country, but also in the other Contracting States.

This patent, however, is not yet the "unitary" European patent as it confers upon the patentee in each of the countries for which it is granted the same rights as would be conferred by a national patent in those countries. It can in other words be considered to be a bundle of similar national patents. Here the second phase of the Europeanising of the patent system starts: drawing together this bundle to form one unitary patent covering the whole territory of the Common Market. In order to achieve this aim, the so-called "Luxembourg Convention for the European patent for the Common Market" was worked out and signed in Luxembourg in December 1975.

With the elaboration of the Munich and Luxembourg Conventions the new European patent system had taken shape. What is now the status of ratification of these Conventions?

As far as the Munich Convention is concerned, by the time it entered into force on 7 October 1977, seven States had ratified: Germany, Netherlands, United Kingdom, Switzerland, France, Luxembourg and Belgium. In February 1978, Sweden became a Member State, followed by Italy in December 1978, Austria in May 1979 and Liechtenstein in April 1980.

The Luxembourg Convention has not yet been ratified by any of the Contracting States, but the parliaments of the following six states have already approved the Convention: Belgium, France, Germany, Italy, Luxembourg, United Kingdom.

As far as the possible ratification of the Munich Convention by more States and the date of entry into force of the Luxembourg Convention is concerned, I shall deal with this in the context of the outlook for the future in the last part of my speech. At this stage, let me only underline that the new European patent system with the Munich Convention now already covers a market of impressive size. In actual fact, the present eleven Member States have together about 270 million inhabitants and represent the biggest market covered by one single patent in the world.

III THE EUROPEAN PATENT OFFICE TODAY

Turning now from this historical survey to the present status of implementation of the new European patent system, I should like to give you an impression of the work carried out by the European Patent Office and the results achieved so far.

1. General Remarks

Please let me start with a few general remarks concerning tasks and characteristics of the EPO in comparison with national patent offices of Contracting States.

The first point I want to stress is the fact that the procedure for the grant of European Patents has been created in addition to and not instead of the national grant procedure of Contracting States. Accordingly the European Patent Office and national patent offices are designed to accomplish different functions. What is intended is not so much competition but rather a rational and effective division of tasks between the European and national offices. The European Patent Office has been created for those inside and outside the Contracting States whose economic interests are not limited to the one or the other country but who see Europe as an economic unit demanding industrial and commercial strategies on the appropriate scale. A keyword in this context is the "Three-States-Theory": the fees for the European grant procedure have been established in such a way as to ensure that the total cost of obtaining a European patent (including the representation and translation) would not exceed the total cost of national patents in three large European countries (e.g. GB, DE, FR). As soon as patent protection is sought for at least three Contracting States, the European route is therefore advantageous.

The second point I want to mention is that for the first time the EPO makes available patents granted after search and examination, which means strong patents, not only for one or the other of the European States but for all Contracting States. From the point of view of the general policy of European States this constitutes a major step towards creating equal conditions for competition throughout Europe and I am personally convinced that the Munich Convention in this respect constitutes an important contribution to achieving the aims of the Common Market, even though the entry into force of the Community Patent Convention is still pending. On the other hand, from the point of view of applicants, the feature of examination seems to be the most important aspect of the European grant procedure as well, since the choice is now between a strong patent, including the risk of refusal of the application, and an uncertain situation due to opting for registered patents or deferred examination under the national systems.

2. Procedure before the EPO

After these general remarks let me now come to the procedure for the grant of a European patent before the EPO. It takes place in three clearly defined stages:

The first stage takes place at The Hague in Directorate General 1. The Receiving Section there performs the examination on filing and the formalities examination, while at the same time a Search Division carries out the search. After this both the application and search report are published.

DG 1 is the former International Patent Institute (IIB) which I mentioned at the very beginning of my speech and which was incorporated into the FPO on 1 January 1978. It now comprises about eight hundred employees, about four hundred of them experienced search examiners. In addition, part of the former sub-Office in Berlin of the German Patent Office with its one hundred and twenty employees has also been incorporated into DG 1. The integration of this staff in The Hague and Berlin enabled the EPO, from the opening of the Office in June 1978, to deal with the first stage of procedure.

The second stage of the procedure takes place in Munich in Directorate General 2. Here an Examining Division carries out the examination concerning novelty, inventive step and potential for industrial application. This stage ends with the refusal of the application or the grant of the European patent. If a patent is granted it is then published and mention of its grant is made in the European Patent Bulletin.

Substantive examination in Munich started in June 1979 for certain technical fields; by 1 December 1979, the Office had opened all fields of technology for substantive examination and has thereby reached the stage of full processing of all applications filed much earlier than planned initially. The first thirteen European patents were granted on 9 January 1980, nineteen months after the opening of the Office and seven months after the start of substantive examination forming the second stage of the procedure.

The third stage of the procedure is the opposition proceedings; they take place in DG 2 in Munich too. Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the EPO of opposition to the European Patent granted. If the patent is revoked as a result of opposition proceedings, the effect of such revocation is retroactive to the grant of the patent.

As the principle of post-grant-opposition was chosen for the EPO and the first patents only were granted only in January this year, this stage of procedure has not yet come into action.

Let me finish my short survey of the procedure before the EPO with the remark that throughout the procedure, there is a possibility of appeal against any decision of the Office. So far, 12 appeals* have been lodged, with which the Boards of Appeal forming Directorate General 3 in

*Stand 31.3.80

Munich are dealing.

Apart from DG 2 and 3, in Munich you find DG 4 (Administration) and 5 (Legal and International Affairs) with a total Munich staff of about 400. The total EPO staff in The Hague, Berlin and Munich therefore now is about 1300; at the end of the building-up period it will be about 2000.

3. Filing statistics

Let me now give you some information on the actual use which has been made of the services of the European Patent Office so far - in other words on the "Patent Policy" of the applicants.

Since the opening of the office in June 1978, more than 20,800 European Patent applications have been filed; included in this figure are about 2,500 international applications designating the EPO under the Patent Co-operation Treaty (PCT).* It is interesting to note that this figure is the result of a steady increase in the number of applications filed per month. The applications jumped from approximately 500 in January 1979 to 800 from February to April of that year and from May on remained constantly above 1000; in March of this year, for example, the figure was more than 1,400.

* Stand 31.3.80

From an analysis of these applications, the following indications may be of interest (European applications without Euro-PCT):

Priority:

94.7% applications claim priority, 5.3% are first filings.

Languages:

English 45.8%, German 39.5%, French 13.5%, Other (Article 14, paragraph 2) 1.2%.

Tendency: Percentage of German decreasing.

Countries of Origin:

State	1979
Contracting States	66.72%
Others	33.28%
DE	30.88%
US	24.57%
FR	10.89%
GB	9.79%
CH	6.30%
JP	4.70%
NL	3.10%
IT	1.55%
BE	1.49%
SE	1.28%
AT	1.17%
All others	below 1%

Designations:

The average number of designations per application filed in 1979 was 6.67.

Offices with which European applications are filed:

EPO, Munich	49%
EPO, The Hague	7%
London	28%
Paris	11%
Berne	2%
Stockholm	1%

All other national offices less than 1%.

Fields of technology:

Chemistry and related technology	: 45%
Mechanics and general technology	: 33%
Physics and electricity	: 22%

Initially the share of chemistry was considerably higher, namely over 55%. Since the opening of all technical fields for examination in December 1979, the balance is evening out. The EPO takes this as a further encouragement since it shows that the European route is used equally by industrial branches which traditionally are not looking for a country coverage as large as is usually the case with the chemical industry.

As far as the relation between the size of a firm and its patent policy is concerned, it has become apparent that the European Patent Office is not an authority used mainly by "Big Business" : 50% of the applicants are medium-sized companies (35%) and small firms or individual inventors (15%). This shows that the European route is in fact attractive for all categories of applicants.

IV PROSPECTS FOR THE FUTURE

What are now the prospects for the future development of the European Patent system?

As to the Munich Convention, there are good chances for more countries joining the present eleven Contracting States in the near future: Ireland for example has declared its intention to ratify, and there is reasonable hope that 1980 will be the year of success. As far as Denmark is concerned, an attempt to file a ratification bill was already made in 1978, but was withdrawn by the government since it would have failed to obtain the required 5/6 majority. We know that Denmark will make a second attempt since Denmark is a Common Market country and the community patent - which is based upon the functioning of the European

Patent Office under the Munich Convention - is an essential factor in the Common Market. Greece is another Signatory State whose policy in regard to the European patent may be influenced by the Common Market of which this country will become a member as from 1 January 1981. Contacts with the Greek authorities with a view to the ratification of the Munich Convention by this country are at present underway. As far as Spain and Portugal are concerned, here again the expected enlargement of the Common Market gives rise to some activity in regard to the Munich Convention. First consultations are at present underway at the political level as well as amongst the interested industrial circles.

As to the Luxembourg Convention, I have already mentioned that it has so far been approved by the parliaments of six EEC Member States. Ratification is also in progress in the Netherlands, but difficulties are being encountered in Ireland and Denmark. At the level of the Council of Ministers of the EEC, a political initiative is therefore being prepared and we hope that this will lead to the entry into force of the Convention in the next few years. In the meantime, an Interim Committee has been created in order to prepare the implementation of the Convention. One of the tasks of this Committee is to review the provisions of the Convention concerning litigation in respect of community patents and at the present time a proposal is under discussion on whether national courts of the first instance should be competent to revoke community patents. Such extension of competence of national courts would eventually be counter-balanced by the creation of a central community patent appeals court which would ensure the uniform application of the Convention in respect of infringement as well as revocation. However, the final outcome of these discussions cannot be foreseen at the present time, but it should be borne in mind that the adoption of a new system of litigation is not a pre-requisite for the entry into force of the Convention.

With the entering into force of the Luxembourg Convention, the European Patent Policy which started to emerge more than thirty years ago will have reached its final aim - a remarkable political achievement in Europe which will, I hope, stimulate similar developments in other fields as well.

PROMOTION OF RESEARCH, DEVELOPMENT AND INNOVATIONS IN THE FEDERAL REPUBLIC OF GERMANY

Dept.Research & Technology

H. Grunau

Promotion of Research, Development and Innovations in the Federal Republic of Germany

(1) In the following I would like to give you a brief survey of the promotion, development and innovations by the Federal Government.

(2) Goals of the Promotion Measures of the Federal Government

The starting position of the Federal Republic of Germany - as in most other industrial nations of the world - is determined essentially by the following factors:

- The vital resources raw material and primary energy are becoming scarcer and more expensive.

- The overtaxing of air, water and soil primarily in regions with concentrated population has reached in some instances alarming proportions.

- Due to rapid technical progress, production and with it the employment structures of the economy are changing more rapidly today than during the past 30 years.

- In important fields the great postponed demand of the post-war period has been met. Demand will not keep pace with growing production possibilities. This effect is additionally enhanced by the fact that a number of "threshold countries" have entered a phase of rapid industrial development and are increasingly also producing for export markets.

- The demand for services is growing, resulting either from achieved affluency or from increased demands on the infrastructural services, such as education, traffic and health.

In such a situation a close, concerted cooperation of economy and government is necessary to cope with the predominantly structural problems. In this the government promotion of research and development constitutes an essential element. With its research policy the Federal Government is pursueing the following points:

- improving of the general state of scientific information;
- improving the citizens' living and working conditions;
- ensuring the supply of material resources;
- maintaining an efficient, modern and thus competitive economy and thereby long-term job security.

In the area of economy, government research policy can encourage the enterprises to take risks and to be open to innovations but it cannot take their place. Actually, the government should give incentives to compensate distortions in international competition and assist in overcoming difficulties in structural adjustment.

2. Promotion Measures of the Federal Ministry for Research and Technology

Fig. 1 gives a survey of the program spectrum of the Federal Ministry for Research and Technology and a classification with respect to the aforesaid objectives of research policy. In 1979 the Federal Ministry for Research and Technology spent a total of approximately 5.5 billion DM for these promotion measures. In 1978 4.9 billion DM were appropriated.

The distribution of funds to the programs clearly shows the emphasis on energy research and energy technology, followed in about equal proportions by space research, technology for health, nutrition and environment, transport and traffic systems, data processing, the general promotion of sciences as well as basic nuclear research.

3. Measures of the Federal Government for Promoting Small and Medium-Sized Enterprises

After this survey of the promotion measures of the Federal Ministry for Research and Technology, I would now like to discuss in more detail the measures of the Federal Government for the promotion of small and medium-sized enterprises.

In the Federal Republic, the economic setup is characterized by a large number of small and medium-sized enterprises, which are staffed by the majority of all employees and produce over half of all goods. As a rule, small enterprises are very flexible and can adapt easily to new market situations. They represent a considerable and important innovation potential.

However, owing to their limited financial resources, their modest R&D capacities and their restricted possibilities for gaining information, small enterprises are increasingly exposed to the risk of not being able to keep pace with technological progress to the extent required in order to maintain their competitiveness.

The Federal Government has therefore introduced a number of measures designed to support small and medium-sized enterprises. These measures are to help the latter to gain better access to information concerning technical developments, to encourage R&D activities in these firms and to improve cooperation with research institutes.

These measures are summarized in the overall concept of the Federal Government for the promotion of research and technology for small and medium-sized enterprises, which was presented in 1978. Fig. 2 gives a survey of the measures, some of which I would like to explain in more detail.

3.1 External Contract Research

External partners play an important role in the innovation process in small and medium-sized enterprises, be it as advisers or as sources or suppliers of technological know-how or of R&D services. Available as partners of the enterprises are the institutes of technical colleges or universities, other publically subsidized research institutions, such as the Fraunhofer-Gesellschaft, but also private firms, such as engineering offices and the like.

For many smaller companies the establishment of own R&D capacities is too expensive and too uneconomical since they do not constantly need research.
They depend entirely on externally conferred development orders.

In 1978 the Federal Government approved a special promotion measure concerning external contract research for small and medium-sized enterprises. It consists of a grant from the budget of the Ministry for Research and Technology amounting to 3o% of the value of the contract subject to a ceiling of DM 12o,ooo.-- per enterprise and year. Grants can be awarded to any enterprise with an annual turnover of less than DM 2oo million, provided that the majority of its shares is not owned by a big firm.

The programm has been well received by the enterprises. To date, somewhat more than 9oo applications have been made with increasing tendency. Grants of as much as 17.8 million DM have already been awarded, which corresponds to a volume of 60 million DM in contract research. The target group of small enterprises has been reached; 75% of the applicants have had an annual turnover of less than 5o million DM. For the year 198o 1o million DM have been provided for the program in the budget of the Federal Ministry for Research and Technology.

The promotion of external contract research is not confined to specific research subjects. It is not a "program-oriented" but a cost-related ("indirect-specific") promotion measure.

3.2 R & D Staff Expenditure Grant

On 27 and 28 July, 1978, the Federal Cabinet decided - on the basis of the recommendations made during the World Economic Summit Conference held just previously - to award small and mediums-sized enterprises grants for R&D staff expenditure. In 1979 the sum of DM 3oo million was appropriated for this purpose in the budget of the Federal Ministry of Economics. The amount in 198o will be DM 39o million. This "R&D expenditure grant" is paid for the expenditure incurred during the preceding calendar year by small and medium-sized enterprises for taxable gross wages and salaries, namely 4o% for the first DM 3oo,ooo.-- and 25% for the amount exceeding DM 3oo,ooo.-- The grant is limited, however, to DM 4oo,ooo.-- per year per enterprise.

The grant is made available to those enterprises in the manufacturing sector whose headquarters and factories are located in the Federal Republic of Germany, whose average annual turnover during the three preceding calendar years is less than DM 15o million, or which employed less than 1.ooo persons on average during the same period amd a majority of whose shares are not held either by one or by several enterprises with an annual turnover of more than DM 15o million. There is no legal claim to grants. The grants are handled by Arbeitsgemeinschaft Industrieller Forschungsvereinigungen, industry' s autonomous organization mentioned earlier.
1979 4.821 enterprises had applied for R&D staff expenditure grants.

3.3. Advisory Services for Technology and Innovation

The hitherto described measures of innovation promotion aim at new internal or external R&D capacities and new R&D results. Moreover, it is economically sensible to make the continuously growing technological information available to potential users in the directest possible way. This applies particularly to small and medium-sized enterprises which often cannot afford their own R & D. A survey of these measures of the Federal Government for promoting technology transfer is given by Fig. 3.

The government promotion of the transfer of existing know-how sets in at two points: at the sources of technology, namely the technology potential of universitities, non-university research institutions as well as R&D intensive enterprises, and in the technology demand of potential users, that is to say particularly of enterprises. This, so to speak, sets the problem to organize a "market" for technological know-how.

I should like to draw attention to one measure in particular from the package, namely the advisory services for technology or innovation.

These services are to provide advice and assistance to small and medium-sized enterprises in connection with all questions involving technology, the possibilities it offers, and the opportunities and problems arising with regard to the innovation process in an enterprise. Help will for example be given in connection with the following issues:

- information on new products and processes using new developments and materials;
- assistance in the use of existing data banks;
- information on government promotion opportunities;
- cooperation with regard to negotiations on the acquisition of licenses and know-how;
- critical assessment of in-plant developments;
- recommendation of expert contractors for contract cooperation.

The innovation advisory services in the Federal Republic of Germany are developed largely within the framework of existing organizations. Since 1977, the Federal Ministry for Research and Technology has been providing initial aid for some of these services in the form of grants toward operation costs. In 1979, these grants amounted to approximately DM 4.6 million.

A "pluralistic" approach has been adopted for promotion. Several innovation advisory services concentrate their efforts on specific regions, whereas others - for the entire area of the Federal Republic of Germany - focus on specific techniques or on certain branches or on a particular category of "cliėnts". One of them, the (Technology Centre Berlin for the Application of Microprocessor Techniques of the Association of German Engineers) will be presented tomorrow. By adopting a multiple approach such as this, it becomes possible to make optimal use of established contracts and relations based on trust between organizations and enterprises.

The innovation advisory services charge no fees. However, the costs of more extended expertise obtained as the result of contracts during consultation must be borne by the enterprise receiving the advice. Special government funds are, however, available for this purpose which are administered by the sponsoring institutions.

Innovation advice is clearly a "service with a future". This is evident both from the considerable interest shown by small and medium-sized enterprises and from the fact that a number of Chambers of Commerce are establishing such advisory services without government assistance.

In addition to the above-mentioned measure, endeavors are underway which aim to establish an infrastructure oriented to technology transfer. These efforts include:

- improving access to available information by establishing specialized information centres, data banks and information agencies concerning patents;

O.N.V.R. - N.R.D.O.

FIFTH WORLD CONFERENCE

Munich, May 28-29, 1980

SPEAKER: Mr. Christian MARBACH, Managing Director of ANVAR.

ANVAR'S NEW METHODS FOR THE PROMOTION OF FRENCH INNOVATION.

The French Government Council of Ministers held on January 17, 1979, decided to improve the means available to encourage innovation in France while, at the same time, simplifying and decentralizing the existing structures in order to increase their efficiency and accessibility for small- and medium- size businesses. With this in mind, a certain number of measures were adopted during 1979. Among them the reform of the French National Agency for Research Development (ANVAR).

The main objective of this reform was to improve the insertion of the necessary economic means into all the stages of the innovation process.

I would like, first, to recall ANVAR's role up to the recent reform:

ANVAR was created in 1967, in order to:

- assist the commercialization of the results of scientific and technical research carried out by public companies and departments;
- assist private inventors and private sector businesses.

During the past twelve years, this Agency has studied more than 18,000 dossiers and aided several thousand inventions. By the end of 1979, it managed 700 licenses granted to 600 companies, and more than 6000 patents.

In practice, it has come up against two sorts of difficulties:

- On the one hand, financial means were lacking at the experimental level, which is necessarily found between the research and the development stages.
- On the other hand, the centralization and complexity of the procedures rendered access difficult for small- and medium- size firms, which are a particularly fertile source of innovation.

The reorganization of ANVAR aimed at correcting these gaps.

The reform proposed:

a) - To enlarge the Agency's task concerning scientific and technical information so that it would become the pivot of a coherent and straight-forward system of assistance for small- and medium- size companies developing innovation,

b) - to broaden the role of ANVAR with respect to the development of assistance through public funds, thus contributing to the development and renewal of the French industry structures,

c) - to place ANVAR under the sole and direct control of the Ministry for Industry and to modify the composition of its Board with the Government Delegate for Innovation and Technology, becoming its President.

All this was accepted by our Government, and the details were worked out in tim

The Ministry for Industry will henceforth be in a position to combine ANVAR's action with that of industrial policy, notably in the fields where coordination at a national level is necessary. The financial ability of companies to carry out their projects will be verified, case by case, by specialized organizations.
ANVAR will be in charge of drawing up and ultimately ensuring the necessary property protection with regard to innovation promoted by the State.

Three complementary lines of action have been established so that ANVAR may carry out these tasks effectively:

1° - Continuity in its role of developing and promoting research results,
2° - Organization of financial assistance for innovation,
3° - Solid regional implantation.

Of these three lines of action, I would like first to deal with:

THE SETTING-UP OF ANVAR IN KEY PROVINCIAL REGIONS:

Twenty-two "Regional Delegates" have been appointed by ANVAR, and all "Regional Delegations" for which they are responsible, were set up before the end of 1979.

These organizations will undertake to distribute assistance in a decentralized manner, so that the small- and medium- size firms may benefit significantly. They will have considerable independence and the accounting procedures of ANVAR will guarantee the use of Regional contributions received for the development of regional actions.

Furthermore, an "Orientation Committee", representing the scientific and economic sectors involved, has been created in each regional Delegation, which it will "assist" and "guide" as specified in the Governmental decree.

Thus, part of ANVAR's new mission may be determined as:

- developing a network to stimulate and give advice so that the sectors of research and industry may better express themselves. This network of Regional Delegations organized throughout the whole of France, intends to work in conjunction with other public and professional bodies, in particular with the Chambers of Commerce and Industry, in order to assist companies ;
- to define their needs through technical studies and market researches ;
- to have access to all available scientific information ;
- to have contact with all French scientific laboratories or research centers. The latter, and particularly those coming under the Ministry for the Universities, may of course apply directly to industry if they wish to commercialize their own results ;
- to develop progressively, in each region, a unique meeting place for industry which enables it to obtain information, technical assistance and access to all the means, financial and others, available through the State.

Industry, notably small- and medium- size companies, should now find in the new ANVAR an active partner, with a much broader field of activity than in the past.

<u>The second of ANVAR's new missions is in the field of economic reorganization related to innovation</u>. Thus, it has been decided to replace existing aids for development and pre-development by a single procedure of "AID TO INNOVATION".

This "AID TO INNOVATION" will replace and extend the existing processes of "AID FOR DEVELOPMENT" (a loan, upto 50% of the strict development cost, non reimbursable in the event of failure), and "PRE-DEVELOPMENT AID" (subsidy granted to a research center, cooperating with a company for the purpose of improving the transfer of technology to the economic sector).

The "AID TO INNOVATION" comprises the following:

- Its general aim is to promote innovation and technological progress, and may concern all the phases of the innovation process: filing applications for, or extending patent protection, market researches, complementary experimentation, prototypes and development.
- The beneficiary may be a company, a research organization, a person acting individually, or several acting in association.
- The requests for assistance are evaluated with respect to the technical quality of the programme, the degree of innovation, and the economic interest of the products or processes (in particular the prospects of commercial outlets).
- The aid will be in the form of either an advance or a subsidy ; ANVAR is however in a position to pursue, through another company, a programme which would have not reached a satisfactory conclusion with the benefit of the aid.
- The technical evaluation of the requests for aid is the responsibility of the services or agencies of the Ministry on whom they depend, or ANVAR. "Crédit National", a division of the Finance Ministry, continues to carry out the financial investigations.

The Regional Delegations are authorized to take decisions for this aid up to 500,000 francs - a threshold to be crossed in the future. Above this amount, and, at the national level, the final decision has to be taken by the Managing Director of ANVAR, after consultation with either a national commission, or a regional commission. The latter, of course, being under the chairmanship of the Regional Delegate of ANVAR.

The "AID TO INNOVATION" will amount, in 1980, to 400 million francs out of the budget of the Ministry for Industry.

<u>The third objective of the new ANVAR will be to help financially the small- and medium- size industries active in innovation.</u>

A completely new procedure has been set up for them: "BONUS FOR INNOVATION". By this means, ANVAR will automatically reimburse 25% of the work contracted out to laboratories or to experts (up to an amount of 1 million francs per company and per year).

A wide-ranging policy will be adopted, concerning the choice of work carried out, as well as the conditions of ANVAR's acceptance. The objective of this original procedure is clear: it must ensure an ever-increasing scope for useful cooperation between the world of research and that of industry. This subsidy is intended for companies employing less than 2,000 persons and not controlled by business concerns quoted on the Stock Exchange.

The expenditure considered will be that paid to either public or appointed private research organizations, or scientific or technical experts appointed by ANVAR. The object of the research may be the development of new or improved products or processes, and studies or initial development of technical processes.

The bonus will be paid by ANVAR upon receipt of pro-forma bills, and corresponding technical reports supplied by the beneficiary.

The corresponding sums will be included in the budget of the Ministry for Industry which will conclude with ANVAR the appropriate convention. For 1980, a first amount of 15 million francs is available for the "INNOVATION BONUS", and more money will be released for this purpose when necessary.

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These recent means, which our Government has made available, must be continually adapted to the changing world of innovation. ANVAR has fixed itself an objective: to become, for its clients, a national and international cross-roads, and to compile for them the best collection of data concerning inventions and new techniques available, in cooperation with other existing agencies and organizations in France and abroad.

LEGISLATIVE DIRECTIONS IN THE USA FOR ENHANCEMENT OF INNOVATION

Research Corporation

W. Marcy

Directions in the United States for Enhancement of Invention

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There is no question but that technological innovation has contributed to economic growth in the United States. However, the importance and effects of this factor have only recently been recognized by American economists. Preoccupied with such absolute concepts as static endowments and quantities of land, labor and capital, students of the industrial society have ignored dynamic factors such as technological innovation and industrial know-how. Emphasis has been placed on other, more easily quantified policy, influencing economic growth, such as fiscal and monetary policy, industrial organization, exchange rates, inflation and the effects of various wars, hot and cold. Besides, until the late 1960s, technological innovation was perceived to be proceeding in a historically normal manner, producing ever more new products and processes. Why technology was even able to put a man on the moon!

By about 1974, however, cumulative evidence began to indicate that subtle changes were taking place and that the American economy was reaching a critical stage and a turning point might be approaching. Throughout the 1950s and 1960s Western Europe (except Great Britain) and Japan experienced higher growth rates of gross national production than did the United States. Whereas Japan was growing at 13% annually and Western Europe at 7%, the United States was showing only 3% to 4% rates. The U.S. share of world gross national product had fallen from about 40% in 1950 to 30% in 1970 while the Common Market share had risen from 11% to nearly 15%. The United States, like Great Britain, was tyring to hold its own in older areas of technology - steel, automobiles, ship building and the like - but had lost its lead in newer technologies, such as electronics, where Japanese firms were taking over.

While these changes were taking place the composition of American imports and exports reflected a decline in the industrial economy, a substantial trade surplus becoming a perennial deficit. At the time some economists viewed these changes as short-term and easily reversible, but other, more astute economic specialists felt that a long-term decline in America's capacity for technological innovation was responsible. American productivity had also shown a declining rate of increase over the two decades from 1950 to 1970, so that this rate was substantially lower than that in the country's major competitors in the 1970s.

In effect the United States had lost many of its technological advantages and had to compete against other industrial countries on a price basis with low profit margins. In addition, new products for both internal use and export were being generated more slowly through innovation in the civilian industrial sector. Moreover, during the 1970s other major economic challenges appeared: OPEC oil price escalation; double digit inflation; threats of resource shortages; and heightened environmental awareness. As a consequence, it is clear today to both governmental and private sector leaders in the United States that a long-term strategy of economic and industrial rejuvenation is necessary.

During the past few years much thought and study has been underway to define the factors contributing to the perceived technological decline and to develop rational means for reversing it. Among those factors examined have been economic and trade policies; environmental, health, and safety regulations; tax policies and venture capital formation; federal procurement practices; direct federal support of research and development; policies governing patents and information transfer; antitrust regulations; and managerial philosophies and practices affecting research and development.

In this paper I single out three areas where intense study is currently underway, indicating the type and extent of expected activity as a result of this study.

Basic Research and the University-Industry Interface

Truly basic research in the United States is almost exclusively performed in universities. Financial support for this research is provided almost exclusively by the Federal Government through a combination of contracts and grants from most of its agencies.

The current notion in government, industrial and academic circles in the United States is that the fruits of basic research are the basis for technological innovation. If technological innovation in the United States is faltering, as it seems to be, basic research is being neglected in some manner: either it is being underfunded and not being done, or its results are not being transferred to the industrial sector where they can be developed into useful products and processes.

Without recounting all the studies and evaluations that have been performed, suffice it to say that both of these possibilities have been deemed deficient. Programs have now been and are being developed to enhance and improve both the support of basic research and the transfer of the results obtained to industry.

Table I gives some perspective on the magnitude and type of support of basic research by the Federal government. By comparison, industrial support, either in-house or at universities, is insignificant, and support from other sources, such as foundations, is less than 0.5% of the government support.

Comparison with other countries of expenditures on basic research is not possible since definitions of basic research differ and most countries do not breakdown such expenditures into basic and applied research or development. However, using as a criterion total research and development budgets in dollars or dollar equivalents and percentage of gross national product, data for representative industrial countries are given in Table II. It is easily seen (from Table I) that the United States Government spends far more money on R and D than the governments in other industrial countries, but that the total amount spent by government and industry together as a percentage of gross national product, while comparable to the other countries, is declining rapidly, whereas this percentage is rising in Japan and West Germany (Table II).

A preponderance of R and D expenditure in the United States is for defense and space and most of this is for applied research and development rather than for basic research. Thus, the amount of money spent for basic research is only, roughly, about 17% of the total R and D budget. Even so the dollars spent range between $3 and $4 billion annually.

Since major support for basic research at universities has been primarily from governmental sources for most of three decades, industry has lost touch with what basic research is actually being performed. While most of the research results are published eventually, no general systematic procedure has been developed for the transfer of these results in usable form to industry. Recognition of the need for more effective information transfer methods has now developed and enhanced methods are perceived as much needed linkages between universities and industry.

A number of ways in which the closer ties between industry and universities can be achieved have been proposed, and most of them are being or will soon be pursued. Secondary objectives also sought as a consequence of these enhanced relationships are a broader educational experience for students; potential employment opportunities for university graduates; and stimulation of faculty members through interaction with industrial scientists, engineers and managers. The strengthening of both the academic and industrial sectors is expected to enhance the quality and relevance of research; the stability and robustness of the research enterprise; the breadth and problem-solving capabilities of university graduates; and the world competitiveness of the United States industrial sector.

One of the most important barriers which needs to be overcome before smooth-working relationships can occur is the difference in management philosophy between universities and industrial companies. These philosophies are not incompatible and their differences can be ameliorated by a development of mutual respect and understanding. Ownership of proprietary information poses another barrier which can be overcome by diligent discussions and imaginative arrangements. The high risks inherent in basic research have to find acceptance by industrial managers; the requirement for much additional research and development before commercial products are possible must be understood by academics.

In spite of these and many other inhibitions, barriers and difficulties deterring the establishment of productive university-industry relationships, many specific arrangements are possible. Table III, summarizing the range of the usual and obvious ones, shows how diverse these can be.

Opinion is divided over the proper Federal role in the initiation and maintenance of university-industry research partnerships. The present consensus appears to be to minimize this role, limiting it, perhaps to the supplying of seed money at the beginning of an untried relationship, such as the multipartner consortium arrangement, and to providing information clearing houses, such as is done presently in a limited way by the National Technical Information Service. Other ways the Federal government can influence university-industry relationships are mentioned in the discussion of the recently publicized Domestic Policy Review program to which I now wish to turn.

Domestic Policy Review

About two years ago, soon after the advent of Mr. Carter as President, the Department of Commerce was charged with making yet another comprehensive study of the United States economy with particular emphasis on how to improve technological innovation. Responsibility for conducting this survey was delegated to the Assistant Secretary, Dr. Jordan Baruch, who worked closely with Dr. Frank Press, Director of the Office of Science and Technology in organizing and carrying the study through. The study involved over 250 officials from 28 government agencies, and some 500 representatives from industry, academia, labor and public interest groups. A final report was delivered to President Carter in May 1979, and Presidential decisions based on the report were delivered to Congress on October 31, 1979. The final document is known popularly as the Domestic Policy Review (DPR) and details a listing of industrial innovation initiatives proposed as first steps in reversing the declining trend in innovation in the United States. The steps to be taken provide a signal to the private sector that technological innovation is valued by the Federal Government and that it is Federal governmental policy to preserve and promote it. If the initiative are implemented, over time it is expected that the rate of innovation will increase and a climate will be established in which it will flourish.

The nine areas singled out for immediate attention include:

Enhancing the Transfer of Information

Two areas are to be emphasized first.

The existing major general channel of communication between federal laboratories and industry, the National Technical Information Service (NTIS) will be augmented through the creation of a new Center for the Utilization of Federal Technology with the mission of improving the transfer of knowledge from federal laboratories to industrial users. In fiscal year 1981 $1.2 million is expected to be spent with about $2 million being allocated annually thereafter.

The NTIS will undertake to collect, translate and make available to industry information on foreign technological and scientific advances which are now virtually untapped in any systematic way in the United States. The first year cost for this endeavor is expected to be about $1.8 million. In addition the Departments of State and Commerce are to cooperate in obtaining similar information from returning overseas visitors, science counselors and other technologically oriented travellers. A cost of $2.4 million is estimated for fiscal year 1981.

Increasing Technical Knowledge

Basically this involves direct governmental investment in the development of technologies, a new area of government support in the United States. Three directions will be supported at first:

Support for generic technology development through the establishment of nonprofit centers at universities or other private sector sites, jointly financed by industry and government with Government's share decreasing with time. Four centers are to be established in fiscal year 1981 at a total cost of $6 to $8 million.

A bolstering of the existing effort by regulatory agencies to develop effective and efficient technologies to meet mandated environmental, health and safety regulations. The estimated cost of this endeavor has not yet been determined.

Improvement of industry-university collaboration on research and development. A new program, begun in fiscal year 1978 in a small way by the National Science Foundation, will be built up to about $20 million in 1981 and alike amount annually thereafter. In addition similar programs will be undertaken at other agencies, including the Department of Defense, Department of Energy, Environmental Protection Agency and National Aeronautics and Space Administration. An aggregate amount of $150 million annually is anticipated eventually.

Strengthening the Patent System

Three efforts will be supported:

A uniform government policy regarding patent rights ownership is to be established, overcoming the present chaotic and contradictory individual policies now being used by over thirty governmental agencies. Disposition of patent rights ownership and/or exclusive licenses will be provided where necessary to contractors and industrial users. The policy proposed by the Executive Branch differs from and is more restrictive than that proposed in legislation being promulgated by the Congress. The Congressional approach is expected to prevail.

Patent Office reform will be sought to improve the presumption of validity of issued patents and to reduce the cost and frequency of defending patents in the courts. This is to be accomplished by upgrading the Patent and Trademark Office's (PTO) filing and classification system, establishment of a single court to deal with patent appeals (many different courts now have jurisdiction), and provision for a voluntary reexamination procedure by the PTO.

Offices will be established in the Small Business Administration and Office of Minority Business Enterprises to assist inventors in the transition from invention to the establishment of a small business for commercial exploitation of inventions.

Clarifying Antitrust Policy

Provide a clear, unambiguous guide in conformance with present antitrust laws to be formulated by the Department of Justice, working together with the Federal Trade Commission and the Department of Commerce, to enable effective collaboration between industrial companies in support of joint research and development for mutual technological and societal benefit. An initial collaborative program in the automotive industry was announced in May 1979.

Fostering the Development of Small Innovation Firms

On the assumption that small, high-technology firms provide the majority of new innovations in the United States, four programs will be supported to provide start-up capital, second-round financing and early management assistance:

The present National Science Foundation Small Business Innovation Research Program which provides funds for making venture analyses for new projects and demonstrating technological feasibility will be expanded. For fiscal year 1981 $10 million has been provided. NSF will work with other agencies to determine whether similar programs should be established. Coordination of these programs and further expansion to $150 million annually is planned under the direction of the Office of Management and Budget.

Establishment of State or regional Corporations for Innovation Development (CID) modeled partly after "the successful National Research and (sic) Development Corporation in Great Britain" and existing similar state corporations. These corporations would provide direct equity funding for start-up, guidance to and second-round guarantors for potential applicants to the NSF Small Business Program, early management assistance, and recipients of Economic Development Assistance funds made available for entrepreneurial ventures. The Federal government will support two regional CIDs in fiscal year 1981 to the extent of $4 million per center on the condition that the region will provide matching funds.

Encouragement of governmental contracting agencies to develop procedures for ensuring that small businesses are not unfairly excluded from competition for contracts; to publicize better opportunities for bidding on contracts especially appropriate for small businesses; and to report annually to the Office of Management and Budget on progress made toward increasing small business participation in the performance of governmental contracts.

Making venture capital more available for investment in small businesses through relaxation of current regulations restricting such use of public monies and private pension fund assets.

Opening Federal Procurement to Innovations

A pilot program, the Experimental Technology Incentives Program, has demonstrated during the last five years that the government can use its purchasing power to spur innovation. The methods developed in this program will be made general policy and used by all governmental agencies wherever feasible. Basically, performance rather than design specifications, and life cost rather than initial purchase price will be used in procurement of items for government use. Special attention in procurement procedures will be given to innovative small and minority businesses.

Greater publicization within the Federal government will be given to the existing New Item Introductory Schedule which lists new items available commercially which might be used by the Federal government itself.

Improving the Regulatory System

While a number of changes in the regulatory system have recently been put into effect, additional changes are proposed to stimulate innovation. These include:

Substitution of performance for design or specification standards in the Environmental Protection Agency programs.

Preparation by all regulatory agencies of five-year forecasts of their priorities and concerns for future regulations under consideration, thereby allowing industry to plan its research and development more effectively.

Expediting clearances for those products that are most innovative and/or have exceptional social benefits.

Expediting the introduction of new drugs in the United States by taking best advantage of foreign experiences surfacing during the U.S. drug clearance process.

In addition to these direct-action programs, recognition is being given to the effect of innovation and technical obsolescence on labor. To alleviate undue stress on labor a long-term labor-technology forecasting system is to be established. The forecasts would provide early warnings of impending changes due to innovation which would allow time for retraining and orderly adjustments by both industry and labor.

To provide a clearly perceived favorable climate for innovation, the Department of Commerce and NSF will host a national conference for deans of business and engineering schools to stimulate improved curricula in technology management and entrepreneurship; a Presidental plaque will be awarded annually to innovative companies in six areas: transportation, communication, health, agriculture and food, natural resources, and energy; and the existing Productivity Council will be charged with monitoring innovation, developing policies to encourage it, assisting governmental agencies in implementing these policies and pursuing the removal of legislative or administrative barriers to the innovation process.

In his message to Congress conveying these initiatives the President recognized that by themselves these are merely first steps and would not solve all current difficulties in encouraging innovation. He pointed out that, under the economic system of the United States, industrial innovation is primarily the responsibility of the private sector, and that, while the Federal government can establish a climate conducive to innovative activity, it is ultimately the decision of the company manager that determines whether innovation will actually take place. The President also recognized that appropriate changes in existing tax laws could make available additional venture capital and encourage further research and development. However, changes of this nature require a broad economic assessment and would have to be studied more extensively before specific programs are devised.

This program has received a mixed reception in all quarters. The consensus seems to be, however, that the program is generally satisfactory in what it proposes, but that it is only a few small steps in the right direction. The program is probably as extensive and imaginative as could be devised at this time considering the democratic process used to develop it, and it probably will be acceptable to the political, economic, financial, legal and industrial sectors as well as to the public at large.

Implementation of the program will probably not take place quickly, especially those items not scheduled for financial support until fiscal year 1981 which begins October 1, 1980. Statutory authority already exists for undertaking most of the programs.

Congressional Action

Many Congressional leaders have expressed displeasure with the Presidential proposals and impatience with the apparent lack of planned follow through as expressed in the Domestic Policy Review program, particularly where it deals with assistance for small businesses and tax incentives. As a consequence, a number of bills have been introduced in the present session of Congress starting early in 1979, and many Congressional committee hearings and task force studies have resulted in the accumulation of a large volume of information from many sources relating to methods for the enhancement of innovation. The remainder of my talk will review briefly the more important proposed legislative thrusts.

Patent Legislation

Congress appears set to resolve the long-standing debate on a uniform government patent policy. The primary issue is whether title to patents resulting from government funding is to remain with the Federal government or to be allowed to pass to the contractor performing the research. Bills have been introduced into both the Senate and the House of Representatives which would allow small businesses and nonprofit institutions to retain title to such patents. The Senate bill has been passed by the full Senate, and House action is awaited on the corresponding bill in that body. Bills have also been introduced into both Houses providing for contractor ownership of title regardless of size or type of business. These bills await further action.

More recently separate bills have been introduced into the Senate proposing that a single patent appeals court be established replacing the present use of multiple court jurisdictions; providing for a reexamination procedure whereby issued patents could be challenged on the presentation of newly discovered prior art; and proposing that the Patent and Trademark Office be constituted as a separate governmental agency instead of its present status as a subunit of the Department of Commerce.

Innovation

Special task forces have been set up in both Houses of Congress to review the whole matter of technological innovation with an ultimate goal of formulating suitable legislation to enhance the process. Many hearings are being and will be held by these task forces and by subcommittess of Congressional committees studying draft bills before definitive legislation emerges, and this will take much time. Meanwhile, a number of bills of relatively narrow scope already introduced in both Houses are at various stages of the legislative process.

One of these is a bill passed by the House designed to stimulate innovations in the materials area. A counterpart bill has not yet been introduced into the Senate.

Another bill introduced into both the Senate and House proposes the establishment of an Office of Industrial Technology within the Department of Commerce, and, as complementary and satellite offices, jointly funded centers for industrial technology at universities around the country.

The House is also considering draft legislation which would create a National Technology Foundation to promote technology for national welfare and coordinate governmental activities in the area. A Senate committee is also considering draft legislation which would provide that each federal laboratory with a budget in excess of $50 million would establish a technology utilization laboratory.

Energy

Both Senate and House have passed basic synthetic fuels bills which are currently being considered in conference between representatives from both Houses, and a number of subsidiary bills are also under consideration. The final bill or bills to emerge will probably include the setting up of an overall authority to coordinate efforts and allocate resources to develop innovations in the energy area, including solar, tidal, geothermal and wind power energy sources. Low interest loans, outright grants and tax incentive programs will also be included. A companion bill setting up an Energy Mobilization Board is also likely to see final Congressional action shortly.

Taxes

Major tax legislation directed towards enhancing the climate for technological innovation has not been considered in detail yet by this session of Congress, but a number of proposals having specific objectives are being studied by several House committees, where tax legislation originates, prior to drafting formal bills for legislative consideration. These proposals include, among other ideas, rolling back taxes on businesses and reducing individual income tax rates, both of which would be expected to increase the availability of venture capital. A more specific proposal under consideration involves tax credits and deductions to companies that contract with universities to sponsor basic research. Another proposal which has been embodied in a formal bill provides for a faster write-off procedure for plant and equipment depreciation than is allowed under the currently used useful-life concept.

Regulatory Procedures

Legislative action to alleviate the effects of unduly restrictive governmental regulations in both the environmental and health area is complex and fluid. Predictions about passage of any legislation would be meaningless at this time. However, the general tenor of the studies and reviews currently underway is to try to find acceptable ways for ameliorating the more restrictive regulations without bringing harm to the public health or safety.

To summarize this brief presentation, it should be obvious that a general perception is present at many policy-making levels in the United States that a new era has dawned when old economic theories and practices are no longer pertinent or even appropriate, when natural and energy resources will be in short supply, and when environmental and health problems will be entirely different from those faced in the past. Public perception appears to be that, to cope with societal problems in this new era, technological innovation must be enhanced, basic scientific research must be fostered and a greater degree of interdisciplinary cooperation must be developed. After much discussion, study and review of alternatives, it appears that action is planned or is underway on many fronts in the United States to correct perceived deficiencies and to meet the challenges of the next decades.

Table I

Government Support of
Basic Research
in the United States
(Dollars in Millions)

	1969	1979	Proposed Budget 1981
Department of Health and Human Services (formerly Department of Health, Education and Welfare)	$ 371	$ 982	$1,840
National Science Foundation	248	755	952
National Aeronautics and Space Administration	380	520	581
Department of Energy	285	468	593
Department of Defense	277	371	523
Department of Agriculture	107	267	324
Department of the Interior	55	168	78
Other agencies	58	106	182
Totals	$1,779	$3,637	$5,073

Source: National Science Foundation as reported in Science and Government Report, December 15, 1979

Proposed Budget for 1981 - Chemical and Engineering News, 4 February 1980

Table II

Expenditures on
Research and Development

	Government only (Dollars in Billions)		Total Government plus Industry Percent of Gross National Product	
	1967	1975	1967	1975
France	$ 2.0	$3.7	2.1	1.8
Japan	1.0	5.3	1.5	1.9
United Kingdom	1.2	2.7	2.3	2.1
United States	15.1	20.9	2.9	2.3
West Germany	2.1	6.5	2.0	2.4

Source: National Science Foundation Science Indicators 1978

Table III

Types of University - Industry Relationships

Undirected Contributions by Industry

Gifts, monetary and physical equipment, for departments, centers or laboratories
Fellowships for graduate student stipends

Procurement of Services

By university: prototypes, testing; on-the-job training for students; advisors and consultants
By industry: education of employees; contract research; consulting services
Industrial Associates: multicompany access to university resources for fee

Cooperative Research

Specific projects of mutual interest: usually basic, non-proprietary research with no exchange of funds
General programs: single company support of portion of programs of special interest to the company; variable amount of personnel interaction
Consortia: multicompany support of basic and applied research on generic problem; special reports, briefings, frequent access to facilities and personnel

Research Partnerships

Long-term research program in areas of mutual interest and significance; contractual arrangements; substantive contributions by both parties

Source: Adapted from a paper entitled "Research and Innovation: The Role of University-Industry Research Partnerships" by Denis J. Prager and Gilbert S. Omenn, Office of Science and Technology Policy

Table IV

Congressional Recent Actions

Identification of Bills as Introduced into the 96th Congress	Major Purposes of Bills
S. 414 H.R. 2412	Uniform government patent policy for small businesses and universities
S. 1215 H.R. 5715	Contractor ownership of title to patents from federally funded research
S. 1477	Single patent appeals court
S. 1679 H.R. 5075	Reexamination of issued patents
S. 2079	Patent and Trademark Office to have separate agency status
H.R. 2743	Stimulation of innovations in the materials area
S. 1250 H.R. 4672	Establishment of Office of Industrial Technology and jointly funded centers for technology at universities
S. 932 H.R. 5726 H.R. 605 H.R. 4471 H.R. 5187 H.R. 5892	Expedite research and development of synthetic fuels and other non-conventional energy sources
S. 1308	Establishes an Energy Mobilization Board
No Major Formal Bills Introduced Yet	Tax relief tied into research and development expenditures; loosening up venture capital; increasing funding of basic research by industry
Many Bills Directed to Specific Technological areas	Amelioration of restrictive regulations consistent with high standards of protection of public health and safety

EMPLOYEE INVENTOR REMUNERATION

Patentstelle für die Deutsche Forschung

W. Hauf

EMPLOYEE INVENTOR REMUNERATION

by Dr.W. Hauf

Patentstelle für die deutsche Forschung (FhG)

I. The aim of this contribution here cannot be a lecture on the complex matter of the right on employees' inventions and the practice of their compensation in an international scope.

After giving you a rough survey of the existing legislation in some other countries in Table I, I would like to set forth the basic features of the German Law on Employees' Inventions and leave the consideration of some examples to the discussion.

Table 1: Service Invention and its Compensation. - Legislation concerning Employees' Right on Inventions.

Austria:	Since 1897, modified in 1925 (included in the Patent Law).
Belgium:	Individual contracts between employer and employees.
Denmark:	Law on Employees' Inventions since 1955.
France:	Individual contracts between employer and employees; partly special regulations for civil servants. Section 68 (co-propriété) in the patent law since 1968; replaced by Law on Employee Inventions since 1979 (4th Sept.).
Federal Republic - of Germany:	Regulations in chemical industry of 1920. Law on Employees' Inventions since 1956.
Italy:	Since 1939, included in the Patent Law.
Netherlands:	Since 1910, included in the Patent Law.
Sweden:	Law on Employees' Inventions since 1949.
United Kingdom:	Jurisdiction on the basis of the Civil Law; since 100 years; Section 56 of the Patent Law.
China:	Decrees of 1963 on compensation of employee inventors.
Japan:	Since 1903; Section 35 of Patent Law (1959); directions for compensation of inventions made by civil servants.
U.S.A.:	Individual contracts between employer and employees; preparation of legislation ("Moss Bill" since 1970).
USSR:	General regulations; decrees of 1973 and 1978; (certificate of authorship).

First I would like to draw your attention to the fact that the Law on Employees' Inventions of the Federal Republic of Germany of July 25, 1957 with minor modifications is published in English in the monthly review "Industrial Property" 1972, page 226 (and following pages), in French in "La Propriêté Industrielle", page 236. In connection with this law you will find the Directives on the Compensation to be Paid for Employees' Inventions Made in Private Employment of July 20, 1959, also in English.

In the same review of 1972 on page 249, in French page 259 (and following pages) a report of the former chairman of the German Arbitration Board, Dr. Schade, is published, entitled: "Employees' Inventions, Law and Practice in the Federal Republic of Germany".

In spite of its shortness, this study gives a good survey on the problems arising from the German law and from the directives mentioned above and certain indications to solutions as far as they are possible in so concise an articles.

II. 1. Contrary to most regulations in other countries, the German law starts from the principle that, according to Section 3 of the German Patent Law, an invention first belongs to the inventor.

If this invention is a so-called service invention, the employer has the right to claim this service invention. By the claim,which is made in a written statement addressed to the employee, the right to the invention passes to the employer. The claim is a unilateral declaration taking effect when received. We call it an "unlimited claim". The law provides also for a "limited claim". In this case the employer gets only a non-exclusive license.

The German law defines a service invention as follows:

> Service inventions are inventions made during the term of employment which either resulted from the employee's obligations in the private enterprise or in the public authority or are essentially based upon the experience or activities of the enterprise or the public authority.

An invention is not only considered a service invention, if its subject matter belongs to the tasks of the employee but also if it belongs to the area of responsibility which is assigned to him by the enterprise. Concerning this fact, it can be laid down as a principle that the greater the area of responsibility, the higher the position of the employee within the hierarchy of the enterprise.

2. Referring to the German law, the original right of the employee is changed by the claim of the employer into a right to a fair share; all service inventions are to be compensated on principle and not only those with an "outstanding benefit", as it is the case e.g. in the new British law.

   The consequence is that a German employer has to compensate on principle more inventions than employers in other countries.

3. The German employer has to file immediately a domestic application for a patent or a utility model based on that invention, unless he sets the inventions free or the employee agrees that no application is to be filed or the service invention is not to be disclosed.

4. If an employer intends to stop prosecuting an industrial property application for a service invention or to give up an issued grant or registration before he has fully

met the demand of his employee for a reasonable compensation, he has to inform his employee accordingly and, at the employee's request and expense, must assign the rights to him. Full compensation has only been paid, if a lump sum has been given.

The last mentioned provision is to enable the employee to exploit the invention, if his employer is no more interested in it. In the meantime, however, this provision has become a bond for those enterprises which use their patents extensively in domestic or even international exchange contracts. If the other contracting party does not explicitly agree to the surrender of the patent and to the possibility of an assignment to the inventor, the employer cannot surrender such patents or applications, unless he satisfies the inventor. Particularly worthless patents, which by their subject matter belong to such an overall contract, cause considerable difficulties, which could not be solved in a way suitable for all cases.

5. The protection of the employed inventor granted by the German law is very extensive, because <u>every</u> agreement, made before the notification of the invention, is considered to be ineffective, if it is to the detriment of the employee, and an agreement made after the notification is ineffective too, if it is manifestly inequitable (Sections 22 and 23 of the German law). But this inequityhas to be invoked within six months following the term termination of the employment contract.

6. In assessing compensation, due consideration must in particular be given to the commercial applicability of the service invention, the duties and position of the employee in the enterprise, and the enterprise 's contribution to the invention (Section 9 of the German law).

7. According to the German law, in all disputes between employer and employee as a result of this law, the Arbitration Board is the first body to be approached. Such an appeal is not necessary if the employee has left the employer's enterprise. Otherwise the courts having jurisdiction in patent litigation (according to Section 51 of the Patent Law) are competent, and not the Labour Courts.

8. One provision of the German law which was considered to be very effective during the legislation proceedings was not so in practice. This is the "limited claim", subject matter of Sections 7, subs. 2, and 10 of the German law. It is very seldom used in industrial economy but sometimes in public authority.

The reason is that, after having stated such a claim, the employer, in dealing with his employee, may not contest the inventions' eligibility at the time of claiming industrial property protection, unless a decision to this effect has been rendered by the Patent Office or a Court of Law.

This risk is normally too high for the employer, even though Sect. 10 provides that the claim for compensatipn does not arise before the beginning of the exploitation by the employer.

This is an exception from the principle of monopoly, the principle of the German law. As the employee is not obliged to file an application for a patent or a utility model, no protection may be obtained and nevertheless the employer has to pay compensation.

However, two decisions of the German Supreme Federal Court with the key-words "Cromegal" and "Gleichrichter" (i.e. rectifier) were caused by this provision. In analogy to this provision, the Court decided that also in the cases of unlimited claims a temporary compensation is to be paid as soon as the employer has claimed the invention and exploits it. Its amount depends on the probability of whether the patent will be issued or not. The compensation paid cannot be reclaimed even if no patent is issued. Even if a patent application has been finally refused, the employer has to pay a temporary compensation, if he has used the subject matter of the invention prior to the refusal. That is the essence of the decision "Gleichrichter". These decisions are strongly critized in Germany. However, the Federal Court is not inclined to change its interpretation of the law.

III. Section 9 of the German law gives only a few clues for the evaluation of the compensation. For that reason the Federal Minister of Labour has issued directives "according to Section 11" for assessing compensation. These directives consist of 43 single recommendations. They are not mandatory. Nevertheless, the German directives are used by the employers, employees, the Arbitration Board and the Courts and they are only modified or disregarded in exceptional cases.

They can be divided into three main parts, i.e.:

1) the ascertainment of the "invention value",
2) the finding out of the "participation factor",
3) calculating the compensation payment.

The German directives consider the "invention value" to be the amount which an independent inventor would receive for the sale or use of a similar free (non-service) invention. This may be current royalties or a lump sum.

The inventions can be issued as a patent or be registered as a utility model, according to Section 2. The value of a utility model is normally considered to be lower than that of a patent. But there are exceptions, for instance the branches dealing with swiftly moving goods, like toys.

First of all we distinguish internal and external use of a service invention. External use can be the issuance of a license or a sale. Another special use to which service inventions may be put consists in "blocking patents".

Finally, unexploited inventions are to be regarded.

1. Internal use, i.e. inventions worked in the enterprise is the most frequent exploitation. The directives propose three methods to ascertain the invention value:

   - "license analogy";
   - Establishing by reference to the measurable benefit to the enterprise;
   - Estimation.

   It depends on the individual case, which method is to be preferred. Lincense analogy and establishment of the value by reference to measurable benefit are considered to be equivalent. Estimation should only be used if the two other methods cannot be applied.

However, it will be considered that such contracts concern not only inventions but also necessary know-how, and in several cases the know-how can be more important and more valuable than the invention itself.

If such contracts exist at all and are known, it is therefore only more or less possible to copy such license factors. It is evident that even if using the license analogy, several factors are often to be estimated.

Another important factor is the so-called "unit of reference". Nowadays it is quite seldom that an invention concerns an absolutely novel machine. Generally inventions only improve existing products or processes.

So the question is, whether the whole machine or only the newly developed part of it is to be considered as the unit of reference. If it cannot be found out what is common usage in economy in regard to that question, it is of importance - following a decision of the Federal Supreme Court - whether the entire device is strongly influenced by the invention or not. That means for example whether the essential functions of the entire device are considerably improved or whether a new type of machine results from the invention that can be used for implementing new functions.

In the case of an extremely large sales volume the German directives provide the possibility of reducing the royalty rate. Such large sales volumes do not have to result only from the invention but also depend on the reputation of the enterprise, on the amount of investments and on advertisement. Even in contracts with independent inventors or between enterprises such reductions are frequent in several branches.

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obtains through his employment knowledge of the short-comings or needs.

Furthermore, the employed inventor can often use activities or knowledge of the enterprise, and often the employer aids the inventor by providing technical assistance. Finally, an employed inventor draws a salary whether he makes inventions or not and he can make his inventions during the working hours.

The German directives use a rating system according to three points of view. These are:

a) posing the problem;
b) solving the problem; and
c) duties and position of the employee in the enterprise.

For each of the first two points of view there is a range of six points. To estimate the position of the employee, there is a range of eight points. An unskilled worker for instance obtains 8 points. An engineer in development work 4 points, and the technical director of larger companies one point. If a problem was posed to an engineer employed in development work, he gets 2 points, if he finds the solution with the aid of his professional approach to the problem, but the solution found is not based on the activity or knowledge of the enterprise and he did not use any technical assistance provided by the employer, he will get 4 points. He will get another 4 points for his position in the enterprise. The total sum amounts to 10 points. This is equal to a participation factor of 21%, following the Table in number 37 of the German directives. Perhaps there is some scepticism with regard to this system. But it has proved applicable, even if the opinions of the parties concerned differ rather frequently in the evaluation of the participation factor. In most cases this factor lies between 15 and 21% of the amount which would be paid to an independent inventor.

IV. According to Sections 28 to 36 of the German Law on Employees' Inventions an Arbitration Board is established within the Patent Office, to which petition may be made at any time in all disputes between employer and employee arising as a result of this law. Proceedings before the Arbitration Board shall require no fees nor payment of costs.

V. The final section of this survey deals with selected examples taken from the practice of contract research within our Fraunhofer institutes.

1st Case:
A medium-sized enterprise has given an order to develop a prototype for diversifying its product line. This case is clear regarding the compensation of the employee inventors. However, some difficulties are arising since the employee inventors belong to both the contractor' firm as well as to our Fraunhofer institute handling the contract research in this case.

2nd Case:
A medium-sized firm has ordered a research work to develop medical devices. In due course an invention of far-reaching and fundamental importance is made. According to the research contract, the right to this invention belongs formally to the contracting firm. The problem is to avoid blocking off the scientific activities of the Fraunhofer institute in this field in giving away the whole right and to ensure an adequate compensation for our employee inventor.

Recent Trends in Export and Import of Technology in Japan

Research Development
Corporation of Japan

1. Features of Japan's export and import of technology

Japan has actively introduced technology from advanced countries since the World War II but also made further improvements and development of technology by effectively digesting and absorbing it to her benefit until she caught up with the advanced countries in many fields of science and technology. The result was that her import of technology far exceeded the export of technology in dollar volume. In the 1970s, however, there were slow changes in the import of technology.
The first was the decrease in the import of innovative technology on one hand and the increase in the technology related to consumer products such as electric home appliances, dress, design and the like and to industrial pollution on the other.
The second was that; until recently Japan's trade of technology has been in great deficit, but as for newly concluded license agreements reported in 1978, the import of technology was 181 million dollars as against 223 million dollars of export, and the imbalance between the export and import of technology is being gradually corrected.

Figure 1 shows the trend of Japan's export and import of technology since 1965. It reveals that the export of technology has been on the increase every year, while the import of technology was stagnant for three years from 1973 to 1975.

Table 1 shows the technology trade of major countries. In the export of technology, the U.S.A. ranks the first, followed by France, U.K., Federal Republic of Germany (F.R.G.) and Japan in this order. In the import of technology, Japan is ahead of others, followed by France, F.R.G. and U.S.A. Of these countries, Japan and F.R.G. are countries whose balance of technology trade is in deficit.

Figure 2 shows the trend of Japan's import of technology in terms of the number of license agreements concluded. It is noted that Japan's import of technology increased in 1965 to 1973 and decreased once, followed by another increase in the last few years.

2. Regulations on import of technology

License agreements for import of technology can be classified into two categories for administrative purpose; agreements whose contract term or payment term exceeds one year and the other agreements. License agreements for import of technology were, as a rule, subject to examination by government authorities on a case-by-case basis either for permit or approval, based on the "Law concerning Foreign Investment" (enacted in 1950) for the former category or the "Foreign Exchange and Foreign Trade Control Law" (enacted in 1949) for the latter. These regulations were applied from the standpoint that the securing of foreign currencies and the reconstruction of the main industries were matters of urgency to the nation. However, this screening system was not necessarily intended mainly to restrict license agreements with foreign companies. For examle, severe restrictions were not imposed on introducing foreign technology that would contribute to saving or acquring foreign currencies or to the development of domestic key industries.

3. Regulations on export of technology

Unlike the import of technology, export of technology requires no permission from the government, except in such cases as designated by the Minister in charge or, for example, when a cross-license agreement is to be concluded with a foreign company, but it is required to notify government authorities of the contract concluded. A company that exports technology receives preferential treatment in tax and is allowed to write off 28% of receipts, that accrue from technology export, out of the corporation's income as a loss, provided that it is up to 40% of the total income in that fiscal year.

4. Trade of Technology in 1978

Now, let us review the aspects of Japan's technology trade in 1978.

Table 2 shows the technology trade as broken down into major industries. Of the manufacturing industries, chemical industry, electric machinery industry, and transportation machinery industry are most active in the technology trade. Many industries import more than they export, but the steel industry exports more than it imports.

Table 3 shows the technology trade as broken down into countries, in which it is noted that more of Japan's technology is exported to Asia, particularly to China. Countries from which technology is introduced into Japan include U.S.A. and major European countries. The ratios between the technology import from and export to U.S.A., U.K., France and F.R.G. are 9.4, 7.1, 7.1, 12.3 respectively. These ratios are decreasing year by year.

5. Features of import of technology

As the postwar economy was making progress, however, there came up demands to liberalize Japan's trade with foreign countries, and these regulations have been gradually eased since 1968. More specifically, in the first step taken in 1968, procedures for introducing foreign technology were simplified, except for seven categories of aircraft, weapons, gunpowder, nuclear power, space, electronic computers and petrochemical industry. Since 1972 overall liberalization of trade has been carried out, though with deferment periods for some items. To summarize the process of such liberalization;

(1) License agreements on technlogy related to aircraft, weapons, gunpowder, nuclear power, and space technology are to be automatically approved unless otherwise instructed by the Minister in charge.
(2) License agreements on technology related to petrochemistry are liberalized except for the technology for producing its derived products. Further, technology for producing the derived products is liberalized in 1973.
(3) License agreements on technology related to the electronic computer are classified according to the amount of royalty to be paid. License agreements on the software technology, except for those involving more than 50,000 dollars payment, and hardware technology, except for those involving more than 100,000 dollars payment, are liberalized. Further, these exceptional license agreements are liberalized in 1974.

As a result of these actions, Japan, the only country in the OECD that reserved the liberalization, withdrew the reservation entirely, and all license agreements for import of technology were liberalized. Furthermore, administrative procedures related to license introduction have been simplified since 1978.

The following is a brief summary of the aspects of Japan's technology import;

(1) Payment conditions

Of the 1755 license agreements concluded in 1978 whose contract term or payment term exceeds one year, payment is made in 1633 agreements (95%), while it is free in 92 agreements (5%). Of the 1633 cases in which payment is made, 1426 agreements (87%) set forth running royalties. Table 4 shows its breakdown. It is noted here that as compared with 1967, the number of cases in which the royalty is less than 5% has decreased, while cases in which the royalty is between 5% and 8% and the number of cases in which it is more than 8% has increased, showing that the payment conditions are becoming severer.

(2) Term of contract

Table 5 shows the term of contract of 1755 agreements concluded in 1978 whose contract term or payment term exceeds one year.

It is noted that the number of cases whose contract term is less than five years is increasing as compared in 1969 and the contract term is becoming shorter.

(3) Cross-license agreement

Figure 3 shows the trend of cross license agreements, which are also gradually increasing.

(4) Commercialization of introduced technology

Table 6 shows the classification of commercialization of introduced technology in foreign countries in 1955 license agreements concluded in 1978 whose contract term or payment term exceeds one year. In 1148 agreements or 68 per cent, the technology had already been commercialized in foreign countries, and in 488 agreements or 28 per cent, it had not been commercialized. As broken down into fields of technology, more technologies are not commercialized in miscellaneous fields than others.

(5) Fields of introduced technology

Table 7 shows the trend of introduced technology as broken down into fields of technology in license agreements concluded in 1978 and 1967 whose contract term or payment term exceeds one year. It is noted that the ratio of the chemical industry, referred to as a research intensive industry, is on the decrease while the ratio of miscellaneous fields including dress, design and sundry goods are on the increase.

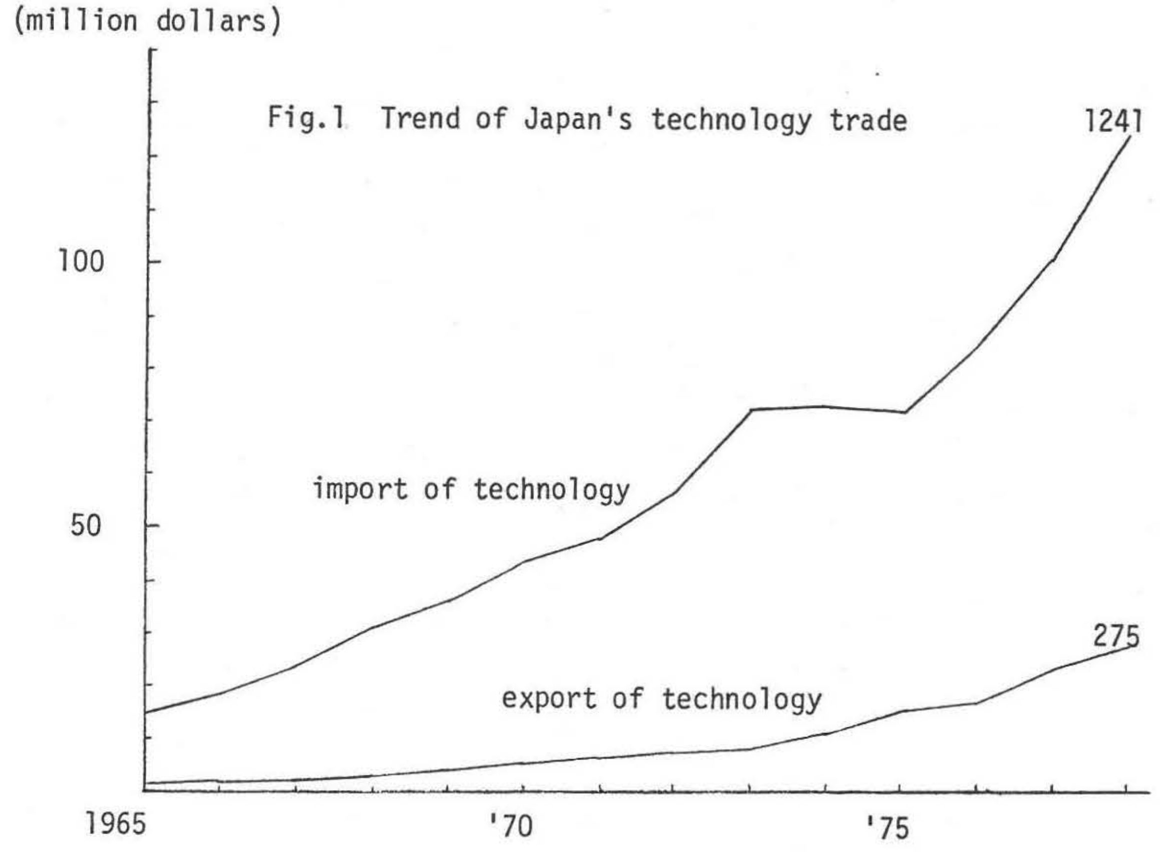


Fig.1 Trend of Japan's technology trade

(source: Bank of Japan)

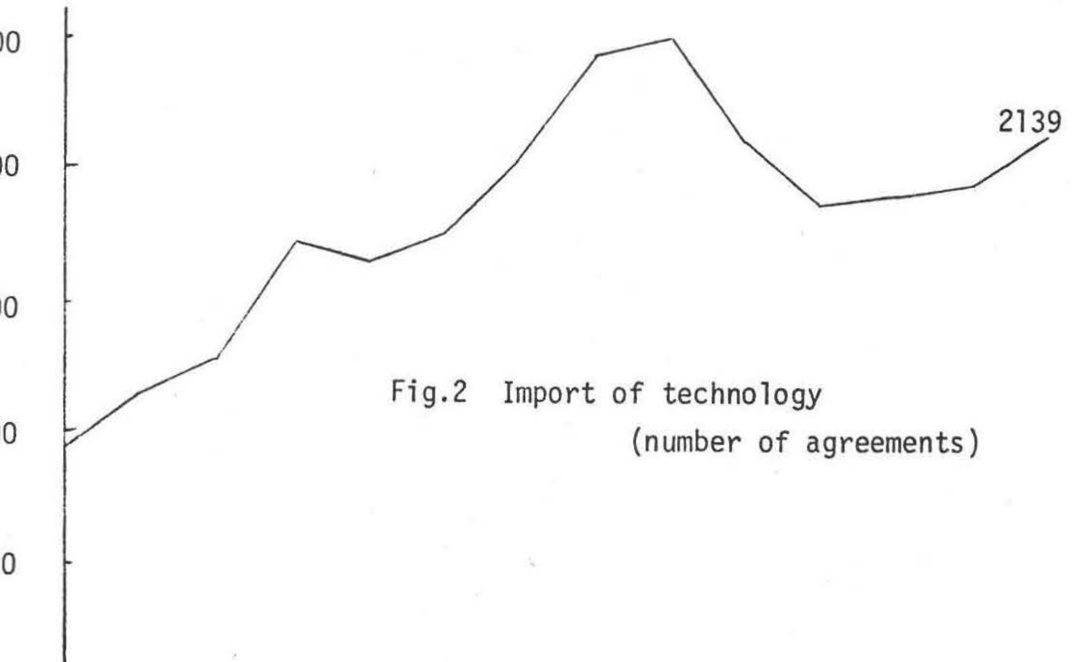


Fig.2 Import of technology (number of agreements)

(source: Science & Technology Agency)

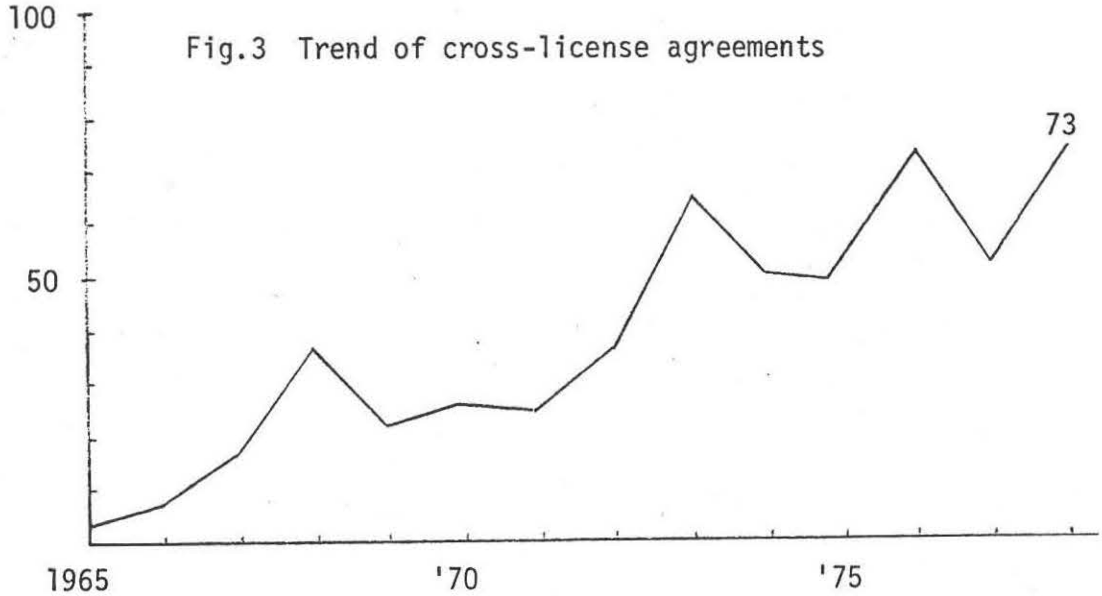


Fig.3 Trend of cross-license agreements

(source: Science & Technology Agency)

Table 1 Technology trade of major countries

(in million dollars)

country	year	export(A)	import(B)	(A)/(B)
Japan	1978	275	1,241	0.22
U.S.A.	1977	4,718	446	10.57
U.K.	1975	493	484	1.02
F.R.G.	1977	335	816	0.41
France	1977	1,776	1,239	1.43

(source: Science & Technology Agency)

Table 2 Technology trade as broken down into fileds of industry (1978)

(in million dollars)

	Export	Import
Agriculture & Marine	1	0.5
Mining	1	3
Construction	133	15
Manufacturing	445	894
Chemical	177	133
Ceramics	20	31
Iron & Steel	83	35
Machinery	18	105
Electrical Machinery	58	224
Transportation Machinery	89	199
Precision Machinery	5	19
Foodstuff	8	52

(source: Statistics Bureau)

Table 3 Technology trade as broken down into countries (1978)

(in million dollars)

	Export	Import
Asia	182	x
R.O.K.	36	x
China	68	x
West Asia	60	x
Iran	35	-
North America	80	595
U.S.A.	62	585
South America	45	x
Brazil	34	-
Europe	89	315
U.K.	10	71
Switzerland	2	59
F.R.G.	8	98
France	5	30
Africa	114	x
Oceania	9	1

(source: Statistics Bureau)

Table 4 Changes in running royalty

year	less than 5%	5% - 8%	more than 8%	others	Total
1967	56.3%	17.0%	1.8%	24.9%	100% 454 agreements
1978	36.3%	26.9%	7.2%	29.6%	100% 1,426 agreements

(source: Science & Technology Agency)

note: "Others" means agreements in which running royalty is not indicated in per cent, e.g. "dollars/pc, mark/m^3, etc.

Table 5 Changes in contract term

year	less than 5 years	5-10 years	10-15 years	not less than 15 years	others	Total
1969	16.4%	32.8%	24.9%	6.1%	19.8%	100% 1,154 agreements
1978	32.6%	27.0%	15.5%	5.4%	19.5%	100% 1,755 agreements

(source: Science & Technology Agency)

note: "Others" means agreements in which the upper limit of the term is not set forth or the term is indicated, for example, within the effective period of the patent.

Table 6 Commercialization of introduced technology in foreign countries

	Chemistry	Metal	Machinery	Electricity	Others	Total
commercialized	154	53	439	221	281	1,148
not commercialized	46	15	103	73	251	488
not known	17	4	55	11	32	119
Total	217	72	597	305	564	1,755

(source: Science & Technology Agency)

note: "not commercialized" means the technology which had not been commercialized by foreign companies.

Table 7 Trend of introduced technology as broken down into fields of technology

	Chemistry	Metal	Machinery	Electricity	Others
1967	29.8%	5.4%	34.1%	17.3%	13.3%
1978	12.4%	4.1%	34.0%	17.4%	32.1%

(source: Science & Technology Agency)

THE CDTI, A NEW EXPERIENCE IN SPAIN

CDTI

J. Luengo Vallejo

THE CDTI, A NEW EXPERIENCE IN SPAIN

by J. Luengo Vallejo

CDTI

In first place and due to the fact that Spain is beeing represented in this NRDO Lecture as first time, I would like to greet very specially all of you as well as the Organizations that you represent. With some of them we have already had very good contacts.

In second place, I would specially ask from you to excuse my English language. It seems to me similar to the Latin language. A dead idiom as I murdered it every time i speak it.

In third place and as I only dispose of 30 minutes if I intent to read the bulky paper that I send several months ago to Dr. Krause I suspect that I would not finish it.

As it has been distributed between the Audience, and with the permission of Mr. Chairman, I will comment something related to some aspects of it, that are directly related with the topics upon with our attention is drawm in the summoning -methods of operation specially of younger organizations and those ones that approach to small/medium industrial firms- trying to relate them in between.

First of all, I shall explain you that the CDTI has been considered by the World Bank a first experience that could become implanted in other countries with similar or less development level that the one we could find in Spain, if we are succesfull in our aim to develop much more technology than we are now generating.

So as to understand best this objective I am obliged to comment that Spain presents a "sui generis" profile that distinguishes us from many other countries.

The incredible Spanish industrial growth of recent years began inspite of a very marked lack of technology, and its favourable progress -perhaps too much so- was not, unfortunately, accompained by a similar phenomenon in the development of original technologies.

In figure 1 are represented some statistical series.

On one hand the Gross Industrial Product (the third column) has grown up to a rate of the 18% accumulative, what indicates that the industrial growth has been very strong, approaching us to the developed countries. In other hand the payments for technology had grown, aswell, up to a rate of the 11.4%, multiplying itself 3 times in the last ten years.

Although our technology export (column two) has multiplied itself 8 times in the last 10 years, the initial base was so low that our technological balance has increased without interruption its deficit.

That means, finally that we are a developed country if we look at our industry and a developing country if our technology is considered.

As many of you know, the increase of the Spanish industry has taken place substantially during the last 15 years. Due to this fact the equipment is rather modern, what has produced that the manufacturing technology as well as the process one had been able to arise a good level.

However, the necessity of offering to the market new products and more sophisticated ones that the spanish citizen scour, as a consumer, in much less time than the european citizen, the way of the radio, the washing machine, television set, the car, the best services, etc., made his appeal to an increasing importation of new creating ideas, under the form of licences so as to manufacture products and, of course, obliging us to import the necessary technology.

In the other side, the compositon of the spanish industrial sector presents a distribution like to one represented in Figure 2.

The highest percentage of employment(37%) is given by only a 4% of the total companies, followed inmediately of the 32% of the employment inside the 31% of companies.

Explaining it a little bit, we have nearly 200.000 industrial companies and, of those, 60.000 have a staff composed between 5 to 50 persons, and 120.000 with less that 5 persons.

Well, it is a well known fact, as Mr. Grunau said this morning, that Small and Middle sized industries:

- provide the largest number of jobs
- produce the largest number of innovations
- have a cost per person dedicated to R&D wich is less than in large industries, and finally that
- are younger and in general terms more agressive than big industries.

Therefore, they offer opportunities of which advantage should be taken, but they also need to receive special attention in order to achieve their true value. CDTI intends to develop, in cooperation with the Institute of Small and Medium sized industries -which is another Organism belonging to our Ministry- a program:

1. to promote creativity in these industries through special economic stimulation of new ideas.
2. to facilitate access to improved information on updated technologies.
3. by urging that use be made of the possibilities of support offered by the existing national scientific and investigation community, and in particular, that which can be considered to be near at hand, to where these industries are located.
4. throughpriority and emergency processing of their proposals.
5. with help in their search of industrial financing -through the Banco de Credito Industrial- (an official bank for financing fixed assets) or some Venture Capital companies, as SEFINNOVA brother company of the French SOFINNOVA.

Another phenomenon that takes place, rather accused in my country, is that, among the small and middle sized industries there are those normally limited to very small geographical areas, which due to local or family traditions have maintained a very specific status. This is particulary true for the following industries:

Metal working machinery
Toy industry

Show Industry
Etcetera

or other such as:

Ceramic Industry
Olive oil industry
Cement Industry
Etcetera

which are subjected to peculiar circumstances. We call them desagregate sectors because for instance the first group of industries:

- are not suitable -for various reasons- for contracting or merging with other firms.
- have got advanced technologies, already mature, althoug their products are subject to deep and rapid changes which depend on external sources (introduction of Electronics, strong increase in salary costs, etcetera)
- they export a considerable part of their production, although the competitive position is in serious danger because the importing countries can suddenly stop doing so, upon developing their own products or they may begin to lose markets in favour of another countries whose products become cheaper due to lower wage scales.
- this industries need a strong push -which they are incapable of doing on their own to get access to more modern and sophisticated products wich are at present manufactured by countries more industrialized than we are.

The second group of industries needs to improve and to tecnify its production systems in order to:

- obtaing higher productivity

- solve some of the problems specific to the sector, as the obtention of the olive oil, contamination, etcetera).
- perferct processes which provide additional energy economy as ceramic, cement).
- etcetera.

The type of activities which are needed are, in the first place, an analysis of the situation of the sector under study which will permit the adoption of a wide variety of solutions.

I can indicate you as an example two cases:

The first one is refered to the sector that manufactures tiles. It is composed by no less than 150 companies, in general of a familiar origin and of not very big dimensions. They are located, almost most of them, in the Spanish area of Levante, near to Valencia in the Mediterranean sea.

The annual value of sales is near to 400 hundred million dolars, of which the 25% is exported.

All the manufacturing technology comes from Italy where the sector multiplies by four the amount of Spanish business and duplicates the exportations.

Well, what's happening?

Inside the production cost of a tile, nearly a 40% belongs to energy costs and almost a 30% belongs to labor output.

If they want to be competitive it is needed to waste less energy and increase the output per person.

This requieres an urgente restate of the production technology and specially of the drying heater, owens of baking and enamelling.

So we begun to work but not only against the technological problem but to create a system that could function and that could permit, if the case arised, that the old equipments that devorate energy inside the familiar industries could be replaced by the new ones, frugal and austere in KW.

In this way we promoted the constitution of a system similar to the one represented in Figure 3.

We obtained the creation of a CORPORATION -we call them INNOVATION COMPANIES- of a million dolar with 1/3 of participation in its capital of the own manufacturers. The other third was subscribed by the IMPI -Institution for the Medium and Small Industry- and the rested third was provided by the REGIONAL SAVINGS BANKS.

This CORPORATION has been the interlocutor of the CDTI and to which the CDTI is proportionating specific economic contributions, so as to accomplish the prototipes of all the equipments that seem interesting to innovate.

I forgot to say that in the part of the manufacturers a Technical Commision was created -4 members were elected in between the technicians of its factories of the most high profesional level-. They actuate as advisers of the Engineering Campany that was selected so as to develop the first two projects.

In the same way, in between the manufacturers, it is put in disposition of the project and suitable for all the testings, experiences, etcetera, a complete line of tile manufacturing.

The Savings Banks have taken the responsability of financing the manufactureres the buying of the equipments, in base of a cooperative guarantee.

TECERSA -Ceramic Technologies Company- has been followed by another

CORPORATION, a Brother Company. I am refering this time to TECNOJUSA (juguete in Spanish means toy)

The toy industry is faced also with the necessity of introducing new technologies in its product conception.

Electronics are at presente a basic part of the toy industry in developed countries and due to the traditional and "familiar origin" of the spanish toy industry sector, it makes essential the fact of proportioning them a type of impulse, comming from the outside, that could permit to all the group of manufacturers to adopt and apropriate the precise electronic technology for:

a. incorporate, inside the traditional toy, the electronic sets in competitive conditions. As an example, receiver-emiter, for remote control, etcetera.

b. try to create, taking as a base the chip of an integrated circuit or a microprocessor, a new line of toys and enterteinments or, such things, that complete a line of products and commercial distribution that has been very agressive in its exportation.

Another type of activity that I think that must be taken into a special consideration, not for the interest that could have for the developed countries, but for that one that could present to the developing countries, is the one refered to the buyings of the Official Organisms.

CDTI is systematically proceeding to establish contact with all the "large buyers of technology" in our country.

What we are doing is to establish an interaction triangle which will result in the development of a prototipe and the manufacture of a first series.

Essentially the Buyer Organizations:

- defines certain necessities

- schedules a minimum purchase of equipment
- establishes the specifications
- controls costs
- contracts and, if necessary, accepts and endorses the prototype
- acquires a pre-series which allows amortization of development costs

The Firm(s):

- develops(s) the project
- contribute(s) their (its) know-how
- create(s) competitive technology
- acquire(s) or consolidate(s) new markets
- create(s) or guarantee(s) employment
- is reseased from foreign ties and provide(s) for its exploitation
- improve(s) technological balance

The operation if effected through a Cooperation Agreement Buyer Organization-CDTI under which CDTI assumes specific economic risks and the buyer certain obligations.

Once the Agreement has been established, the cycle is closed through a Supply Contract between the Buyer Organization and the Firm(s), and a Collaboration Agreement between CDTI and the Firm(s).

As an example of this we find out the bigest operation developed by CDTI up to date with RENFE.

Once the first contacts with RENFE were established, it was decided that one of the most urgent necessities of Spanish railway traffic for the 1980's would be specially designed rolling stock for commuter services.

It should be emphasized here that railway construction in Spain is very highly developed and even some important exporting has been done. However, except to a very limited degree, there are no original designs. Nearly all that is produced is based on foreign technology.

From an economic standpoint the international market price if a commuter train is estimated at 2 million dolars and the development cost of the prototype in 10 million dolars. The diference (8 million dolars) is to be absorbed 50/50 by CDTI and the firms, while RENFE has agreed to purchase the prototipe (as long as ti meets all specifications) at the international market price.

RENFE has also agreed to buy 80 more trains and can opt to buy an additional 20.

The project is estimated to last 36 months.

It should be noted that 5 companies are participating. Among them the 2 multinationals are obliged to carry out all phases of the development in Spain and that no type of royalty is to be paid to foreign sources under any conditions.

This project is the begining of a series of collaborations forseen between RENFE and CDTI and in the future will be extended to other types of equipment and materials and will allow the development of original technical solutions adapted to national railway equipment needs.

Right, I think that with the reading of the document that we sent that is an historical-philosophical synthesis of the CDTI, and with this comments that I have just done, you could be able to understand best which is our work.

As a personnal comment, I would like to include that we consider inside the CDTI, as very satisfactory, the way the events are taking place. Throughout and anonymous poll in between the companies with whom we have had contacts, we have detected a favourable vision towards our measures, that we try it to have the biggest entrepreneurial spirit.

Me myself I have worked inside the private company until May 1978 month in which the CDTI was created.

I would like to take advantage of this situation and put at the disposal of all of you the CDTI and myselfe. Thank you very much.

TECHNOLOGY TRANSFER IN SPAIN

	PAYMENT Mill.$ US.	ENTRANCE Mill. $ US	PIB Mill. $ US.	PRICE INDEX Base 1955
1969	133,0	9,2	26.577	200,9
1970	133,8	16,0	34.636	204,2
1971	155,0	16,8	39.447	215,8
1972	199,6	20,6	50.352	230,7
1973	249,1	27,5	63.828	254,4
1974	313,8	35,8	82.863	300,6
1975	292,2	49,1	95.486	338,0
1976	468,5	60,8	100.341	389,7
1977	378,2	59,0	111.638	456,2
1978	397,4	72,5	136.194	520,1
Δ aa	11,38	21,47	18,11	12,32

Fig 1

S T R U C T U R E   O F   T H E   S P A N I S H

I N D U S T R Y

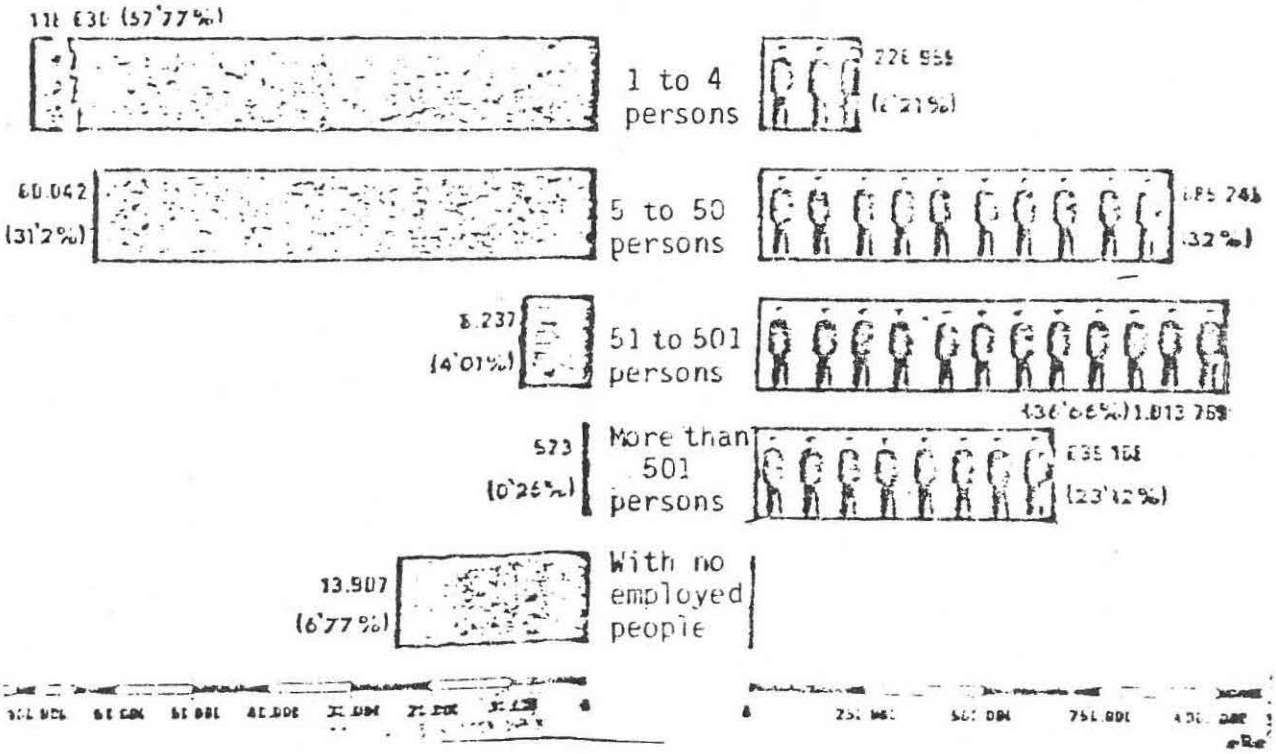


Fig 2

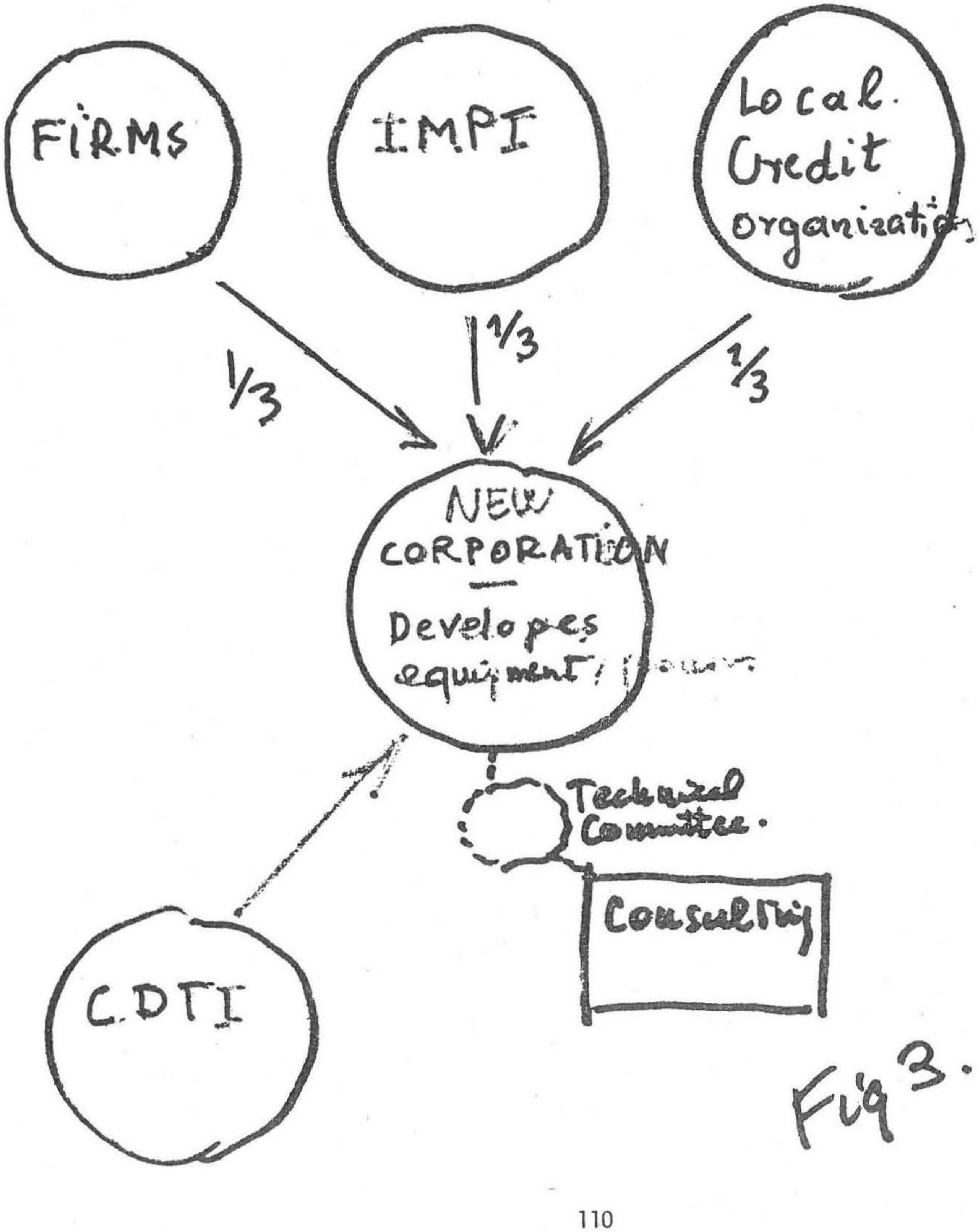
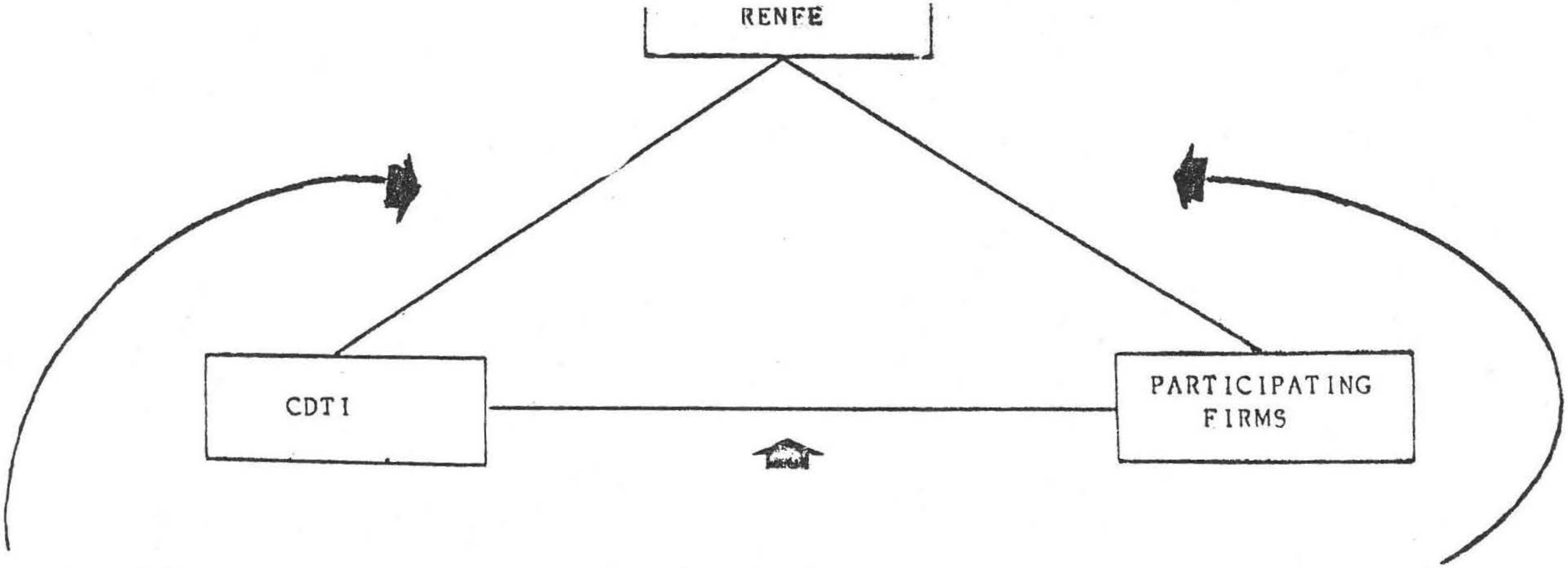

FIRMS
IMPI
Local
Credit
organization
1/3
1/3
1/3
NEW
CORPORATION
Developes
equipment
Technical
Committee.
Consulting
C.DTI

Fig 3.



OPERATION AGREEMENT

ESTABLISHES CONDITIONS FOR:

1. RELATIONSHIP BETWEEN BUYER-ORGANIZATION AND CDTI
2. GENERAL PLAN OF ACTION WITHIN OVERALL SET-UP FINANCIAL PARTICIPATION OF ALL PARTIES INTERVENING IN THE PROJECT -TARGET OF THE AGREEMENT BETWEEN CDTI-PARTICIPATING FIRMS (RENFE-CDTI MANUFACTURERS).
3. SPECIFIC FACULTIES OF FOLLOW-UP, CONTROL AND INSPECTION OF ALL WORK CARRIED OUT AS A RESULT OF THE AGREEMENT CDTI-PARTICIPATING FIRMS
4. REGULATION OF ALL PAYMENTS TO BE MADE BY EACH OF THE PARTIES IN ACCORDANCE WITH UNITS OF WORK COMPLETED

REGULATION OF THE DEVIATION LIMITS TO BE PERMITTED FOR THE DURATION OF THE PROJECT

COLLABORATION AGREEMENT

ESTABLISHES CONDITIONS FOR:

1. END RESULT SOUGHT THROUGH COLLABORATION AGREEMENT
2. DEVELOPMENT OF PROJECT PROGRAM
3. REGULATION OF ECONOMIC APORTATION OF ALL PARTIES INTERVENING IN THE PROJECT
4. STIPULATION OF THE RATE OF RETURN OF CDTI'S ECONOMIC PARTICIPATION IN THE PROJECT
5. OWNERSHIP OF THE INDUSTRIAL PROPERTY RIGHTS WHICH WILL ORGINATE FROM THE PROTOTYPE

SUPPLY CONTRACT

ESTABLISHES CONDITIONS FOR:

1. RELATIONS BETWEEN PARTICIPATING FIRMS AND BUYER-ORGANIZATION
2. REGULATION OF TECHNICAL SPECIFICATIONS WHICH MUST BE MET BY THE PROTOTYPE DEVELOPED IN ACCORDANCE WITH AGREEMENTS
3. REGULATION OF THE PRICE OF THE PROTOTYPE FOR WHICH RENFE HOLDS A PURCHASE OPTION.
4. A DEVELOPMENT CONTRACT FOR THE PROTOTYPE AS DEFINED IN THE AGREEMENT BETWEEN CDTI AND PARTICIPATING FIRMS
5. REGULATION OF THE MAXIMUM TIME PERMITTED FOR CONSTRUCTION OF THE PROTOTYPE AS WELL AS FOR THE TRIALS AND DEMONSTRATIONS TO WHICH IT WILL BE SUBMITTED
6. NUMBER OF UNITS OF THE PROTOTYPE WHICH WILL BE PRODUCED AS A FIRST SERIES

Fig 4

THE CDTI, A NEW EXPERIENCE IN SPAIN

NEW STRATEGIES

FOR

TECHNOLOGICAL DEVELOPMENT IN SPAIN (Submitted Paper)

I. In May 1978 the Technological Industrial Development Center of the Ministry of Industry and Energy began operations. If it were necessary to find reasons to justify its creation, we think that those which are listed below, and which contain the basic motivations, deserve to be known, even if only in this very brief form, since they also serve as the basis for a better understanding of the attitudes and activities which CDTI holds and plans for 1980.

1. The incredible Spanish industrial growth of recent years began inspite of a very market lack of technology, and its favorable progress -perhaps too much so- was not, unfortunately, accompanied by a similar phenomenon in the development of original technologies. Therefore not only was that technology which was needed imported, but also that which could have accrued on its own. Such a great amount of technology was acquired that much was not even used, although at times it permitted at least the use of familiar sounding brand names or "guarantees of origen" for those who were sceptical of our own sources.

This "use and abuse" situation together with the outflow due to its cost in international markets made necessary an intervention by the Ministry of Industry and Energy which, through a special Registry for technology transfer began to become familiar with and classify the problems involved in the technology needs of the different industrial sectors.

2. Our model of society is undergoing a great change. Undoubtedly the energy crisis has played, plays and will continue to play a crucial part in this change. But other factor as well, for example, the explosive growth of Electronics -in all its varied forms- or the continuous change in certain social mores, are driving us to a type of industrial society in which present day rules as to stationary employment, the length of the working day or the giant-size concept of industrial installations are going to become completely out-moded.

Basic to all this will be a dramatic reduction of the need for work such as we presently conceive it.

Automation and the Computer Sciences will allow us, by the end of the century to do away in industrialized nations with from thirty to fifty percent of the present number of industrial sector employees. Although many will find work in the Services' industries, other will join together with those who, due to technological under-development, will have been unable to maintain their jobs in firms which will, as well, tend to disappear as a consequence of a new phenomenon which will probably be typical of the Second Indsutrial Revolution, and which will originate from (this is already happening), the rhythm of technological evolution.

These same causes will mean that those who in 1920 had a work expectancy of 30 years in firms in which they entered upon completion of studies, and whose expectancy today is from 15 to 20 years, will see this time reduced by the year 2000 to only 10 years. A professional will normally work, therefore, in three or four firms during his life-time and in a way which will be very different from that which we now know.

However, we are not necessarily moving toward a "lazy" society, but one of adequately administered leisure. But in order that this can be achieved without sacrificing present high living standards, we must develope new methods.

3. We are going to need to make an enormous joint effort to adapt, and another, no less important, in order to be creative.

On our part, we will need to create and sustain a spirit of industrial innovation, the base and foundation of which will need to be, above all, the technological capacity and abilities which we will develop .

4. With the establishment of the two basic fundamentals which follow:

a) One of the important factors basic to industrial strategy is, precisely, industrial innovation, and

b) It is absolutely essential to stimulate that phase of the innovative process in which the technologies of the innovation's end-result are generated,

the Ministry of Industry and Energy took note of the necessity of creating an organization, called the Technological Industrial Development Center, which would be agile, efficient and imaginative enough to face a problem known to be complex, far-reaching and unclear.

We are not going to go into the process which led us to the definition of the underlying philosophy of the Center's operations, but dc believe it worthwhile to point out that our approach was completely original due to the fact that we realized that the Spanish industrial system differed considerably from those of other countries and that the transplanting of experiences resulting from other social, economic and technological contexts different from our own, could lead us to the gates of failure.

We also wish to point out that upon comparing a posteriori our system with others with which we were to become familiar, we were pleased to note the many coincedences in basic concepts.

Therefore,

The CDTI should adopt for formation of its policy entrepeneur oriented criteria, as much for its own procedures as for those of selection, evaluation and final interventions in projects.

The processes of selection and evaluation of projects should place special emphasis on the possibilities for commercial success of the innovations proposed for possible CDTI intervention. In order that this can be determine the project participation Requests submitted to CDTI should include estimate which must be as exact as possible, of the product's potential market and competition, the firm's commercial capacity, its export experience, etc.

Any and all projects for which it is known beforehand that CDTI's investment will be irrecuperable should not be considered. Some type of procedure which would link CDTI to the commercial success or failure of the operation should be negotiated. This could be achieved through the development of a contractual formula which would allow CDTI to recuperate money invested through a royalty collected on the sales of the product, procedure or technology developed in the course of the project.

This formula would permit pursuance of two objectives:

1. At middle-term - between five and eight years - CDTI could autofinance itself with the income derived from its operations, to the extent that if not totally, it could become nearly independent of official state budgets, which are always subject to political tensions which could have a negative effect on a long-term program for the technological development of an industrial strategy.

2. Although CDTI could and should invest in projects whose success would not be measurable in financial terms -national strategic interest projects or those which have particular social benefits- the majority of the projects in which it cooperates will be calculat in such terms. CDTI's ability to autofinance itself could become an objective measure of its social value.

In accordance with this, CDTI should avoid intervention in the individual phases of an innovation process, to such a degree that if in some project participation Request, funds are requested for a particular phases of a product -for example, a prototype- CDTI should participate only in the case that there is a reasonable guarantee that the proposer will be able to obtain the additional funds necessary to complete all phases of the project up to and including its successful commercialization.

CDTI should plan its interventions, keeping in mind that it cannot aspire to occupy more than one particular section of the overall spectrum of a typical innovation process. Therefore, it should be certain that its acts are in accord with those which preceed or follow in the natural sequence of said process.

CDTI should use its financial capacity as "seed capital", or better said, always try to obtain a multiplication effect of its returns on investments.

CDTI should act in response to one of these two reasons:

1. In response to other firm's initiatives of intervention in projects.
2. By stimulation of initiatives of technological development through the discovery and identification of necessities and opportunities which are created by the Spanish industrial system. These initiative should always be channeled through business firms.

II. Thus established our "house rules and regulations" we shall attempt to analyze those situations which could come up.

Our first attempts have provided us with a wealth of material which, today, corrected and enrichened by additional experiences with real cases with which we have had to cope, has permitted us to compile a list of "Recommended" CDTI interventions:

TABLE I

CDTI ACTIVITIES AND INTERVENTIONS

1. Patent, Invention and Technology exploitation.

   - Evaluation.
   - Promotion and commercialization of Inventions, Patents and Technologies of private origen.
   - Negotiation and promotion of patents originating in Ministry dependent Investigation Centers and Institutions.
   - Financing of Patent Registration.

2. Participation in market and technological forecast studies.

   - Market evaluation studies.
   - Analysis and selection of priority areas, products or processes.
   - Middle- and long-term technological forecasts.

3. Technical, Economic and Financial participation in projects.

   - Intervention in Industrial Innovation and Technological Development Projects with recovery of investment from sales revenue.
   - Financial aid during the innovation stage of development.

4. Financing for assimilation of foreign technologies.

5. Guarantee Fund for first buyers of new technology as well as

for demonstration purposes.

- Buyers credit.
- Insurance against use risk.
- Financing of demonstrations.

6. Opportunities promotion.

- Exploration of private or public markets for promotion of national technologies.
- Promotion of technologies of mutual interest to a given sector (Cooperative technologies).
- Intervention in Special Programs of strategic interest.

7. Special programs for Small and Middle-sized Industries.

8. Information and documentation services.

Of all these activities or interventions which CDTI should try to carry out, some are already completely operational, part are about to become so and others are considered "sub iudice" as they present reasonable doubts as to their future due to their own nature or due to their still being considered in the light of CDTI's legal capacity to undertake them.

It would seem necessary to include here a brief exposition so as to illustrat the outline of activities presented in Table II, in the hopes of providing a more complete picture of the actual material form in which these activities have been developed in accordance with the following:

1. Patent, Invention and Technology exploitation

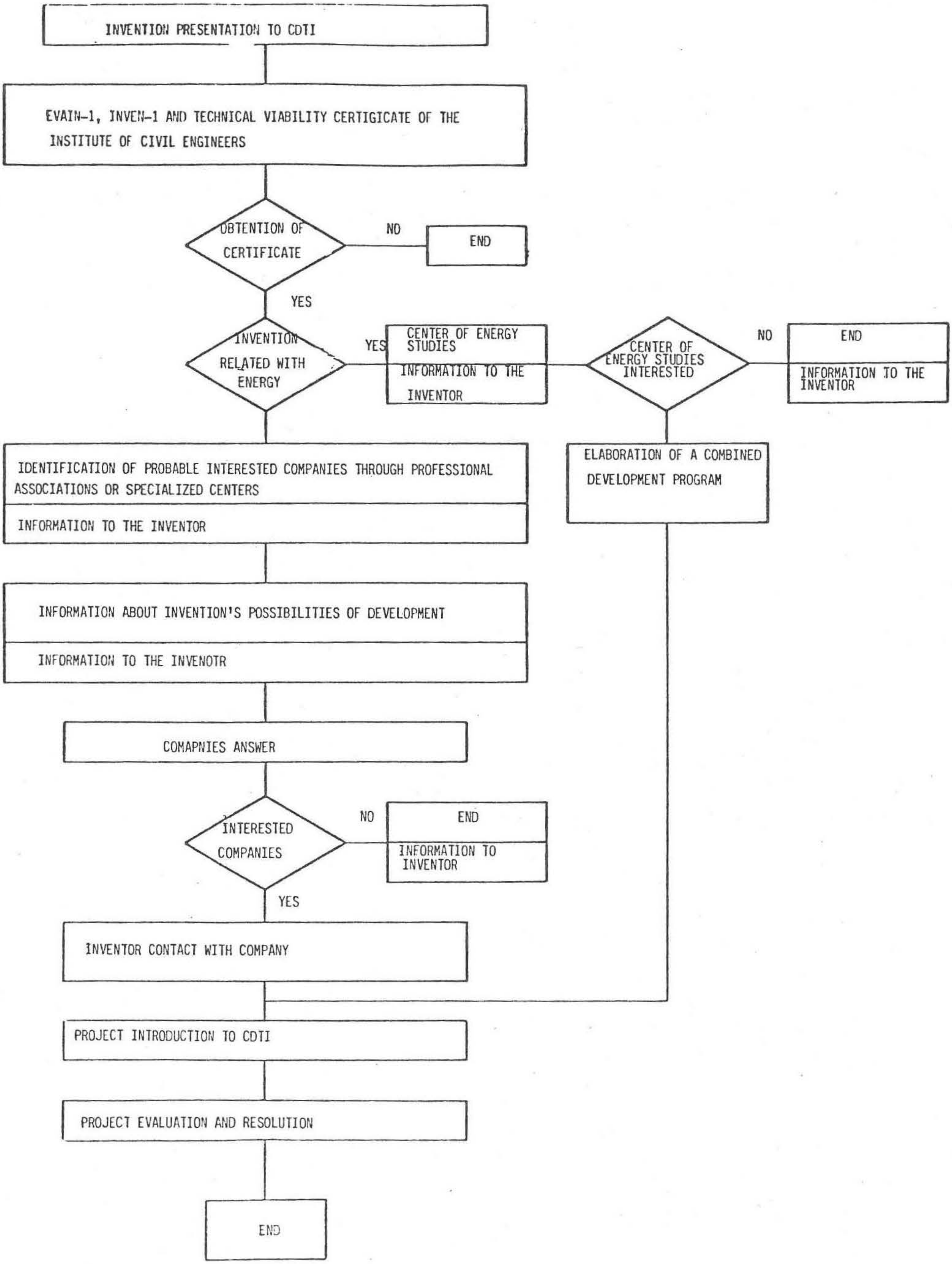
That which is sought is, above all, the calculation of the value of those inventions considered to be of interest. The creativity and genius of the human race is well known, but, unfortunately, among all the ideas which are forthcoming, only a few are economically and socially profitable.

Thus is born, as foremost, the need to distinguish between viable ideas and those which are not, and, in any case, to encourage the inventor to criticize his own invention in order to improve and perfect it, eliminating the contra-indications which he may know, and also to familiarize him with the "ins and outs" of Industrial Property Rights. We have for this purpose published two brochures entitled: "Evaluación de Invenciones" ("Invention Evaluation") and "Guía del inventor" ("Inventor's Guide").

The second stage is directed toward the establishment of conditions favorable to the inclusion of the invention in a production process, its use to improve an existing product or to develope a new one, any one of which will meet with commercial success. In order to achieve this we attempt to determine the partner normally needed as well as to find him. We have prepared a brochure on Capital-risk firms which are able to provide some help to inventors.

In the third stage CDTI participates through what we call the Agreement for

FIGURE 2


INVENTION PRESENTATION TO CDTI
EVAIN-1, INVEN-1 AND TECHNICAL VIABILITY CERTIGICATE OF THE INSTITUTE OF CIVIL ENGINEERS
OBTENTION OF CERTIFICATE
NO
END
YES
INVENTION RELATED WITH ENERGY
YES
CENTER OF ENERGY STUDIES
INFORMATION TO THE INVENTOR
CENTER OF ENERGY STUDIES INTERESTED
NO
END
INFORMATION TO THE INVENTOR
IDENTIFICATION OF PROBABLE INTERESTED COMPANIES THROUGH PROFESSIONAL ASSOCIATIONS OR SPECIALIZED CENTERS
INFORMATION TO THE INVENTOR
ELABORATION OF A COMBINED DEVELOPMENT PROGRAM
INFORMATION ABOUT INVENTION'S POSSIBILITIES OF DEVELOPMENT
INFORMATION TO THE INVENOTR
COMAPNIES ANSWER
INTERESTED COMPANIES
NO
END
INFORMATION TO INVENTOR
YES
INVENTOR CONTACT WITH COMPANY
PROJECT INTRODUCTION TO CDTI
PROJECT EVALUATION AND RESOLUTION
END

Project Cooperation which will be explained with more detail further on.

In addition, and in order to explore the opportunities which may arise from the studies and developments carried out in State Investigation Centers, whether or not these belong to the University system, we are working jointly with the University-Business Firms Foundation on a project which will allow us to establish some positive system for this purpose.

2. Participation in market and technological forecast studies.

Due to our Nation's circumstances, we feel that the markets "solicit" technology and not vice-versa.

Therefore whether it be in response to a request from some sectorial professional Association or due to private initiative, generally very concrete studies are made as to the situation of specific markets and of their predictable evolution due to the changes in technology and incorporation of new products so as to satisfy the demands of same.

This type of activity is usually carried out in the form of Studies Collaboration Agreements when the initiative has its origen in a business firm, although when no one in particular has suggested the study, it is done by an engineering or other specialized firm contracted by CDTI.

With a more indefinite and distant objective in mind, CDTI is also trying to form an opinion as to the future situation of emerging technologies, such as solar energy, compound materials, microbiology, etc.

It is doubtful in the above mentioned cases that business firms, which foresee to a much shorter distance, will participate economically, therefore CDTI intends to finance in their entirety studies, the results of which we will eventually publish for orientation of the pertinent sectors.

3. Technical, economic and financial participation in projects.

This section covers what could be considered the basic operation of CDTI and in it are to be found, if not all, nearly all the rest of its activities.

In order to understand the goals which guided CDTI to establish this procedure basic to its operations, one must initially understand how an innovation process is developed.

Table III depicts graphically the sequence of events through which virtually any new product or process passes from Original Idea up to Product Abandoned.

The dotted curve represents the "mortality of ideas". The bottom line of dashes: the progressive cost which the selection of ideas incurs. As time goes by -represented on the horizontal plane- and during the Premarket Phase, its transformation into a tangible product, evolution, development of the prototype and its testing, the first pilot-production, etc., more and more expenses are accrued (represented by the vertical plane).

The Cashflow area is negative due to the fact that there is investment and amortization without any possibility to offset these as there is as yet no income revenue.

At this point an Industrial Production Stage as well as an Introductory Commercialization Phase begin in which CDTI does not directly participate, because by definition the Banco de Crédito Industrial (Industrial Credit Bank (Official)) finances all machinery and equipment necessary for production, and as for commercial introduction, IRESCO in the national market and the Banco Exterior de España or the private banks have special policies at the international level -for market prospecting and participation in Fairs- which can supply the necessary funds.

At a given moment the Market Phase is begun and the first Sales take place. The line which represents Sales grows rapidly and in time curves until becoming horizontal. At this point the profits are important, although later on they begin to fall, even more rapidly than the actual Sales.

CDTI's participation could be represented by the shaded areas.

CDTI acts as a "partner" in the project and, therefore, during the Premarket Phase contributes to the expenses as they come up, paying part of them, thus helping the firm.

This participation is represented by the dot and dash lines.

As Sales begin CDTI begins to receive a return of money invested in the form of a percentage or Royalty established against Sales. When the returns cover the amount originally contributed by CDTI the Recovery Period is considered to have ended (length of time, T).

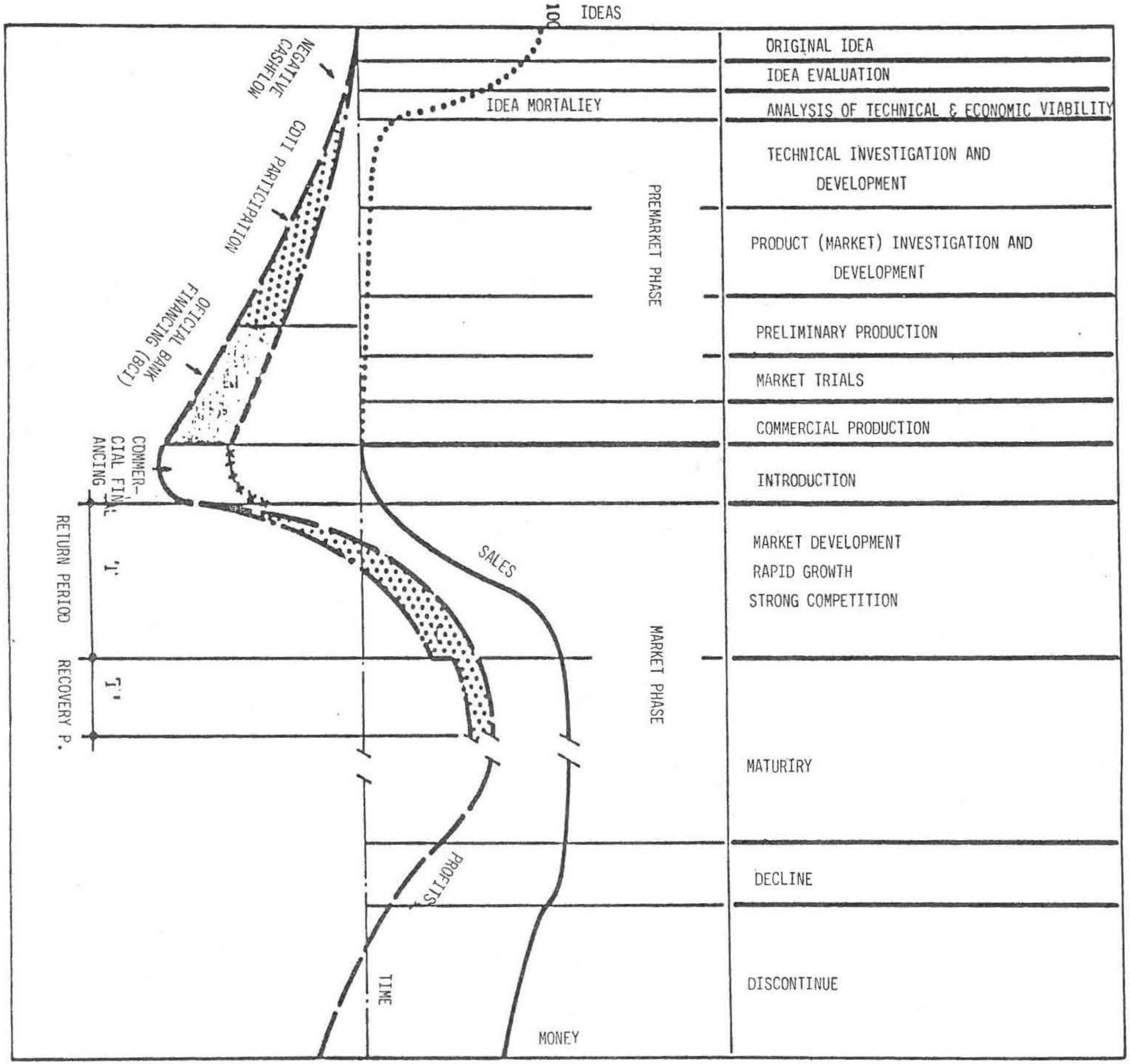
From this point on, and during the entire Return Period, whose length of time, t', is related to T through the formula:

$$T' = KT,$$

K being a factor which depends on the market, and the life expectancy of the product, as negotiated a priori between the business firms and CDTI, we continue to receive a percentage or Royalty -generally a fraction of the original amount- on the amount we received during the Recovery Period.

When T' ends the Agreement for Project Collaboration also comes to an end.

In this way we achieve:


IDEAS
100
ORIGINAL IDEA
IDEA EVALUATION
IDEA MORTALIEY
ANALYSIS OF TECHNICAL & ECONOMIC VIABILITY
TECHNICAL INVESTIGATION AND DEVELOPMENT
PRODUCT (MARKET) INVESTIGATION AND DEVELOPMENT
PRELIMINARY PRODUCTION
MARKET TRIALS
COMMERCIAL PRODUCTION
INTRODUCTION
MARKET DEVELOPMENT
RAPID GROWTH
STRONG COMPETITION
MATURIRY
DECLINE
DISCONTINUE
PREMARKET PHASE
MARKET PHASE
NEGATIVE CASHFLOW
CDTI PARTICIPATION
OFFICIAL BANK FINANCING (BCI)
COMMER-CIAL FINANCING
RETURN PERIOD
RECOVERY P.
T
T'
SALES
PROFITS
TIME
MONEY

a) Sharing the risk that the entire innovation process presuposes.

CDTI becomes a partner in a firm for a specific project, with possible profit or loss.

b) A return on CDTI's economic participation proportional to the success of the project.

If the anticipated results are not met and failure is the outcome, CDTI will lose its contribution. If it is a success, the greater the Sales the larger the return.

c) A self-imposed limitation as to CDTI's return.

In the case of success, the recovery period is shortened and, proportionately, the return period as well. That is to say, there is a specific wish to not continue receiving profits indefinitely.

d) As participation is not in the form of a subvention, nor a loan, there is no question of interest payments. And no where in the participating firm's Accounting should CDTI's contribution to the project be reflected as a risk.

e) Since among CDTI's goals, as stressed at the moment of its creation, is promotion of the industrial exploitation of the technologies developed, it is obvious that the Center must see that the innovative cycle is complete, making certain that production and commercialization of the prototype developed become reality.

It would be quite a waste if projects begun by Official Organizations were to be unfinished due to a lack of cooperation with other Organizations and Institutions. Therefore, CDTI has established Contracts and Agreements with the Banco de Crédito Industrial, with the Instituto de Reforma de Estructuras Comerciales and with the Banco Exterior de España, in order to achieve an adequate coordination of the different tasks of these Organizations and through mutual efforts results are most complete and efficient.

4. Financing for assimilation of foreign technologies.

There are many examples of Spanish firms which have technologically improved, or are capable of doing so, those products which they at present produce under licensing agreements, which means that formal development of these technologies would permit their nationalization.

CDTI participates in projects of this nature to exactly the same extent as has been explained in the previous section.

5. Guarantee Fund for first buyers of new technology as well as for demonstratio purposes.

MARKET EXPLORATION AND OPPORTUNITY DETECTION SERVICE

TABLE IV

OBJECTIVE		IDENTIFICATION OF EQUIPMENT WHOSE TECHNOLOGY SHOULD BE DEVELOPED IN SPAIN & PROPOSED ACTION			
OBTAIN INFORMATION	ACTIONS	STUDY OF TECHNOLOGICAL SITUATION, PRODUCTIVE CAPACITY & EXPORT POTENTIAL OF SPANISH MANUFACTURERS	ANALYSIS OF PREDICTABLE FUTURE DEMAND	RESTROSPECTIVE STUDY OF DEMAND UNSATISFIED BY SPANISH PRODUCTION	
	PARTIAL RESULTS	INFORMATION OF IMPORTED EQUIPMENT	ESTIMATE OF FUTURE DEMAND & IDENTIFICATION OF EQUIPMENT	INFORMATION ON TECHNICAL SITUATION & PRODUCTION & EXPORT CAPACITY	
INFORMATION ANALYSIS	IDENTIFICATION OF EQUIPMENT	IMPORTED EQUIPMENT	EQUIPMENT MANUFACTURED IN SPAIN		
		WITH FOREIGN TECHNOLOGY	WITH NATIONAL NON-COMPETITIVE TECHNOLOGY	WITH NATIONAL COMPETITIVE TECHNOLOGY	
RESULTS OF STUDY AND RECOMMENDATIONS	EQUIPMENT AND TECHNOLOGY CLASSIFICATIONS	EQUIPMENT & TECHNOLOGY WHOSE DEVELOPMENT OR MANUFACTURE IS CONSIDERED UNINTERESTING DUE TO TECHNICAL LIMITATIONS OF MARKET OR OF PRODUCTIVE CAPACITY	EQUIPMENT WHOSE TECHNOLOGIES COULD BE DEVELOPED OR IMPROVED IN SPAIN, BUT WHICH HAVE NOT BEEN UNDERTAKEN BY PRIVATE ENTERPRISE	EQUIPMENT WHOSE TECHNOLOGIES ARE IN A DEVELOPMENT OR IMPROVEMENT PHASE BY ENTERPRISES	
	EQUIPMENT AND TECHNOLOGY CLASSIFICATIONS	TECHNOLOGIES WHOSE DEVELOPMENT IS CONSIDERED UNINTERESTING DUE TO MARKET OR PRODUCTIVE CAPACITY	TECHNOLOGIES WHOSE DEVELOPMENT NEEDS DIRECT CDTI INITIATIVE	TECHNOLOGIES WHICH CAN BE DEVELOPED BY PRIVATE ENTERPRISE WITH CDTI HELP	TECHNOLOGIES WHICH CAN BE DEVELOPED BY PRIVATE ENTERPRISE ON ITS OWN
FINAL RESULT		NEW PRODUCTS	NEW PROCESSES	NEW TECHNOLOGIES	

Industrialists are often very hesitant to make use of new technologies. It is obvious that to be the first to use an unproved technology presupuses running one of the risks which general business practice attempts to avoid by acquiring equipment which has been proven through use to be satisfactory or when the manufacturer's reputation is in itself a guarantee.

In both cases the Spanish innovator is always at a competitive disadvantage with those nationalities which are famous for the quality of their technology.

In order to solve this problem CDTI has created a Guaranteee Fund which will:

a) Provide certain financial help -in the form of a credit- to the buyers, both foreign and national, of new Spanish technologies.

b) Permit the establishment of a type of insurante policy for the risks incurred in the use, for the first time, of a new technology.

c) Facilitate contractual acquisition of products and processes for demonstration purposes or for obtaining data and for observation and control of specific phenomena which by any other means would be impossible to obtain.

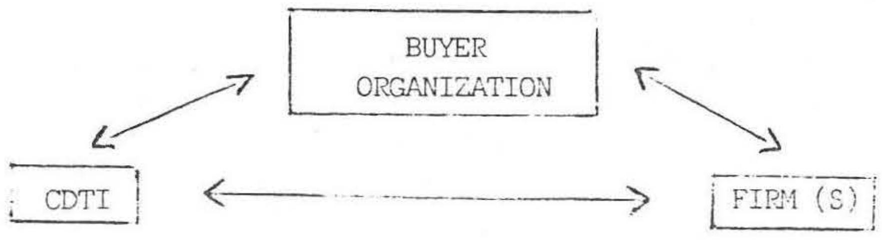
6. Opportunities promotion.

6.1. The creation of the need for new technology which can arise from the functioning of the Government when this is composed of many different Organizations which use technical resources which only they need is well known.

Radiotelevisión Española, the Instituto Nacional de Previsión, today Instituto Nacional de la Salud (National Health Institute), RENFE (Spanish National Railways), etc., constantly have need of new equipment -and the technologies involved in their creation which causes technical dependence or can inspire original local development in accordance with the availability of time, financing and resources.

CDTI is systematically proceeding to establish contact with all the "large buyers of technology" in accordance with the system presented in Table IV.

What is actually attempted is to establish an interaction triangle which will result in the development of a prototype and the manufacture of a first series.



Essentially the Buyer Organization:

. Defines certain necessities.
. Schedules a minimum purchase of equipment.
. Establishes the specifications.
. Supervises the development of the project.
. Controls costs.
. Contracts and, if necessary, accepts and endorses the prototype
. Acquires a pre-series which allows amortization of development cost.

The Firm(s):

. Develop(s) the project.
. Contribute(s) their (its) knwo-how.
. Create(s) competitive technology.
. Acquire(s) or consolidate(s) new markets.
. Create(s) or guarantee(s) employment.
. Are (is) released from foreign ties and provide(s) for its exploitatio
. Improve(s) technological balance..

The operation is effected through a Cooperation Agreement Buyer Organization - CDTI, under which CDTI assumes specific economic risks and the buyer certain obligations.

Once the Agreement has been established, the cycle is closed through a Supply Contract between the Buyer Organization and the Firm(s) and a Collaboration Agreement between CDTI and the Firm(s).

6.2. Frequently one finds that among the small and middle-sized industries that there are those, normally limited to definitive geographical areas, which due to local or family traditions have maintained a very specific status. This is particularly true for the following industries:

Machinery
Toy Industry
Shoe Industry
Etc.

or other such as:

Ceramic Industry
Cooking oil industry
Cement industry
Etc.

which are subject to peculiar circumstances.

The first group of industries:

are not suitable -for various reasons- for contracting or merging with other firms.

. Have at hand advanced technologies, although their products are subject to profound and rapid changes which depend on external sources (introduction of Electronics, rapid change in salary costs, etc.).
. Export a considerable part of their production, although the competitive position is in serious danger because the importing countries can suddenly stop doing so upon developing their own productos, or they may begin to lose markets to another countries whose products become cheaper due to lower wage scales.
. Need a strong push -which they are incapable of doing on their own- to take advantage of more modern and sophisticated products wchich are at present manufactured by countries more industrialize than we are.

The second group of industries needs to improve and to tecnify its production systems in order to:

. Obtain higher productivity.
. Solve some of the problems specific to the sector (contamination,...).
. Perfect processes which provide additional energy economy.
. Etc.

This type of activities which are needed are, in the first place, an analysis of the situation of the sector under study (see Table V), which will permit the adoption of a wide variety of solutions among which is the one, surely the most highly developed, which es given in Table VI.

6.3. Certain Special Programs provide CDTI with yet another ocassion for helping to identify those technologies which might possibly be developed.

This is de case of the National Computer Science Plan in which CDTI lent help to the Ministry of Industry and Energy, serving as Coordinating Secretary for the two Work Groups -Computer Science Industry and Applications to the Private Sector- to which it was assigned and participated in four other ones which were directed by other Ministries.

It will also participate, for example, in certain organizational aspects of the World Football Championship which will be hold in Spain in 1982, etc.

CDTI has been particularly preoccupied with middle- and long-term technologies. The projects presented to CDTI by Private Enterprise correspond to present day problems. They are, therefore, projects whose development will take about two years and they are limited to very definite and specific products and areas.

There are, however, technologies, like those that have to do with solar energy, compound materials, etc., which will undergo very important development in the second half of the 80's.

TABLE V

DIAGRAM OF A SECTORAL STUDY FOR THE DEVELOPMENT OF NATIONAL EQUIPMENT OR TECHNOLOGIES

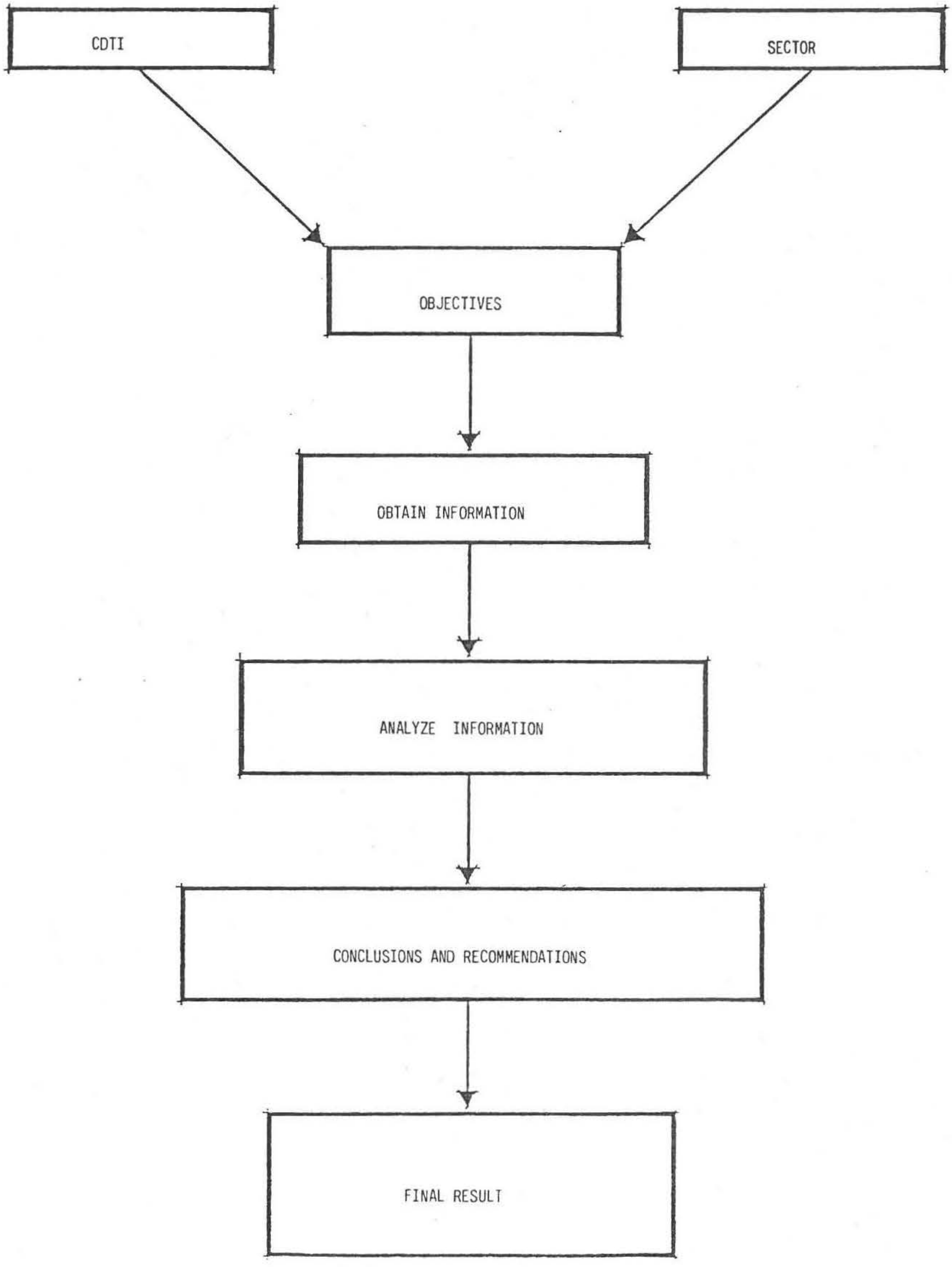


TABLE VI

FUNCTIONAL DIAGRAM FOR THE DEVELOPMENT OF
TECHNOLOGIES OF MUTUAL INTEREST TO A DEFINITE SECTOR

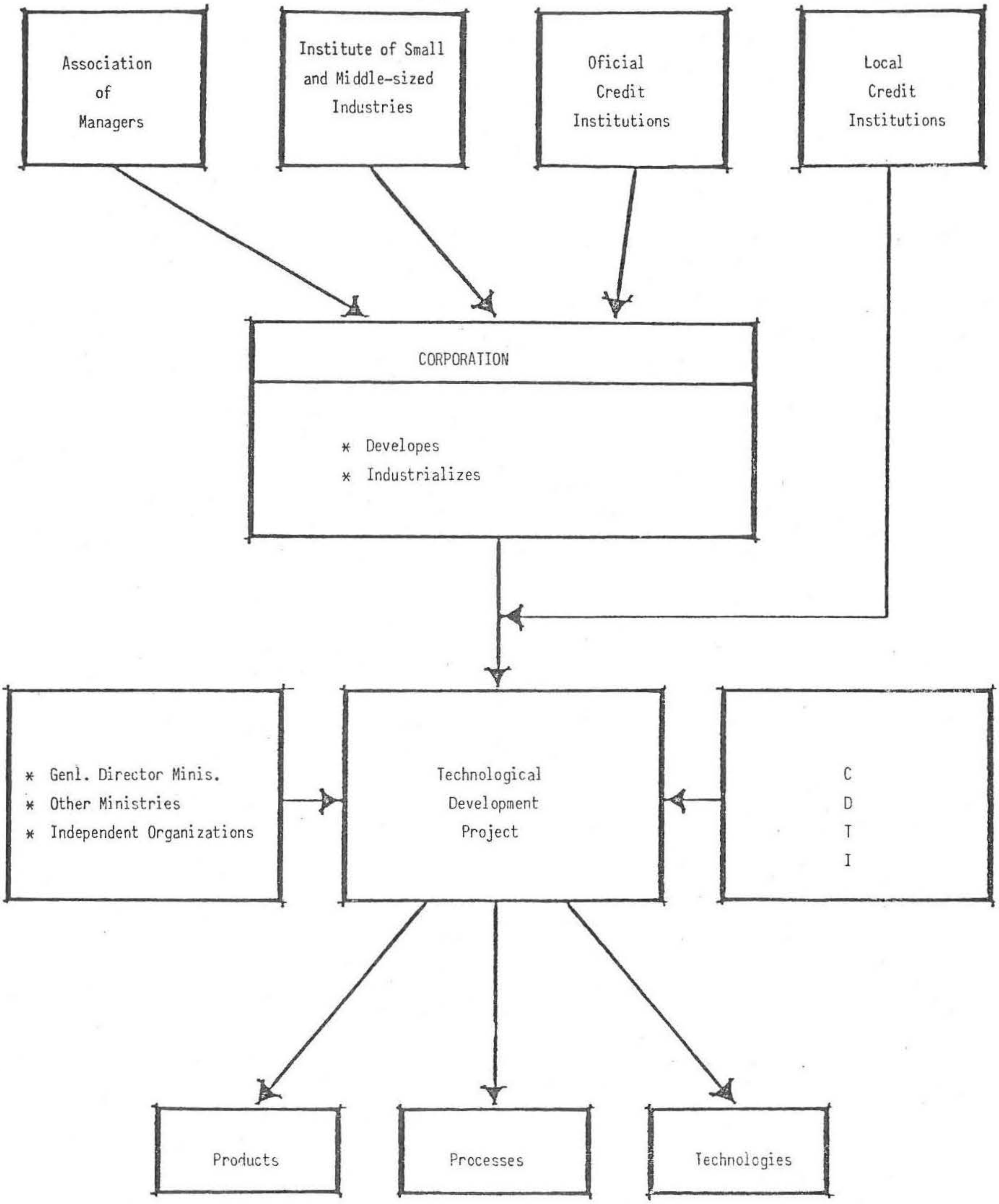
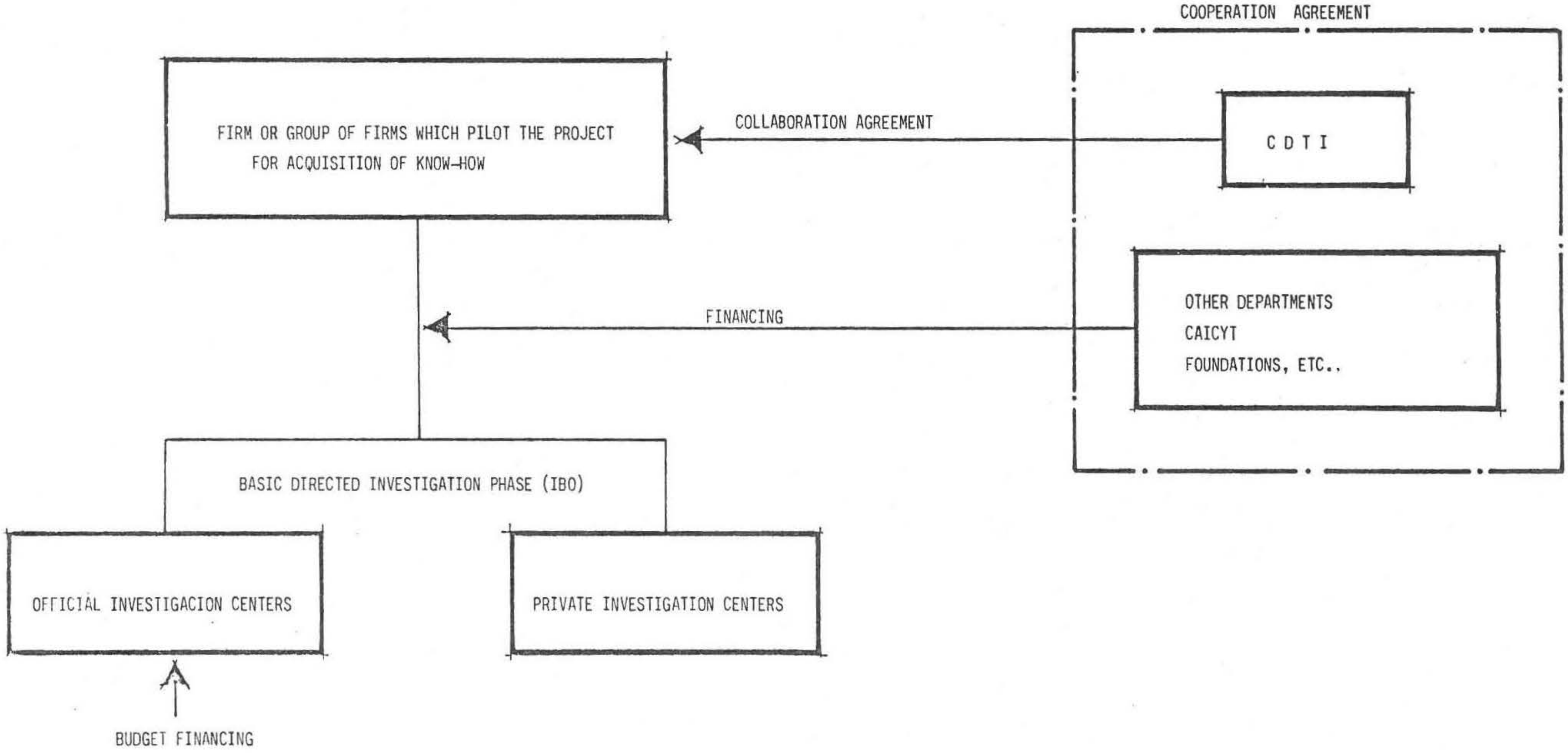


TABLE VII


COOPERATION AGREEMENT
FIRM OR GROUP OF FIRMS WHICH PILOT THE PROJECT
FOR ACQUISITION OF KNOW-HOW
COLLABORATION AGREEMENT
C D T I
FINANCING
OTHER DEPARTMENTS
CAICYT
FOUNDATIONS, ETC..
BASIC DIRECTED INVESTIGATION PHASE (IBO)
OFFICIAL INVESTIGACION CENTERS
PRIVATE INVESTIGATION CENTERS
BUDGET FINANCING

In order to be able to exploit the market opportunities that will become available, it is absolutely necessary to begin now, and to continue in the future, to study not only the international development of those technologies which are considered to be of interest, but also to begin to build a team of technically prepared specialists who will be well versed in the same at every moment.

Of course this means maintaining long-term programs which offer no inmediate profits and in which therefore the business community will not want to participate. In many cases these projects will mean participation in investigation programs which will not be carried out only in the industrial sector.

Thus arises the necessity of structuring programs which will continue to be coherent as time goes by and to plan for the cooperation of all those Institutions which as patrons, participants or sponsors of the programs will become involved.

In order to approach, define and analyze a project, and to formulate the recommendations which are thought to be the correct ones, CDTI can follow a procedure similar to that which was developed for the National Computer Science Plan with an operative organization for financing which can be like that which appears in Table VII.

7. Special programs for Small and Middle-sized Industries.

It is a well known fact that Small and Middle-sized Industries:

a) Provide the largest number of jobs.
b) Produce the largest number of innovations.
c) Have a cost per person dedicated to R&D which is less than in large industries.
d) Are younger and in general more aggressive than Large Industries.

Therefore, they offer opportunities of which advantage should be taken, but they also need to receive special attention in order to achieve their true value. CDTI intends to develope, in cooperation with the Institute of Small and Medium-sized Industries, a program:

1. To promote creativity in these industries through special economic stimulation of new ideas.
2. To facilitate access to improved information on updated technologies.
3. By urging that use be made of the possibilities of support offered by the existing national scientific and investigation Community, and in particular that which can be considered to be near at hand to where these industries are located.
4. Through priority and emergency processing of their proposals.
5. With help in their search for industrial financing -through the Banco de Crédito Industrial- for exploitation of the idea includ ing circulating capital -with economic apportations-, risk sharing, promotion, etc.

8. Information and Documentation Services.

The generation of innovation demands participation in a definitely creative atmosphere, self-enrichment by being among ideas and experiences which have come of age in societies which are favorable to the same or sharing of ones own ideas and experiences with the international community of innovators.

CDTI selects, with this purpose in mind, from news bulletins and other specialized publications edited by the large centers dedicated to the promotion of technological development (NRDC, ANVAR, NRDJ, NASA, NSF, Licensitorg, etc.), the industrial innovations which are discovered in the more progressive nations.

The different Professional Associations are informed monthly of these innovations, classified by sectors, so that they in turn can informe the individual member-firms.

This aid to industry, called Servicio de Información de Nuevos Productos y Procesos (SINPPRO) (New Products and Processes Information Service), is at present in an experimental stage so as to permit improvements -if it is actually seen to really be beneficial to the users- in order to achieve, at a later stage, a reverse effect, compiling Spanish innovations for foreign publication.

We have attempted to make a resume, which we hope is easy to understand, of the objectives, activities - and tools available and which are considered as of - now to be the most adequate and efficient to carry - out the tasks assigned to the Technological Industrial Development Center.

We hope that familiarization with this brochure will stimulate professionals, industrialists and managers to continue or to begin their activities with great innovative spirit, knowing that there is a possibility of receiving some type of help for the same from the Center as stresses in our motto:

C D T I

F I N A N C E S

T H E F U T U R E

THE FOUNDATION OF FINNISH INVENTIONS

SITRA

C.E. Carlson

"THE FOUNDATION OF FINNISH INVENTIONS"

By Prof.C.E. Carlson

When presenting the case of "The Foundation of Finnish Inventions" I report on the achievements of an independent body, which has since 1971 successfully promoted the work of private inventors in Finland. On the same time, however, I will give an example of how a NRD-organization like SITRA has solved the perpetual question of mixing the support to the established industry or research organizations with the much more diversified and troublesome task of dealing with small inventors. According to its statutes SITRA has to finance research and development work made by private persons as well as by collective bodies.

The early beginning of an organized help to inventors was made already in 1957, when the Finnish Culture Foundation established a bureau for that purpose, financed by the legacy of a donator, Maili Autio. The object of the bureau was to assist in developing inventions until their real practical value would appear, to protect the rights of the inventor and to find a suitable user for the results. To this end a permanent council was appointed and a small office set up. In 1961 a workshop for building and testing prototypes was started.

During the end of the 1960's more and more attention was paid to the importance of R & D in Finland. After SITRA was founded in 1967, it soon established a close cooperation with the Inventors Bureau and granted also smaller sums of money which were distributed by the Bureau.

Rather soon it became evident that stronger effort was needed. The state officials in charge of technology, The Ministry of Trade and Industry, who recently had entered the field of direct support of development projects, was also interested in an intensification of the inventor's aid. Finally, in the year 1971, the Foundation was organized. A large support by interested parties is secured by establishing a board of commissioners including 27 people representing various organizations in the field of research and education, financing, industry and public administration as well as the inventors themselves. The board of directors has six members from the organizations mostly involved. The burden of financing, to which I return later, is divided between the Cultural Foundation, SITRA and the Ministry.

The activity of the Foundation follows very closely the working principles of its predecessor, the Bureau, but in a substantially greater scale. When trying to give a picture of the achievements hitherto, and the present activities I will start with some figures and finish with some examples of typical projects.

	71-72	73	74	75	76	77	78	79
Total expenses	1298	1363	1695	2150	2157	2329	3100	2700
Direct financing of inventions	431	575	1040	1446	1375	1397	1118	1450
Renevues from inventions	11	16	81	33	101	50	109	200
SITRA's contribution	420	499	566	521	649	749	1736	980

Table 1. Financial data from books of the Foundation of Finnish Inventions, in 1000 Fmk's (1979 real value)

The table 1 displays the financial development of the Foundation from the beginning until last year. The figures are adjusted to compare with the real value of 1979 money. The four indicators shown are total expences, direct grants to invention projects (the rest being mainly used for consultation and administrative expenses), returns from contracts and SITRAs share of the total financing.

The returns from contracts are based on the fact, that when the Foundation decides to take up a project for financing, it makes an agreement with the inventor about a repayment rate, calculated on the future earnings. A normal rate varies from 20 to 40 % of the royalties the inventor receives from his licences, depending on the Foundations's contribution to the developing costs. This claim is, of course, sometimes considered high by the inventors, but as seen from the statistics, it by no means suffices to cover risks taken.

The Ministry of Trade and Industry is the biggest financer of the Foundation. SITRA's share has consequently been less than half of the total. The year 1978 shows, however, a somewhat changed picture. The explanation is, that SITRA made a special grant of 1 Mill. Fmk. to be given as support to inventors, which are willing to go into business on their own. In Finland, as many other countries, entrepeneurship has stagnated and the number of newly established firms dwindled. The opportunity to offer money as conditional loans for the inventors first investments in an own firm has been welcomed by the Foundation. This arrangement was considered an experiment. The results have, however, proven so encouraging that a new million is granted for this year. It is evident that the new entrepeneurs must be chosen very carefully and that this form of exploiting inventions is confined to relatively small objects with modest demand on production equipment and selling cost. We fully realize that more advanced inventions should preferably be incorporated in existing industrial organizations.

The activities of the Foundation have gradually increased, as seen from the steady rise of the overall costs. It employs about 10 persons in the office and workshop. About 300-400 applications are handled yearly and the workshop is currently taking part in the testing and development of about 20 inventions. A considerable part of the staff's working time is devoted to consultations, which are free of cost. The number of these are estimated to as much as 5000 every year. The Foundation has been actively promoting the commercialization of inventions e.g. by participating in international Inventors Fairs. A new attempt has been the appointment of an agent for selling inventions abroad. Each year the Foundation grants a number of honorary awards to successful inventors. The national union of regional inventors associations also receives monetary support from the Foundation.

After all, the inventions themselves are the best measure of the results achieved. A short cavalcade of slides shows some examples, which are typical for inventions which have been technically successful and in many cases also have reached the stage of commercial exploitation.

1) The Finnpipette Analyzer System
2) A plastic parachute
3) Continuous feeding of reinforcing strands to big tubes
4) Deep-freezing and peeling of potatoes
5) Terrain vehicle "Finncat"

From the point of view of SITRA, the Inventors Foundation has proven a very practical and efficient way of solving the problem how to support private inventions. Since a representative of SITRA's staff has permanently occupied a seat in the Board of the Foundation, we are able to follow the work closely and take part in the decisions. Private persons who approach SITRA are, if worth while, directed to the Foundation and, vice-versa, the Foundation can suggest new ventures to be financed by SITRA. Maybe the most important benefit from this two-parted organizational arrangement is that the personnel can really specialize in their own field. Dealing with inventors requires a.o. special knowledge in the legislation concerning inventors rights and licensing procedures plus a great amount of psychological talent and patience. Industrial contacts are handled in a more businesslike manner. They require experience in the management of firms and especially their R & D-functions. The Inventors Foundation has saved SITRA from many time-vasting negotiations about trifling issues and even from an armed assault, while the finnish inventors certainly have got more and better help than SITRA's office ever could have offered them.

EXPERIENCE OF THE TECHNOLOGICAL TRANSFER UNIT (T.T.U.) IN ASSISTANCE TO TECHNOLOGICAL PROJECTS

CONICYT, Venezuela

F. Chalbaud

presented by : K. Zagustin

NRDO-CONFERENCE 1980, Munich

"EXPERIENCE OF THE TECHNOLOGICAL TRANSFER UNIT (T.T.U.)
IN ASSISTANCE TO TECHNOLOGICAL PROJECTS"

By : Fanny Chalbaud, CONICIT, Venezuela

I

The "Unidad de Transferencia de Tecnología" (Unit of Transfer of Technology) coordinates a program of Assistance to technological projects that include :

1.- The evaluation and reformulation of the application, from the technical point of view as well as from the administrative financial and the social interest of the project.

2.- The following up to the project, that is, the control of the execution from the technical and administrative point of view.

3.- The technical assistance that includes providing the technical and related information, legal and technical advise.

Financial assistance granting loans as risk capital.

4.- The transfer and exploitation of the interesting results of projects, that could take the form of its commercial exploitation, regulated through a technology contract.

For the receiving of the application a rigorous mechanism or procedure has been designed. It consists of the formalization of the application using a Form to be filled by the petitioner.

To the effects of this discussion paper, the interesting thing is to call the attention to the fact that as a public entity without interest in profits, Conicit give priority and give assistance to the applicants in relation with the social impact that could have the technology derived from the presented project. That is, the criteria of social evaluation, that have been developed by the unit are applied.

For the evaluation of the applications it relies on the support of external advisers specialist on the subjects involved in the project.

The attention to this program is directed mainly to:

a) Independent inventors.

b) Researchers of Universities and Centers or Institutes of Research.

c) High level profesionals who work or own engineering firms or work in public entities not dedicated exclusively to investigation.

The majority of petitions correspond to these three groups in the same order in which they are presented here. As it is to expect, the request of this kind of program by industrial firms does not occur very often, because they have funds or enough resourses, or because they are not inclined to research or to develop products.

Research Institutions non university, very occasionally applied, they have bigger resources of their own or work with projects under contract paid by the users (the government, industries etc.).

The characteristics of the average petitioner are:

1.- Without experience in the formulation of a research project or technological development, although in a number of cases, they are persons who have developed some innovations, or possess patents on previous inventions or have participated in research projects.

2.- Without enough resources of their own and without access to financing sources or services suppliers in the country. (Only recently was launched the first non-governmental firm, as a lucrative enterprise, for assistance and to provide services in the development and exploitation of innovations in Venezuela).

3.- They have not realized previous studies on the innovations.

4.- They do not have training nor appropiate information on the commercial and legal aspects of technologic innovations. They are unacquainted with the difficulties of fabricating new products.

5.- They are not prepared to receive external advise because the fear their ideas could be stolen or forged or because they do not trust the professional and technical capacity of other experts to understand or improve their innovations.

6.- Most of them are not prepared to commercialize by themselves the results of their investigation or technological developments, they prefer as a first choice to sell the technology or as a second choice to license it.

In the last two cases, they do not have elements to judge suficiently the marketable results, this includes a) they do not know how to determine the commercial value or the forms of favorable commercialization.

b) related to the previous one, they ignore that is necessary to go from the ideas, design, project and prototype phases to the phase of specifications, engineering studies and fabrication of the products. That is, they do not distinguish fully the differences between "invention" and "innovation".

Of course, these characteristics are more typical of group a) which is the major one of the three groups. We suppose that these characteristics are typical of the independent inventors of the "house base inventor" of most countries. In Venezuela there is not an "Inventors Association" that could change this situation leading and informing to all interested people on these questions; the Patents Registry Office does not provide this information to the public because it is not considered as part of its functions. Even the people that introduce patent in their own must go to a lawyer that acquaint him of the requirements imposed by National Legislation on Patents (and of their international implications). (See a short description of the Venezuelan Regime on Industrial Property on Annex II)

II

In relation to the profile of the projects handle through CONICIT (U.T.T.) we could note the following predominant characteristic

a) Most of the requests are referred to product more than to process. Within these, most of them are "new products" and the rest improvements of products already existing. Some of them are actually revolutionary inventions in the speciality from the techno-scientific point of view.

b) The area of activity (and field of application) varies, it covers the following areas: Chemistry, Civil Engineer, Hydraulics, Mechanic Engineer, ElectricEngineer, Electronic, Food Technology, Automotive Engineer, Pharmaco-Chemistry.

c) The level of technological complexity of the projects, including the activities and the complexity of the products and results, is very heteregenous, that is, it includes very complex as well as very simple technologies.

d) In relation to the marketability or economic importance of the transferable results, as a consequence of what has been said before, the spectrum goes from products that could be easily protected (technically and legally) to products very difficult to protect.

e) The extension of the lapse required to conclude the research and development and related activities is very variable, this according to the complexity of the matter.

III.- Criteria of Evaluation of the Projects

The following are the critera used for the evaluations of the projects:

1.- Novelty:	Whether it is a original technology, at a national and world-wide level taking into account if it has been applied, divulged or registered before. It includes adaptations and improvements, excludes copies.
2.- Technical feasibility:	Whether there are conclusive evidences about the efficient function-ing of the process or equipment or of the properties of the products.
3.- Utility:	Whether the needs satisfied by the technology are important. Whether it is applicable whether it is versatile.
4.- Social interest:	The importance for the country, for the users of this technology, due to its effects on the improvement of the quality of life (this includes

the environment) and working conditions. Includes the effect it could have in the development and autonomy of the country.

5.- Rentability: Whether the process or product could be exploited economically in the internal market or for exporting, including the different applications it could have.

6.- Scientific Interest: The interest it could have for the development and enrichment of national science and its impact on scientific research structure in the country.

7.- Technical level: Degree of optimizing of the technology, needs of perfecting the prototype for its efficiency and better adaptation to its functions. Level research on neccessary specifications.

8.- Capacity of the applicant: Credentials and technical abilities to guarantee the accomplishment of the proposed plan.

9.- Available resources: Premises, equipment, personnel, financing, information available to the applicant in national institutiones and abroad.

10) Cost of the project: Whether the financing requested for allows the accomplishment of the proposed plan.

11) Capacity of adsorption: Whether the national industry and engineering is able to use the new technology, in new plants or already existing ones or on the contrary they do not have the technical level required to do so. Appropriable.

12) Substitution Power: Whether it substitute a previous technology, if could displaces it from the industry or could compete sufficiently against it, or if on the contrary there are economic, sociological or legal factors that prevent such a technological change.

As could be seen, there are included some additional criteria to the traditionally used for patents (1, 2 and 8), requirements taken most of them from the field of Social Evaluation of Projects and Evaluation of Technologies.

IV

General Policy of Conicit (U.T.T.) towards the projects.

The policy of Conicit towards the assistance petitions are a resultof the content of the criteria mentioned before. It stands out that is not enough for a proposed technology that is has the basic requisite of novelty, technical feasibility and commerciability. a product would be marketable but if it does not have any importance and it will not provide the requested assistance. Of course this brings, as a consequence, that this request is left without assistance and without official protection. There are not non lucrative enterprises to provide these services, the ones established are for profits and put the inventor in a very weack position.

Then, there are not established priorities to provide the funds and the technical assistance. That is, there is not a hierarchy of petitions to attend their requirements. The reception is made following the chronological order they come in and according to the budget availability the Unit has at the moment the petition is evaluated. Those forwhich there are not funds available for the moment, are postponed for the next budget.

Now, there is a ruled fundamental requisite that is the favorable evaluation of two experts in or outside the institution to approve a project or to at least reformulate it. This means more problems: the first one is to identify the indicated advisers, that is, actually experts on the area; the second one: these adviser should know the methodology of projects evaluation, for wich purpose a brief orientation is given and thirdly: they should be reliable, that is, they should respond promptly, discretly and with the neccessary rigor, this unfortunately not always happens. This inconvenient, and the delay in collecting the information to evaluate internally the project makes very slow the evaluation; it generally extends for more than three months. This compiling of the information covers as a general point the following:

a.- Study of anteriority (patents and non patented technology)

b.- Industrial standards and official technical specifications.

c.- Actual market information (channels, services, products, suppliers, prices, etc).

d.- Applications and uses of the product . Enterprise potèntially interested on its exploitation or use.

e.- Feasibility study (production function).

f.- Legal aspects of the invention.

These activities of collecting the information also serve subsequently for the phase of evaluation, that is, are elements that will allow the reorientation of the project inasmuch as it determines:

- The different applications of the process or product.
- The distinct advantages wich allows to insist on determined aspects of the project or characteristics of the product.
- Reformulation and technical redesign based on information about other existing technologies.
- Centers that provide technical services and information

not considered in the original project.

- Patenting strategy.

In the case of independent inventors, the unit demands as obligatory or at least recommends (1) and induce the applicant to use the services of advises and/or research institutes that improve the quality of the innovation and issue certificates on the results of the project. In this sense, the policy of the Institution, tends, in general, to favor scientific-technical institutions within the country above foreign ones, to promote the national research structure. Only if it has been shown that the specialized entity in the country is not able to provide the requested services in adequate conditions, it will authorize the payment of services abroad.

An important point, already mentioned on advising is <u>confidentiality</u>. The functionaries of the institution have the character of public functionaries, and consequently: are obliged to the preservation of the information contained in the files by law (Ley de Carrera Administrativa de Venezuela). Nevertheless part of this imformation must be revealed to:

- obtain information and external advice.
- commercialize the technology.

In this case is divulged only that part of the information that is unavoidably for the proposed objective (that is, the information given is on that which is available), this because there are not guarantees that those receiving the information are not going to use it for their own particular ends and benefits. For example, it could be that the most able expert on a given technology, is the less indicated to evaluate a given project within his area because he is a technician or an executive in a private industrial firm that is in the market of that same technology. Perhaps just making it known that that research is to be realized becomes a negative handicap for its development.

Internally the possibility of loosing of documents or data that could be of particular interest could not be discarded although it has not happened until now. On the other hand, the inventor or researcher does not give all the information he has to the Institution, neither provides replicas of prototypes that could facilitate to copy or forge the invention.

In relation with the request for funds, Conicit provides financing for personnel involved in the project, equipment, materials and services. Within the last item is included the cost of patenting procedure (drafting documents, translations, professional charges, drawings) in the country as abroad. Since Venezuela has not subscribed the Agreement of the Patents Convention, we find advantageous to apply for the patent in any country signer of the Convention with the aim of obtaining its benefits. This country is U.S.A. inasmuch as this does not require residency of the applicant as a requisite for the title petition, requirement that is demanded in most of the European countries.

In relation with the terms of <u>execution</u> of the proposed tasks the Institution is very flexible and receptive, although as required by the rules there are limits on the terms given to present the proposed results. On the lapses to complete the transferring of the exploitable results there are not fixed terms; its extension depends on the requirements to finish to point the technology, and on the characteristics of the market for each particular case (and on the hability of the inventor or of Conicit to promptly negotiating and in good terms).

V

Experiences on commercialization of results

Since the moment this program was created at Conicit, it is orientated to link the results of the investigation with the user. That was the reason to name the program initially as "Transfer of investigation results into the productive sector". This meant that: 1) The agent that generates the innovation generally was not its user. 2) That from its conception the project was oriented to a transfer signed mainly for the economic benefit, that is, the commercial interest that it would have for an industrialist. Of course also the innovator and Conicit would perceive some incomes even in an amount superior to the cost of investigation and development. The participation of Conicit is fixed for each case, within these following general alternatives: 1)Without limits on quantity 2) Establishing a limit to the recovered quantity. At the same time the percentage of participation of Conicit on the royalty varies from case to case from 5 to 50% of its total according to

a) the amount of money given b) the risk involvedin the project c) the quality and quantity of assistance given to the project.

As a consequence of the two just mentioned questions from the begining of the execution of a project, or even before, it starts to identify possible candidates interested on the results of the project wich are: - Users of the product in its different models, versions and applications.

- the dealers (wholesale) of the product.
- suppliers of materials and services and pieces for the product.
- licensee or buyers of the technology.

In the same way, if the chosen option by the inventor is to invest and produce by himself, it starts looking, to substitute for the last mentioned (licensee and buyers) for source of financing or partners and contractors that could take part in the business under different modality (for example, a contract of leasing a workshop, a contract of services).

When the inventor intention is to license or sell, we consider the best strategy to offer the technology to industrialist established on the business, that is that produce similar articles or work with similar technologies or that could change its production to the new product or process. In the same extent that the answer given by these is positive there would be a mutual benefit; above all the inventor will account on an income more rapidly because the already established could contract quicker and make effective the contract earlier.

Moreover if the market is saturated and there is a large amount of non used capacity, is very difficult to think in the entering of a new producer, eventhough the new technology could be very superior economically and technically. Evenmore that new product will take more to make effective the contract and with more difficulties will retribute the inventor better than to those already established, this will be so even if the contract includes clauses very favorable for the offerer of the technology.

In general, our advise to the innovators is to license the technology rather than sell it. Beside that it is more difficult to find somebody to buy for the correct price. It must be added that in the last analysis the licensee will become a partner of the licenser, that is, will develop or improve the product, will manufacture it in a massive way, will finish up the engineering studies on design and production. Inclusive both together will be able to offer the technology to third persons as a technological package sharing the benefits. In this way the technology will be offered through an industrial firm, wich is in a better capacity to negotiate with an inventor or with non lucrative institution. This firm could also offer a more complete technical assistance; above all if it has been manufacturing the product for some time.

The experience obtained until now allows us to confirm the theory that it is more difficult, although not impossible, to introduce original technologies with a lower level of development. This is due to two factors on part of the firms: one is of a sociological, subjective nature, the mentality towards risk common in the enterprises, that is the lack of initiative and audacity on the technological of the industrialists, their lack of confidence on the technology of local origin. The other which probably causes the previous one, is that objective data from the market are against the innovation: reduced markets, lack of skilled labour force, poor receptivity by the financial institutions, a big competition in the industrial trade. On the other hand, it must be taken into account that foreign companies established in the national market generally do not consider research and development activities in the receiving countries. In any case any decision is centralized at the parent firm.

This lead in many cases, to think in exporting the technology to more developed countries, wich will be good if we think it over from the point of view of revenues, of recovering the invested funds, but it is self defeating or contrary to the established objectives as the technological advance is transfered to another markets, to other countries and on that way the social and economical benefits that it could bring. In some cases, it could happen that the patenting, certification and exploitation of the technologies abroad facilitates later exploitation in the country because the antecedent diminishes the risk of the domestic promoter. For that the contracts on technology must be considered by territories or countries, that is, is better to license than sell and it must be given territory in the country where production would be established (or countries linked to it).

Among the initial concrete experiences on negotiation, we think the followings are ilustrative:

An inconclusive case.

Autovalve: This is a hydraulic mechanism for the self-controled opening and closing of flow that could be of water or oil or any other liquid whichever its viscosity or relative acidity. Its creator is an independent inventor who had developed a related patent (heater-shower) and had exploited it industrially. He developed and improved the prototype with financing from Conicit, he finished it up in 1978. He relied on advisers to improve some elements of his invention and develop several applications: for sanitary tanks, water reservoirs, gasoline expenders, industrial tanks, etc. Previous studies realized by us, permited to verify the originality of the invention and its superiority over other already existing because it has: a) wider range of sensitivity to the imput-pressure of water, b) more resistant to liquid impurities, that is, resistance to tamponage, c) less parts.

Several demostrations were prepared on the functioning and operation of the dispositive, to which were invited inventors, industrialist and traders on this line of products.

It was determined that on the market of these products competitors were integrated: two companies with fairly new technologies had under control 70% of the production and had a captive market of no replacement because they are at the same time the manufacturers of sanitary equipment on ceramics. There were other three companies that were sharing the replacing market with the two already referred to and wich have a lot of non used capacity. These three at the same time had very good relations with the wholesale dealers. One of these recently obtained a technological package abroad and was the one with the newest technology.

Of all of them two answered the offer, one of the big ones, we call it A, and the most recent one, let us call it C. As could be seen the two which responded were precisely those using the newest imported technology, one acquiredby licensing and the other one purchased as a technological package.

The company C made a concrete offer of licensing with a rate of 4% for the first two years of exploitation and 5% the following 7 years, this on estimates on sales at the factory door. This firm with publicity, brand use and a sales campaign, was expecting to an inrreasing share of the market assuming that it was favored by the change of conduct by the final consumers (home owners). There were reasons to think that the justification of the company looking for a premature technological change (they had not yet amortice its industrial and technological investment) were that:

1) Its installations could be easily converted to the new design.

2) The design or technology they were using had shown several problems of quality and adaptation to the medium, particularly in relation with the water supply in the country, factor wich had not been considered by them previously.

Our opinion is that the offer was good, that negotiations should be continued and that the offer could be improved because the above mentioned factors indicate that we were in a good position for bargaining.

In this negotiation Conicit acted as a attorney of the inventor, but he maintained the right to veto, that is, a negotiation could not be closed without him expressing his consent.

In that sense the answer from the inventor was inmediate and sharp: his aspiration was to sell or a big initial payment in cash combined with an equal amount on royalty (5% fix during the nine years of the contract). It was offer to him a remission of the debt for two years to payback the capital that was lent to him and it was also offer to him financing for the engineering costs of the producer. His aptitude did not change and he did not answer the offer from the industry. An inquire was made on the his financial state, finding that there was a delay on the payments corresponding to the initial amortization wich was understandable because the recent initiation of operations and the difficulties of the product and market.

After this frustated negotiation, there was some insistence in making the offer to company A, although there were some adverse opinions about the possible behaviour of the firm. Newertheless, the firm addressed itself again directly to the inventor whom has not participated the results of the discussions to Conicit. This has made contact with private inventors opposed to our appreciations already expressed and that were made known to the inventor.

On the other hand, companies producers of taps and faucets wich were approached did not answer the offers. Almost all of them are Venezuelan firms. These are firms with a very good position that are working at full capacity and that produce most of its production by buying orders.

A third alternative that was not explored was to offer a contract of service to a company producer of plastics, do production orders, send the mold to be casted and then place the goods with wholesalers but that required of the entrepreneur and the inventor at least was not prepared to do it for different reasons.

Although it could be considered as a non successfull case, there still exist some posibilities inasmuch as it remains as a new technology. Among the though alternatives is exporting the technology (eventhough it is a technology only after it has broken the barrier of large scale production).

Nota 1) (Página 12) The researcher signs a contract with Conicit but he is entirely autonomous in the management of the project, including the given funds. Frequently he goes against rules and recomendations expressed by the institution.

ANNEX I

Balance General:
Número de Solcitudes: 72

Incluye:
Recibidas
Aprobadas
Negadas
Desistidas
Rechazadas
En evaluación

Total financiamiento: Bs. 12.000,oo (miles de Bs.)

Listado de Proyectos culminados, como éxito tecnológico (incluye no transferidos aún o que no son éxito económico)

	Nombre del Proyecto	Costo de Financ.	Area	Solicitante
1.-	Taximetro Electrónico	205.000,oo	Electrónica	Investigador
2.	Central Telefónica	900.000,oo	Electrónica	Empresa
3.	Sistema EME	1.011.000,oo	Construcción	Consultante
4.	Autoválvula	141.000,oo	Hidráulica	Inventor
5.	Regulador de Par	56.900,oo	Mecánica - Industrial	Inventor (Técnico)
6.	Retención Inclinada	50.000,oo	Agricultura (Riego)	Ingeniero
7.	Fermentador	30.000,oo	Salud	Biologo
8.	Recuperación Ag.	10.000,oo	Química	Profesor
9.	Prensaestopa	52.700,oo	Petróleo	Inventor (técnico)
10.	Freno de Seguridad	41.000,oo	Automotriz	Inventor Obrero.
11.	Catalizador	—	Petróleo	Investigador
12.	Conector	—	Electricidad	Empresario Productor
13.	TRI	—	Electrónica	""
14.	Mecanización de la Yuca	365.200,oo	Agricultura	Investigador

Todos tienen solicitud de patente o patente concedida, excepto las dos primeras.
Casos noexitosos: N°2 (en términos económicos)
No definidos aún: N°1, 4 y 10.

ANNEX II

BRIEF DESCRIPTION OF THE REGIME ON INDUSTRIAL PROPERTY IN VENEZUELA

The industrial property in Venezuela is regulated by a Law from 14-10-55, wich deroguesthe previous one from 1927. Its application is on charge mainly of The Registry of Industrial Property, which depends administratively of the Ministry of Foment (Ministerio de Fomento, Ministerio de Industria y Comercio)

The most outstanding characteristics of the Venezuelan system on Patents are:

= The Titles adknowledged by law are fundamentally two:

- Patent of invention, improvement, industrial drawing or model which is extended for ten years.
- Patent of introduction which is extended for five years.

That is, it does not aknowledge or do not provide the figure of "Author's Certificate" neither the figure of "adscription's Certificate" (for foreign patents).

= An invention from a foreign country which have been declared as "no patented in its country of origin" is treated as a national invention.

= Patents of introduction do not give the right to stop a third person from importing to the country similar objects and the priority is given to the proprietor of the foreign patent in the country of origin. Because of this and its short duration this figure is not commonly used by the applicants.

= To approve an application for a patent the criterion of relative novelty is applied, although because the lack of sistematic local information, the criterion of absolute novelty is the one applied in many of the cases examined.

= There is the obligation to use the patent since the first two years.

= The tax on patents rights are annual, they are fixed and they amount to a very small quantity (generally Bs. 100 - $ 23)

= The decisions of the register on expeditioning, caducity, annulation, publishing of patents applications, are published in an official monthly bulletin. It is published regularly although the information is delayed an accumulates.

= To exàm the applications the registry relies on some internal examiners but fundamentally on external examiners.

= The applicants could do the transactions by them selves, without any mediators.

= The cession of total or partial rights must remain consigned at the Registry.

= The applications for patents should be made by the inventor, except what is established in the Labor Law (Ley del Trabajo)according to which inventors under contract to do research work could no claim the right to patent their inventions made under those conditions, the same applies to those working in a firm that have made an innovation but the firm could prove that the success is due to the company and that it is interested to introducing the patent under its name.

= The current law have not been regulated, and besides that it is under reviewing due to the subscription by Venezuela of the Decission 85 on patents and brands taken at the Cartagena Convention. The new project of law have not been definitely drafted and it seems as if it is not with the acquiescence of the Agents of Industrial Property.

In relation with the exploitation of patents, be of national origin or foreigns, it occurs in a very low proportion of them. The total of national patents represent 4 to 9% and the numbers of patents rights given annually varies around 800 titles.

Supplement :

(to be included in proceedings only)

"Case studies : Industrialized Construction Systems"

Case studies: Industrialized Construction Systems

We shall now refer to the case study which, due to its novelty, projects that emerge from it and that are transferable have not been finished yet. We selected one case: "EME System, for a nationally concieved technology for house construction", which has been advanced the most.

Buildings construction technologies (particularly for housing) are an interesting and important technological case study, mainly because of the following reasons:

* There is a noticeable volume of technologies that have been generated locally.
* New technologies play a key role for overcoming the housing question.
* housing technologies are adaptative technologies.
* housing technologies are transferable and negotiable in more favourable market conditions as compared to manufacturing technologies.

The case we are considering now, is a very recent project, still being developed. Its performers are professional architects and building engineers, all with vast experience and previous work in the same field.

The group has its own high managerial capacity, so that technology management is under their direct responsabilbity rather than under CONICIT's responsability. This for sure is not meant at all to diminish the importance the institution has for the success of the project.

BRIEF DESCRIPTION OF THE TECHNOLOGY

It is useful and necessary to make a brief and clear technical description of the EME System so to better understand what is being proposed.

EME System: Building System for the construction of socially needed housing.

This system consists of a set of technologies for the construction of two or more storey buildings for housing, itself designed by a Venezuelan consulting firm with the technical support of a Rumanian laboratoty and a consulting firm from the same country. (This technical support -with the guarantee of confidentiallity- from Rumania, came because there were no sufficient services and infrastructure in the sector which could be able with reference to the project, specially in sismics simulations

The EME System has begun only recently yet is ready to be transfered. It will be used in a Project in Venezuela for the building of 300 apartments beginning next January.

This System includes:

1. A method or construction technique.
2. A specially designed moulding machine and a metallic mould that can be expanded.
3. Special techniques for treating concrete (heating).
4. Design and manufacture of a newtype of partitions and. joints for external and internal closure. Includes moulds.

5. Design and techniques for service units (toilet and kitchen).

6. Architectural design.

And can include, optionally:

7. Specifications as to finishing and materials for finishing (doors, windows, floors).

8. Plan for site implementation and administration of construction projects.

Technology is protected by patents pending for Venezuela and abroad and can be transfered through joint ventures.

This technology is particularly adequate for the construction of standard sized/low-cost housing (more than 80 m^2, 2 yards), of short construction time, for industrialized basis, with tested antisysmical properties and aimed at drastic savings in terms of iron (bars and beams) per square yard of construction.

Also it allows a greater work safety for it is oner of the systems that makes most use of protective tasks (at ground level). It entails the use of heavy cranes, concrete injectors, and other imported equipment and a reduction of labour force inputs.

Internal design of apartments is flexible and adaptable to individual family requirements.

Brief description of the system

The modular part of this technology is the conception of a structure of the site based on a concrete and iron bar-moulded cubes, which is an original desing improving. Those existing in other countries or offering a new version. The cubes include walls and roofing, incorporate all services and have a rather acceptable internal finishing.

As different from the traditional system based on cubes, where one is welded on top of the other or next to each other, the EME System forms virtual "towers", joined by means of post-tension and neoprene inlays at the joints. The "towers" are raised in paralel form, so that every two cubes are tied to each other by means of slab-bridges.

Cubes are made on large metal moulds which are placed (several units) at the very construction site (which becomes a mobile industrial plant); then, after taking off the moulds, heavy cranes are used so to raise and take them to the place where they will be assembled-(screwed or bolted). Then the slab-brigge are set, and in the end, the partition walls.

The postensioning is made both vertically and horizontally . If wanted a fixed plant can be established in a city and modules transported to the construction sites.

Available documents

- Description of the patent (in Spanish and English).
- Ilustrated technical document describing the features and stages of the process.

Other documents and technical reports are available on a confidential basis for those who request them, provided an agreement is reached on confidentiality. Those documents include data on sysmical behaviour, characteristics of concrete structures and other technical specifications. Also, studies are being made on costs, both global and per square meter, of particular projects and on the quality of particular inputs, and work site dimensions (number of buildings, number of apartment-houses, number and size of rooms, and external and internal finishing features)

Scope of S.M. Technology Transfer

The adopted strategy for the transfer of this technology includes both the national and international market, thanks to its universality and to its adaptability to the conditions of many other countries.

Within the national market, a comparison is made first of all, with other available technologies, identifying the agents involved in the process. i.e.:

- The information field: CONICIT, Fundaconstrucción (Network) and oriented press and publicity
- The customers field: consumers. Construction companies, both national and foreign.
- The promoting and organizing institutions: INAVI, Mindur
- The finantial institutions (warrants for risk capital): CVF, Banco Industrial, CONICIT, Banco de los Trabajadores

The market introduction of new technologies has a series of obstacles which are the same for all markets: higher initial production costs, training of specialized skilled labour, and integration of the technology "package", including equipment, etc. and receptivity of final consumers (consumer costs. confidence, trade mark loyalty. etc.)

As we said previously, negotiation is basically under the control of the inventors and CONICIT's management is restricted to support. The drafting of the patent itself was made by the patent holders and patents are being requested simultaneously in the US and Venezuela (started 12 months ago). The research on previous patents established that it was a new invention in a world - wide sense. Patent rights are being requested for the 4 research team members, and one of them is given the right to undergo the legal procedures.

Now, how the four adverse factors mentioned above work in the Venezuelan case, and specifically in the case of construction technologies?

Firstly, it must be noted that, as different from a normal manufacturing investment, and from industrial process technologies in general, in the case of the construction industry. The inherent regime of manufacturing does not apply As different from it MARKET ENTRANCE is not difficult for new producers, for there is no major barriers to entry.

The equipment needed for industrialized construction has a high initial cost which can be discounted fairly rapidly, and to a large extend is of a universal and standarized type. The rest of the equipment is of our own design and /or of specialized nature that can not be easely transfered to other ends. This is important because in the latter case financing becomes more difficult, both in the case of public or private sector.

Nevertheless, financial requirements and non-transferability of equipment is even more serious in the case of industry, considering the anual production scale for the plant and equipment at an individual level. In the manufacturing industry the risk is higher. In the manufacturing industry the usual ways for a market such as ours, is to transfer the technology to an already established producer, for industrial branches are saturated with competitors and barriers to entry are usually high. In manufacturing a new producer, even if making use of a new and more profitable technology, has no guarantees of survival if it cannot overcome this barriers to entry, (such as trade marks, marketing, engineering consultancy capacity, finance, etc.). This did not occur in the case of EME technology, which is not manufacturing technology as different from the previous experiences we had in the case of two specific industrial technologies for durable industrial products that do confront all those obstacle and that faced enourmous difficulties to enter already established firms (industries).

An additional aspect which favours EME System technology is that its experimental and improvement phase is actually concluded. High standard service institutions provided their low cost support for such phase, thus the scientific potential of the authours was not the only basis we counted on. In the case of the two other technologies mentioned above, the product-improvement or technology improvement phase had not actually been concluded. Thus, they had not transformed themselves from <u>invention</u> to innovation. Therefore, industrialists or businessmen demanded inmediately engineering studies or devalued the inventions failing to meet the offers the inventor expected to get. There always are some rather subjective additional negative factors in the process of transfer and negotiation, such as:

1) The desire of the titular of the innovation of quick enrichment with its cessionn or transfer without getting involved directly with the problems of actual production, and the applying of the technology.

2) The exagerated fear to be forged or stolen, that leads to an abusive and injustified confidentiality.

3) The refusal to accept the need for improvements in the experimental as well as in the prototype phase. This makes them fail to appreciate the differences on the adverse conditions of the initial negotiations and the need for further studies and investments during the initial production phase.

In that sense, the system of "joint-venture" is the best way out. Another way could be the offering of the technology to the International market for its explotation in countries more used to technological developments, with more open minded entrepreneurs receptive to new technologies and bigger markets.

These three factors are not present in our case because the adequate understanding of the technological question and previous experiences in technology negotiations.

Negotiation capabilities and proposed contract models

On this, there is a set of favorable conditions that improve the negotiating capabilities of the offerer, its position as negotiatior such as:

1) Novelty, feasibility and profitability of the technology.
2) His high level of information.
3) A suitable assistance on industrial ownership (patents protection).
4) Access to conform a complete technological package.
5) Appropiability of the technology.

On the first point, all new technology has a wide comercial and industrial potentiality. They have a rising curve of return on the investment, it could even have a start in a not to low level. for the initial production. The initial contracts benefit of the relatively low requirements of the level of investment, specially in equipment.

The equipment to be used, of own design, could be built by request by various firms on the capital goods business. Unfortunately, this is not a highly developed industry in the country, but nevertheless there is a relative variety of sources from where it could be obtained or requested. This also applies to the construction equipment that is not of own design.

The technological package does not include exclusive technologies of other proprietors,so there is autonomy of management.

The possession of technical data, patents rights, technical secrets as know how, guarantees the exclusiveness of the technology for a long period of time. Nevertheless, once the initial contracts finish. is very likely that different agents contract (adquire, buy, use) the technology.

Is unlikely that a single consortium use alone a construction technology because the very high volume of production and investment that its exploitation in a big scale requires.

The distribution,among various buyers or licensees diminishes in a long time the apropiability of the technology (exclusive of its enjoyment), diminishs the buying price as occurs in all process of transfer of technology, but only after amortizying by far the development costs and after the patent right have finished. The benefits of the technology should be measured,in a private sense, more on the indirect benefit (the comercial benefits of its exploitation) that on the benefits from its negotiation. In other words, the industrial earnings are bigger than its royalties.

On the other hand, its benefits are not reduced to the private benefits. Technologies also offer, once they are exploited, benefits to the consumers and users. In other words, it is not only the owner of the technology who gets the benefit, or the firm that contracts, but the consumers who get a lower price, or improvements in the quality and durability of the goods they buy, made with the new technology. In the case of the EME System it is conceived to obtain both type of benefits. This depends whether, before anything else, the decrease in the cost of production for square meter, is taken by the construction firms, or in the other way,they are transalated in a decrease of the sale price in comparison with market prices. Beside the price question, the question of quality is guaranteed: it offers a more habitable home, lasting, easier to mantain and pleasant aspect.

Role and nature of contracting abroad

The execution of the project required test and analysis of laboratory,as well as technical advice. Such services are paid for and are included in the cost of development of the technology, being one of the most important determinations of the investigation cost.

Due to the speciality of the services required it was necessary to contract them abroad. The receptivity of the consulted institutions was good, mainly because this project is supported by CONICIT. This meant very good conditions and terms for obtaining the requested services. For that purpose was suscribed a very detailed contract with the selected firm: a Rumanian-German consortium, established in Bucarest. In the agreement, several mutual concessions were made specially in return for the right to use the obtained results. Better conditions of payments and a better guarantee on the quality of the services. were obtained.

Moreover, the commercial relations with the manufacturers, of the equipment to be used in the projects were made easier. This was very useful particularly in the case of the equipment and the specially redesigned mold used in the system.

Furthermore, the interest of the consortium in exploiting the technology in its country shows backing of the project and improves its technical-economic feasibility.

Commercialization and negotiation of the technology

The first project to be built with the technology of the System EME, has the characteristic of a prototype, that is, independently of being sold and used normally and with adequate range of functionality and security, it is a experimental model, that is to say, its architectural and technical characteristics as well as its cost, are under test and revision. It is not a definitive model, it could be improved and in its construction it will provide a lot of experience in the technical, administrative financial and manpower fields related to the project.

In such conditions, the technology must be offered at a price relatively below its cost in the first or initial projects. It starts becoming profitable, amortice, as it recovers the funds invested in its developments.

On the other hand, in the first project, a high proportion of the cost of the machinery and moulds should be amortice as they must be paid for in a short term to the suppliers.

The terms in which the use of the system are ceded should appear in the same contract in which the owner firm normally offers its services. That is, the contract for technology is included in the general contract.

In that contract should be included clauses on the transfer of technology especifically: 1) Right to use the technology. 2) Severance benefit. 3) Confidentiality obligation. 4) No subcontracting.

The contract on the technology concludes with the projects general contract. It is not a typical contract for license ona technology in the sense that it does not allow to exploit the technology in a determined time and place but'in a determined time and place but in a determined work. This is very common and acceptable in construction technologies.

To settle the rights, was selected a royalty equivalent to 2 % of the works value, that is, of the fabrication price. This means a quantity per square meter (an added cost per square meter). This value was fixed taking into account the following elements:

1) The savings in cost derived from the use of the system, including that derived from the economy of time on the execution of the work.
2) The previous value was deflated in view that it is a first project with characteristics of prototype. Its results will add value to the technology for future projects.
3) The financial requirements to amortize the cost of development of the technology.
4) The reference of the magnitude of the rate of royalties and other technological payments in the market of the building industry.

The figure resulting from the weighting of these four factors is of Bs. 1.000.000 ($220.000), that is the equivalent to Bs. 20 ($4.75) per square meter and to 2% of total cost of the works, that is cost price, no selling to the public price.

As conclusions and recommendations

From examining this case, some useful lessons could be obtained in relation to the negotiation and transfer of a national technology, that is, of cases in which the technology in not generated, nor adjusted by the agent that will apply it.

These observations and conclusions could be:

1) Increase the financial capacity of the institutions that provide the risk capital to projects of technological developments.

1.1 Increasing the budget and operation capacity of the entities that provide that capital.

1.2 Tuthorize some other financial institutions to provide risk capital for technological developments.

1.3 Agilize the credits operations in its statutory and administrative level

1.4 Appraise national innovations and patents to the end of its utilization, specially through the acknowledgement of the title of patent as an intangible asset to the effect of evaluation of requests of industrial credit.

2) Establish a register of the internal technological contracts, adscript to one of the institutions already existing. It should register (and eventually evaluate and

regulate) the national technological contracts. At the moment the "Register of industrial property" (Registro de Propiedad Industrial) carries a following of the ceding of patents which is a good indicator of this kind of movement (flux). On the other hand, the SIEX only regulates the non national technological contracts.

3) Establish an Advisory Service on Technology negotiations, placed in an already existing state office. This service is out of the functions of the SIEX to regulate the contracts on technology as it is a distinct activity. The users of the services could be public as well as private firms, specially small and medium size ones.

Parallelly to this service must be established a Foundation for the Commercialization of Technology of national character, which transfer the results obtained in centers of generation of technologies. In that respect a feasability study of it should be started now.

4) Within the area of patents, specially of the innovations and inventions of independent inventors, should be established a regular mechanism of information and legal-economic orientation to them, with the aim of protecting their intelectual and economical rights.

5) Credit on account the autogenous technology as part of the national component and internal added value of the projects.

6) Stimulate the incorporation of national technology by the firms...

established in the country, through economic and non economic, coercive and non coercive mechanisms. It includes inducing a receptive behaviour of the entrepreneurs and the technocrats towards the national technology and the experimental production of new, one's own technology.

7) Establish and improve the technological information services that will allow the gathering of the national and international data on:

a) Adequate putting into execution of the projects of technological developments.

b) The examination of the novelty of the patent, relative (local) as well as absolute (worldwide).

c) Evaluation of the technologies.

EXPLOITATION OF INVENTIONS ARISING FROM EUROPEAN RESEARCH PROGRAMS"

Commission of the European Communities
Directorate General XIII
Batiment Jean Monnet
Luxembourg

B.B. Goodman

1) Background

The notion of Community wide research can be traced right back to the first of the three main treaties which govern the activities of the European Community and, for historical reasons an extremely complex legal framework has since envolved.

The European Coal and Steel Community Treaty (1951) provides for research to be carried out notably by the coal, iron and steel industries and in their associated laboratories, subject to rules for the exchange, dissemination and utilization of the results.

The Euratom Treaty (1957) gave the Community a role in nuclear research. For that purpose the Community's own Joint Research Centre (JRC) was set up, with laboratories at Ispra (Italy), Geel (Belgium), Karlsruhe (Federal German Republic) and Petten (Netherlands)with similar rules. Other nuclear research has been carried out by external contractors.

Research in other fields than coal, steel and nuclear energy began under the Common Market Treaty (1957) in 1973. Regulation EEC No 2380/74 of the Council* on 17/9/74 lays down rules concerning the utilization of the results.

Today the fields covered include coal and steel technology, mechanical engineering, physics, electronics, chemistry, metallurgy, nuclear technology, solar energy and other new energy sources, high temperature technology, environmental protection, materials and measurement methods. The total budget amounts to about 2% of all publicly funded R+D in the Community.

Inventions arising from R+D carried out at the JRC belong to the Community, which generally grants non-exclusive licences to undertakings in its territc However, under certain circumstances the Community is entitled to grant exclusive liceces for non-nuclear research carried out at the JRC. Inventioı arising from R+D carried out under contract usually belong to the contracto in exchange for which he assumes certain obligations concerning the dissemination and exploitation of the results.

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* The Council represents the governments of the Member States of the Community.

The exploitation process proceeds somewhat differently according to whether an invention belongs to the Community or not. In particular the Community is entitled to levy royalties for the exploitation of inventions it owns, but in other cases this is not usually so.

However, the exploitation of inventions arising from publicly funded R+D presents numerous problems, many of which are not of a legal character, and so I shall not examine this legal framework in more detail. Instead I want to take advantage of the sufficient similarity which exists between the ways in which the exploitation process proceeds in the various cases in order to outline a more market oriented approach to these problems.

2) The Exploitation Process

Inventions are notified to Directorate General XIII of the Commission either directly by the inventor in the JRC or by the external contractor concerned and the following steps in the exploitation process may be distinguished.

2.1) Preliminary screening

The preliminary screening of an invention (in terms of patentability, know-how, proven technical advantages, possible market opportunities and further development potential) is managed within DG XIII for Community owned inventions. For contractor owned inventions DG XIII can advise.

While this preliminary screening, and any associated patent priority search, constitute a familiar process, the next step which has been developed over the last few years, appears to be less usual. It is based on the increasing recognition that innovation can only take place successfully if actual or potential market needs are properly understood.

2.2) Preliminary market surveys

This consists in asking a marketing consultant, specialised in the relevant area, to do a preliminary market survey representing usually no more than one or two weeks work.

This approach has the following advantages :

- Through a network of such consultants who are more numerous and specialized than the available staff in the Commission we can obtain a more complete picture of the possible outlets for Community funded inventions than would otherwise be possible.

- An early dialogue between the marketing consultant and the inventor leads to the rapid elimination of unpromising inventions and to a better orientation of the technical work on the others towards the real needs of the market place.

- It frequently provides guidance on which specific firms to approach for the exploitation of the invention and on what degree of patent coverage should be sought.

At first sight this approach may appear somewhat costly. However costs are kept under control by eliminating, at the preliminary screening stage, numerous inventions which, while scientifically interesting, only appear to have limited market potential, our minimum requirement usually being a potential market in the Community of the order of at least 100.000 ECU* p.a. As appropriate exceptions can be made to this rule for inventions whose exploitation appears particularly easy or difficult. The costs of such a market survey are always tiny in comparison with the corresponding R+D costs, and are more than justified by the opportunities they have identified and the economies they have made possible.

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* At the time of writing (January 1980) 1 ECU = £ 0.63 = $ 1.44 = BF 40 = DKr 7.78 = DM 2.49 = HFL 2.75 = FF 5.84 = Lit 1161

2.3) Selection of potential licensees

If an invention appears to meet minimum market requirements the identification of potential licensees may involve such usual additional channels as exhibitions, technical notes and press articles. However the Commission has a particular concern that the exploiter of the invention (be he the owner or not) should have a commitment to the invention and should cover the needs of the Community market.

This concern has led to the adoption, as appropriate, of one or more of the following measures :

- in depth market surveys may be carried out, aimed at

  - defining requirements for the invention more precisely in terms of the Community market rather than in terms of a smaller national one;
  - identifying possible licensees having an appropriate profile of skills, and
  - recommending marketing strategies;

- steps can be taken to promote contacts between firms and laboratories in different Member States and having complementary skills and interests; this frequently takes the form of collaboration at exhibitions with various organizations represented at this meeting;

- as tangible evidence of his commitment to the invention the licensee is usually required (in the case of Community owned inventions) to make a significant down payment, which is deductible from future royalties.

2.4) The promotion of effective technology transfer and exploitation

Once an appropriate licensing agreement has been concluded it is imperative to follow it through by real collaboration between those concerned This may sound trivial, but the opportunities for misunderstandings between an inventor and a licensee are numerous, and may be heightened by cultural and language barriers. Frequently an inventor who, in his own mind, thinks he has solved a problem, may have difficulty in appreciating just how much the licensee has to learn and to organize before his invention can be launched successfully. Fortunately we are usually able to ensure that inventors devote a substantial part of their time to making the transfer of their technology effective. Further market surveys are a possible method of ensuring that, during the exploitation phase, evolving market needs for the innovation are being met and, if not, they provide a method for suggesting corrective strategies.

Figure 1 is a schematic flow diagram of this technology transfer process showing, in particular, the close involvement of the inventor.

3) Results

At present about 20 inventions per annum pass the preliminary screening, about 90 dossiers are open, 32 agreements are in force and 17 have given rise to royalty payments. Between 1976 and 1980 royalty income, while still modest, is expected to have increased approximately fourfold.

The time which elapses between the signing og a licence agreement and the appearance of the innovation on the market shows wide variations but it is typically of the order of five years. During this period it is of course against the interests of licensees to divulge details of the potential innovation which concerns them and it is imperative to adhere to this policy in the case of non exclusive licences.

Nevertheless it can be said that so far particulaly significant results have been achieved in the commercialization of the following innovations :

- a particle size analyzer
- a chromatographic device.

The following are likely to lead to significant levels of exploitation in the near future :

- an electromechanical device based on the use of microprocessors
- a spark machining tool
- an automatic welding method
- a method of recovering lead and zinc from blast furnace flue gases
- an improved superplastic alloy
- devices based on heat pipes
- a quality control method for use in connexion with the continuous casting of iron and steel
- a high temperature seal for corrosive processes
- an improved gas turbine heat exchanger
- a solar energy device.

Generally speaking we find that the amount of work we have to put into ensuring effective technology transfer depends much more on other factors than on the market potential. This is a further justification of our decision to concentrate our limited resources on a few inventions with significant market potential. In a number of cases a turnover exceeding 1 MECU p.a. is anticipated in due course.

On the other hand a factor which has often limited the exploitation of inventions arising from Community R+D has been a lack of resources for developing an invention to the prototype stage.

4) Future prospects

Looking to the future, three considerations seem to be worth mentioning.

In the first place the work described above shows that continued progress should be possible in the Community level of exploitation of Community funded R+D. Special features include the following :

- through their contacts with DG XIII firms interested in a licence are able rapidly to obtain advice on conditions in other Member States than their own

- in many cases we have been able to bring together firms and laboratories in different Member States having complementary strengths; as a result of this, the partners have become aware of important market or technical differences between countries, even within the Community, and there have resulted important savings in time and resources

- firms are usually able to envisage writing off their development costs over a larger market than might be the case for a project handled on a national basis, which may transform an non-viable project into a viable one

- on the other hand there is an understandable tendency for the Community to find itself handling only the most risky projects. As soon as a project looks promising it often tends to find its way into a national orbit!

The second consideration is that, in the last few years there has been a large increase in the proportion of Community R+D which is carried out under contract and the first big wave of such contracts is now coming to an end. This event will provide an opportunity for evaluating the effects of the Council's 1974 Regulation referred to above. That Regulation generally has the effect of leaving the ownership of industrial property rights in the hands of the contractor, who accepts an obligation to exploit or have exploited any inventions arising from the research. Furthermore it allows the Commission, under certain circumstances, to grant exclusive licences for inventions which it owns.

More recently President Carter's "Domestic Policy Review" on Industrial Innovation (1979) also concluded that is was unproductive to leave the ownership of patents with a governmental agency which could only grant non-exclusive licences. However the present American intention does not seem to go as far as the Council Regulation towards putting the responsibility for initiative in the hands of contractors*.

Finally, still further developments can be expected in the way Community R+D and its exploitation are managed. In a recent report on"The Organization and Management of Community R+D"(1980) the Community's Economic and Social Committee called, inter alia, for closer links between national and Community R+D policies, and for Community R+D to be further oriented towards innovation and the satisfaction of user's needs. In this context the Commissio would welcome closer links with the national organizations in the Community represented at this meeting.

At request of the Council the Commission is now working out proposals to further improve the contribution of Community R+D and its exploitation to the attainment of the Communites' economic, social and other objectives.

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* See, however, the paper by Mr. William Marcy.

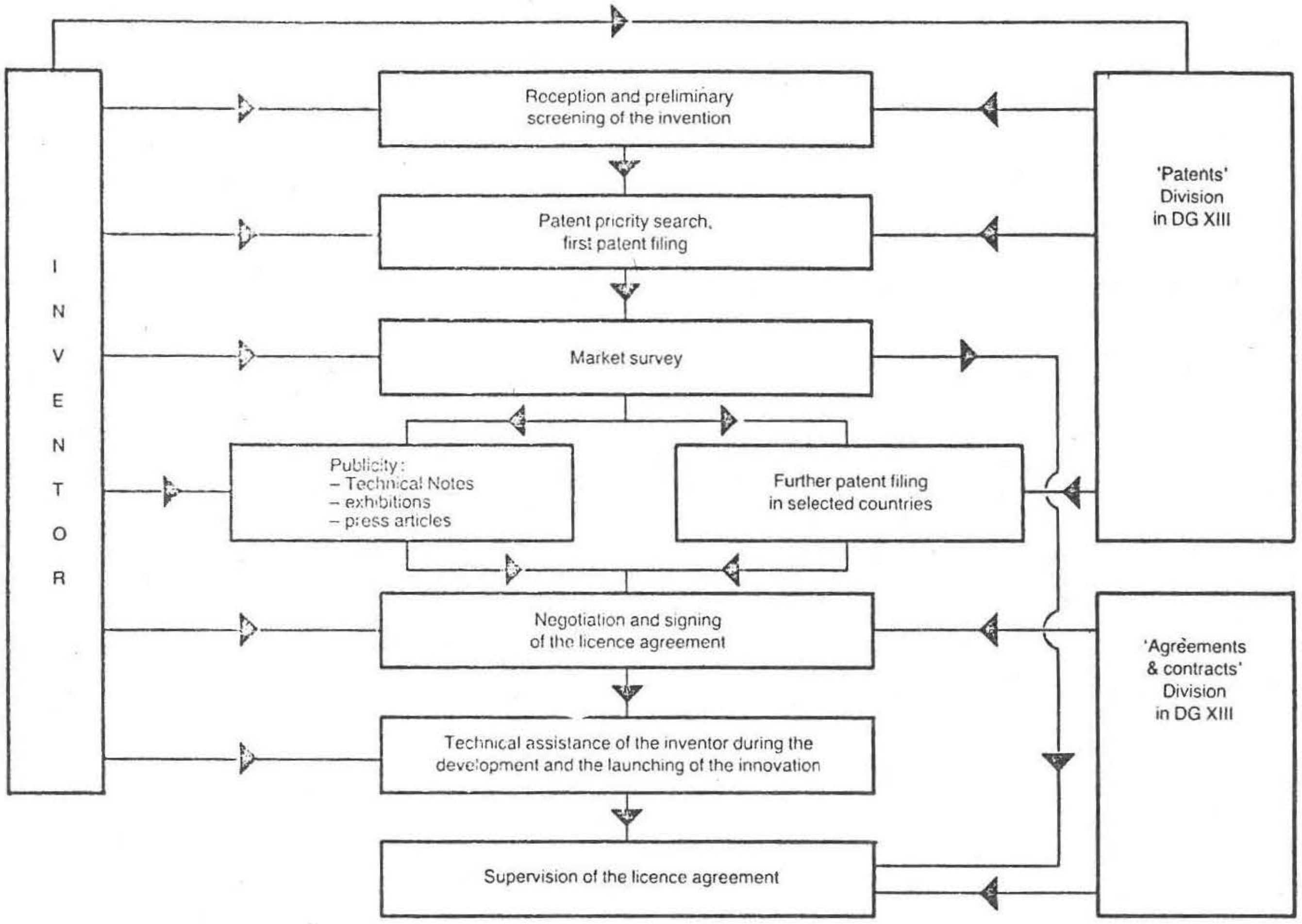


Figure 1 : Schematic flow diagram for a typical technology transfer.

THE VDI-TECHNOLOGY-CENTER APPROACHES TO SMALL/MEDIUM SIZED FIRMS IN THE APPLICATION OF MODERN MICROELECTRONICS

VDI-Technologie-Zentrum

K.P. Friebe

The VDI-Technology Centre approaches to small/medium sized firms in the application of modern microelectronics.

by Klaus P. Friebe

The VDI-Technology Centre was founded in Berlin on april 1, 1978. It is active throughout the Federal Republic of Germany as an establishment of the Verein Deutscher Ingenieure (Society of German Engineers) and is partially financed by the Federal Ministry for Research and Technology (BMFT) - a circumstance which assures the neutrality of its activities.

The technological areas which are focal points of the work of the VDI-Technology Centre are as follows:

- physical technologies,
- application of microelectronics, and
- printing and reprography.

The concept of the Technology Centre is based upon a new kind of assistance to research and development. It takes into consideration the foreseeable effects of the appropriate technologies, thereby recognizing that economic action and social behaviour are closely linked through the development of new technologies (cf. for example microelectronics).

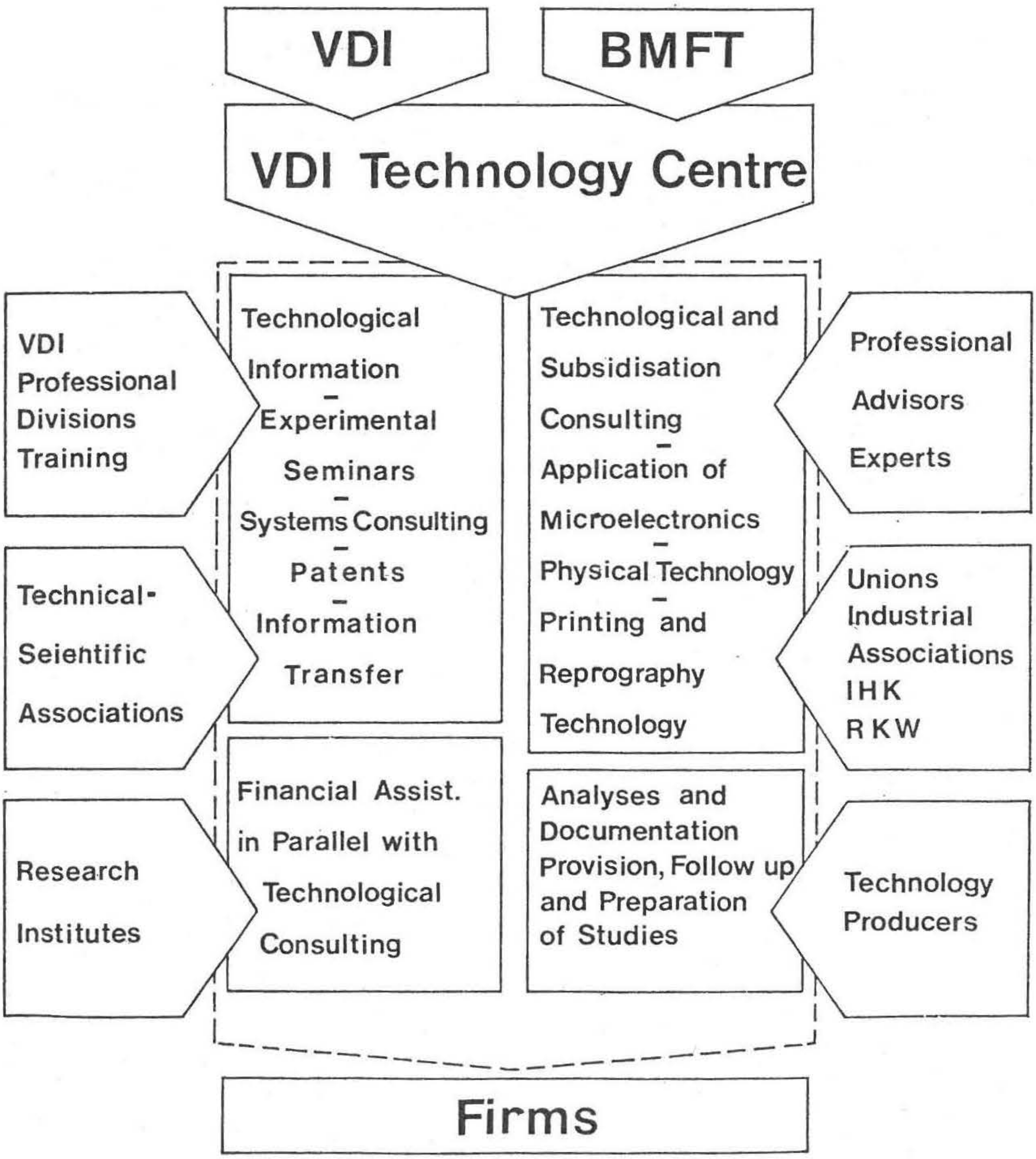
The application of knowledge gained through research is only possible insofar as an intensive technological consultation using background knowledge goes hand in hand with available financial assistance.

This combination is an established basis of the Technology Centre. The activities of the Technology Centre are dedicated to medium-sized industries which, under pressure to survive, must continually discover new slots on the market. The goal of the Technology Centre is to assure not only short-term success, but also the long-term security of the firms. Use of the experience of the Technology Centre allows the application of microelectronics and other physical technologies and the creation of new opportunities especially in medium-sized industries, thus making possible sound economic growth.

The activities of the Technology Centre in these areas are related not merely to direct financial subsidy (assistance to research through the BMFT) and to general technological consulting, but also to the consideration of products into which a new technology can be introduced.

The VDI-Technology Centre recognizes that, in addition, a series of organisational questions related closely to technology must be considered if advances such as microelectronics are to be successfully introduced in a firm. The introduction of microelectronics may not only result in an alteration of the structure of the production process, but also in a change of the sales and marketing concept as well as of the relationship to suppliers; furthermore close cooperation with the manufacturers of semiconductors becomes necessary. It is precisely in the latter point that the Technology Centre can offer valuable help through its diversified contacts and practical experience (Fig. 1).

Figure 1: **Tasks and Functions of the VDI Technology Centre**



Presently, the VDI-Technology Centre consist of four groups:

- technology information;
- technology consulting and financial assistance;
- financial consultation and transactions;
- analyses and prognoses.

The interaction of these areas, has led to the widespread utilisation of new technologies throughout the industry - an approach that is within the framework of state responsibility for economic growth and the efficient application of technologies. It has been confirmed by the support of the industry over the past two years.

The diversity of the projects conducted under the Centre's guidance (by the end of 1979, ca. 300 R&D projects) and the resulting contacts have given the consultants and advisors involved in these projects know-how that constitutes a source of information for medium-sized industries on the application of new technologies.

But foremost is the initiative by the firms and their managements toward requesting this information and aid.

Technological Information Group

The charter of the Information Group of the VDI-Technology Centre is to dessiminate to a broad public the results of research and development that evolve from the close cooperation between suppliers and users of technology. It is particularly important to bring such developments to the attention of the firms that could use these technologies and translate them into products.

The forms of publication of such knowledge may be quite diversified to facilitate the most efficient translation of knowledge into products. For example recently a series of seminars for management personnel of users of semiconductor components was set up throughout the Federal Republic, so that such personnel could be informed promptly about the effects of this technology.

Technological Consulting and Financial Assistance Group

For many firms technological consulting is the first and most important aid toward the realisation of new ideas with the help of new technologies (Figure 2).

A prerequisite for the successful dialogue between the firm and the technological consultant from the VDI-Technology Centre is the development of an open form of communication on all questions. On the part of the Technology Centre this is assured in the consultants have practical experience in the field in which they are consulting; in addition, they are pledged to strict neutrality.

Subsidy Consulting and Transactions Group

The basis of this group is governed by the rulings of the Federal Minister for Research and Technology. (BMFT)

For the major activities of subsidy with which the VDI-Technology Centre is concerned ca. 50 million DM have been available annually; these funds are used principally by small and medium-sized firms. As a rule, the BMFT expects to subsidise 50 % of an individual development project.

In every firm, the financial assistance must be accompanied by prerequisites for the translation of technology into production. In contrast to the conventional models for financing, the Technology Centre includes in its consultations the firm-specific economic conditions for the utilisation of a new technology.

Experience in transactions involved in subsidy proposals - to date ca. 300 - demonstrate that success, i.e. the translation of new technology into new products, increases with the quality of its planning.

Analyses and Prognoses Group

This group attempts to make available to the three above-named departments the necessary know-how. Here, not only internal information is analyzed, but studies are also undertaken on commission for the BMFT in which expected changes that affect industrial products are recognized promptly so that solutions can be developed in order to take advantage of these changes.

The example of the clock industry can be used to demonstrate the general approach used in these studies. The technology closely related to the market for new products and technologies is to be studied and presented. Furthermore accompanying sociological studies evaluate the organisational form, qualification, and expected restructuring processes in firms and communities. It is in just this area that very few institutions in the Federal Republic are active, despite the variety of institutes in the field of social sciences. The group also develops new methods in this area, since these questions are of the great relevance for employer as well as for employee. Analysis is thus an activity to which increasing attention must be devoted in the future, since technologies continue to have as rapid and immense an impact as in microelectronics.

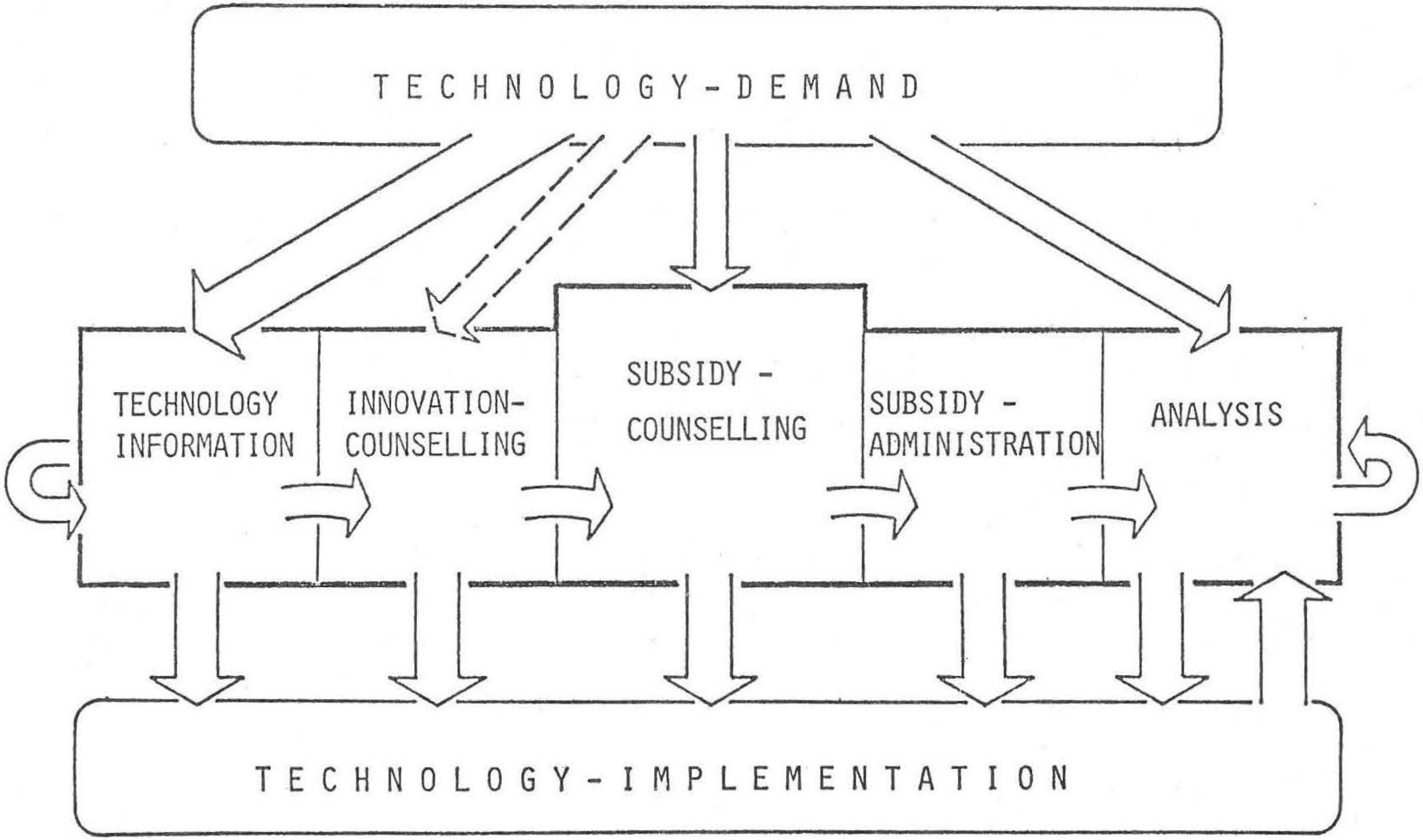
Only through this combination of analysis, assistance and consultation an effective and successful technology transfer is possible.

In the future, not only the purely technical aspects should be considered but the alterations imposed by related areas should be included as well. According to this approach, innovations and technology transfer is a necessity in order to cope successfully with increasing competition on international markets, and in order not merely to survive but to set new accents for the future.

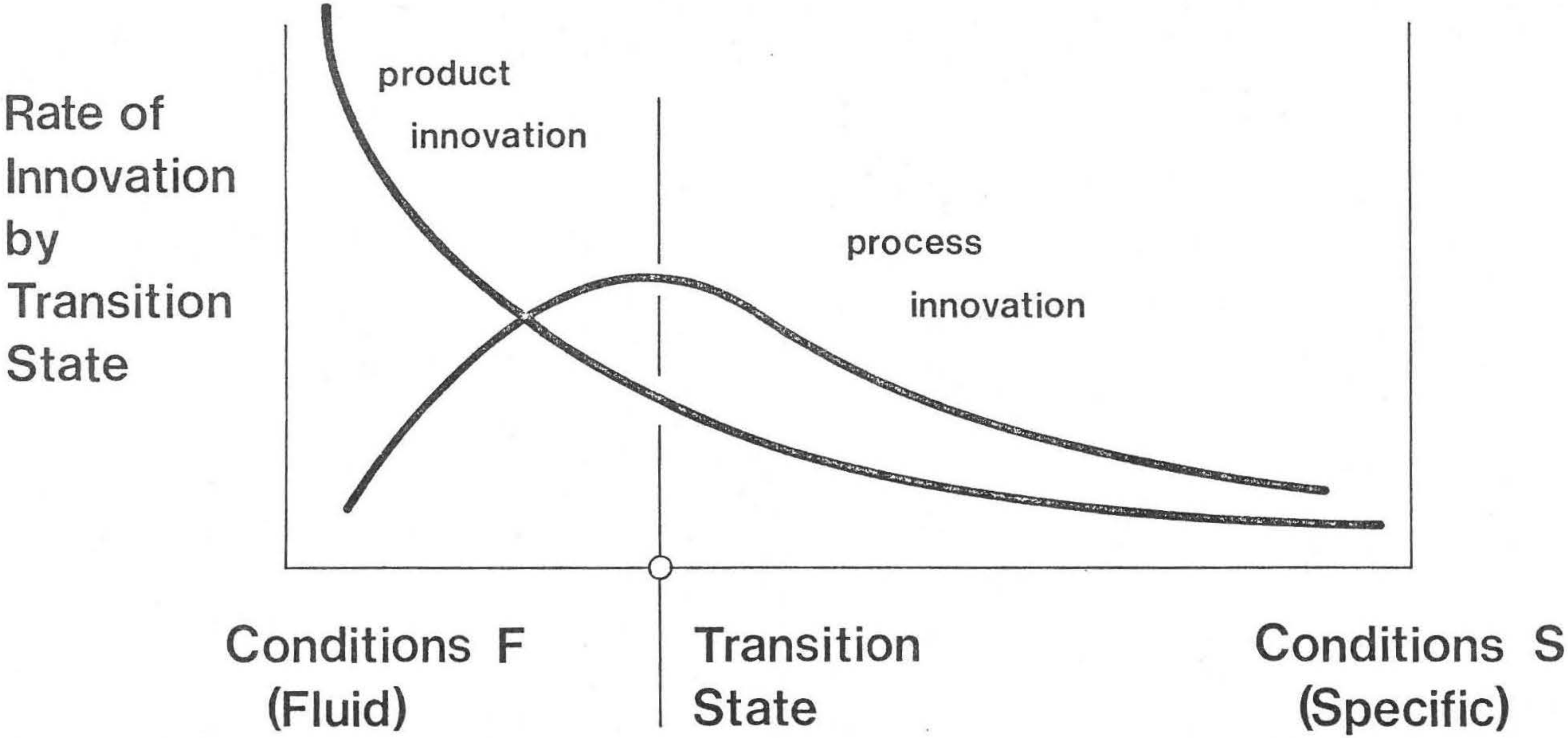
april 1980

Fig. 2

Activities and Organization
VDI-Technology-Center

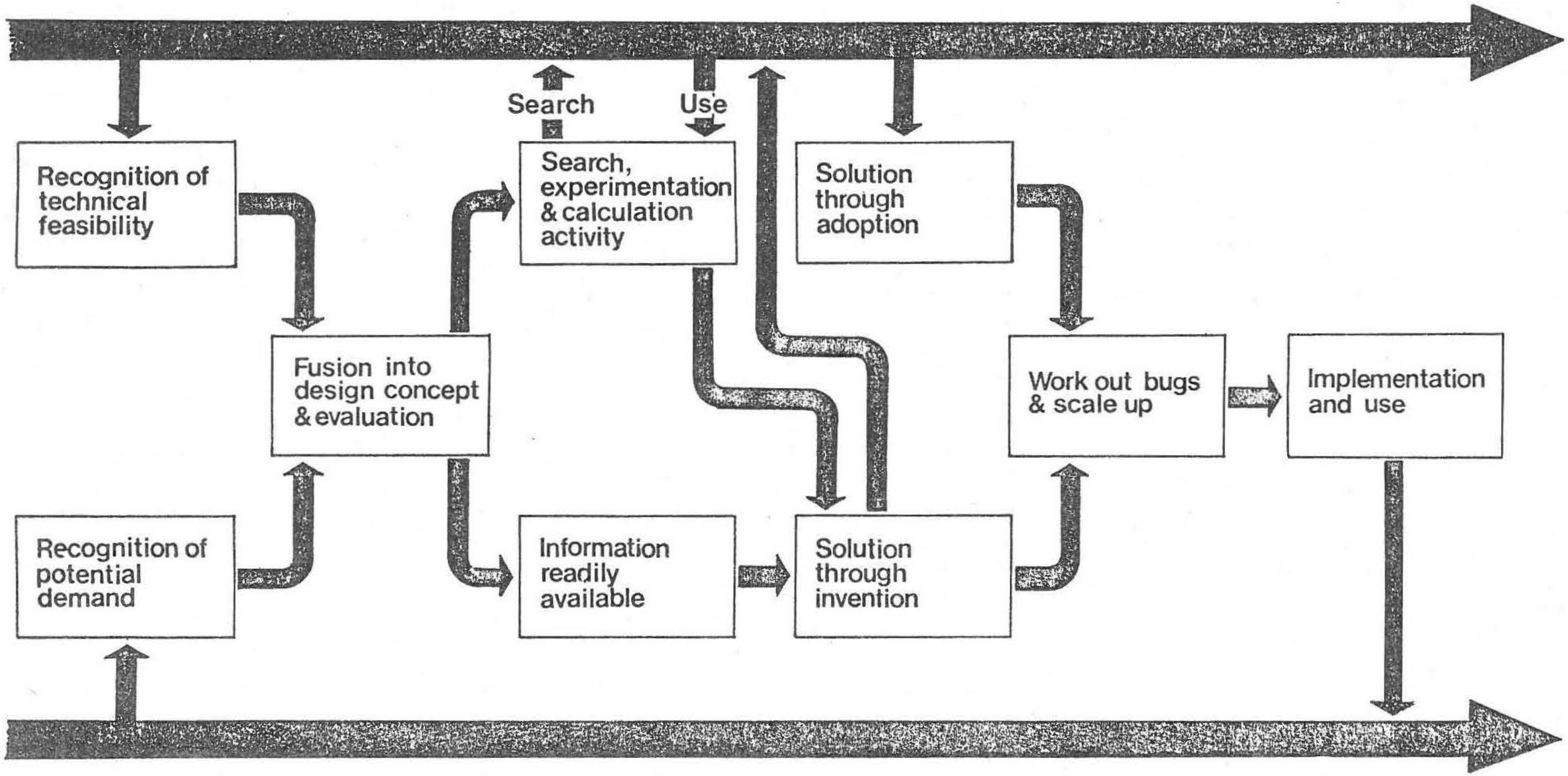


Transition, Boundary Conditions & Innovation



Ref.: M.I.T. Center of Policy Alternatives

Model of the Process of Innovation



1. Recognition → 2. Idea formulation → 3. Problem solving → 4. Solution → 5. Development → 6. Utilization & diffusion

Ref.: M. I. T.

SUCCESSFUL/UNSUCCESSFUL PROJECTS UNDERTAKEN BY SMALL AND MEDIUM SIZED FIRMS

Research Development Corporation of Japan

Y. Takeyasu

SUCCESSFUL/UNSUCCESSFUL PROJECTS UNDERTAKEN BY SMALL AND MEDIUM SIZE FIRMS

Yoshimitsu Takeyasu
Research Development
Corporation of Japan

1. Introduction

JRDC promotes commercial exploitation of research outcomes in all technical fields contributing to the national economy. Developments that involve great risks in commercialization and require a large amount of development fund are undertaken by interested companies by contract with JRDC (JRDC advances 70 to 80% of the required development fund, which is not to be refunded, should the development prove unsuccessful.), while developments that involve small risks in commercialization and require a relatively small amount of development fund are undertaken by interested companies through the coordination for license by JRDC. (Usually, JRDC only goes between the inventor and company, but sometimes loans up to 42,000 dollars for some projects to promote licensing.)

Companies that undertake these developments either by contract or by coordination range from large to small companies. The following table shows the development projects of JRDC selected and completed during the past ten years from 1965 to 1974, as broken down into the scale of company. (Here, small and medium size company is referred to as one whose number of employees is not more than 300 and whose capital is not more than 42,000 dollars.)

(in 10,000 dollars)

	Contract development			Coordination for license
	No. of projects (A)	Development cost (B)	(B)/(A)	No. of projects
Small and medium companies	25 (28%)	700 (15%)	29	28 (45%)
Large companies	64 (72%)	4,000 (85%)	63	34 (55%)
Total	89 (100%)	4,700 (100%)	53*	62 (100%)

* shows the average value.

As can be seen from this table, opportunities for small and medium size companies to take advantage of the JRDC's development subsidizing system are not few. JRDC's policy in selecting an undertaking company is not to favor large companies but to afford equal opportunities to any small & medium companies only if equipped with technical competence. These small and medium companies may own Japan's top level technology in specific fields of technology or may be a manufacturer of unique products, dedicated to technological development.

In view of the important roles small and medium companies play in the Japanese industry and in changing its industrial structure, JRDC places an increasing emphasis on technology development by small and medium companies while maintaining harmony with large companies.

This paper discusses, based on our experiences, what caused successes and what caused failures of development projects undertaken by small and medium companies, either by contract or through its coordination, and studys actual cases of success and failure.

2. Causes of Success and Failure

(1) The undertaking company must own its unique technology.

It may be undeniable that small and medium companies are generally inferior to large companies in total technological strength, but it is often the case that knowledge-intensive or technology-intensive small and medium companies have greater technical capabilities in specific fields.
If a technology development is undertaken by a right company having such a technical background, the company often exhibits its higher capabilities than a large company and overcomes technical difficulties. Thus we should say that the possibility of success is very high if a project is carried out on the basis of technical advantages of small and medium companies.

(2) Personnel engaged in the development, particularly their leader, must have ability.

"The key to successful development is personnel " as the saying goes. In fact, the success or failure of a development project greatly depends on the brain and efforts of those concerned with the development, particularly on the leadership of the manager.
Sometimes, technically-oriented small and medium companies, particularly ones experienced in technology development, have capable engineers. When a small and medium company carries out a development project, it is sometimes the case for them to organize competent engineers within the company and to carry out the development intensively, with the project team under direct control of the top management or president.
Furthermore, if, taking advantage of the characteristics of a small and medium company that it has an atmosphere of a family and that the communication with the top management is usually good, the team work or motivation of those engaged in the development is done successfully, the team functions

effectively and favorable results can be obtained. Accordingly, developments that can be carried out by a small number of personnel are better suited to small and medium companies rather than large companies.

(3) The undertaking company must be equipped with an ability of merchandising and sales promotion.

To make practical useful products and to effectively promote their sales, it is important that the development section works closely with the marketing section and that aggressive marketing activities can be initiated after the development is completed.
Since the advantages of small and medium companies are manoeuverability and flexibility and the communication between the development section and marketing section is easier, they can take quicker actions in response to the changing needs of the market. Also the top management is directly involved in the marketing activities, so that marketing of the product, in which human factors play important roles, can be carried out more effectively. On the other hand, their marketing capabilities are rather limited if the product is to be sold through widely organized channels or advertizement. In such a case, it is necessary to tie up with a sales agent or take other actions to overcome their disadvantage.

(4) The undertaking company must own an ability to change the development program dynamically depending on circumstances.

At the outset of development a detailed execution program is mapped out and the development is carried on according to the program. It often happens, however, that a development project does not proceed as planned or the plan must be changed due to changes in outside technical and economical conditions. In that event, in the case of large companies, much time is often spent on adjustment with other sections within the company and others, but in the case of small and medium companies, their manoeuverability and flexibility allow them to make quick decision and take proper actions to cope with the situation. On the other hand, small and medium companies sometimes are not equipped with enough information and JRDC must take care not to be misled by the information furnished by them.

(5) The undertaking company must have reasonable financial strength.

A company that undertakes development must possess a financial strength that can meet with the requirements of the project. In appraising its financial strength, we should not be on the safe side for no reason in selecting the undertaking company among small and medium companies or should not take the stand of the bank that regards material security as everything but should evaluate the real situation correctly. We understood from our experiences that there are cases when the company looks financially not strong but its financial position is not actually so much a problem or when the financial condition is not healthy at the time of examination but there is a prospect of recovery or when the company has a potential for growth. In such cases, there may not always be obstacle to proceed the development. On the other hand, there are also cases when the company appears to have no problem superficially but has difficulty or when the company's financial position worsens because of later changes to hamper the progress of the development project.
Therefore, it is very important to identify whether the company has a reasonable financial strength or not or how the financial position will change in the course of development, by examining the situation from every angle, except when the financial position is definitely good or bad.

(6) Types of technology must be suited to small and medium companies.

Large companies and small and medium companies have their own fields in which they have more advantages over the other, irrespective of the discussion whether an individual company is good or bad. This is the reason why small and medium companies are active in specific fields of industry in harmony with large companies.

The types of technology suited to development by small and medium companies may be summarized as follows;

- Technology for producing a large variety but a small amount of unique products rather than mass production
- Technology that brings profits within a short period though the market may be small
- Technology that can be developed in a specialized field or by a small number of brains
- Technology that can meet diversified and sophisticated needs with a small amount of fund
- Technology highly specialized that takes part in efficient production of a big industry.
- Technology that takes advantage of local resources and geographical conditions

3. Case Study on Successful/Unsuccessful projects undertaken by small and medium firms

SUCCESSFUL CASE 1 - Nylon photopolymer printing plates

The development of this technology aimed at attaining the mass production technology for nylon type photosensitive resin printing plates which had been regarded as difficult.

At that time, the importance of the photosensitive resin printing plate was increasing with the widespread use of phototypesetters and computer-controlled typesetters, while in Europe and other countries, nylon photosensitive resin printing plates were just being used. Although they were more costly than those using other types of resin, the production volume showed a rapid increase.

The company that undertook this development had earlier noted the usefulness of this technology and was engaged in joint research with the researchers of this technoloy of the national research institute. As a result, the company already possessed know-how and knowledge on the technology. Furthermore, the company is a specialist in industrial chemicals producing a wide range of products, including chemicals, chemicals for the electronic industry, photosensitizer, materials for photoengraving and others, and most of the products are fine chemicals which are high in value added, requiring a high level of technology. The president of that company, who once worked at a national research institute, had keen interest in research and development and was engaged in joint and contract R&D with national research institutes and private big companies, besides its own R&D. The company, a knowledge-intensive company, backed by the manouverability and flexibility which characterize a small and medium company, was growing steadily.

In the course of development they encountered various problems and the initial development period of two years was extended by nine months, but backed by their high technical capabilities and the president's philosophy of placing emphasis on research and development, they attained the objective and the development ended in success. As the research was carried on extensively for extended application, the turnover of the products was approximately 8 million dollars during the four year period and the development costs were all recovered. Incidentally, the annual turnover of the products is approximately 3 million dollars. This project was first thought to invlove more difficulties in commercialization than others. Major factors that made the project so successful are that the top management and engineers concerned were experienced in research and development and that thanks to their financial strength, they could afford to develop the technology for extended application, not to mention that they had acquired know-how on similar technology through joint research projects.

SUCCESSFUL CASE 2 - Disposable dialysis-pack (artificial kidney)

Before this technology was commercialized by this company, all artificial kidneys were imported. Because of high cost and awkwardness in handling, they were used only for a much limited number of patients.

This technology relates to a laminated type artificial kidney based on the blood dialysis method and its development was intended to eliminate the drawbacks of the conventional laminated type artificial kidney by designing the dialytic portion in a package so that operation at the clinic site can be simplified and the reliability can be improved through rigorous production control. Thus the technology, though small in scale, initially drew attention as a promising technology.

The company that undertook the development by contract was originally a supplier of medical equipments and had a wide network of sales for this kind of products. The president, who founded the company, was much interested in research and development and the company had put a number of original products on the Japanese market. The company had approximately 120 employees and was fairly well known as specialist in medical equipment. It had also been engaged in its own research of the blood dialytic method related to this technology for more than 10 years. For the development, a powerful project team was organized under the direct leadership of the president. The development proceeded smoothly without encountering any particularly serious problem and a result that far exceeded the initial target was accomplished. The clinical tests were carried out extensively, backed by president's close relations with hospitals and others and his personal credit. This, along with the accomplishment of the development, affected the project very favorably in the marketing stage.

Thus the company could start the production of artificial kidneys on a commercial basis immediately after the completion of the development. In three years, the development costs were recovered and the total turnover so far amounts to more than 4 million dollars.

<u>SUCCESSFUL CASE 3</u> - Blood cell osmotic fragility analyzer

This technology is intended to develop an apparatus that permits accurate and rapid precision measurement of the osmotic resistance of blood cell with a very small amount of blood in the hematological study and diagnosis of various diseases. The apparatus is characterized in that sample tube, wound in a coil around a supporter which is fixed between the upper and lower rotary disc bodies, makes special double rotation similar to the revolution and rotation of a planet and that the production requires special design technology and precision machining as well as medical analysis of the measured results.

The company that undertook the development by contract was a small venture business with approximately 60 employees, whose main business was the design and production of developed models in collaboration with universities. When the contract was concluded with the company, the company was not in a good financial condition with a capital of only 42 thousands dollars. Although the amount of the fund required for the development was small (approximately 84 thousands dollars), there was a slight concern about its financial position.

Regarding the technical capabilities of the company, the president had noted the usefulness of this technology and had been engaged in joint research with the researchers of this technology. The company had also manufactured developed models, that required sophisticated technology, such as electronic equipment, automated equipment, control equipment and others as a subcontractor for large companies. Thus we could well rely on the company's technical capabilities.

In the course of development, they encountered various problems such as the vibration of gears and the effects of temperature variations on the measured value and others, but the president, who was an engineer himself, took leadership in the development and organized outside engineers to tackle the problems that could not be solved by the company's engineers. They concentrated themselves on the development and finally succeeded in attaining a result that far exceeded the initial target. During the past six years of marketing, collaborating with a sales agent, they sold approximately 250 apparatuses (13 thousands dollars/apparatus) to domestic large hospitals, pharmaceutical companies, research laboratories and others. The apparatus is now the major item in their product line and sales are expected to increase as more data on clinical application is obtained.

SUCCESSFUL CASE 4 - Gnotobiotes (mice and rats)

The production of good quality experimenting animals is becoming increasingly important in life sciences. Under these circumstances, this technology had been researched by a public research institute for experimenting animals (invested by 18 representative Japanese pharmaceutical companies), subsidied by the Ministry of Agriculture and Forestry. It aimed at producing gnotobiotes such as mice and rats in which germs present in the body are already identified. The company that undertook the development by contract was spun out of the above-mentioned institute and specialized in the production of mice and rats, holding almost 95% share of the domestic market for the products according to the conventional technology. This means that employees had a high level of rearing and care of experimenting animals. Also the company was located adjacent to the institute and its facilities were easily available for use by the company personnel. All these made it easy for the company to work closely with the inventors and other members of the institute in the development.

In the development occurred a serious problem of a group of animals being infected, but it was overcome by joint efforts of the company personnel. The project was completed in success six months after the expected development period of three years. So far, the company sold more than 10 thousand mice and 2000 rats and more than 2000 apparatuses for rearing experimenting animals at pharmaceutical companies and hospitals. The turnover of the products has been increasing year by year.

SUCCESSFUL CASE 5 - Seamless flexible containers

Most flexible containers used in packaging and transportation of pulverulent body and granular body are produced by sewing together tarpaulin sheets. The problmen is that it requires tedious procedures to produce and the quality of products is not stable.

The aim of this technology was to allow continuous production from raw material to production for improved quality of products (in life and performance) and reduced cost. In this technology, threads are wound directly around a metal mold, which is coated with resin to form a cocoon-shaped container, instead of using tarpaulin sheets as raw material.

The company that undertook the development by contract was the largest manufacturer of canvas products in Japan, including the conventional type of containers using tarpaulin sheets.
The president, founder of the company, was a leading member of the Japan Youth President Organization and was known as stressing the importance of technology development by small and medium companies.

Noting the outstanding features of this technology, the company had earlier been engaged in the study of resin and made prototypes of the winding device by itself to acquire expertise for commercialization. At that time, however, the company had just invested a large amount of money in equipment to expand the canvas division and container division and could not afford to carry out the development by its own fund. Also five competitors were fighting very hard on the container market at that time to expand their own market shares. Thus the company showed keen interest in the offer from JRDC for the contract development of this technology.

In the development, the company concentrated itself on the project and the project was directed by the president himself, with the result that the project was completed in success within only 20 months. The products were immediately put on the market and the total turnover so far is 5.4 million dollars.

SUCCESSFUL CASE 6 - Differential precision manometer

This technology relates to a highly reliable, high precision manometer for micro pressure that permits absolute certification of pressure which has been impossible with the conventional manometer. The important elements in producing manometers according to this technology are the material, shape and machining of the bell, that detects the pressure, special spring plate, that supports the bell, and other structural members.

JRDC invited companies equipped with the related technology for development, and a small and medium company specializing in scientific instruments expressed a desire to implement the technology. Since the company was experienced in the development of physical measuring instruments such as anemometers, flow meters and others and its subsidiary company specializing in spring materials possessed technology related to spring materials, JRDC held that they were technically competent to undertake the development and the arrangement was also in line with the inventor's wish.
Thus the license agreement was immediately concluded through JRDC's coordination.

Although this technology was invented by a researcher at a university, the research accomplishment was already mature in principle. The company had already attained the related technology and worked closely with the inventor. Thus the development proceeded smoothly until they made prototypes for commercialization. In addition to their intensive development for extended application and aggressive propagating activities, the instruments drew users' attention through the researcher's presentation at scientific meetings and seminars. At present, it is used in a wide range of application from study in the wind tunnel test to pressure control of air conditioning, quality control of gas stoves and others, meeting diversified requirements in differential pressure measurement. They have already sold more than 200 units (Approx. 200 dollars/unit) and expect to sell more than 50 units a year in coming years.

UNSUCCESSFUL CASE 1 - Fire-resistance, lightweight building members

This technology relates to the production process for inexpensive lightweight building members having excellent characteristics such as fire resistance and others by using unused resources such as coal dust, low-grade pottery stone and perlite.

In selecting a company to undertake the development, the important criteria were the geographical conditions in access to raw materials and the degree of interest in undertaking the development. We examined a local tile manufacturer specializing in tiles with approximately 150 employees to select it as a candidate, but it was found that the company was in a financially difficult condition because of the sluggish domestic market and price competition with manufacturers in developing countries. Considering it necessary to support the company financially, a joint contract for development was concluded with the parent company, a china manufacturer with approximately 530 employees.

As feared in the beginning, the company went bankrupt during the course of development and the parent company took over the development and managed to attain the initial target. Although it was also necessary to establish the method of work execution in order to commercialize this type of building members, the parent company lost interest in commercialization for the reason that the company had no relation with the construction industry, it was adversely affected by the bankruptcy of the subsidiary, and it was not the main company that undertook the development. In the meantime, other new building materials came up on the market, and the commercialization of the product was given up, with only a small production volume.

UNSUCCESSFUL CASE 2 - Resin concrete products

Resin concrete is a high strength, durable concrete in which the cement paste, which is the bonding agent of the ordinary cement concrete, is replaced with resin. This technology was intended to mass produce resin concrete plate materials and columnar materials to be widely used in civil engineering and construction.

The company that undertook the development by contract was a manufacturer specializing in communications equipment such as safety devices, fuse pipes and the like. It had earlier commercialized resin concrete products by the casting method in compliance with the request by a government organization and held a leading position in the Japanese market. The company had already the expertise related to this technology by making prototypes of small rolling and forming machines for mass production.

The development proceeded smoothly until plate and columnar resin concrete could be mass produced, but the development ended with no prospect of producing building materials such as flooring, wall materials and others which was the major intended application, though the application to structures (in marine and river), chemical tanks and others was found feasible.

In this type of development, it was necessary to consider the workability, operational efficiency and operational restrictions by law in contrast to the current work method, but the company was not equipped with the capability of carrying out the project from the production to work execution. Despite many efforts to apply the product to building materials, the company had to give up the project because they were unexperienced in that field.

UNSUCCESSFUL CASE 3 - Minute dust particle collectors

JRDC has been active in promoting the technology development related to pollution such as disposal of waste liquid, sewage sludge, industrial waste and others. This technology belongs to this category and is characterized by the capability of removing minute and high resistance dust particles, which has been difficult by the conventional method. The development of this technology, which is based on the application of static electricity, was contracted to a company equipped with advanced technology in this field.

This company had been active in the application of static electricity since its foundation and had developed electrostatic dust collector related to this technology as well as electrostatic spray painting equipment, electrostatic oil applying equipment and others.

The key man in the development of this technology was Mr. Y., executive director of the company, who was well known in the field of static electricity. He was not only responsible for all technical affairs of the company as a co-worker of the president but also was a researcher of several hundreds of patents and patent applications both in Japan and foreign countries. He had been awarded a number of prizes from the Director General of Patent Office and others. Taking advantage of his intimate relations with universities and industry, he had also sold developed products to them.

As such, he was assigned the total responsibility for the project, but his sudden ill health prevented him from devoting himself to the development of this technology. Since the development was entirely dependent on his personal ability, the project lost its momentum. Although the first prototype of this equipment was built, no further process has been made.

UNSUCCESSFUL CASE 4 - Instantaneous graphitization of amorphous carbons

This technology was intended to carbonize and graphitize amorphous carbons in a short time by flowing a great current to amorphous carbons such as formed coke, carbon black and the like to produce graphite to meet a variety of applications.

Although the research outcome had some problems before it could be developed for practical application, JRDC was actively involved in coordination to transfer the technology to an interested company through its license coordinator. In the meantime, a small and medium company with approximately 125 employees expressed a strong desire to implement the technology. Since the technology was better suited to small amount production of a large variety of products and the development fund would not be so great, JRDC thought it was better suited to a small and medium company. On the other hand, that company, a manufacturer specializing in industrial mechanical seals and bearings made from carbon, had been well known in this field and had been much interested in technology development. They did not appear to have any particular financial problem. Thus the inventors gave technical assistances to the company, before the license was transferred to the company. More recognizing the usefulness of this technology, the company invested 21,000 dollars in the project and the joint research with the inventors was continued for one year and half. However, there were still problems to be solved before the technology could be developed for practical application, and JRDC gave financial assistance of 10,000 dollars to conduct further experimental works with the technology from industrial point of view. Thus the company obtained a research outcome that let them initiate the development. The project required a development fund of approximately 84,000 dollars and JRDC decided to advance half of the fund as a licensing promotional loan. The license agreement was concluded and the development was carried on for approximately two years. As a result, the development of the production process was nearly completed, but to put the process into production on a commercial basis, it was found necessary (1) to obtain higher quality material because the electrode material and mould material used in the research stage were found unusable, (2) to reduce the production costs for scale merits, which would require a large amount of fund for investment in the equipment, (3) to develop the technology for extended application. These problems being unsolved, the project was given up. The major reason was the management policy that the commercialization of a technology that involves a large amount of equipment investment should be postponed.

We have reviewed the factors that cause successes and failures of development projects undertaken by small and medium companies and typical cases.

We recognize that it is important to promote technology development by small and medium companies. In this respect, considerations to small and medium companies are not adequate in our current development promotional system and its operating system. In order that the development promotional system of JRDC may be more widely utilized by small and medium companies, many improvements must be made, such as (1) JRDC's procedural regulations should be simplified, (2) JRDC should set up regional branches or use local organizations such as Chamber of Industry and Commerce and local self-governing bodies for improved communication with small and medium companies, (3) JRDC should intervene between such companies and public research institutes and universities for more opportunities of joint research, (4) JRDC should not intended to promote the development of the highest class technology alone but select practical technology that would contribute to the activities of such companies, (5) conditions of refunding the development expenses advanced by JRDC should be eased, i.e.,(i) the development expenses are to be refunded in yearly installments within five years after completion of successful development, but the refunding period should be longer, (ii) the development expenses should be repaid in proportion to the sales of the developed products, (iii) a part of the development expenses should be relieved of refunding, (iv) the security to be offered after completion of successful development should be reduced, and others, (6) JRDC should look after the company even after the completion of the project by way of coordination for another loan, assistance in marketing and others.

Being aware of these problems, JRDC will make every effort in this direction.

This table shows evaluation, after completion of development, on the undertaking companies, which appear in our case study, in view of the factors of success and failure.

		development program		undertaking company		factors					
		expenses	period	capital	employees	technical capability	personal ability	sales power	manoeuver-ability	financial strength	suitability of project
successful cases	(1)	$640,000	1971-'74	$420,000	380	A	B	B	B	A	B
	(2)	140,000	1971-'73	80,000	120	B	B	A	A	B	B
	(3)	70,000	1970-'71	40,000	65	B	B	B	B	D	B
	(4)	260,000	1969-'72	200,000	65	B	A	A	B	C	B
	(5)	230,000	1966-'68	170,000	570	B	B	A	B	C	C
	*(6)			330,000	300	B	B	B	B	B	B
unsuccessful cases	(1)	230,000	1971-'72	330,000	580	C	D	D	C	E	C
	(2)	550,000	1972-'74	750,000	300	B	C	D	C	B	C
	(3)	230,000	1973-'77	1,250,000	270	B	D	C	C	B	C
	*(4)	40,000		150,000	125	C	B	C	B	D	B

A: excellent B: good C: fair D: poor E: poorer

* shows a case in which a technology was licensed through JRDC's coordination.

CASE STUDIES ABOUT SEARCH FOR LICENCES FOR SMALL/MEDIUM INDUSTRIAL FIRMS IN SWEDEN

Swedish National Development Co., SU

O. Storakers

NRDO Conference 1980

Case studies on search for licenses for small/medium-sized industrial firms in Sweden

By Owe Storakers, STU, Sweden

I have been asked to comment on our experiences at the Swedish National Development Company (SU) in our search for new products and licenses primarily for the account of minor and medium-sized industrial firms in Sweden. Before coming to our experiences of this activity I would prefer to begin by giving you a brief background information describing the Swedish National Development Company and the Swedish State Company Ltd, our parent company.

The Swedish National Development Company was formed in 1968 as part of the Government program at that time aiming at increased Government support of technical research and industrial development work. Since 1976 we are a fully owned subsidiary in the State Company Group. There are three main tasks for us today. The first one is to function as a central development resource within the State Company. We are thus to search for and supply new products and business ideas to this State Company Group and to perform the development commissions given us by the State Company Management. Our second task is to search for and develop new products, methods and systems of community-oriented character. This task is the original one of the State Company and is in the main financed by the Government. The third task imposed on us by the Government is to function as a channel for the development of innovations supplied primarily by minor companies and individual inventors.

Our operation is financed partly with orders from the State Company and its subsidiaries and, partly, with state subsidies as far as the development of new community-oriented products are concerned, and for the purpose of searching and channelling of products and licenses to small- and medium-sized companies in low-occupation regions.

The Swedish State Company, Statsföretag AB, is one of the country's largest business groups. It has a turnover of some 2 000 million dollars half of which comes from exports. It has about 45 000 employees in Sweden and abroad. Statsföretag AB was created by the Swedish Government in 1970 as the parent company of some twenty companies which had previously reported to eight different government departments. The activities of Statsföretag range across the basic industry and other sectors of the economy including mining, steel, engineering, pulp and paper, chemicals, consumer products and services. This spread is mainly due to the diversity of companies inherited in 1970, rather than the aspiration to become a conglomerate. A number of these companies are the largest in their respective branches. The group produces about 5% of Sweden's total industrial output. The companies in the Statsföretag group operate on the same terms as and in full competition with the private sector and they are expected to make profits. However, the Government has added a number of special obligations to Statsföretag's normal commercial objectives, in particular to strengthen Sweden's staple industries to help maintain and expand regional employment and to promote industrial democracy.

After this brief background information I will proceed to a case study which will better reflect the problems and opportunies involved in the search for licenses for small- and medium-sized companies.

The Swedish Ministry of Industry has commissioned us to look for new products and licenses primarily in Japan and the United States for small- and medium-sized companies preferably located in low-occupation regions. The Ministry's interest thus displayed in the pursuance of such activities goes back to the extensive restructing to which Swedish staple industries have been subjected during recent years and which in many cases has negatively influenced employment in different regions. The company I represent has been engaged on this task as one of serveral firms of consultants. The objective has thus been to search for such products as may be expected in a comparatively short time to have favourable effects on employment. However, these activities must be regarded only as complementary to other contributions on the part of the central administration for the purpose of maintaining employment at a satisfactory level.

The companies selected within the scope of this project and who have announced their interest to participate can be roughly divided into three different categories. Group number one is made up of subcontracting-oriented companies possessing a highly developed technical competence but very limited customer segments. More than half of all companies belong in this category. The second group consists of home-market-oriented companies manufacturing their own products but catering to a limited clientele. In this group belongs approximately every third company. The third group is constituted by export-oriented companies with a knowledge of the market and a more diversified range of customers and as a rule possessing a highly developed technical competence. Only one company out of ten falls into this group. Via the Ministry of Industry information on these companies has thus been obtained with regard to their size, marketing resources, current product lines and products desired. A selection of companies has next been effected enabling the search performed to be concentrated to approximately 10 different product groups. In the main, the search has been for not too complicated products of not too advanced technology content, this in consideration of the receiving companies' frequently limited development capacity and resources to take on new projects. Furthermore, the products should be in a fully developed condition and preferably be already launched in some other market. From the marketing viewpoint the product should primarily be in demand in Scandinavia and secondarily within Western Europe.

Our company has been commissioned in particular to look for license objects in Japan and the United States. In this search we have chosen to operate in two steps. Step number 1 has, as a rule, meant contacting authorities, institutions, and license agents in order to find potential licensing companies within the selected product areas. Step number 2 has involved direct contacts with the selected companies partly over the telephone and, partly, by personal visits. At the evaluation subsequently undertaken in Sweden some 60-70% of the offers received from the USA and Japan have been sorted out. Of the remaining companies approx 10% are expected to lead to more serious contacts between potential licensors and licensees whereas possibly 1-2% can be expected to result in license agreements.

As far as the search in the USA is concerned the State Company has a firm of their own in New York which has acted as a contact-adminstrating function for the duration of the entire search project. Within the scope of Step number 1 this office has, setting out from a search pattern received from us, placed limited commissions with agents in order to obtain names of suitable companies; selected institutions and other agences to be visited; drawn up visiting programs, and administered advertising in different industrial publications, newspapers, etc. At our first visit in the United States we consequently visited the selected institutions, agents a.o. An examination of the results of this first search yielded a few hundred names of companies recommended as potential licensors within the specified sectors.

In the course of a few months after this our US office collected information from the companies who had displayed an interest. This information was co-ordinated according to a special processing pattern and sent to Sweden for evaluation. Particularly interesting companies were next visited by our company for the purpose of obtaining supplementary information and in order to evaluate the license objects in more detail. One of the experiences gained by us in the search in the US market is that a carefully prepared selective telephone campaign is an efficient way of finding companies having a serious interest in doing license business with Sweden. In a telephone conversation with the right person you can quickly make considerably more progress than if writing a letter to the company concerned.

As far as our search in Japan is concerned we have used as a contact channel the technical and scientific attaché office run by Sweden in that country. On the basis of a search pattern provided by us they selected, as Step number 1, some 20 institutions and companies judged to be of special interest. We also advertised in bulletins published by different industrial agencies. When in Japan the first time we visited these institutions and a number of major companies. The end result of this was a considable number of names of companies recommended as potential licensors. Out of this number a selection for further contacting was next made. These contacts were then made by the staff of the attaché office who got in touch with them by telephone. After this, there remained 30-40 companies having displayed a serious interest in license business with Sweden within the product sectors specified. During a second stay in Japan, for the purpose of Step number 2, these companies were visited, resulting in 70-80 documented license propositions.

Until now our trial activity in Japan has yielded the following experiences. Japan is an institutionalized society with many different group constellations. In order to obtain the right business contacts a structurized approach is consequently demanded and a two-stage operation required. The existing "hidden" product market is large. This product supply cannot be reached, however, before one has passed the first step in the search program and obtained the right contacts direct with the companies willing to offer licensing. Frequently, these companies are subsidiaries in a major company group. Another requirement is that one have access to Japanese staff due to the language problem and also for other reasons A number of valuable propositions have been received from small and specializing companies with a high export volume. On the other hand our contacts with the trading corporations in Japan have not yielded any tangible results. This is probably because these corporations are primarily interested in selling their products as hardware and only secondarily in marketing under license contracts.

The licensing propositions received from companies in the USA and in Japan have subsequently been evaluated in Sweden from technical as well as market aspects, a primary objective having been to judge the product's market potential in Scandinavia. In this phase of the work a mayor proportion of the license offers have been sorted out (60-70% as already mentioned), the remaining offers having via the Ministry of Industry been presented for consideration by the companies asumed to be interested in the products. Within the scope of the project as pursued until now we have from this side delivered well over 100 license offers to interested companies. As yet we have registered an interest from about 20 % of the companies approached in additional information on the license objects; in a number of cases the company concerned has asked to be put in direct contact with the potential licensors for further discussions.

As yet it is too early to draw any conclusion from the now completed project but certain experiences of value for continued efforts in this field can be laid down. To begin with, it is of fundamental importance that the consulting firms engaged in the search obtain a better direct contact and more and better information about the companies interested in new products or licenses. For the purpose of the continued efforts in the product field we have in consultation with the Ministry of Industry consequently arrived at the conclusion that a number of companies should be selected as worthy of special actions. During this second phase of the project, which we have recently commenced, approx 10 companies have been selected from a specific region. We have visited these companies and there tried together with the company management to form an opinion of their resources and motivation to engage in a possible license project, their financial position, and their technical and market know-how required for the exploitation of a new product. In doing this, we have tried to obtain a group of companies as homogenous as possible in order to not have the search effort unnecessarily diversified. The information obtained has subsequently been distributed to our co-operating agencies in the countries concerned and together with them we will try to find the companies which might become suitable license partners with the Scandinavian companies selected. During our earlier search we have noted that certain companies in Japan and the United States have shown too little interest in obliging us simply because we have not been able to present the opportunities, resouces etc, of the applicant companies in more detail.

The reasons why Japanese companies may be interested in licensing is that they have earlier exported their products as hardware to Western Europe whereas now they prefer a closer interaction with their customers in respect of service, etc. Other influencing factors may be freight costs or the fact the Japanese home-market absorbs all production capacity.

As a complement to the direct search activity in these countries we have also been searching via the established license agencies, such as Technotec and Dvorkowitz who are now doubt well-know to all of you. This has in fact enabled us to make an evaluation of both these search systems since we have tested them in a parallel fashion. The results have been of varying character.

In some cases quite a number of interesting propositions have been obtained but in most cases the dividend has been meagre. It should be kept in mind that a certain amount of training and experience is required in order to utilize systems of this kind in the appropriate manner. However, our preliminary conclusions are that we will not employ the services of either Dvorkowitz or Technotec to a mayor extent, at least not within the scope of these projects.

As part of our searching for products capable of creating employment-promoting effects in certain low-employment regions we have also chosen to explore other possible avenues than licensing. I therefore intend to comment on another project pursued by us during last year. In this case the object has been to find replacement production in communities where the State Company textilesgroup has for structural reasons reduced its operation or liquidated production units. In this effort we have concentrated on four pupulation centres in northen Sweden which we have subjected to selective search activities. As a result of our central position in the State Company Group and also in other ways, we are frequently approached by people offering business propositions, innovators, minor companies, and project-holders. In this capacity we have been in position to engage in and place certain of these projects in population centres subject to our selective search and have until now been instrumental in the forming of five new companies during the past year, the total employment effect being 100-150 individuals within approx 6 months after start of production in the companies concerned. In this, our company has participated all the way from finding the ideals, processing them, bringing forth the business operation plans, negotiating with exploiting parties and project-holders and seeing the projects through to full realization. The outcome for three of these centres is that their occupational problems today are solved to the extent that all previously employed textile industry personnel have been given other jobs in these new companies. This work has been carried on in close co-operation with the regional development funds, one of the primary objectives of which is to develop business and industry within the region concerned.

I also want to briefly mention our experiences of the search for licenses via established license agencies such as Licensintorg. ANVAR, etc. Thus we have in this case functioned as agents in Sweden for the Soviet Licensintorg agency for about five years. It has proved to be very difficult and to require much effort to arrive at an agreement in matters of buying technology by licensing from the Soviet Union. We have also had a similar task to negotiate licenses from other East-Europian nations with Swedish industry. The experiences are the same. We have found that it is indeed difficult to achieve profitability in acting as an agent because of the considerable time lag before negotiations lead to concrete results which constitute a prerequisite for commission to be paid to the party negotiating the deal.

I want to go on to comment briefly on the problems and experiences we have obtained in searching and negotiating licenses and products. To begin with, it is of mayor importance that when searching for new products and licenses you make it fully clear what requirements apply to the projects you actually want to find, in respect of technological level, degree finished, complexity, marketing resources, development resources, etc and that the product suit the company in question. A search for products can be quite meaningless if you do not already from the start try to define these factors. In order to make a reliable evaluation of product offers you need technical as well as commercial competence. For my own part, I am prepared to name the market-related and commercial analysis as being of highest important and belonging in the initial stage. You can frequently obtain product propositions which are technically highly interesting but for various reasons impossible to sell. Sometime this is because one tries to sell a more sophisticated product than the market needs and is prepared to pay for. Another problem which can be very hard to judge is when a product is right for introduction. Often the case may be that a product has already been launched in the market, for instance in the United States, and you find it interesting, but then it appears that the Scandinavian market is for one reason or another not ripe to accept it. It is essential to have a feeling for when a product is ripe for introduction although this is a matter which is extremely difficult to decide.

In searching for products and licenes, primarily abroad, you also have to count in the costs and financing aspects. Many small- and medium-sized companies may - in many cases perhaps because of lack of resources - find it difficult to keep up the external contacts judged interesting for its future development. If, as an alternative you engage in a more general search activity, maybe together with several other companies in order to cut costs, you experience the inconvenience of getting your own interests in a squeeze between those of the other participants. It is no doubt difficult to offer any general advice as to which of these avenues would be the most effective ones in the case of small- or medium-sized companies if you have to consider the costs at the same time. As far as the financing aspect is concerned you can as a rule of thumb expect the cost for finding, purchasing and exploiting a license object to rarely be less than ca $200 000 for a company. This should be fully clear from the start to these minor- and medium-sized companies.

If for a moment you consider the opportunities offered a company by a product and license search you will probably find that an external search for new products and licenses can in some cases bring a product complement to your company which is less expensive than the corresponding in-company development of the product. Also the technical risk involved is frequently less. A well structured contact network offers the management of small companies many advantages also in the long-term and enables it to monitor the technical and market-oriented development within the company's business sector.

In conclusion, I wish to emphasize the increasing interest on the part of the Swedish Government authorities in respect of the search for new products and licenses. As I have already mentioned, the Ministry of Industry is engaging quite extensively in the process of finding new license products abroad of a nature to suit small- and medium-sized companies in low-employment regions in Sweden. Furthermore, an operation concerning import of technology has recently been instituted in the Ministry of Industry and means have also been set aside for this purpose. These activities will probably be directed towards supplying in a longer perspective new technology to Sweden in areas where Sweden is judged to have a competitive potential.

If this development is regarded in a wider perspective the search for new products and licenses stands out as a quickly growing market, seeing that there is a growing realization of the importance of this activity and a market where increasing resources will no doubt be invested.

However, we feel indeed the greatest respect for the difficulties involved in solving this type of problem but this activity is nontheless a necessity parallel with the regular product development pursued by the individual companies.

SMALL AND MEDIUM SIZED INDUSTRIAL FIRMS IN GERMANY AS A SOURCE OF LICENCE OPPORTUNITIES; EMPIRICAL DATA

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SMALL AND MEDIUM SIZED INDUSTRIAL FIRMS IN GERMANY AS A SOURCE OF LICENCE OPPORTUNITIES; EMPIRICAL DATA

by Dr.M. Reinelt, ARPAT (FhG)

1. Initial Situation and Approach

The measures incorporated in the integrated policy concept of the German Federal Government for research and technology in relation to small and medium sized companies (Bonn, 1978 and amendment, 1979) also include a variety of instruments for the transfer of technology and for technology and innovation consultancy. They do not take into account the potential existing in the private market for licenses, a field which does not seem to have been cultivated sufficiently well even by private initiative. The Arbeitsgruppe Patentverwertung (ARPAT) has repeatedly been requested by small and medium-sized companies to make its services as an agency for licenses available also for those inventions which were generated in R&D funded by those very companies. The same finding is the outcome of a study by the Coblence Chamber of Commerce on the innovation capability of small and medium-sized companies[+].

In the light of this experience, ARPAT launched a poll in order to compile an empirical data base on the extent and quality of the unexploited licensing potential of small and medium-sized companies.

The questionnaire used for this purpose (see Annex) contains the following groups of questions:

- Type and size of company (Questions 1-4).
- Potential for inventions and know-how (Questions 5 and 6).
- Use of this potential (Questions 7-10).
- Unused potential, willingness to grant licenses (Questions 11-20).

The questionnaires were sent out to those 300 small and medium-sized companies (with sales not exceeding DM 200 million) which regularly receive information from ARPAT about possibilities of obtaining licenses on patented inventions generated in R&D financed out of public funds.

The results of the poll will show in more detail that these 300 small and medium-sized companies are mostly enterprises which are more innovation-minded than the average.

[+] Kein technischer Fortschritt ohne Mittelstand (No Technical Progress without Medium-sized Industries), November 1979, p.9.

Replies were sent in by 132 small and medium-sized companies, which is a return rate of 44%. Five questionnaires had to be discarded because they had not been filled in completely. The evaluation is therefore based on a total of 127 questionnaires completed and returned. A statistics program (FIDAS-STASYS) developed by the Gesellschaft for Mathematik und Datenverarbeitung was used for evaluation.

2. Evaluation

In addition to the overall evaluation of the 127 data sets a detailed evaluation was made with respect to those small and medium-sized companies which would use the services of ARPAT to offer their licenses (Question 20).

2.1 Overall Evaluation

2.1.1 Types and Sizes of Companies

On the basis of the replies to Question 1, branch, and Question 2, line of business, it was possible to classify small and medium-sized enterprises unter the six main headings of mechanical engineering (Mach); electrical engineering (ET); chemistry, including plastics, asbestos, rubber and paper processing (CH); precision mechanics and optics (FuO); iron and steel, sheet metal and metal working (EBM); building, quarry and stone, wood working industries (Bau). The size of a small and medium-sized company was to be characterized by its sales volume (Question 3). Under this heading, firms were subdivided into four size categories. The 127 small and medium-sized companies which had returned the questionnaires can thus be summarized as follows with respect to branches and sales volumes:

Table 1: Branches and sales volumes of the 127 small and medium-sized companies

Size categ. in million DM sales	Mach	ET	CH	FuO	EBM	Bau	Total	%
0 - 5	10	8	1	4	1	1	25	19.7
5 - 20	13	10	2	5	1	-	31	24.4
20 - 50	14	5	8	4	3	4	38	29.9
50 - 200	14	4	5	2	7	1	33	26.0
Total	51	27	16	15	12	6	127	
%	40.2	21.3	12.6	11.8	9.5	4.7		100

The percentage distribution into branches and sales categories is shown in Fig.1 below:

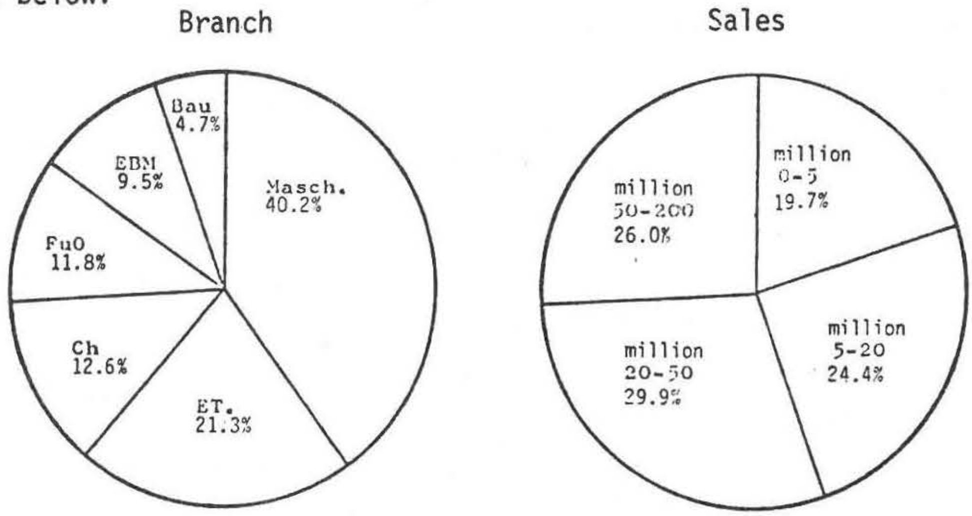

Fig.1: Branches and sales categories.

The figures indicating the branches represented are striking especially because of the high percentage of mechanical engineering firms. In our opinion, this is indicative of the fact that this branch of industry is eagerly looking for new products and new techniques. The data relating to sales volumes are characterized in particular by the relatively uniform distribution of small and medium-sized companies over the four categories.

2.1.2 Potential of Inventions and Know-how

116 out of the 127 small and medium-sized companies have applied for patents on inventions (Question 5), the total adding up to 4415 inventions. This amounts to an average of 38 inventions per company. In addition, unpatented technical know-how is a factor of major importance as far as sales are concerned (Question 6):

In 85 companies	(= 67%)	it	is	of	"great importance"
" 33 "	(= 26%)	"	"	"	"medium importance"
" 9 "	(= 7%)	"	"	"	"minor importance".

The percentage distribution of replies is shown in Fig.2.

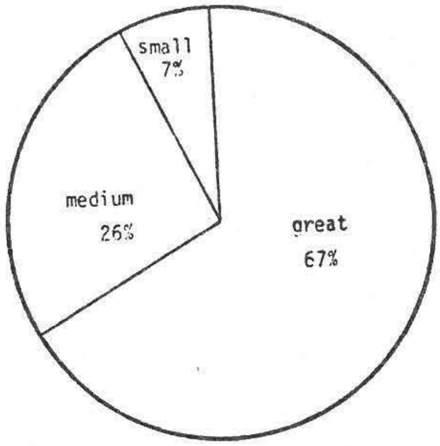

Fig.2: Importance of unpatented know-how.

2.1.3 Present Use of this Potential

Use in this case implies both application within the company and the use by granting licenses. One company out of the 116 with patented inventions to their credit does not make use of its own inventions, while the other 115 small and medium-sized companies utilize this potential as follows:

- 2006 out of the total of 4415 patented inventions are used within the company (Question 7) (see also Fig.3).

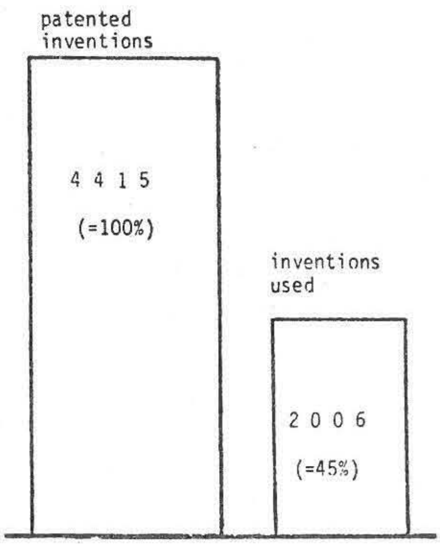

Fig.3: Use of patented inventions within the company.

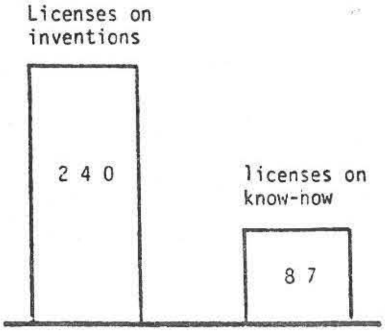

Fig.4: Use through granting licenses.

This 45%-rate of utilization is 15% below the degree of utilization in comparable small and medium-sized companies (with sales volumes not exceeding DM 250 million) as determined by the IFO-Institut für Wirtschaftsforschung[1]. However, IFO's result in this case is only based on the evaluation of 471 patents, while ours takes into account 4415 patented inventions.

- 46 out of the 115 small and medium-sized companies granted a total of 240 licenses on patented inventions (Question 8). 40 companies granted a total of 87 licenses purely on know-how (Questions 8 and 9) (see Fig.4, p.5). 65 companies (=50% of the 127 small and medium-sized companies) granted licenses on patents and/or licenses on know-how. Compared with the results of the IFO study[2] this percentage is high, which indicates that the small and medium-sized companies cooperating with ARPAT rank above the average as far as granting licenses is concerned.

2.1.4 Unused Potential and Willingness to Grant Licenses

The question for the percentage fraction of know-how unused (Question 11) was answered by 96 small and medium-sized companies as is shown in Fig.5.

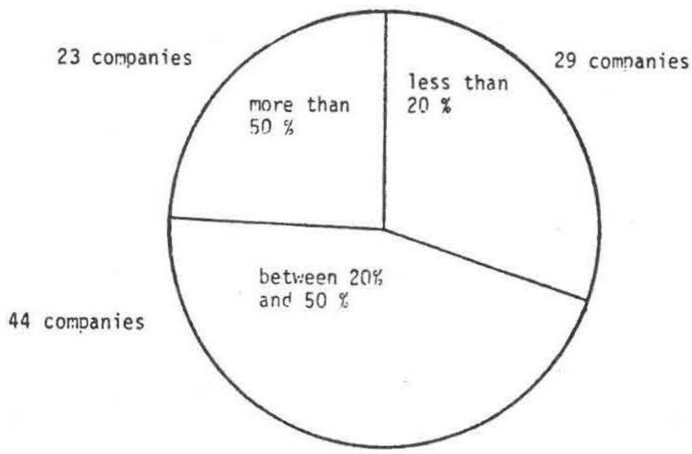

Fig.5: Existence in small and medium-sized companies of unused know-how, expressed in percent of the total know-how available.

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[1] Patentwesen und technischer Fortschritt (Patents and Technical Progress), Göttingen, 1974, Pt.I, Table 57.

[2] op.cit., Pt.II, Table 21: In the Mach and ET sectors, the corresponding number of licenses granted on patents and/or know-how is between 30 and 40%. In Table 18, op.cit., which takes into account also a larger number of branches other than Mach and ET, the corresponding figure is even as low as between 5 and 17%.

These figures demonstrate the existence of a considerable potential of unused know-how within these small and medium-sized companies investigated. As is evident from the statements below, the companies concerned are prepared to grant lincenses on this untapped know-how.

78 out of 127 small and medium sized companies are willing to grant more licenses (Question 12), i.e., 68 would do so on know-how already exploited (Question 13), 39 on know-how not yet exploited (Question 14).

The questions asking about the numbers and types of licenses (Question 15 and 16) were answered by only 64 out of the 78 companies. Those 64 small and medium-sized companies would offer an aggregate 395 licenses, of which 208 would cover patented inventions, 187 unpatented know-how.

The licenses offered are distributed in the fashion shown in Fig.6 with respect to their development status (Question 17-19).

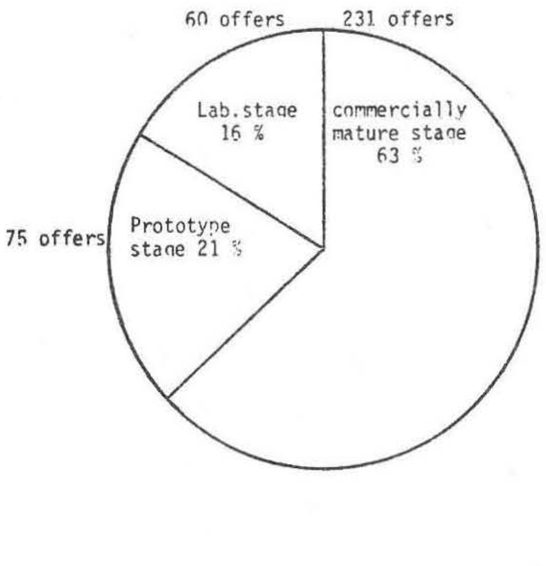

Fig.6: Development status of 366 out of the 395 licenses offered.

The difference relative to the 395 offers referred to above is due to the fact that some small and medium-sized companies did not reply to Questions 17 - 19.

These data show that 50% of the companies covered are willing to grant a considerable number of licenses, the objects of which they feel to be particularly attractive for exploitation in the light of the development status indicated above (231 licensing objects at the level of commercial maturity). 50 out of the 78 companies prepared to grant licenses, i.e. 64%, would try to find their licensees through the services of ARPAT (Question 20). From this result it can be concluded that the companies participating in this poll are interested in a service agency of this type.

2.2 Detailed Evaluation: Assessment of the Fifty Companies Interested in ARPAT

This detailed evaluation is to furnish answers to the following questions:

- What is the patent and licensing behavior of those fifty small and medium-sized companies which would work through the services of ARPAT?
- What are the characteristics of the licenses offered by those fifty small and medium-sized companies?

Table 2 is a compilation of statements characterizing the attitude vis-à-vis patents of the fifty companies interested in ARPAT. For comparison, as in the other tables below, the data are indicated which relate to the total of all 127 companies.

Table 2: Potential of inventions and know-how

Relating to Question No.	Statement	50 comp. interested in ARPAT	Total number of 127 comp.
5	Number of companies holding patented inventions	47	116
	Total number of patented inventions involved	1927	4415
	Average number of inventions per company	41	38
6	Percentage ratio of comp. for which unpatented technical know-how is of importance as well		
	great	64%	67%
	medium	36%	26%
	minor	0%	7%

It can be gathered from these figures that the inventive creativity of the companies interested in ARPAT is at least equal to that of the total number of companies. This finding does not depend on company size, for the average sales volumes of the two sets of companies differ only slightly.

Table 3 shows that the percentage fraction of small and medium-sized companies which granted licenses on patents, on know-how or both is always higher than that of the total. However, the average number of licenses on patents and know-how, respectively, is smaller per company.

The rate of exploitation, which is defined as the quotient of the number of patented inventions exploited and the total number of patented inventions, differs only slightly in both cases.

Table 3: Present exploitation of the potential of inventions

Relating to Question No.	Statement	50 comp. interested in ARPAT	Total number of 127 comp.
7	Number of companies exploiting patents within their companies	48	115
	Number of inventions used in the company	887	2006
	Rate of exploitation = $\frac{\text{No.of inv.pat.\& expl.}}{\text{Total No. of inv.pat.}}$	46%	45.4%
8	Number of companies granting licenses on patents	24 (48%)	46 (35%)
	Number of licenses granted on patents, average per company	115 4.6	240 5.2
9	Number of companies granting licenses on know-how	18 (36%)	40 (31.5%)
10	Number of licenses granted on know-how, average per company	32 1.8	87 2.2
9, 10	Number of companies granting licenses on patents and/or know-how	30 (60%)	64 (50%)

Table 4 reveals that the companies interested in ARPAT

- make better use of their know-how than the average of the companies do (Question 11),
- want to make available patented and unpatented know-how to a larger extent, despite a higher rate of in-house exploitation.

Table 4: Unexploited know-how potential

Relating to Question No.	Statement	50 comp.interested in ARPAT	Total number of 127 comp.
11	Number of companies whose know-how is unexploited		
	0-20%	15 (30%)	29 (30%)
	20-50%	22 (44%)	44 (46%)
	50-100%	13 (26%)	23 (24%)
13	Number of companies willing to grant additional licenses on know-how already exploited	42 (84%)	68 (54%)
14	Number of companies willing to grant additional licenses on know-how not yet exploited	31 (62%)	39 (31%)
	Number of potential licenses offered		
15	- on the basis of patented know-how	144	208
	. average per company	2.88	1.63
16	- on the basis of unpatented know-how	112	187
	. average per company	2.24	1.47
17-19	Number of licenses offered with development status		
	laboratory stage	46 (19%)	60 (16%)
	prototype stage	57 (24%)	75 (21%)
	commercial maturity	139 (57%)	231 (63%)

The potential licenses offered to the companies interested in ARPAT come from these branches:

- mechanical engineering	120
- chemistry	65
- EBM	29
- electrical engineering	24
- building	14
- precision mechanics, optics	4
	256

3. Conclusions

The results of the poll indicate the presence, in small and medium-sized industries, of a considerable unexploited potential for licenses which, according to statements made by the companies participating in the exercise, includes a large percentage of products and methods commercially mature. However, it must be borne in mind in this assessment that the small and medium-sized companies to which we put questions probably represent a positive selection with respect to innovation behavior.

The willingness shown by many small and medium-sized companies to entrust ARPAT with the initial steps in the licensing procedure seems to point to a need for the services of an intermediary above and beyond the direct granting of licenses. The impartial way in which ARPAT conducts its business, which is well known to the companies concerned, has probably helped to establish the necessary basis of confidence.

Since a poll inquiring about quality and market potential of the inventions on which licenses would be available can only reflect subjective attitudes and, with respect to a request to start licensing procedures, can only indicate the potential intentions of those queried, it should be verified by means of a demonstration project whether the establishment of a licensing agency for small and medium-sized companies would be justified in objective terms.

4. Excursion: Obstacles to Patent and Licensing Policies in Small and Medium-sized Companies

It must be assumed that small and medium-sized companies in general will not pursue deliberate, let alone systematic patent and licensing policies (see also pp.118 of the IFO study quoted under 2.1.3 above). In our opinion, this is mainly due to the following factors:

- Absence of any planned product policy.
- Biased attitude relative to patents and licenses (lack of knowledge of the system and the language, cost factor, disclosure, fear of competition).
- Excessive workload for entrepreneurs and lack of willingness on their part to delegate responsibility either internally or externally.
- Wrong estimate of the possible income to be derived from licenses granted and of the savings in R&D as a result of licenses obtained.

The effect of these obstacles is the more profound, the smaller the company.

The existence of an impartial licensing agency charging fees only in successful cases would offer incentives to these small and medium-sized companies to test "Patents and Licenses" as a source of income at little risk and, after having become familiar with the interdependencies existing in the field, to develop systematic patent and licensing policies of their own.

Annex

- PATENT EXPLOITATION GROUP -

Assessment of the Unused Licensing Potential in Small and Medium-sized Companies

Q.No.	Question	
1	Branch	....
2	Line of business	....
3	Sales volume of your company	DM.............million
4	Workforce	
5	Number of inventions (patents, applications, registered designs) patented to your company.	....
6	In addition to these inventions, how is the significance of <u>unpatented</u> technical know-how with respect to your sales volume?	Great Medium Small
7	Number of patented inventions exploited within the company.+	
8	Number of patented inventions on which you granted licenses.+	
9	Have you ever granted licenses on know-how only?+	Yes No
10	If so, how many?	....
11	In your estimation, what is the percentage of your unexploited know-how as compared to your total know-how?	

+over the past ten years

Q.No.	Question	
12	Would you grant more licenses?	Yes No
13	If the answer is yes, a) on know-how already exploited?	
14	b) on know-how not yet exploited?	
	What would be the number of different offers for licenses resulting from this policy:	
15	a) on the basis of patented inventions	No.
	b) on the basis of unpatented technical know-how	No.
	How many of these potential offers of licenses have reached the following levels of development:	
17	laboratory stage	No.
18	prototype stage	No.
19	commercial maturity	No.
20	Would you be interested in ARPAT finding licensees for these licenses offered?	Yes No

Suggestions, wishes:

SWEDISH GOVERNMENTAL SUPPORT FOR PRIVATE INVENTORS

National Swedish Board for Technical
Development, STU

P. Jörgensen

presented by : S. Karth

Peter Jörgensen

SWEDISH GOVERNMENTAL SUPPORT FOR PRIVATE INVENTORS

STU (National Swedish Board for Technical Development) has the main responsibility for supporting private inventors in Sweden. This is done by giving advice and financial support as well as involvment in technology marketing.

General information about STU

It is STU´s task to encourage technical development and to promote technical research. Some of its programmes are tailored in particular for development projects and within this scope advice and financial support are provided at the initial project stage. Thus the STU covers the area from the basic idea to the stage when the development has reached a working system of prototype. Pilot production, investment in production equipment and marketing to the end user are not funded by the STU. The financing of these latter stages are provided by other organizations such as Regional Development Funds, The Swedish Investment Bank or commercial banks.

Financial project support provided by the STU is given as a grant or loan and shall be used for development, demonstration and evaluation of ideas behind new products, methods and processes. It is STU´s task to finance risk-bearing projects and the STU is also providing the means for projects in areas where differences in profitability exist between the national economy and short-term business economics. Examples of such areas are: aids to disabled persons, environmental conservation and factory safety equipment. Financial support may be given with conditional repayment, meaning that STU will demand a refund, should a project turn out a success. For projects conducted by companies STU normally provide only half the project cost. Private inventors and small firms are normally provided with 100 per cent of the project cost.

Support to private inventors - are part of the innovation policy

The support to private inventors is a small but important part of the innovation policy in Sweden. Until 1979 it was a special programme at STU but is now an integrated part of several programmes at STU

The reason for having a special programme catering to the needs of inventors was partly historical. In 1968 when STU was formed, a special agency for support to inventors merged with several other agencies also supporting research. Another reason, also historical, is the great respect Swedes have for inventors. Men like Gustaf Dahlén and Alfred Nobel helped to create that respect and actually, during the first half of the present century a very large part of the Swedish industry was both created and started by inventors like the ones we have mentioned.

A more rational reason for the present programme is the fact that a large part of the radically new innovations do in fact come from private inventors and small companies. Recent prominent US-examples are the techniques marketed under the trade marks XEROX and POLAROID. Another reason is that an organisation or a programme designed to assist private inventors has rather other characteristics than an organization funding research.

Since 1979 the new programme has been fully integrated with other programmes at STU. Special efforts have been made so as not to decrease or lessen the quality and quantity of the support given through the earlier programme. Thus the government has stipulated a minimum amount that STU must reserve for project assistance to inventors. For the fiscal year 1979/80 this amount is 25 million SwKr (about 6 million US dollars). Project applications by private and small industry inventors are vetted by technical officers with special experience in the field and who also have industrial experience.

How STU considers an application

STU receives about 1000 applications from inventors every year. In the application the inventor normally describes the use and function of his invention and how he intends to exploit the new innovation. Of these 1000 applications about 20 per cent are rejected after a brief examination.

The rest of the applications, about 800 a year, is considered in greater depth. Points such as evidence of technical progress and real possibility to exploit the new idea are carefully considered. The potential market is roughly estimated. The relative advantage of the following factors is then looked at, estimated production cost, buyer's risk-factor, who would buy the new product, who is evaluating it, what is the potential domestic market and how does the new product fit in with existing or changing regulations. The result of this examination is a rather vague estimation of the project's potential value, and the more radical or unusual the project is the less definite is our estimation of it.

When considering the possibility to exploit the project two other factors are also studied. The patent shall normally stand a licensing negotiation. The examination done by a potential licensee is normally more thourogh than the examination made by the patent authorities. For obvious reason is it also done with another aim in mind. The question is then, will the patent give a sound protection from competitors. When studying applications, this is the question asked. The possibility to exploit the project is also dependent on the number of possible licensees within the country. The experience is that exporting non-proven technology is difficult and that the licensee has to be found in Sweden. Some projects could lead to the start a new company, many say. This is true, but only for some unique projects.

Finally, is the applicants competence evaluated. This is extremley difficult to do especially concerning those who have no previous record of having invented something or someone without formal technical training. On the other hand, how should you look at an inventor with some failures behind him. He might have learnt enough to manage nest time.

Normally about 25 per cent of the proposed projects are supported. The evaluation time is about three months. External expertise is sometimes consulted. The average grant is about 50 000 SwKr (12 000 US dollars). Support is given with conditional repayment as mentioned earlier. The inventor has all rights to the project and the patents but for the conditional payment.

During the work with the project, the inventor can be assisted in different ways especially concerning the establishment of contacts. E.g. STU officers help inventors to find good workshops where they can have their prototype produced and tested. Sometimes university professors or consultants are contacted to assist with calculations, marketing estimations, feasibility studie

As the project is advancing at some point marketing has to start. STU can assist with the finding of suitable partners with negotiations as well as with the actual writing of contracts. These activities are sometimes carried out under a special programme by the Technology marketing department. The support is given with a conditional repayment clause concerning the STU manpower costs.

Results

In the beginning of 1976 a major study was completed covering all projects that had been supported during the years 1968-1975. A special part of the study covered 67 inventions supported during the 3-year period 1968-1971.

These 67 projects proved to have managed rather well both with regard to production and to marketing. STU's grants amounting to about SwKr 1,6 million enabled 22 per cent of the projects (15 of them) to reach a combined sales figure of SwKr 29 million in 1975. Already four years after the inventors had received the STU grants, the actual sales generatee by these inventions was 16,3 times as great as the initial STU grants. The support also includes grants for projects (78 per cent) which at that time, had not reached the production stage. After three years the factor was 9,7.

When studying these figures one should notice that the STU grant only covers the development costs and not production and marketing costs. However, the projects with the highest sales were licensed so production and marketing investment were probably reasonable. The effect of the inflation has not been taken into account. A very small number of the projects do generate a very large part of the total sales.

A more recent survey showed that STU spent 18,8 million SwKr (about 4,5 US dollars) between 1968-75 on projects from innovators. The sales generated from these projects amounted to 100 million SwKr (about 24 million US dollars).

Unfortunately, it has been possible only to study sales. It would have been interesting also to examine net profits and return on invested capital. The accounting procedures of the companies concerned are so different, however, that such analyses would have been unreliable.

Some more findings from the study done in the beginning of 1976 may be of interest.

- Of the inventors who received grants from STU 25 per cent had previously succeeded in exploiting at least one invention without support from STU. Just over 5 per cent had exploited more than five inventions.

- Approximately 59 per cent of all the grant recipients were working in the manufacturing industry, and in building and mining. Only 40 per cent of the occupied population is engaged in these branches. The engineering industry was particularly well represented, accounting for 25 per cent of the beneficiaries but only 6 per cent of Sweden's employed population. Industries which were poorly represented included foodstuffs, clothing, wood products and furniture, pulp and paper, and the graphic industry.

- The grants were awarded to "spare-time inventors" in 54 per cent of the cases, and to owners of companies in about 25 per cent.

- In many cases the development of the invention has involved a change in the employment status of the person seeking the grant. In about 45 cases companies were subsequently formed. In a number of other cases the inventor became part-owner of new company.

- Design and manufacture of prototypes was normally undertaken by the inventor himself.

- The main problems encountered in the course of the development work were in financing and in assessing the sales potential and market conditions according to the inventor.

- Insuffiency of financial resources was the biggest problem affecting the manufacture as well as the marketing and selling of the inventions according to the inventor.

Development of the support

Measures are now taken to find new ways to support inventors. One is to find industries that are interested to define and present actual problems to inventors. Different ways are examined to exploit this concept.

Courses concerning patenting-strategy and licensing-negotiations have also been tried.

DENTAL MATERIALS

NRDC

G.M. Blunt

MUNICH CONFERENCE 1980

NRDC PAPER ON DENTAL MATERIALS

By G.M. Blunt, NRDC

Of all our pains, since man was curst,
I mean of body, not the mental,
To name the worst among the worst,
The dental sure is transcendental.

Thomas Hood, English poet, 1780-1842

INTRODUCTION

In this talk I shall be describing some of the inventions which we have successfully exploited in the field of dentistry, the manner in which they arose, the difficulties we have had in securing patent protection, problems with negotiating licences and how we coped with infringers. Whilst dental technology may not appear to be exciting or even particularly interesting, our activities in this field do provide an interesting and, I hope, instructive case study from which many lessons may be learned.

ALUMINOUS PORCELAIN

In the early 1960's, the Ministry of Health, very much concerned with the escalating costs of dental treatment, which in Britain is provided free under the National Health Service, set up a committee to sponsor research into improved dental materials. It was believed that substantial savings could be made if better materials for artificial teeth or for restoring natural teeth could be developed. The rate at which false teeth wore out and needed replacement was causing particular concern. Reluctantly I have to admit that in the British National Health Service low cost treatment is generally prescribed, and for dentures that invariably means plastic teeth, made of acrylic which, whilst of pleasant appearance, is rather soft. A dentist in private practice with an interest in research, who was one of the dental profession's representatives on the Government committee, was asked to take on responsibility for investigating this problem, and it was suggested that he contact one of our Government research establishments specialising in minerals to see if they could recommend any fillers for strengthening this type of acrylic plastic. The dentist concerned, who ran a flourishing practice with private fee-paying rather than N.H.S. patients, was well known for his work with porcelain restorations, and he had very little enthusiasm for the use of plastics for false teeth or for dental repairs. I am not suggesting that this was the reason for his failure to come up with a recommendation for a better acrylic material, but during his visit to the Government laboratory the scientist with whom he was discussing the subject handed him a small piece of crystalline alumina (aluminium oxide) and said "I don't understand why artificial teeth are not made of this stuff. It is white, very strong and highly non-reactive. Moreover it is easily moulded into any desired shape." "It is too opaque and dense looking", came the reply, "but it could be used as a core material with translucent porcelain moulded round it." That was how a new idea for stregthening porcelain teeth came about; a long way from plastic teeth, but an invention for all that. One immediate technical problem was that conventional dental porcelain did not match alumina in thermal expansion. The scientist then set about developing a new porcelain which would be suitably matched to alumina and with the required aesthetic properties. We were to discover in later years just how important the question of aesthetics is in developing new dental materials. The solution turned out to be a porcelain which contained around 50% by weight of crystalline alumina. This new material was called, rather obviously, "aluminous porcelain." Thus, another invention had been made: aluminous porcelain, which could be used not only for making artificial teeth for dentures, as at first intended, but also for making jacket crowns for capping and restoring natural teeth. Restorations made in this new material turned out to be stronger than those made with conventional dental porcelain.

The dentist who originally inspired this work used aluminous porcelain that had been made up in experimental quantities at the Government laboratory in his own practice for crown and bridge work. He found that there were far fewer breakages both during manufacture of the resorations by the dental technician and after insertion in the patient's mouth.

Crown and bridge work of this type is very much "up market" dentistry, certainly as far as Great Britain is concerned. In any event this treatment is very specialised and the market in porcelain powders for making these restorations is relatively small. Splendid though these results may seem from a health point of view, the invention did not seem very exciting. But the application to artificial teeth for dentures was another matter. Consider these figures: 600,000,000 artificial teeth manufactured per annum worldwide; one firm alone in the United Kingdom was said to keep a stock of 18,000,000 at a cost of 25p each. At that time we were also told (by the inventors incidentally) that porcelain teeth were much better than acrylic teeth, which they would soon replace, especially when the advantages of alumina reinforced teeth were realised. Here was a prospect to get excited about. How did we fare? Patent applications were filed on the two inventions (ie the tooth with an alumina core and aluminous porcelain) in the United Kingdom in October 1963, at the conclusion of the initial research programme, in the names of the two inventors, McLean, the dentist, and Hughes, the Government scientist. The rights stemming from Hughes' contribution were offered to the NRDC under our standing arrangement with the Government, and we negotiated a private arrangement with McLean for the assignment of his share to the NRDC.

Within a few months of filing the patent applications we were having our first discussions with industry. The result was a bitter blow. The companies we spoke to, whilst recognising the advantages of aluminous porcelain for jacket crowns, the market in which would be small, were not at all interested in the new proposal for artificial teeth. In particular they disagreed with the advice we had been given that acrylic teeth would soon be superseded by porcelain teeth, and to adopt the new form of tooth construction would involve a difficult and time consuming development programme. The investment in new plant and machinery could not possibly be justified commercially. In the face of this rebuff, I must confess that we tended to lose sight of the value of aluminous porcelain as a jacket crown material in its own right, a fact that led us to make a rather bad decision when later we eventually negotiated our first licence.

A few months later, in the first half of 1964, a German manufacturer arrived on the scene and saved the invention from oblivion. Most surprisingly they took an optimistic view of the commercial prospects for factory made teeth but naturally they wanted an exclusive licence. In view of our previous experience we could hardly refuse, and an exclusive licence for 7 years for the artificial tooth invention was agreed upon, and the aluminous porcelain invention was thrown into the package on a non-exclusive basis. The royalty negotiated in the expectation of manufacture of artificial teeth, mass-produced in millions per annum, was naturally on the low side bearing in mind the competition from existing porcelain teeth, which other firms considered perfectly satisfactory anyway. Our negotiations were unusually protracted. There were two long meetings with the prospective licensee in London in April 1964 and again in October 1964. A draft agreement was put together in November the same year but was not approved and signed until the 1st October 1965. Even then it was only an option for one year with the right of extension. We eventually agreed to a piece-meal exercise of the option, which meant revising the whole agreement, the final version of which was not settled and signed until the 19th July 1967. By that time the Company had come onto the market with a very nice package of aluminous porcelain materials for making jacket crowns, dental inlays and dental bridges. However, they never succeeded in developing and making artificial teeth with the alumina core and neither has anyone else since.

In the mid-60's we at the NRDC flirted with the idea of financing ourselves the making up of 10,000 teeth for clinical trials, but we thought better of it. I think this invention was really a non-starter, but we can now see clearly how our initial enthusiasm for it caused us to make an error of judgment. Its illusory potential was allowed to detract from the aluminous porcelain invention, which admittedly had smaller commercial potential, but which turned out nonetheless to make a valuable contribution to dental tratment. Certainly by our efforts we had secured its introduction to the market with considerable speed, bearing in mind the sophisticated porcelain technology that was needed to develop the commercial product. The inventors also received their due reward but the NRDC made much less money out of it than we should have done. Licensing it with another invention, apparently more significant commercially, had meant that we had fixed a royalty geared to the other case, when we could have negotiated a royalty more appropriate to a high quality, highly priced specialised product, the profit margin on which would have justified a royalty of two or even three times the figure we settled for. Another consequence of putting the two inventions into one package meant that our costs in seeking patent protection were far higher than they need have been. It was on the recommendation of our licensee that we filed applications on both cases also in West Germany, Switzerland, France, Italy, Israel, Holland, the United States and Japan. As we prosecuted these applications through the various patent offices the fortunes of one case seemed to depend on the other, and it became difficult to drop the case on the artificial teeth even when we had come to the conclusion that it was a failure. Moreover, we could quite easily have confined our patent filings to the United Kingdom, West Germany and the USA. We eventually had licensees in Britain and the United States, although they never contributed anything like as much to our income as the original West German company.

I am glad to say the inventors, McLean and Hughes, have done rather well, even if the NRDC is out of pocket. McLean, the dentist in private practice, negotiated for himself the whole of the 50% of our net revenue that we normally allow inventors, on the grounds that his co-inventor, Hughes, being a civil servant, would not get any monetary reward. But in recent years the Government have been more generous than in the past and are apt to make quite handsome ex gratia awards to civil service inventors. These awards are paid out of our income although they cannot exceed 50% of the net. In this case, therefore, we will have had our net income halved twice over and only be left with 25%. We won't make that mistake again!

ZINC POLYCARBOXYLATE CEMENT

It was barely a year after we took on the aluminous porcelain invention before we were blessed with another dental material. This turned out to be more significant and certainly far more profiable for the NRDC than the previous case. In its heyday it ranked sixth amongst our top revenue earners. But it had modest beginnings and right from the start we again had misgivings about being able to secure effective patent protection.

The invention arose in a fairly typical manner. The inventor, a post-graduate chemist, was in receipt of a grant from the Medical Research Council to carry out research into materials adhesive to natural teeth. None of the materials used at that time for lining or filling tooth cavities, all such materials being called "cements", provided an adhesive bond with either the hard enamel coating of the tooth or the softer underlying dentine. All known cements used for filling front teeth eventually failed due to leakage round the margins of the restoration. The development of an adhesive cement which would prevent this leakage and eventual failure was therefore very important. The material would also have to have the other properties considered desirable in this field: ease of manipulation, strength, low irritancy and toxicity. (We should distinguish here between fillers for front teeth in which aesthetic appearance is all important and back teeth where it is of less importance and for which mercury amalgams are popularly used.) On the 2nd December 1964 the inventor sent us the following letter which surely must rank as a text book model of how to approach NRDC type organisations, wonderfully brief and to the point.

Turner Dental School
University of Manchester

2nd December 1964

Dear Sir,

We have a dental filling material which appears to represent a patentable proposition. I would be glad of your advice as to the appropriate steps to take to obtain your assistance in this matter.

Yours faithfully,

D C SMITH PhD MSc FRIC
Senior Lecturer in Dental Materials

The letter was accompanied by a brief account of the research leading to the invention, which Smith described simply as:

> "Zinc oxide and a solution of polyacrylic acid can be mixed to a paste consistency which will then set to a hard strong product fo low solubility in a few minutes."

Our Patents Department was quick to reply :-

"My reading of your account indicates that the two components of the material would have to be mixed just before use and the two components would therefore be marketed separately. Since the individual components are known in the broad chemical sense we could not obtain patent protection for them individually and therefore could not control their marketing ..... but there is the possibility of getting cover based on concentration and molecular weight range for the polyacrylic acid."

This view, which indicated that we would not be able to secure broad commercially valuable patent protection for the invention, coloured our attitude to it for some time. But the view was too severe. Whilst zinc oxide and polyacrylic acid as specified for the invention were known substances, they would surely be sold together by a manufacturer in a single pack with instructions for mixing. Such a pack would be novel - there was no argument that the mixed cement was a novel composition - and we therefore drafted our patent claims to a "cement pack" so as to cover the product actually sold commercially rather than claiming the formed cement, which would only be infringed when made up by the dentist himself. At that time the doctrine of contributory infringement was non-existent in British patent law (now modified by the Patents Act of 1977 which has brought British practice more into line with European law). There were few and not very reliable precedents for pack-type inventions for us to follow. Nonetheless we now have granted patents in several countries with claims of this kind and we have been successful in following the same practice in patenting our other dental inventions, which I will come to later on.

Two more years of research were required before the inventor was satisfied that he had achieved the optimum composition and we first filed the patent application in the United Kingdom in December 1966. The inventor was then free to conduct clinical trials and he read a paper on the results at an international dental congress in Paris in July 1967.

This zinc polycarboxylate cement was considered on aesthetic grounds as unsuitable for filling cavities because of it's opacity. It was developed therefore as a cavity liner and for cementing other restorations, like crowns and bridges, into place. Such materials are used in quite large quantities. Dentists may use about a bottle per week. In 1966 we estimated the world market to be between £3m and £5m per annum.

The advantages claimed for the new cement were that it provided a strong bond with the tooth (although not a truly adhesive bond as had been hoped for), was in itself strong and was non-irritant to tooth pulp. It was the latter feature that was to prove its major selling point since it was much blander than zinc phosphate cement, which had been in use for the previous thirty years. Naturally we hoped that our new material would supplant zinc phosphate cement entirely but we had not reckoned on the innate conservatism of the dental profession.

Following the paper read by the inventor in Paris, we were inundated by enquiries from prospective licensees. In our discussions with a selection of these firms it became apparent that unlike aluminous porcelain,which required sophisticated glass technology for its manufacture, zinc oxide and polyacrylic acid could be produced by almost any manufacturer with simple laboratory apparatus. Infringers would, so we were told, be springing up all over the place if the material should prove at all successful. Moreover some of these infringers might not be too careful about their quality control and the product would get a bad name before it had properly established itself. Would it therefore be better for the NRDC to have an exclusive licensee, who would help us chase infringers, or grant licences to all-comers? The firms we were talking to made it quite clear that they would not be interested if the latter policy were pursued,and the argument for an exclusive licensee in this case did not seem convincing. Consequently we chose the middle course and decided to keep the number of manufacturing licensees in Europe to three. Interest by American dental companies was to come later. Unlike our experience with aluminous porcelain, our licence negotiations for the new cement went smoothly and were swiftly concluded. I think we got the terms and royalty provisions about right. Except perhaps on the patent side,we have had no reason to regret any of the decisions we made at that time.

With doubts still in our minds about the patentability of this invention, we limited our overseas patent filing to the USA, West Germany, Switzerland and Holland. Later we regretted we had not filed in Japan as well but it is doubtful whether we would ever have been granted a patent there.

Opinions about the Smith cement amongst our prospective licensees were sharply divided. One company, not already manufacturing a competitive product, was wildly enthusiastic about being able to jump ahead with the new product in a field which had been stagnant for a generation or more, whilst another commented: "Smith offers a cement with minor advantages over existing materials. The average dentist would have to be persuaded; the material has no possible utility in time, mixing application or economy." This firm was wrong about the cement's advantages but prophetically correct about the average dentist's need to be persuaded.

I understand that dental material manufacturers are never quite sure whether it is better to be the first out with a new material, in the expectation of cornering the market, or to delay deliberately in order to witness the mistakes made by the first manufacturer and then to bring out a second-generation improved material. With zinc polycarboxylate our West German licensee was determined to be the first and they exhibited the product at the Dental Trades Fair in Cologne (Köln) in August 1968, only just over a year after the company had heard the inventor read his paper in Paris. It went under the trade name DURELON and its price was about three times that of existing zinc phosphate cement, which it was expected to replace, and we received our first royalties from sales in January 1969. This company was a small one at that time, having about one hundred employees and a turnover of about DM 4.5 million. It made mistakes and had to withdraw some of its supplies for a time, but in the long-run the reputation of the product did not suffer. Being the first on the market with this invention seems to have paid off because the company's sales up until the present have outstripped all our other licensees put together.

Later we granted several licences in the USA, some of which have now been terminated, but we are left with one licensee in the UK; two in West Germany; one in France and four in the USA. Recognition for the inventor came swiftly. In October 1968 he left the UK for Canada to become the world's first Professor of Dental Materials Science, at the University of Toronto.

Less than a year after DURALON was launched, the first infringing product appeared in West Germany from a manufacturer in Berlin. We were unable to take legal action against this infringer at that time because our patent application had not yet been examined in the West German Patent Office, but we then took steps to have the examination procedure expedited. The company would have been prepared to take a licence but we were not prepared to negotiate with this firm.

A few months later, in November 1969, a far more serious potentially infringing product appeared in the UK and West Germany manufactured by a company in Switzerland.
The Swiss company concerned was an excellent firm and we decided it would be prudent to offer them a licence, an offer which they emphatically declined. There was nothing more we could do until our West German application was laid open on the 23rd December 1970. As soon as the Auslegschrift appeared, the two potential infringers opposed the grant of the patent. We were advised by our West German patent attorney that the opposition would not succeed and that there were grounds for our suing for infringement. The matter was put to our Board and authority was accordingly given to institute the necessary proceedings, which under West German practice can be commenced before the patent has actually been granted. Warning letters were sent by our attorney to the two companies concerned and one of them (the Berlin manufacturer) promptly withdrew his product from the market. (It was not enjoying much commercial success

anyway.) The Swiss company, however, did not respond and we refrained from any further action pending settlement of the opposition proceedings in the Patent Office.

I regret to say that the West German Patent Office found against us on the grounds of lack of inventiveness and novelty and we took the case to the West German Patent Appeal Court.

The grounds for the opposition were simple enough: there was a prior German patent in the name of Walter Bauer, first published in 1954 and granted in July 1957, which was cited in, I believe, many of the patent offices in the countries where we were seeking patent protection, including West Germany, and we had had no particular difficulty in persuading the examiners that it did not anticipate our invention. However, in the context of the opposition proceedings, the Bauer patent was made to look far more damaging. In a passage about conventional zinc oxide/ phosphoric acid cements were the following words:

> "The phosphoric acid can be replaced wholly or in part by monomeric or polymeric acrylic acid".

That was all. No indication was given as to how the replacement would be carried out and there was no mention of the need for an aqueous solution of polyacrylic acid to react with the zinc oxide. The specification was also vague and unclear in many respects. Moreover, the material to which Bauer was alluding was not actually claimed in his patent. Our German attorney was emphatic that the statement in the Bauer patent would not prevent the grant of our own patent. The same view had been taken previously by our Counsel in the UK when we had consulted him about the possible Swiss infringement. We consulted a number of scientific experts, who all confirmed that the teaching of the Bauer patent would not lead one to the Smith invention, and we filed appropriate affidavits to this effect as well as to the advantages and benefits of the Smith invention in dental treatment. Our German licensee was even prepared to disclose to the Court (and hence to his competitors) his sales figures to demonstrate the commercial success of the invention.

The hearing was on 21st January 1975 and you may already have guessed - we lost. Why we did so is still a subject of debate. I personally believe we should have done more in the first round in the Patent Office itself, leaving the opposition to appeal against a finding in our favour instead of the other way round.

During the hearing one of the judges asked us how we had fared in the Dutch Patent Office, which has a reputation of being even more severe on inventiveness than the German office. The judge looked, so it seemed to me, somewhat disconcerted at learning that we had successfully overcome a similar opposition filed by the same party on the same grounds. But the appeal against that finding,in this case by the opposing party, had yet to be heard. We subsequently won that appeal but of course we had already won the first round. It was certainly an intellectual victory but of little commercial value. I have wondered since if the timing had been different and the Dutch appeal had been heard before the German one, whether we would have been successful in Germany after all.

With our German patent gone, our West German licensee excused himself from paying further royalties on his manufacture except for the products sold in countries where we still had patent protection. He had been willing to pay the full royalties due throughout the years whilst this dispute had been going on, to encourage us to sustain the fight and to help finance the costs incurred. The failure of our application in Germany meant a loss of over fifty per-cent in our royalty income.

We have a strong patent position in the USA but in spite of favourable notices and official approval by the American Dental Association, sales of the Smith cement in America have been disappointing due, we think, to the extreme conservatism of the traditional dentist. The patent there has a few more years to run and there is still time for change to take place although I do not think we shall see any dramatic improvement before the patent runs out.

GLASS IONOMER CEMENT

I have mentioned earlier that in dentistry the term cement is used for materials which may be used for filling cavities, for lining cavities or for cementing other restorations into place. The Smith cement was designed for lining and general cementation purposes but cements for filling cavities in teeth are used in much greater quantities. In front teeth the filling is conspicuous and must therefore have the right aesthetic or cosmetic appearance. Until the 1970s the dominant material for filling front teeth was the silicate cement made by mixing a glass powder, formed basically from alumina, silica and lime, with phosphoric acid. Although in use since the beginning of the century, these cements had been criticised for their irritant effect on living tissue before they had fully hardened. Similar dissatisfaction with zinc phosphate cement had, you may remember, led to the Smith invention. Silicate cements also had poor adhesion to the tooth, which eventually led to failure and replacement.

It may have seemed obvious therefore, by analogy with the Smith invention, to replace the phosphoric acid in silicate cements by polyacrylic acid, which was known to be non-irritant and to have adhesive properties, but when this was tried, the cements turned out to be weak and hydrolytically unstable. By good fortune the Laboratory of the Government Chemist (LGC), which is responsible for analysing a whole range of foods, drugs and other materials which have to comply with certain safety regulations, had carried out an analytical study of dental silicate cements, which had led to a better understanding of the principles of cement formation in these materials. The LGC were then able to demonstrate how to produce a glass which would in fact form a dental cement with polyacrylic acid. Thus the glass ionomer cement was born. It was at first called ASPA, standing for alumino-silicate polyacrylic acid, and we still use this term. Later we actually registered the name as a trade mark and it was used at first by our UK licensee, but it has now been dropped. At that stage, towards the end of 1969, we were asked whether we thought it had any commercial potential. With our previous experience of dental materials we could see at once that this could be a potential winner, and we encouraged the LGC to go on with their work, financing the development ourselves over a period of six to seven years. A patent application on the basic invention (called ASPA I) in the names of the two inventors, Wilson and Kent, was filed in December 1969 and subsequent filings made in West Germany, Switzerland, Holland, France, Sweden, East Germany, USA, Canada, Japan and Australia.

Development proved to be much more difficult than at first assumed. I will not describe in detail the pitfalls or the technology involved, interesting though it all is, but here are the essentials.
When the first batches of the material were produced commercially in the UK, the liquid (a fifty per-cent aqueous solution of polyacrylic acid) gelled after a few weeks. Although a cement could be mixed quite easily from this gel, the 'feel' would be unfamiliar to the dentist. The alternative of warming the bottle under the tap to reduce the viscosity, no self-respecting dentist could be expected to do. An answer had to be found - and found quickly. I should mention that samples had been kept

by the LGC for over a year without difficulty but it seemed that the degree of purity obtained in the laboratory could not be reproduced in commercial manufacture. The addition of methanol appeared to be effective, and that led to a fresh patent application known as ASPA III (February 1973) which was later dropped when it was discovered that methanol reduced the strength of the cement. Eventually a new itaconic acid copolymer was discovered which remained stable over a wide range of temperatures and for long periods of time, and which otherwise produced a cement with the same properties as the original liquid. This was the subject of yet another patent application called ASPA IV (April 1973).
Another problem which really only came to light when clinical trials began was that the cement did not set hard fast enough when placed in the mouth. This was solved by adding a chelating agent to the liquid component, such as tartaric acid, and that gave rise to the invention ASPA II (March 1972).

We thus built up a very wide measure of patent protection on the glass ionomer cement comprising three separate inventions, all of which were essential for a sound commercial product.

However, the biggest disappointment of all was that the cement lacked sufficient translucency for it to be acceptable aesthetically for front teeth fillings. In all other respects it was highly commendable: strong, resistant to acid attack, highly insoluble in the mouth, and highly adhesive to tooth material. It could be stuck directly into a cavity without the need for providing for mechanical retention. For that reason it was marketed at first as a filling for erosion cavities, i.e. those cavities formed along the gum margins of teeth as a result of excessive brushing. These erosions are common in the middle-aged and restoring them has always posed a difficult problem. The tooth is narrow at that point and the dentist previously had to cut away sound tooth material to provide an anchorage for the conventional filling material, but with ASPA this was unnecessary - the cement could be put straight in and it would stay there for two, three or more years. Only time will tell for how long. For this application the invention was an instant success when it eventually appeared on the market in September 1965, manufactured by our British licensee, but the search went on for a more cosmetic-looking material.

During the early development at the LGC a whole range of special glass compositions had been prepared but the only ones found to form a useful cement were those described in the ASPA I patent, on which the commercial product was at first based. However, with the advent of ASPA II - the addition of a chelating agent to improve the setting characteristics - it was found that several of the other glass compositions would form good cements and what was more important, they were translucent and comparable cosmetically with the best competitive filling materials. We quickly filed another patent application on these new glass ionomer systems (ASPA V), although they were not actually new, the details having lain in the LGC's notebooks for some years. We are expecting a new generation of glass ionomer cement to appear on the market very shortly as a general-purpose filling material for front teeth, thus fulfilling the objective we set ourselves ten years ago. The present product is suitable not only for filling erosion cavities, but also for fissure sealing of children's teeth and for general lining and cementation purposes. The new product will continue to satisfy these applications as well.

On the whole we seem to have been fortunate in prosecuting our numerous patent applications. From our point of view, the key countries in the dental field for patents are West Germany, the United Kingdom, USA and Japan, and to date the position is:

	ASPA I	APSA II	ASPA IV	ASPA V(a)	ASPA V(b)
U.K.	granted	granted	granted	granted	granted
W. Germany	accepted*	accepted*	granted	pending	pending
U.S.A.	allowed	allowed	allowed	allowed	pending
Japan	allowed*	allowed*	allowed	allowed*	pending

* = under opposition

The oppositions in Germany have been entered by the Swiss company that challenged us on the Smith invention and it will be interesting to see whether we can do better this time. With regard to the opposition in Japan, we are negotiating licences with the company concerned and hopefully we will be spared having to continue with these time-consuming and costly proceedings.

Our licensing policy on this invention has been more conservative than in the other cases I have discussed, partly due to the long and arduous development which we have undertaken. Preference was therefore given to our British licensee, which has in fact been licensed since August 1961, although it was another four years before the invention appeared on the market. There is, I regret to say, quite a good infringing product around in Europe and the USA, manufactured in Japan, and we are currently engaged in negotiating with this company. The Japanese manufacturer in its brochure makes no bones about where the invention came from, quoting the references to our inventor's publications. The English edition of the brochure also carried this delightful sentence:

> " We have at last realized a dream which has been the focus of our aspirations for many years."

We also have a West German licensee, the one that did particularly well with the Smith cement, but they have been holding back: having done well once by winning the race and being first on the market, they have not wanted to push their luck twice and are presumably trying the alternative philosophy of being the first out with a really good product. Clearly this invention has not reached its full potential yet.

Other Applications of the Glass Ionomer Cement

It was not long after the first publication describing the characteristics of the glass ionomer cement appeared in the scientific literature, that people began to speculate on other possible applications for it. A quick setting, strong, adhesive and water-resistant cement should surely have uses other than in dentistry.

From the scientific point of view the chemistry of the cement is most interesting. The glass powder is made conventionally by grinding up a fluoro-alumino silicate glass which has been prepared by fusing a mixture of silica, alumina, cryolite, fluorite, aluminium fluoride and aluminium phosphate to 1,050 - 1,350°C before cooling rapidly to form a stressed opal glass. When this glass powder is mixed with a 40/50 per-cent solution of a poly acid, like polyacrylic acid, a cement is formed which at first is a putty-like paste, in which state it can be worked for several minutes. After a few minutes more the paste begins to set rapidly as protons from the poly acid penetrate the surface of the glass, decomposing the alumino-silicate network to a siliceous hydrogel and displacing ions of aluminium, calcium and fluorine. These ions migrate into the polyelectrolyte phase where they cross-link polyanionic chains, causing the cement to gel and set. Overall the reaction may be seen as one where flexible hydrogen bonds in the liquid are progressively replaced by more rigid ionic ones leading to gelation. The set cement is a composition of glass particles sheathed by a silica gel bound by a metal anionic matrix.

A serious look at other uses for ASPA began in 1972/73 when a research project was set up and funded by NRDC at Brunel University. Kits comprising a quantity of glass powder and polyacrylic acid were made up and offered to a wide range of possible industrial users. In all, about twenty-five kits were distributed, a charge of £25 each being made, and several kits were sent overseas to Europe, Japan, the USA and Australia. In spite of some initial enthusiasm the outcome has been disappointing. The main reason for this soon became apparent. The glass would be far too expensive, for example, for use in tile grouting or in cement paints, for which ASPA has in fact been seriously considered. Raw materials for uses of this kind are generally based on naturally-occuring minerals, which are far cheaper than artificially-made glasses. An attempt was therefore made to see if it would be possible to replace the glass in ASPA by naturally-occuring alumino-silicate minerals. Although these would react with polyacrylic acid to form cements, I am sorry to report they turned out to be much weaker than ASPA and were seriously affected by water.

In spite of this disappointment we are continually trying out new ideas and renewed interest in the industrial field is now being shown by a major glass manufacturer. It is highly probable that useful cements could be made using different and cheaper glass formulations than those originally designed for use in the mouth.

I am glad to say that there is one industrial application where ASPA has been found to be a significant advantage and that is as a foundry sand binder, but cost again is a factor that may restrict its use for the present. There are already forty types of foundry sand binder on the market but they all comprise phenolic materials which give off toxic fumes and are believed to be a health hazard. We may have to wait for anti-pollution legislation to get round to this problem before industry will pay the higher price for a non-toxic substitute like ASPA.

Surgical Splint Bandage

To round off this paper I will briefly describe one major success we have had so far in finding a non-dental application for the glass ionomer cement, but that means returning to the medical field. About a year after we started making a serious search for industrial applications for ASPA a member of our own staff, Dr Robert Parker, suggested that it could be used as a replacement for plaster-of-Paris for making splints for supporting fractured limbs. Those of you who have been unfortunate enough to have broken an arm or leg will know what it is like to be encased in a plaster-of-Paris splint. As you know the splint is applied in the form of a gauze bandage, impregnated with the plaster, which is soaked in water before being wound around the affected limb. A considerable thickness has to be built up for the splint to give adequate support. On account of its weight the splint causes a certain amount of discomfort but it has other disadvantages as well; it is easily damaged and badly affected by water. Many unsuccessful attempts had previously been made to find a substitute for plaster-of-Paris, which I believe was even used by the Romans for this purpose.

To make a splint bandage with ASPA it is necessary to impregnate the gauze with both the glass powder and powdered polyacrylic acid, so that when the bandage is soaked in water in the customary manner, the acid will go into solution and react with the glass. The reactivity of the glass and the glass/acid ratio were adjusted to give the required length of working time before the material set to a hard cement. A splint made from ASPA is only about half the weight of one made from plaster-of-Paris, because ASPA is inherently a stronger material. Moreover, ASPA is more resistant to damage and impervious to water. In fact it is at its best in a moist environment, next to the skin.

A patent application on the ASPA splint invention was filed in the United Kingdom in 1973 and overseas applications made in Australia, Brazil, Canada, France, West Germany, India, Israel, Italy, Japan, Mexico, South Africa, Spain, Sweden, USA and Venezuela. Some of these applications were made at the request of our British licensee.

We were fortunate in having in Britain one of the world's largest manufacturers of splint bandages, Smith & Nephew Limited, and they immediately began to develop a system which would be acceptable to the medical profession and capable of being mass produced at an economic price. Inevitably it was going to be more expensive than plaster-of-Paris, which is a cheap naturally occuring mineral. An ASPA bandage is about 5 times the price of a plaster-of-Paris one, but since fewer bandages are used for a splint the cost per treatment is not quite so great. Commercial development and clinical trials took nearly 6 years to complete and the product was launched on the market under the trade name Crystona in the Autumn of last year. The ASPA system is particularly good for use on infants and children and for whole body splints. The present product, however, is not likely to replace plaster-of-Paris entirely but it has considerable potential for further development.

Again we have been fortunate so far with our patent applications and the current position is as follows:

Granted: UK, Australia, Canada, France, India, Israel, Italy, Japan (allowed), Mexico, South Africa, Spain, USA (2 patents) and Venezuela.

Pending: Brazil, Germany and Sweden.

We thus started out in 1969 with a minor development programme to produce a humble new dental material. The result was a unique chemical system, which has turned out to have ramifications far beyond those we originally expected. We often blame ourselves for failing to visualise this from the beginning, but I am by no means certain that we would have been able to plan our exploitation more effectively had we foreseen the importance of this invention at an earlier date.

Dentistry has a painful image and I suppose it is only natural that we should have agonised over the exploitation of these cases. As I started out on a painful note so shall I end on one, with the following quotation:

> "One of the greatest pains to human nature
> is the pain of a new idea"
>
> Walter Bagehot
> English economist and sociologist
> 1826 - 1877

THE H-S-RAILWAY-BOGIE

South African Inventions Development Corporation,
SAIDEC

A.F. Schady

THE H-S BOGIE

A CASE HISTORY

by

A M SCHADY and A A de WAAL

INTRODUCTION

1. The Invention

When the South African Inventions Development Corporation (SAIDCOR) was first approached by a private inventor with the offer of a new design of a Railway Bogie, our initial attitude was one of scepticism.

Our view was that a Railway Bogie was a relatively straightforward mechanical device consisting of a simple load bearing structure mounted on four wheels. As far as we were concerned, rolling stock design was a well-established field and there was little justification or interest in further improvements.

We were therefore surprised to learn that there were still major and only partly resolved problems associated with Railway Bogie design.

Traditional design practice represented a compromise between two conflicting requirements, namely, good curving ability on the one hand and stability at speed on the other hand.

Generally speaking, the conventional approach to bogie design had been to locate the wheels and axles very rigidly on the bogie frame. This provides a fair degree of stability at speed on straight track but at the cost of poor curving ability with consequential high flange wear. In turn, the flange wear that occurs tends to reduce the bogie's stability at speed on straight track.

These shortcomings, particularly with respect to low cost bogies for freight waggons, have been accepted by railroads as unavoidable. While many new designs had been proposed over the years - and several hundred patents on this subject give testimony to the efforts of rolling stock engineers to improve riding qualities - none of these designs really proved useful within the limitations imposed by costs.

The problem of hunting instability and high flange wear presents itself in an acute form in South Africa.

In our country, we have a relatively high inland plateau separated from the coastal region by a steep escarpment. In order to negotiate the escarpment, railway curves having radii as short as a hundred metres are not uncommon. In the past, this has resulted in exceptionally high wheel flange wear. As a result of the worn wheels, the speed of South African freight trains over long straight stretches on the plateau has had to be curtailed because of the instabilities that result from the worn wheels.

This situation prompted Herbert Scheffel, an engineer with the South African Railways, to re-examine afresh the traditional approach to bogie design in the early 'seventies.

Scheffel proposed to solve the problem of high flange wear in curves by two means. Firstly, he proposed using wheels of a higher-than-normal effective conicity so as to increase the steering forces in curves. Secondly, he proposed to mount the axles and wheels flexibly to the bogie frame so as to permit the wheelsets to align themselves to the radius of curvature of the track.

While this would provide a solution to the problem of flange wear in curves, such an arrangement would provide the worst possible conditions for instability at speed on straight track. This he proposed to resolve by interconnecting the wheelsets with diagonal connections or "cross-anchors". With these "cross-anchors", any instability developing in one set of wheels would result in an immediate correcting force being applied by the other wheelset, thus damping out wheel yaw which is the major cause of hunting instability.

When Scheffel came to see us with his invention he had already developed a rigorous mathematical model for his design and his computer studies showed that his bogie would be stable at speeds much higher than those commonly used on freight waggons.

More significantly, he had tested the validity of his mathematical model with a crude prototype of his bogie for about 20 000 km - enough to show a marked difference in performance between his bogie and conventional bogies.

Our initial attitude of scepticism therefore changed into one of enthusiasm. Our reasons for this change in attitude were fourfold and I believe of great importance in the evaluation of any invention.

Firstly, it was clearly established that this invention arose from a real need or challenge. Secondly, the inventor was clearly an authority in his field and able to back up his claims in theory and practice. Thirdly, the invention had already been reduced to practice and shown some degree of success. Fourthly, the problems of flange wear and hunting instability of freight waggons, we learnt, were not unique to South Africa and occurred to a varying degree on other railroads elsewhere.

2. Patentability

Having been convinced as to the value of Scheffel's ideas, our first priority was to secure protection for the invention and to determine whether it was patentable.

Since this invention was in a long-established field of technology, we anticipated a good deal of prior art. But had we known just how much prior art existed we might very well have given up before we started! In the United States alone, we found about one hundred patents on railway bogies, some dating back to 1841.

From our search, we found that all three of the basic features of Scheffel's design, namely, high conicity wheels, flexibly mounted axles and diagonal connections between wheelsets had already been disclosed in the patent literature.

Fortunately, these three key features had been disclosed separately in various patents and no patent disclosed the combination of all three which Scheffel argued was essential for a stable self-steering bogie. Nevertheless, we realized that we would face problems of obviousness, particularly in the USA where, as you know, patent examiners are inclined to adopt a "mosaic" approach.

Through the combined efforts of the inventor, our patent attorneys and ourselves, we managed to draft controlling claims which we believed were both novel and non-obvious. After a long struggle, we have now obtained patents in examining countries such as the USA and the UK and, more recently, have had claims allowed in Germany.

We were particularly fortunate in our inventor. Herbert Scheffel has an instinctive appreciation for the patent system which facilitated communication between the patent attorney and ourselves on the one side and the inventor on the other.

I would say that the lesson we learnt from this exercise is that if an idea provides an effective solution to a well-established problem, it is likely to prove patentable, even in a long-established field of technology.

3. <u>Division of Royalties</u>

In the case of private inventors, our normal policy is to offer the inventor 10% of the gross royalties. SAIDCOR retains the balance of income until our book costs are recovered and thereafter net royalties are shared with the inventor on a 50:50 basis.

However, in this case the inventor was in the full-time employment of the South African Railways and it was necessary to first establish who held the rights on Scheffel's invention.

We were advised that the South African Railways allowed their employees freedom to exploit their inventions as they wished, subject to the Railways receiving a royalty-free licence to use the invention in South Africa.

In view of this, we were free to deal directly with the inventor in terms of our standard royalty-sharing arrangement mentioned above.

However, it became apparent that a good deal of further development would be necessary and that the active involvement of the South African Railways was desirable. Fortunately, the inventor had the necessary discernment to see this as well and a three-way split of royalties was worked out as follows, to ensure a financial participation by the Railways Administration in the invention.

The inventor would still in the first instance receive 10% of the gross income, the rationale being that the promise of short-term cash flow would do much to motivate the inventor.

Thereafter, SAIDCOR would retain the balance of the income until book costs were recovered. As SAIDCOR would be solely responsible for funding patenting and licensing costs, it seemed only equitable that we should retain the bulk of any royalty income until these costs had first been recovered.

After recovery of our book costs, the balance of income would be shared in the ratio of 15% to the inventor, 30% to the Railways and 45% to SAIDCOR.

Thus SAIDCOR voluntarily reduced its net participation by 5% and the inventor by 25% in order to secure the Railways' participation in this invention.

In retrospect, this voluntary cession of participation rights has proved a wise decision as we have required a good deal of active collaboration from the South African Railways in connection with the development and testing of Scheffel Bogies and even the testing of bogies intended for other railway organizations.

While the laissez-faire policy of the South African Railways to inventions certainly made it easy to work out an arrangement with Herbert Scheffel that would provide him with sufficient financial motivation to collaborate with us in exploiting his invention, it did create other difficulties.

As the development programme at the South African Railways expanded, other engineers began to contribute useful patentable improvements to the basic invention.

In terms of the patent policy adopted by the Railway Administration, the new inventors were, of course, free to exploit these inventions to their own account so that there was a danger that they might endeavour to work out private licensing arrangements on their own. From our point of view, it was desirable to license the basic invention and the improvements as a single package in order to strengthen our overall position

Fortunately, we were able to persuade the new inventors to "join the club", arguing that their improvements, valuable as they were, could not be easily exploited without access to the basic invention which we controlled. However, our task was made more difficult as we could not offer the improvement inventors a predefined share of royalties as we did with Herbert Scheffel. The reality of the matter was that the basic invention and the improvements would be licensed as a package with a single royalty paid by the licensee for all the inventions. Under these circumstances, it would not be easy to quantify in advance what percentage should be allocated to any particular design improvement, particularly as a steady flow of improvements could be anticipated in the future.

To overcome this problem, we undertook that once a year we would at our discretion allocate a share of the total royalties received to the "improvement" inventions, according to our judgment as to their contribution towards the overall success of the project. Any royalties allocated to improvement inventors is treated as an expense which is borne pro rata by Scheffel, the Railways and ourselves. Although such an allocation is largely arbitrary, we can to some extent claim to be a disinterested party as the officers of SAIDCOR do not personally participate in royalty income.

4. Patent Programme

At one time or another, I am sure that all of us have, in a burst of over-optimism, incurred unnecessarily high costs on a territorially over-ambitious patent filing programme. I know we have made this mistake more frequently than we like to admit.

Recognizing that very few inventions prove commercially rewarding, we have more recently tended to restrict our filing programmes to only a few countries, generally those countries with advanced technologies and which offer substantial markets.

With a patent to control the licensee at the point of manufacture, one is often in a position to earn royalties on sales in possibly a large number of non-patent countries. Generally, such a strategy works well with products that are made, say, in country A and which can be conveniently shipped to a large number of other countries.

In the case of the Scheffel Bogie, such a strategy did not appear feasible for a number of reasons.

Because of the high mass of railway bogies - generally about 4 tonnes - and the fact that those countries with large railway networks generally have the technological capability to produce bogies, railway bogies are mostly manufactured in the country where they are to be used.

Furthermore, in most, countries, railways are State controlled. Governments generally like to arrange their procurements by way of competitive bids. Thus, even if we were to licence our design to one firm in a particular country on a "know-how" basis, there is a real danger that a Government-owned railroad would insist on competitive bids. Having a patent could prevent this or at least place us in a better negotiating position should the procurement be decided on a tender basis.

These factors therefore forced us into a territorially wider-than-usual filing programme and countries were selected in accordance with the extent of their railway network and the engineering capability of the country. Patent filings were thus made in as many as 16 countries, our patent costs to date being about $100 000.

How successful have we been in our selection of countries? It would seem that in retrospect 12 of the 16 countries selected appear to have justified selection by virtue of the interest being shown. Included in our list were countries such as Australia, Korea and Brazil - countries which do not normally appear in our patent programmes. We have since had occasion to licence our bogie in Australia and Korea and there is a strong possibility that we shall work out a licence arrangement in Brazil.

While we maintain that in general restricted patent filings are the preferred strategy, our experience with the Bogie is a reminder to us that we should not be dogmatic on this point and one should tailor a patent programme to the realities of the invention.

5. Licensing in the USA

Because of the large market and its receptiveness to new technology, the USA was a prime licensing target for us. Fortunately, we decided to commission a market study of the US railroad industry before embarking on a licensing programme in that country.

Such a survey served to quantify the market for railway bogies in the USA. Perhaps of greater value was the insight we gained into the structure of the American rolling stock industry. To our surprise, the survey showed that no company was responsible for the overall manufacture and marketing of complete freight bogies as would be the case, say, with automobiles or tractors.

Certain companies would offer to supply proprietary bogie designs to the railroad companies and would accept responsibility for the performance of their designs. Whilst such companies would to a varying extent supply certain key components, generally those linked with their proprietary designs, it was left to the railroad companies themselves to procure other components such as wheels, axles, springs, damping devices and braking systems from other independent suppliers. Car bodies were procured from specialist waggon builders. The railroad company would then take responsibility for assembling the bogies and fitting them to the waggon bodies.

Under these circumstances, who does one licence - the railroad company, the car builder, companies offering proprietary designs or component suppliers? Who infringes? If one excludes considerations such as contributory infringement, probably only the 100 or more American railroad companies who assemble bogies for their own use from multi-sourced components would actually infringe. But who wants to licence more than 100 users?

In the end, we selected two US companies whose prime business was the production and marketing of proprietary bogie designs and granted each an exclusive licence, one for freight bogies and the other for passenger bogies. It is perhaps a moot point whether our American Licensees actually infringe our patents but our licence grants their customers - the end users - immunity from infringement and our Licensees seem satisfied with this arrangement.

In countries where the railroad is State-owned, we have endeavoured to licence non-exclusively because governments prefer competitive bids in making procurements. This consideration did not apply to the USA where railroads are, of course, privately owned.

A further consideration persuaded us to grant exclusive licences in the case of America. At that early stage, we had no proprietary designs ourselves. All we could offer was a patent licence and some "know-how" from the inventor to assist our licensees in preparing their own proprietary designs based on our invention. Our American licensees argued strongly that as they would be involved in a major design effort they should be entitled to exclusive rights to exploit their proprietary designs respectively for freight and passenger bogies.

We had no choice but to accept the situation at that time. Licensing is, of course, a dynamic activity and one should not hesitate to make changes to one's licensing approach in the light of changing situations.

6. Change in Licensing Approach

Although both our US licensees have now completed their proprietary designs, the experience gained from this exercise showed that many mistakes could have been avoided and time saved if SAIDCOR itself prepared and licensed proprietary designs in future. Such an approach would greatly strengthen our negotiating position and would make us less dependent on the continuing validity of our patents. Furthermore, it would enable us to capitalize on the growing experience of the South African Railways who now have some 8 000 freight waggons fitted with various types of Scheffel Bogies in operation.

In consequence, we now maintain our own design facility utilizing the services of a full-time draughtsman and the part-time services of those railway inventors who have contributed to the development of the bogie. The fact that both the South African Railways Administration and the inventors participate in royalties has greatly facilitated this arrangement.

In addition to offering proprietary designs, we now make it a condition of our new licence agreements that our inventor-consultants should visit the railway system on which our bogies are going to be used before production commences. We also stipulate visits to check on manufacturing procedures and that our consultants should attend commissioning trials. This involves us in a considerable amount of effort not normally required with inventions but in this instance we deem it necessary and well worth the trouble.

In short, circumstances have forced us to change from merely being a licensor of inventions made by others to a developer of our own technology which is licensed. This has increased our financial commitment and our ongoing responsibilities but we believe the effort is justified.

The lesson we have learnt from licensing this invention is to adapt the licensing package to the real demands of the situation even if this involves changing the nature of NRDO and to insist that the licensee accepts this package even if he does not at the time recognize the need for it!

7. Royalty Rate

Some difficulty was experienced at arriving at a suitable base for determining royalties, particularly in America.

Firstly, our early patents did not relate to specific hardware but rather to certain key design features needed for good curving ability and stability. Secondly, our licensees would not themselves manufacture the complete bogie but would merely be responsible for the design and possibly certain key sub-assemblies peculiar to their proprietary design. Thirdly, at the time royalties were being discussed there was some doubt as to what hardware our licensees would ultimately choose to supply.

Computing royalties as a percentage of the overall cost or selling price of the completed bogie presented difficulties because of the fragmented nature of the American rolling stock business.

The royalty based on the selling price of those components or sub-assemblies supplied by our licensee to the end customer - the railway company - would have the disadvantage of requiring an unduly high percentage if we were to secure an adequate return. Furthermore, there was some uncertainty at the time of negotiation as to the value of the components and sub-assemblies that our licensees would choose to supply.

To resolve these difficulties, we required our licensee to pay a flat fee for each bogie assembled by the railroad company as a result of a design and/or components or sub-assemblies supplied by the licensee. Such an arrangement does pose problems of equitably adjusting for inflation. Fortunately, we were in all instances able to overcome these problems by linking the fee to a mutually acceptable index.

Although we generally favour a royalty rate based on a percentage of selling price as this automatically adjusts for inflation, our experience on this invention shows that such an approach is not always appropriate.

8. A Lucky Break

At the time that licensing operations were initiated, no Scheffel Bogies were in use. Admittedly, our Railway Administration had decided to equip 100 test waggons with the new bogie for field evaluation purposes but these had yet to be commissioned.

Railway Corporations are by their very nature extremely conservative and are understandably very reluctant to accept unproven ideas. Thus our initial licensing approaches produced little positive results.

We then received a lucky break.

A large South African mining company had initiated a large iron ore export project and were seeking suitable rolling stock for their private railway line of some 1 000 kilometres connecting the mining village of Sishen to a seaport at Saldanha Bay. Possibly because they were free of the tradional conservatism of railway organizations, we were able to persuade the Mining Company to reverse their earlier decision to procure standard bogies in favour of a Scheffel design which we offered to prepare for them. In consequence, some 3 500 Scheffel Bogies were put into use on this line within 18 months of finalizing an agreement. Their performance justified our best expectations.

Because this mining project attracted a good deal of international publicity, it materially assisted us in finalizing licence arrangements with the American companies who had hitherto been lukewarm to our approaches.

Royalties earned on this venture also permitted us to finance the heavy patent programme on which we had then embarked and provided a welcome financial encouragement to the inventor to maintain his efforts.

At about that time, a second lucky break occurred. The Aqaba Railway Corporation in Jordan had opened a new railway line to the sea to handle the export of phosphate ore. Serious flange wear and hunting instability with their conventional bogies were being experienced. The conditions of their railway line, namely high axle loads, steep gradients and sharp curves were rather similar to the conditions we faced in South Africa and which led to Herbert Scheffel's invention.

These factors doubtlessly prompted the Deutsche Eisenbahn Consulting Organization who were acting as consultants to the Aqaba Railway Corporation to visit us to assess the Scheffel design.

Subsequent trials on a pair of bogies which we airfreighted to Jordan confirmed the superior performance of the Scheffel Bogie and the Aqaba Railroad Corporation decided to procure additional bogies based on the Scheffel system.

At that time, only one company - Dorbyl Engineering of Johannesburg - had any experience in building Scheffel Bogies and prudence suggested that they be awarded the contract.

However, Aqaba insisted that the procurement be handled on a competitive bid basis and requested us to licence the successful tenderer and provide the necessary design "know-how".

With some reluctance we eventually agreed to this requirement. In retrospect, it was a fortunate decision.

The Aqaqba procurement was the first tender which publicly called for a self-steering bogie based on the Scheffel invention. It attracted a good deal of attention and resulted in a large number of licence enquiries to SAIDCOR. Although only one company - the Gregg Car Company of Belgium - was awarded the tender, as a consequence of the publicity engendered we were able to licence Japanese and Korean firms with our invention subsequently.

Our experience with the Jordanian and South African Mining Projects is a reminder that successful licensing involves exploiting opportunities as they arise. It is perhaps also a reminder that the concessions made to the Aqaba Railway Corporation can pay off in terms of increased licensing business later.

9. Conclusion

It is some seven years, since we accepted this invention.

While we have had some fortuitous contracts such as the South African Mining Project and the Aqaba Railway Corporation which have served to generate royalty income at an early stage, it would be true to say that we have not really broken into the major bogie market.

Nevertheless, there are encouraging indications for the future.

The performance of our Bogies in Jordan have been satisfactory and this is motivating the Gregg Car Company to seek additional markets for their new bogie design under licence from us.

The performance of our bogie on the Sishen-Saldanha line with heavily laden iron ore trucks has stimulated interest from the Australian Mining Companies, many of whom operate their own rolling stock. In consequence, our Australian licensee will shortly be supplying them with a small number of bogies based on a design we are preparing, for evaluation purposes. The Sishen-Saldanha project has also resulted in a licence enquiry from a large Brazilian Mining Company and we are hopeful that in time business will materialize from this quarter. Negotiations are also under way with British and German Engineering Companies who have expressed interest in our Bogie.

Nevertheless, the key to future success is the USA. This is for two reasons, Firstly, the USA constitutes the largest single market for railway bogies with between 40 000 and 70 000 new freight waggons being commissioned each year. Secondly, many of the third world countries tend to follow specifications laid down by the American Association of Railroads. Acceptance in the USA will therefore ensure acceptance of our bogie elsewhere.

At present, over 100 freight waggons equipped with our bogies are undergoing long term field trials by the Union Pacific and other American Railroads. Encouraged by their performance, our one American licensee is planning to supply the Railroads with several hundred further Scheffel Bogies during the current year. In this way, we hope to overcome gradually the traditional conservatism of the American railroad industry.

A pair of passenger bogies, built according to a design prepared jointly by General Steel Industries and SAIDCOR, will be fitted to a passenger car shortly for high speed stability testing at the Pueblo Test Centre operated by the Federal Railroad Administration.

While we are hopeful that we will ultimately gain overall commercial acceptance in the USA, time is passing and our costs are mounting. We are spending to-day to achieve an income tomorrow.

Patents have a limited lifetime and it seems that at best sales will begin to take off near the expiry time of our patents.

This is the predicament which NRDO's often find themselves in, particularly with an invention such as the Scheffel Bogie having a long lead time. We will, of course, endeavour to maintain license agreements by continuing to provide proprietary designs, by filing improvement patents and by controlling trade marks which could have a growing value as acceptance of the Scheffel design grows.

The extent to which we can succeed with these efforts will determine whether this venture will ultimately prove profitable to us.

Perhaps we may have an answer to this by the time of out next conference?

THE LICENSING OF A PROCESS FOR THE CHEMICAL STRENGTHENING OF GLASS

Research Corporation

H.Howe

MANUSCRIPT

THE LICENSING OF A PROCESS FOR THE CHEMICAL STRENGTHENING OF GLASS

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In 1959 Dr. Samuel S. Kistler of the University of Utah, formerly Dean of Engineering, made a remarkable and far-reaching discovery. It had previously been known that glass, inherently a very strong material, usually breaks in tension due to the propagation of small cracks throughout the structure. It was known also that in view of this glass could be considerably strengthened by putting the surface layer in compression. It would then be necessary for an imposed force to overcome the compression and subject the surface to tension before the glass failed. This production of a surface compressive layer had been accomplished by the familiar technique of heat tempering--heating the glass to a relatively high temperature and then quenching it rapidly. The surface would cool first, becoming rigid. Then as the interior continued to cool and shrink it would draw the surface inward, building compressive strains in the outer layers. The strength of the glass would thus be significantly increased.

Many earlier workers in the field of glass technology had also experimented with the diffusion of ions into the surface of glass articles for a variety of purposes--to color the glass, to etch it, to alter its physical characteristics, or merely out of scientific curiosity. It was recognized that smaller ions could be diffused into the surface, replacing larger ones, and it was also known that larger ions could be diffused in to replace smaller ones. It was believed, however, that the replacement of small ions with larger ones would be a very slow process and that the ulitmate result would be a shattering of the glass article. It was also felt that any compressiv strains that might be anticipated would be released at the high temperatures at which the diffusion would have to be carried out.

Dr. Kistler's discovery--and the basis for his amazingly simple but extremely important invention--was that the exchange of large for small ions could take place with reasonable speed at a relatively high temperature, and that the compressive strains in the surface could be preserved if the process was carried out just slightly below the "strain point", defined as the temperature at which a glass retains its structural integrity but at which internal strains are gradually released. Working with tiny articles such as laboratory stirring rods and watch glasses and microscope slides, which he immersed in molten baths of potassium nitrate, he showed that sodium ions in the surface of the glass could be replaced by larger potassium ions to a significant extent, and that thereby the strength of the glass could be very substantially increased.

At this stage the invention was submitted to Research Corporation for possible administration under its Invention Administration Agreement with the University of Utah. In spite of the limited amount of experimental work that had been done, the classic novelty and the commercial potential of the invention was quickly recognized and it was accepted for administration. A United States patent application was filed and corresponding applications were subsequently filed in Great Britain, France, Belgium and West Germany. The invention and the patent rights on it were assigned to Research Corporation under its agreement with the University of Utah.

Licensing efforts were initiated as soon as the patent applications had been filed. Dr. Kistler had for many years consulted for Corning Glass Works, one of the world leaders in glass research, and Corning quickly expressed licensing interest in the invention. A license agreement was consummated with Corning in 1962 and within a short time Corning was marketing a line of pipettes, graduated cylinders and other laboratory glassware strengthened by the use of the Kistler process. Later Corning utilized the process in the production of windshields for military aircraft and certain American Motors automobiles, in nose cones for space capsules, and for a quality line of tableware called Centura. It appeared that the success of the invention was assured and that it would rank with some of the highest income-producing inventions that Research Corporation has handled.

Then came the bombshell! A U. S. patent issued to Dr. Neill Weber on an invention which appeared to be essentially identical to the Kistler invention. Although the two patent applications had been pending simultaneously in the United States Patent Office, the Patent Examiner, for some mysterious reason, had not declared a Patent Office Interference to determine priority but had instead permitted the Weber patent to issue. He then rejected the Kistler application on the basis of the Weber patent.

In order to continue the prosecution of the Kistler application it thus became necessary to copy the claims of the issued Weber patent so that an Interference could be declared. Furthermore, as junior party in the Interference it was incumbent on Kistler to show that he had been the first to conceive the invention and that he had then been continuously diligent in working on it until he had either filed a patent application or effected an actual reduction to practice.

Upon investigating these matters with Dr. Kistler it was found that he had worked on the invention essentially on his own time and with very little assistance. He had kept careful laboratory notebooks, as most scientists do, but he had unfortunately never had the pages witnessed by an impartial third party. Although it appeared that he had conceived the invention at an early date, therefore, and had been diligent in reducing it to practice, the Patent Office ruled that he had not produced sufficient corroboration of his achievements. It therefore ruled that the Interference proceeding should be dissolved, thereby awarding the patent to Weber. This decision was appealed by Research Corporation to the Court of Customs and Patent Appeals in the District of Columbia and the CCPA upheld the Patent Office. Consideration was given to requesting a review of the CCPA's decision by the United States Supreme Court,but on advice of counsel this step was not taken because it was felt that the decision would not be reversed. A U. S. patent on the Kistler invention did therefore not issue.

All was not completely lost,however. When the Weber patent emerged, it was found that it was owned by Brockway Glass Company and that certain fields of technology, specifically the use of the process for the treatment of flat, optical and ophthalmic glass, had been licensed exclusively to Pittsburgh Plate Glass Company for the life of the patent with the right to sublicense others. PPG was also highly skilled in glass technology and was in the process of developing products for the market under its license from Brockway.

With the incidence of the Kistler/Weber Interference, therefore, a rather difficult situation developed. If Kistler won, Corning would be happily licensed and PPG would find itself an infringer. If Weber won, the roles would be reversed with PPG the licensee and Corning the infringer. In view of the investment that both companies had made in developing their respective products, neither could tolerate being forced from the market.

In addition, both companies had a host of improvements and uses for the basic process on which they had obtained or were obtaining patent protection. There was thus a total of more than forty patents and patent applications relating to the chemical strengthening process, including either the Kistler or the Weber patent, depending on the outcome of the Interference. Some of these additional cases were potentially quite significant and others were of minor importance.

In an effort to resolve this situation it was proposed that Research Corporation, Corning and PPG enter into an agreement under which Research Corporation would be given the right to license all of the patent rights and both Corning and PPG would obtain licenses. While the Interference was proceeding in the Patent Office and in the Courts extensive negotiations were conducted among the three parties in an effort to arrive at a solution. Shortly before the Interference was finally settled the so-called Three-Party Agreement was completed.

Basically the agreement provided for the following:

1. Research Corporation was given the exclusive right to sublicense all of the patent rights in the flat, optical and ophthalmic fields.

2. Corning and PPG each obtained a license with an obligation to pay royalties on their sales.

3. Research Corporation had an obligation to grant non-discriminatory licenses to all applicants under any or all of the patent rights.

4. Research Corporation was to receive an annual "administration

fee" of $6000. All other income generated by its licensing of the patent rights was to be shared among the three parties.

5. The amount of the income shares of PPG and Research Corporation would depend upon the outcome of the Interference. Research's share was to be 25 percent if Kistler won, 15 percent if he lost. There was thus a strong incentive for both parties to make every effort to win.

After the Three-Party Agreement was completed Research Corporation proceeded with its efforts to license the patent rights as required under the agreement. The first task was to draft a standard license agreement that could be offered to all potential licensees. In doing this it was recognized that there were potentially serious misuse and antitrust problems associated with the licensing of a package of forty or so patents and patent applications. Great care was taken in designing the license to avoid these problems and the assistance of a patent law firm with expertise in antitrust problems and litigation was enlisted. It is believed that the standard license agreement that resulted successfully avoided the problems mentioned above and could well serve as a model for other package licensing situations. The principal features of the agreement were the following:

1. The licensee had the option of selecting any one or more of the forty odd patents and patent applications included within the licensed patent rights. This selection could be changed from time to time at the option of the licensee.

2. The royalty rate to be paid by the licensee depended on the number of patents and patent applications selected. Each case

was assigned a prime value and an incremental value, based upon the estimated value of the patent or patent application. The royalty rate for a particular licensee was the sum of the highest prime value and the total of all of the other incremental values of the cases selected. In no event, however, would the royalty rate exceed 2 percent even if the entire package were selected. The selection of patent rights could also be changed from time to time at the licensee's option.

3. There was a most-favored-treatment clause to assure that there would be no discrimination among licensees.

4. The entire agreement could be terminated by the licensee at any time without cause or penalty.

Several licenses of this type were issued.

An event then occurred, however, which altered the licensing situation drastically. In 1972 the United States Food and Drug Administration promulgated regulations requiring that all eyeglass lenses, both prescription and non-prescription, pass a certain impact strength test called the "ball-drop test". Although such lenses could be strengthened by the old thermal tempering method it turned out that the chemical strengthening process was ideally suited to meet the FDA requirements. We were thus faced with the happy but monumental task of attempting to license the 1400 or more opthalmic laboratories that were potential users of the process. Although there were some that were members of large chains owned by companies such as Bausch & Lomb and American Optical Company, most were small independent firms that had had very little previous contact with patents and licensing.

In order to make it easier for these firms a simplified license agreement was prepared that still conformed to the earlier standard license agreement. It was recognized that of the forty-odd patent rights, only two patents were likely to be used in the treatment of eyeglass lenses. The licensee was thus given the option to select one or both of these patents and the royalty depended on which were used. The licensee had the further option of paying a percentage royalty on the net sales value of lenses treated or a fixed dollar amount per pair of lenses, escalated in accordance with the Consumer Price Index. Record keeping and reporting requirements were kept as simple as possible to make it easy for these small firms to operate under the license agreement.

In the meantime, parallel discussions had been underway with some of the large chains of laboratories, especially Bausch & Lomb, American Optical and Commercial Optical. These firms questioned the validity of the Weber patent and refused to take licenses except under the most marginal terms. In addition, they apparently transmitted their opinions to the Optical Wholesalers Association, resulting in a recommendation by that organization to its members that they not sign licenses until we had been successful in licensing either B&L or AO. Our licensing program thus came to a grinding halt and it was apparent that the program would founder unless litigation was initiated against one of the major infringers.

The potential royalty income from the ophthalmic industry at this point, through the expiration of the Weber patent, was estimated to be approximately twenty-eight million dollars. Research Corporation's share of this income was relatively small, however, being only about 6 percent, and its potential return from the patent through its remaining life was estimated to be about $1.8 million dollars.

It was recognized that the cost of an infringement suit in the United States would be very high, in the neighborhood of a million dollars. It was also estimated by our litigation attorneys that our chances of success in the litigation were perhaps 60-40. On the basis of the odds only, therefore, it did not seem to make much sense to spend a million dollars with an only 60-40 chance of recovering $1.8 million.

This problem was discussed with Corning and PPG with the thought that these two parties to the Three-Party Agreement might be willing to share in the litigation costs. Corning was reluctant to do so, primarily because the very companies that might have to be sued were their customers for optical glass and they did not want to jeopardize their relationship with these firms. PPG, however, was anxious to go forward with the litigation.

Finally an agreement was worked out under which the Three-Party Agreement was dissolved and all of the patent rights were returned to their original owners. The rights to the Weber patent thus reverted to PPG who was then in a position to initiate litigation at its own initiative and expense. The Dissolution Agreement provided that all three parties would continue to share in any income generated, but in view of the fact that PPG was to bear all of the expense and risk of litigation the shares of Corning and Research Corporation were reduced over those that had prevailed in the Three-Party Agreement.

In February, 1976 PPG filed a suit against Bausch & Lomb for infringement of the Weber patent. The litigating firm representing

PPG was the same firm that had assisted us in the drafting of the package license agreement and they were already very familiar with the general background. In its defense B&L charged patent invalidity and raised several other technical defenses, but they did not contest the question of infringement of the patent claims.

In November, 1979 the District Court in the Western District of New York rendered its decision. The Weber patent was held to be valid and it was found to be infringed by Bausch & Lomb. This decision was still appealable to the Circuit Court and theoretically could be further appealed to the United States Supreme Court.

In January, 1980 PPG and B&L announced that an agreement had been reached settling the litigation. Under the terms of this agreement B&L agreed not to appeal the decision to the Circuit Court so that the litigation is now terminated. In addition, B&L agreed to enter into a license to cover its future use of the Weber patent and to pay PPG $550,000 for its past and future use of the process. The royalty rate is 11.2 cents per pair of lenses treated, which results from the original royalty of 7 cents being escalated in accordance with the Consumer Price Index. It is interesting to note that some years previously, while PPG was attempting to negotiate with B&L prior to the initiation of litigation, B&L was offered a license at a royalty rate of about half that which resulted from the settlement agreement. It is also significant to note that the cost of the litigation to PPG was between $1.1 and $1.2 million, and presumably the cost to B&L was in the same neighborhood.

Now that the litigation has been terminated and the validity of the patent has been upheld, PPG is setting out on a program to license the remainder of the industry. Simple agreements have been drafted to release firms from past infringement in return for a lump sum payment and to license them for future use of the Weber process. The royalty rate will be 11.2 cents per pair of lenses treated and it will continue to be escalated in accordance with the Consumer Price Index.

Research Corporation will continue to administer the fifty or so licenses which it issued prior to the Dissolution Agreement. Many of these licensees had been deferring the payment of royalties pending the outcome of the PPG-B&L litigation. Payment of back royalties will now be required, and these licenses will be brought to a current royalty-paying basis.

It is interesting and instructive to look back over the history of this case. The original invention was made in 1959 and the Weber patent issued in 1965. To this date, in spite of the basic and important nature of the invention, only very modest royalty income has been produced. Now, after more than twenty years and the expenditure of well over two million dollars in litigation and licensing expenses it appears that the invention may finally produce significant income, although even this is by no means certain at this time. This seems to illustrate well some of the virtues that are needed in order to carry out a successful patent licensing program; patience, persistance, determination and plenty of money.

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