OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as "developed", "industrialized" and "developing" are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

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

D03618

Distr.
LIMITED

ID/WG.110/12
6 October 1971

ORIGINAL: ENGLISH

United Nations Industrial Development Organization

Workshop on Creation and Transfer
of Metallurgical Know-How

Jamshedpur, India, 6 - 10 December 1971

THE DEVELOPMENT AND ACQUISITION OF STEEL TECHNOLOGY KNOW-HOW, IN BRAZIL[1/]

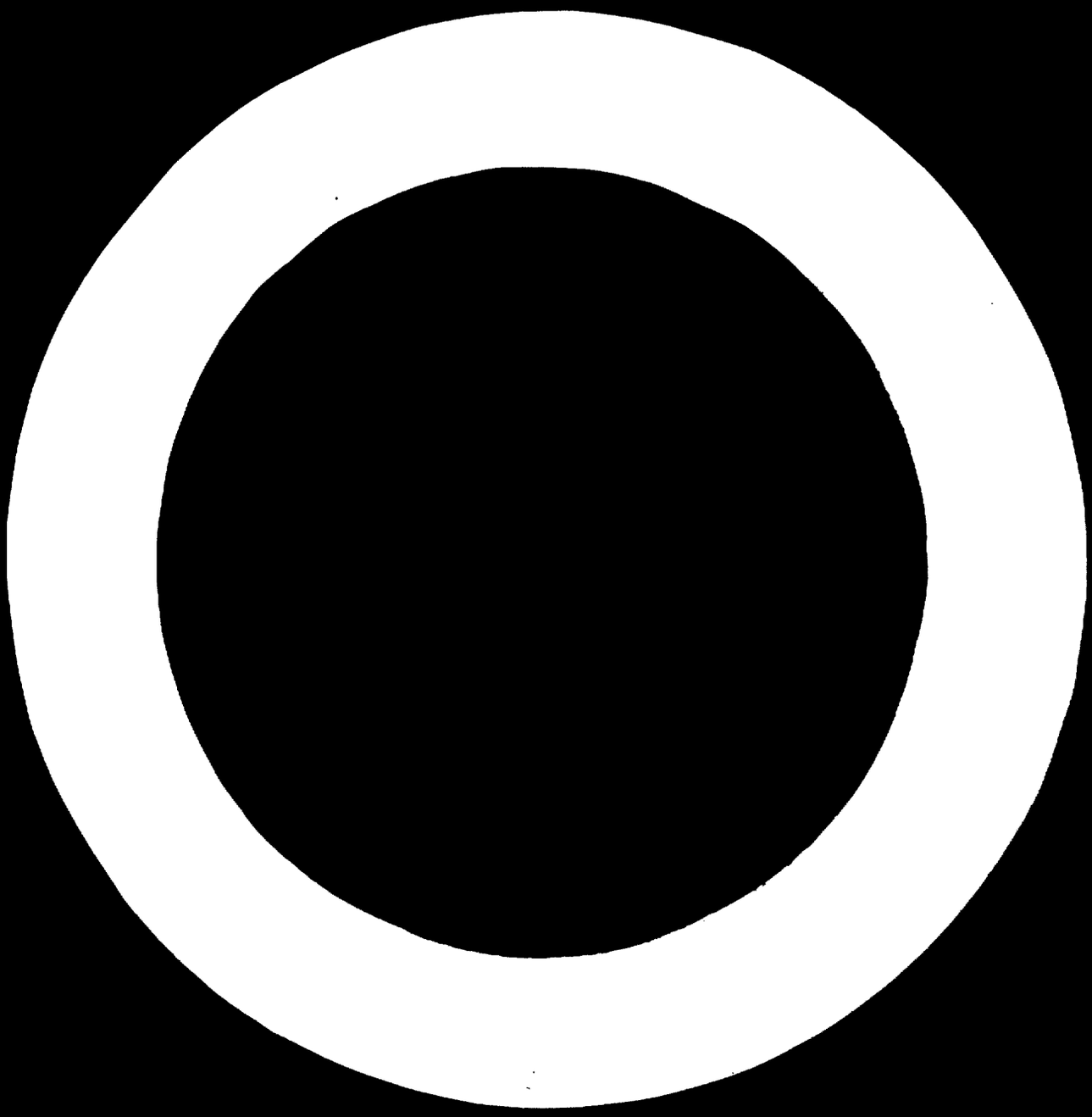
by

Marcos de A. Costrucci

TECHNIMETAL
Botafogo
BRAZIL

1/ The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.



THE DEVELOPMENT AND ACQUISITION OF STEEL TECHNOLOGY KNOW-HOW, IN BRAZIL

Introduction

1. This paper intends to gather some aspects concerning the development of metallurgical know-how, in Brazil. It will list some specific cases of the brazilian practice concerning the acquisition and local development of metallurgical know-how. It is not intended to suggest or defend the adoption of any of the different solutions that come to be listed but just to expose specific cases to subside discussions and reflexions about the matter. Some conclusions are anyhow sketched, leading to the formulation of some recommendations.

2. The author wants to acknowledge the kind collaboration received from Dr. Luís Fernando Sarcinelli Garcia, Executive Secretary of the CONSIDER, Dr. José Pelúcio Ferreira, President of FINEP, Dr. Manoel Moacélio Mendes, Superintendent of Projects of USIMINAS, Dr. Klaus Johannpetter, Superintendent Director of Siderúrgica Riograndense, Dr. Raul Schmidt Technical Director of Fundição Tupy, Dr. Claudio Bardella Superintendent Director of Bardella S.A., Dr Fabiano Pégourier Executive Secretary of IBS (Brazilian Steel Institute) and Dr. Ethienne Poubel from IBS and CONSIDER

Industrial Know-How

3. In a global manner it can be said that the brazilian industry, as a whole, still presents a technological pattern typical of most of the developing countries, marked by a strong propension to the acquisition of foreign "know-how" instead of local development. Indeed, either the fabrication of products or the aplication of processes, in the country, are still strongly marked by the acquisition of foreign know-how in as many forms as it can be made,

such as: purchase of patents and drawings, payment of "royalties", technical assistance for the manufacture of products and to the application of processes, and so on. Just to give an idea of the importance of the expenditures of the country with these items of the foreign trade balance, it can be said that, in 1970, these expenditures amounted to 104 Millions of US$. Yet, an effective transference of know-how is affected by many problems among which it should be mentioned the improper interpretation of what know-how exactly means and what should do a "recipient" company, in order to assure the maximum profit in terms of actual absortion of knowledge from a contract of technical assistance.

4. In more recent years, however, a significant change in attitude have been clearly evidenced, and a large number of important industries are proceeding to relevant research and development projects some of them involving the installation of important research centers. This is the case of most of the large state owned companies as Petrobras (oil), Cia. Vale do Rio Doce , CVRD (iron ore), USIMINAS (steel) and of private companies as Ford Willys (vehicles). On the government side, also, the creation of special funds, assuring long term loans for the specific purpose of suporting research and development projects and personal formation, favors this natural trend of thought.

5. This change in attitude derives from the fact that it has been recognised that the technological needs for the country's development could no longer be solely supplied by foreign imported know-how as far as a global strategy for the development of the country was concerned, regarded the peculiar features of its own internal market and of the special conditions prevailing in the country. Also, and this seems to be an argument to stress, national personal talents for creation must find local application for their vocation. In this line specific measures have been tried, in the last two years, in Brasil, aiming

to the atraction of brazilian scientists working abroad. All the participants to this workshop are well acquainted with the problems involved in changing the "know-how pattern" of a developing country from a mostly "imported know-how pattern" to a pattern that shows a more adequate share between locally developed and imported know-how. So, it is not necessary to say that all the programs of this kind require a quite long period of time to an effective contribuition in national terms.

Steel and related industries know-how

6. In the particular approach intended by this paper, it can be said that three distinct fields of aplication, and, in consequence, of necessity of know-how in the steel and related metallurgical industries, can be listed:

1st. The know-how required to fabricate metallurgical products and to operate metallurgical plants at a convenient techno-economic level of efficiency.

2nd. The know-how to conceive, plan and design metallurgical plants, adapted to local circunstances.

3rd. The know-how required to the manufacture of metallurgical equipment.

Metallurgical Plant know-how

7. As far as the first case is concerned, the needs for know-how in a plant, involve the following aspects.

a) the fabrication of metallurgical products

b) the aplication of processes

c) the management of productive means

8. In the brazilian case, the following products have required foreign acquisition and/or local development of know-how:

a) special steels, (specially silicon and stainless steel sheets)

b) carbon steel quality sheets (deep drawing and special corrosion resistant grades)

c) rolling mills rolls

d) malleable and nodular iron cast products

e) seamless pipes and centrifuged iron pipes

9. In another hand the metallurgical processes that gave rise to the need of transference or local development of know-how, have been, mostly:

- the oxigen and electric processes
- the blast furnace process

10. Many procedures for acquisition and local creation of know-how, in the above mentioned applications, have been tested, in Brazil. We selected two specific cases to bring here, to help the discussions of this workshop to develop on a practical approach.

The case of Fundição Tupy

11. This company is one of the largest latin american foundries, producing now around 2.500 t/month of castings in all grades of malleable, nodular and quality gray iron castings. The company started, at some 30 years ago, in an almost handicraft basis, starting the production of whiteheart malleable iron fittings. A good level of quality kept by its production enabled the company to enter the automotive castings field, by the mid of the fifties, when the automotive industry started production in the country. By this time the company faced the option of contracting foreign technical assistance against

the development of local know-how through an intensive program of experiences, on a number of items, for many car manufacturers, specially Volkswagen and Mercedes Benz. Once decided to develop internally the know-how required, a very good german foundry technologist have been hired and definitively moved to Brazil, thus assuring a substantial amount of personal experience to be added to the local staff. The biggest problem faced by the company was to provide an adequate local staff with specific formation, regarded the requirements of such a program.

12. In more recent years, the necessity of going through the production of automotive castings, in nodular and pearllitic malleable iron, lead the company to another option between internal development of "know-how" against the purchase of this know-how from outside sources of technical assistance. Again, the internal development have been given preference though with the help of an independent foreign advisor. This time it has been assured the assistance of an experienced retired american metallurgist with over 30 years of experience in the manufacture of automotive castings. This advisor made four missions to the foundry, during a two years period, assisting on the conduction of a prestablished plan of experiences aiming to the development of local technology. These experiences envisaged the control of all variables affecting the production of these castings as: the amount of innoculiants and alloying elements, pouring temperature, cooling time, molding sand carachteristics, and so on, gauging all these factors with the objective of putting into production commercial series of castings, until the required quality level and the desired productive yields were met.

13. In two other occasions, however, the company purchased external know-how from local (national) sources. For instance, some 10 years ago, the company had problems concerning the quality of locally supplied charcoal. The company than purchased from a firm in S. Paulo drawings and technical

operational assistance of a more efficient furnace for the production of charcoal and furnished these drawings to local suppliers, thus resulting in a substancial increase in the charcoal quality. In another case, it have been bought from the Technological Research Institute of São Paulo, the rights for utilization of a vacum destillation process to recover Zinc from galvanizing bath cinder.

14. In general, the company says that the solutions adopted were quite satisfactory. Indeed, the company is now exporting fittings, to Europe and USA, on a quite competitive basis, and started exports of castings to South Africa, Australia and other countries. Nevertheless, company admits that , to provide qualified people to act as recipients of the external know-how , have been always a delicate problem and recognises that, on a long term basis, a program of personnel formation should always be undertaken, prior to any serious attempt in terms of know-how development.

The case of USIMINAS

15. A large integrated, government owned steel plant, USIMINAS, has a minoritary participation on its capital of Nippon Steel that act as the main external source of know-how.

16. The presence on site of a number of foreign specialists, to advise on specific problems and, principally, the training of brazilian personnel in Japan, has been the main features of the know-how transference in the USIMINAS case.

17. The same company in spite of having avaiable this "channel" that undoubtedly, facilitates the transference of know-how from a more developed center, develops an intensive program of internal development of know-how on a newly created research and development department,directed to practically all area

of productive interest of the company. It is also stressed,by the company principals,the critical aspects represented by the need for adequate personnel to absorb know-how from the external sources and, specially, to manage technological development programs. This explains why company emphasises its efforts in terms of personnel formation. The company considers also the problem of technological development as a matter that should involve all the sectors of the enterprise and that the formation of a global concern,in terms of a mentality of technological improvement,is a must within every company.

18. It must be noticed that this effort for local development of technology is specially concerned with the areas where no foreign technology is avaiable as for instance in the case of utilisation of local raw materials and fuels.

19. Two examples in this area can be cited:

- the development of the utilization of up to 5% of charcoal fines at the coke plant

- the development of a method for the utilization of low grade brazilian coal, at the sintering plant

- the development of the internal production of ingot molds aiming to the increase of the useful life of this items of cost.

20. This job is being undertaken in collaboration with the Research Institute of Ouro Preto Metallurgical Engineering School in an extremely interesting collaboration University x Industry.

21. Company presents the following figures as practical results of technological development within the plant:

Ingot yield: increase of 1.6% in relation to 1967
Slab/ingot yield: increase of 1% in relation to 1967

Heavy plate/Slab yield: increase of 5% in relation to 1967

Ingot molds consumption: redution to 13 kg/t as compared with 25 kg/t, in 1967

Deep drawing quality sheets: reduction of rejection index at quality control from 2.6% to 1.0%, in 1970

22. The analysis of this case presents an intense utiliser of foreign technology also as a dynamic enterpreuner of internal know-how development programs. This might suggest that an important factor in know-how development could be stated as management belief in factual benefits that can be derived from it.

Planning and engineering know-how

23. The second big nucleous of know-how requirements for steel and related industries, is the execution of services of planning and design of metallurgical plants. This field can also be divided into some distinct phases as:

- feasibility and related economic studies including marketing
- basic design
- detailed engineering

24. As to the first phase cited, one might say that an adequate level of internal avaibility of know-how is already in existense. This is attested by the large number of work made in the country in the last years and for the fact that practically no foreign companies have been required to develop this kind of work for brazilian enterprises in the last years.

25. A relevant case in this field is the master plan for the steel industry. Some five years ago the ellaboration of this master plan has been contracted with a foreign consulting firm - with the participation of TECNOMETAL. The up to dating of this master plan and new more detailed

market studies have been fully contracted, by IBS, with TECNOMETAL, while other studies involving the techno-economic analysis of various alternatives for expansion of non-flat production is being enterprised by TECNOMETAL under request of CONSIDER and BNDE, two brazilian government agencies involved with the systematic planning of this sector.

26. As far as basic design is concerned one might say that, for specific techniques as for instance foundries, the full range of services of basic design and even detailed engineering is already avaiable, in Brazil. In the case of steel plants, in spite of the existence of scattered capabilities within steel plants and engineering companies, much have still to be made in the field so, one day, this creative force can be put together.

27. A fact that seems very important to stress and that reinforces the conviction of the need for the development of local capabilities for basic design and consulting engineering, is the need to develop and applied know-how concerning the selection of technological solutions really adapted to the conditions prevailing in developing countries. Indeed, a relevant fact on the present status of world technological development is that, naturally, the large amount of expenditures in research and development is clearly directed to the specific needs of the more developed countries In other words, the technological solutions resulting of research programs, performed as a rule at developed countries, are, almost ever, gauged to the specific conditions of developed countries markedly influenced by the scarcity and high prices of labor and by the avaibility and lower interest rates of capital, as compared to the exactly reverse conditions prevailing in the developing countries. This fact leads the technological solutions to be oriented towards a clear aim of intense labor substitution at the price of a more intense capital expenditure. At this point it must be said that the term "technological solution" shall not be understood only at a level of process solutions but also at the simple

level of equipment devices or ancillary equipment. An example of that can be cited. When developing the project for the expansion of a large foundry in Brazil, TECNOMETAL faced the problem of screening out of the solutions internationally avaiable all the "over mechanization and automation" that most of these solutions presented. In this case some interesting figures of the brazilian practice could be compared to figures prevailing in developed countries, showing that, while a US$ 10,000 investment, to substitute one non-skilled man, at USA, will pay out in one to two years, the same investment, in Brazil, labor and capital costs compared, would require more than ten years to pay out. The fact that production series are considerably higher, in developed countries, stresses also the importance of careful selection and adaptation of technology, what requires the development of a considerable amount of specific know-how. A right, reasonable balance shall nevertheless, be find since, on the other hand, there is no doubt that, developing countries shall not be forever enchained to handicraft and old-fashioned technologies, under the risk of being definitively out of the international market, for quality reasons. Once such know-how is avaiable in developing countries, one would avoid that enterpreneurs decide for the adoption of non adequate solutions while having the impression of acquiring the last up-to-date technology.

28. As to the detail engineering the requirements in Brazil are more and more being supplied locally through the engineering departments or subsidiaries of the large integrated steel plants, acting, as a rule, jointly with foreign firms hired by their mother companies.

29. The reduced market for steel engineering, as compared to electric, oil or public works engineering, prevented this activity to reach a more significant level of development in the country up to now.

Equipment manufacture know-how

30. The know-how for the manufacture of equipment for the steel and metallurgical industries requires a considerable amount of investment in research and development to keep pace with world technological advancement. It seems that only the production for a large scale market, allowing the cost of this development to be adequately shared among a large number of orders, can justify these investments. This fact is the main problem to a more intense development of know-how out of the large international equipment manufacturing groups that work on a worldwide market basis. Tradition and reliability play also a significant role in this case. Also, and this is a somewhat big difference from the plant operation and planning know-how, in the case of equipment, the development of the know-how has to be necessarily associated with a rather relevant fixed investment in machines and productive facilities, otherwise it would have no meaning. Another problem would be the fact that local production of equipment involves the need for quite relevant local avaiability of funds for long term financing of this equipment what, it must be recognized, is not yet in existence now in most of the developing countries. These factors, in our opinion, explain why the development of local know-how for equipment design would necessarily be the last step in any integrated effort to develop local know-how on a developing country.

31. In Brazil, although rather relevant heavy equipment production facilities are already avaiable, only a quite discret local development of original know-how is already taking place. As a rule, all the heavy equipment manufacturers produce under license importing know-how in the form of drawings and of technical assistance. The fact that large international groups have subsidiaries in Brazil favours the creation of a permanent channel for know-how transference, but traditional national equipment manufacturers have also assured adequate programs of acquisition and development of know-how

through specific know-how agreements. One case is specially relevant to be cited here. The Association of a large brazilian equipment manufacturer BARDELLA, with the international engineering company, MOELLER NEUMANN, rolling mill manufacturers of international relevance, allowed the performance of local engineering for non-flat rolling mills and ancillary equipment. This association have been responsible for the manufacture of almost all light and medium sections rolling shops in the last 10 years, in the country. It have been already shipped the firat brazilian made continuous billet mill to Argentine and another continuous billet mill is under construction to Latrobe Steel, in the United States. The relevant fact about this case is that an effective engineering group was formed for the purpose of developing individual solutions for every client's case, based on the adaptation of equipme of foreign design.

32. Nevertheless, the development of local know-how of equipment design precludes the existence of local orders for equipment and this may suggest to developing countries governments, to pay attention on this point in order to assure adequate protection and incentives to indigenous manufacture and engineering.

Conclusions

33. Based on cases cited, in previous paragraphs, one might conclude that:

1) Wherever there is a steel plant, a rolling shop, a non-ferrous production plant, a foundry, an engineering company or an equipment manufacturin; plant there is place and need for the acquisition and local development of know-how. The sistematic development and the condiction of specific know-how development programs being, in fact, a company's must, that has to be faced as a normal, though delicate activity, accessible to all creative people.

2) Every possible alternative of strategy for transference of know-how, present its "pros and cons". However, it seems valid to say that the sucess of a know-how transference program depends largely on the recipient's agressiveness in terms of an effective absortion of the know-how at its disposition, this depending largely on the quality of the local group assigned to this mission. Indeed, it might be also said that foreign acquisition and internal development of know-how should always be considered on a joint manner. In essence, a know-how development program can be considered as primarily depending on the avaiability of qualified people and of up-to-date information.

3) A very important role on the mechanism of internal technology development programs, is played by the proper conscience that must prevail at all sectors of the enterprise, on the importance and effective benefits that can derive from know-how development. In particular, top management belief in the good results of this efforts, seems to be a decisive factor on the effectiveness of such programs.

4) The scarcity of qualified and adequately trainned people to manage know-how development programs, risks to became a bottleneck in the process of know-how development. Also the acquisition and development of know-how shall be envisaged, internally, as a highly prioritary goal and shall be object of an adequate budgeting and control. Specific programs shall be submitted to careful analysis in terms of priority and economic convenience.

5) Specially in what respects to the use of local raw materials and fuels, it is quite difficult to buy foreign technology. In this case, local programs of research and development are quite recommendable and, no doubt, in many cases, can pay-out in a very short time.

6) The development of local planning capabilities is extremely desirable, specially as far as the selection of more adapted technological solutions, for the specific case of developing countries, is concerned. The

development of engineering capabilities shall necessarily involve the participation, either of a company, or of individual specialists from more developed countries, on account of the extreme delicacy of the planning and design activity.

7) The local manufacture of metallurgical equipment seems to be more adequately supported, at least at an initial phase, through the importation of foreign know-how, although much can be made locally in terms of adaptation of projects. Provided a good know-how is avaiable, developing countries where heavy equipment manufacturers already exists, should attempt to the good opportunities that may develop in terms of external market, through the growing competitiveness of their production thanks specially to their favorable conditions in terms of cost and avaiability of labor.

Recomendations

34. Following the line of the conclusions of this paper, some tentative recomendations to UNIDO have been set, as a contribuition to the debates in this workshop. Indeed, it seems that it would be extremely desirable if UNIDO could:

1) To undertake the creation and management of a world wide Metallurgical Information Center that would act as a collector of technical information , mainly originated from developed countries, that would act as "donors". This information would be distributed to sub-centers, in developing countries probably maintained by metallurgical institutions. This central system would be also avaiable to developed countries institutes, in terms of interchange of information.

2) To activate programs of personnel formation, specifically oriented to the formation of key people to perform technological and applied research work and to act as local counter parts in know-how transference programs. Special emphasis shall be given to the formation of research managers.

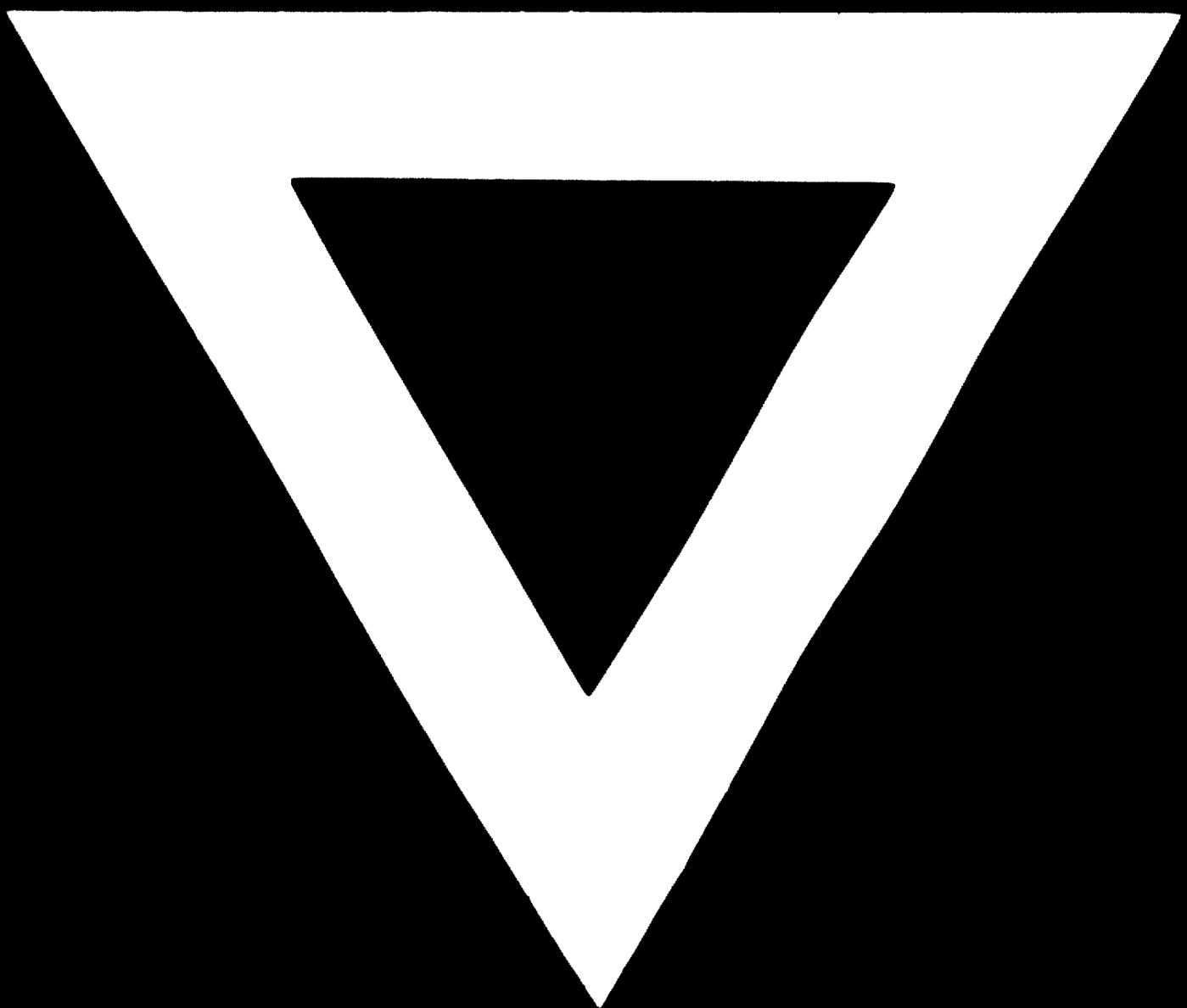
3) To constitute a group of experts specially concerned with the economic evaluation, organization and management of research and development and know-how transference programs to advise upon request of developing countries.

4) To maintain an up to date list of selected experts that would volunteer to participate, as advisors, in specific programs in developing countries. The costs of these services should be covered by the intitutions that would benefit from the program. In some special cases these costs could be covered by UNIDO, but it shall be emphasized that research and development of know-how can pay for themselves on a rather short term basis.

5) To promote a worldwide survey on the mechanisms adopted, in the present or in the past, by developing or developed countries, aiming to support and/or to promote and incentivate, know-how transference and technological survey programs, evaluating their performance in the countries they have been adopted, and putting the results of this survey avaiable to all developing countries so these countries could be helped in stablishing a set of measures aiming to the promotion of these activities. UNIDO should also promote, in a broad manner, close to developing countries governments, the convenience of adoption of such programs.

6) To prepare a document to serve as a standard base for know-how transference contracts, similar to the United Nations standard clauses documents, that regulate international trade conditions for the supply of equipment. This document of standard clauses, would also define the meaning of typical concepts involved in such contracts and the obligations and rights of parts.

[redacted]



19.12.73