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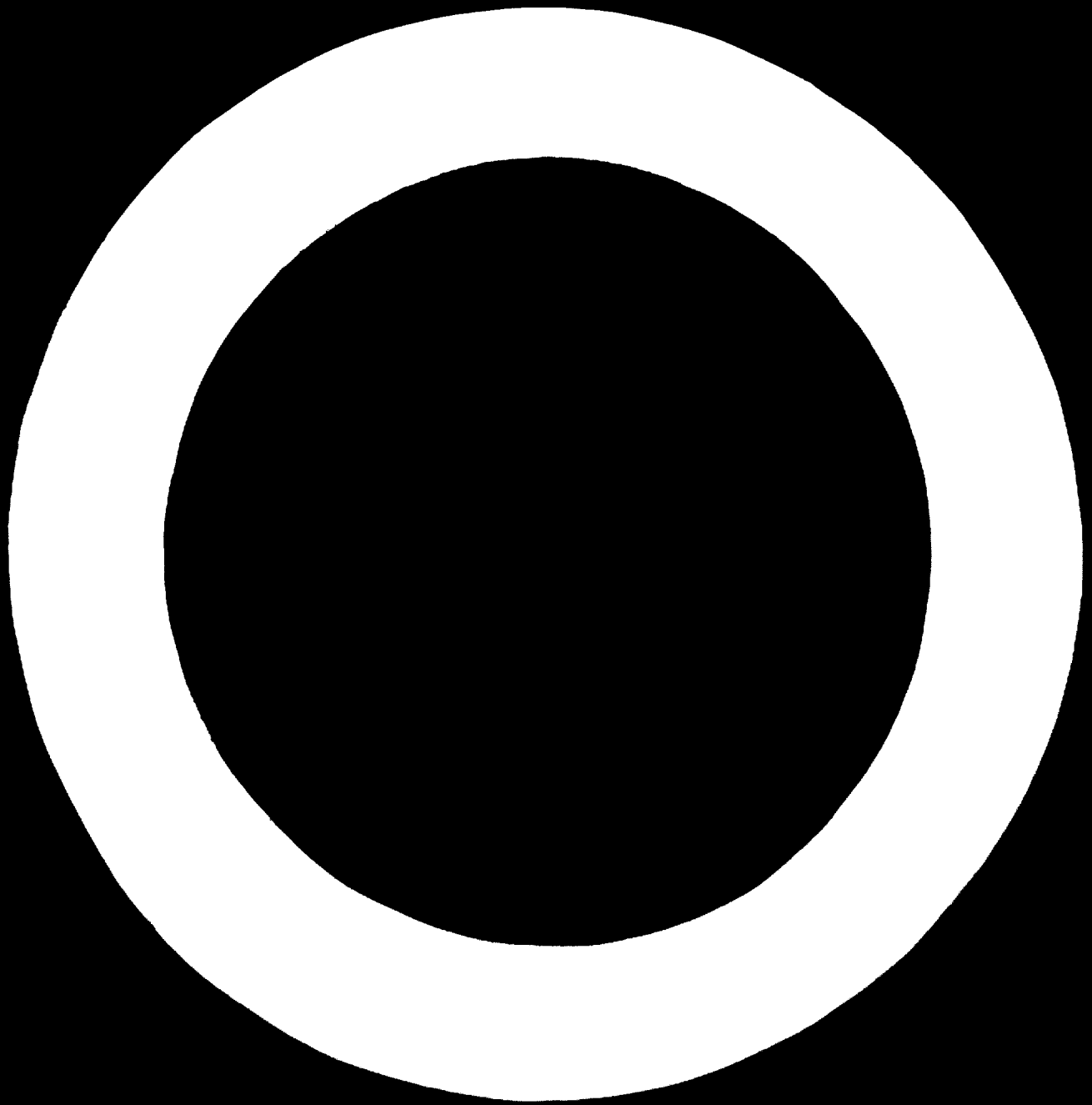
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Research for the Iron and Steel Industry in Latin America

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THERE ARE THREE characteristic stages in economic development: the first is when a country has no industry; the second when industry exists but is incapable of developing new processes and products; and the third, when there is full capability for the creation of new technology.

The second stage of development is characterized by industries based almost entirely on the transfer of know-how from abroad, in addition to very limited local adaptation of techniques developed elsewhere. Argentina, Brazil, India and Mexico are examples of countries that have completed the second stage of development and stand on the threshold of the third.

It is only through full development and the use of a local creative technology that it is possible to satisfy the triple requirements of full industrialization, namely increased production, higher productivity and better quality.

Industrial activity today can be described as a sequence of activities: research + development + planning + design + construction + production + control. This constantly repeated sequence results in continuous changes in processes and products.

Research and development, in particular, have already become an essential part of the industrial process, because problems increase in number and complexity propor-

tionately to industrial progress. Possibilities for new processes and products also multiply and must be the subject of research.

Activities closely related to research

Applied research is seldom carried out in isolation. In general, it is associated with such related activities as testing, examination and diagnosis, trouble-shooting, special studies, documentation, dissemination of expertise and information, technical assistance, inspection and quality control, specialized training, technical consulting, technical exchange with other institutions, experimental production and the setting up of standards and specifications. The organization of research groups in developing countries will have only a limited effect if such groups do not carry on these activities.

Success depends on a number of factors, including qualified personnel, with specializations pertinent to the problems to be tackled; material resources such as equipment, supplies and auxiliary services; a stimulating atmosphere of intellectual exchange; and close contact with a market for the results of research.

Technological evolution of the iron and steel industry

Although the scientific revolution after the Second World War had an impact on the iron and steel industry, the use of scientific knowledge came late in the development of an industry centuries old and has not caused any spectacular change. Such techniques as pelletizing, oxygen conversion, continuous casting and vacuum degassing, however spectacular, are not derived from or dependent on new scientific discovery. They are the result of technological research and development. The same applies to metal transforming, including rolling, forging, extruding, welding and casting.

The effect of scientific discovery on the properties, behaviour and application of ferrous alloys has, however, been marked. It is expected that spectacular progress will soon be made in steel product development based on scientific knowledge.

Much remains to be studied on the transition from ore to finished steel, specially on the reduction of oxides and on the reactions between liquid metals and slags. Opportunities for developing new processes and equipment abound. The developing countries can participate in the general research effort and can make important contributions.

Increased competition for markets will add to the importance of industrial research and bring about important improvements in productivity, quality and variety of products in the next few years.

The iron and steel industry in Latin America

Although Latin America has made significant progress in the development of its own iron and steel industry in the last twenty years, the state of the industry is by no means satisfactory.

Latin America is a vast conglomerate of some twenty countries, with a population approaching 200 million and an area of some twenty million square kilometres. It is roughly equivalent to the Union of Soviet Socialist Republics in population and in size. Its present annual production of some ten million tons of steel ingots is far from meeting the actual and potential needs of its population. It is essential for the region to increase production considerably in the next twenty years.

Developing countries are facing today a set of conditions which differ greatly from those that prevailed during the last two decades. The forces that will increasingly work against the development of their iron and steel industry are: competition from exporters of iron ore; competition from producers, mostly developed countries; and difficulties in finding external finance to develop industries to the extent required to meet the needs of their populations.

Latin American countries have reached a critical point in the development of their iron and steel industry. Mistakes made in planning, financing, designing, constructing and operating their first large iron and steel plants must not be repeated. The need for local capability in creative technology is apparent.

Research problems

A survey of research problems in the iron and steel industry was made in 1966 under the sponsorship of the Economic Commission for Latin America (ECLA). The countries surveyed were Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. Consultations with local engineers, businessmen, technologists and professors resulted in the compilation of a list of 150 problems covering all phases of iron and steel-making from the preparation of raw materials to product control and application.

The list indicated a remarkable variety of problems of different levels of complexity, many of them not particular to the Latin America iron and steel industry but common to the industry in other parts of the world.

Results of the survey

A summary of the observations found in the survey is given below.

- The development of the iron and steel industry of Latin America will increasingly depend on the application of modern technology.
- A diversified demand for research exists, not only for the solution of trivial plant problems, but also for the solution of problems of national and regional importance.
- There is a demand for more efficient services and activities related to research, such as technical information and assistance, specialized training, and the preparation of standards and specifications.
- The methodology of the present industrial research varies from group to group, but, in general, there is a lack of well-defined research projects. Those that exist frequently bear little relation to needs.
- Insufficiency of human and material resources is coupled with dispersal into groups often too small to maintain a flow of ideas, experiments and application.
- The need for a larger number of qualified personnel is apparent.
- The dearth of information is felt everywhere. Contacts with foreign centres are tenuous and infrequent. Libraries and documentation centres are deficient in number or in efficiency. Few journals for the exchange of technical information are published regularly.
- There is a lack of planning, administration and financing of research for the iron and steel industry at all levels.
- Iron and steel companies of the area encounter difficulties in maintaining a significant research programme because the necessary financial and human resources are scarce and the risks of failure are a deterrent to action.
- It is the general consensus that the simple transfer of foreign technology is not satisfactory; it is necessary to adapt and create technology suitable to local conditions.

Possible measures conducive to development

In the most important centres of Latin American industry, metallurgical engineering courses should be established. Amazingly enough, certain countries with sizable iron and steel industries do not yet grant degrees in metallurgical engineering. A course of study should include the following subjects: physics of metals; metallurgical physical-chemistry; non-ferrous extractive metallurgy; iron and steel metallurgy (ore to ingot); mechanical transformation of metals, and ferrous and non-ferrous metallography. The courses should include a good proportion of laboratory and plant work.

Post-graduate courses should be set up with the aim of training a maximum number of engineers according to the interests of local industry and development. Degrees and diplomas should be of secondary importance. Post-graduate courses in Latin America should have a predominantly utilitarian character varying from long-term course leading to an advanced degree to intensive in-plant training.

The training of metallurgists, covering the scientific, technological and industrial aspects, should be intensified and form part of the regular policy of companies, institutions and countries.

The creation of institutions capable of stimulating technical interchange by means of meetings and publications at both the national and regional level is essential.

The Brazilian Society for Metals (ABM), which is holding its twenty-fourth annual meeting this year, is an example. Its membership is 2,500, and it has published 1,000 papers and ten books since 1944; it issues a monthly periodical *Metalurgia* of the quality characteristic of much older journals in developed countries. A more recent but no less successful example, at the regional level, is the Instituto Latino-Americano del Fierro y del Acero (ILAFA), whose monthly bulletin *Revista Latino-Americana de Siderurgia* is well known.

The maintenance of a significant research effort in Latin America is also necessary. This effort should include, besides local groups attached to universities and schools, independent institutions for technology undertaking testing, diagnosis, research, technical assistance and providing information. Such institutions can be of great help to industry as has been demonstrated, for example, by the Instituto de Pesquisas Tecnológicas, São Paulo, Brazil.

Co-operation in research among Latin American countries is most desirable. A regional organization such as the British Iron and Steel Research Association (BISRA) or the Institut de Recherches de la Sidérurgie (IRSID) would be of enormous value to the region's industry. Such a regional centre would enable Latin America to compete on better terms with the developed areas. Similar regional centres might also be useful in Africa and Asia.

Objectives of a regional centre

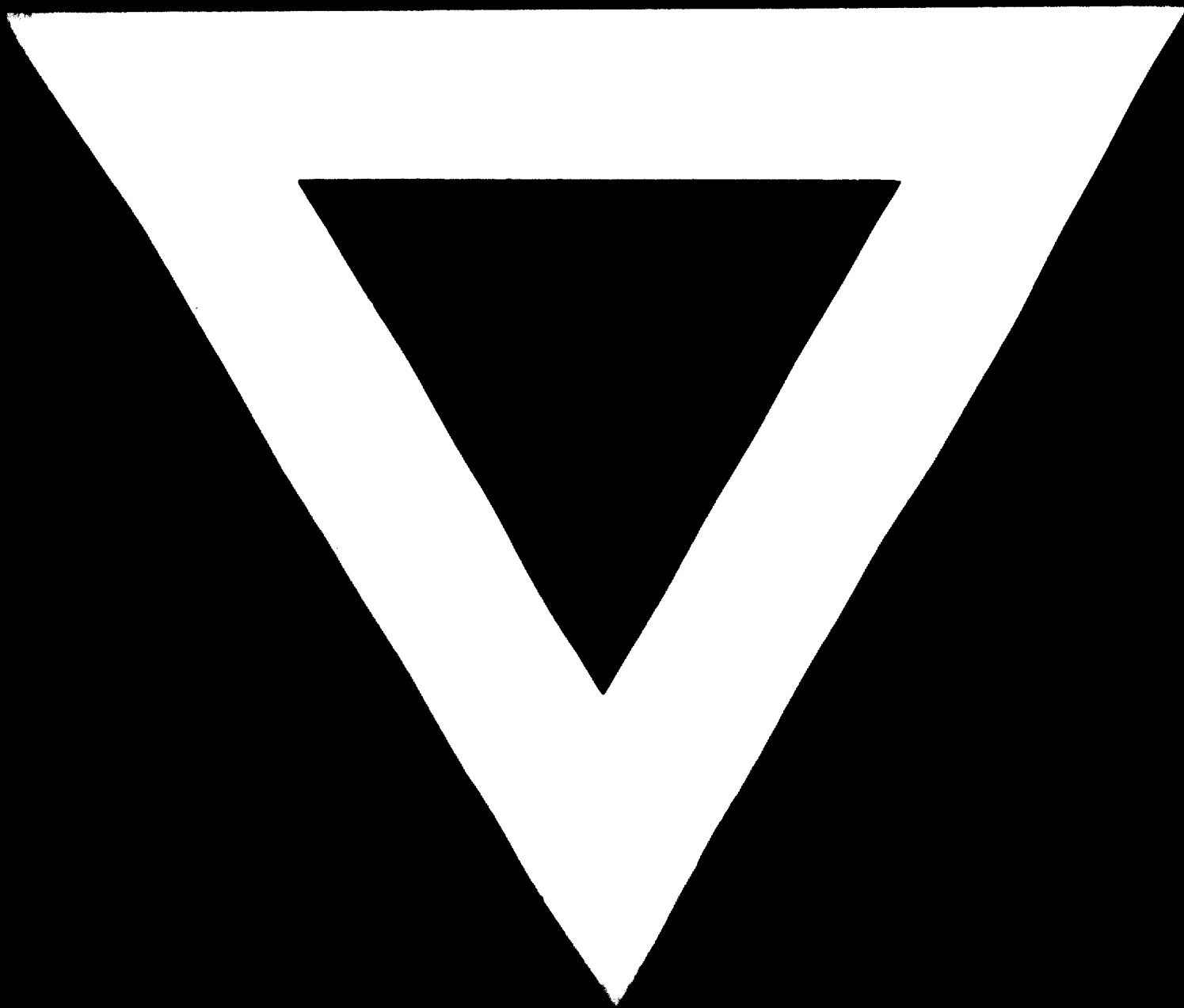
The long-range objectives of a regional centre for iron and steel research in Latin America should be to:

- Disperse information on such subjects as assistance, improvements, new processes, new materials and patents;
- Attack problems that are of little interest to the developed countries but are of importance and urgency to Latin America;
- Demonstrate that a successful blending of scientific, technical, industrial and economic knowledge is profitable for solving industrial problems;
- Achieve by concentration of resources what small research groups in universities, industries and independent institutes of the area cannot undertake;
- Aim at the rapid creation of Latin American know-how for its iron and steel industry.

More specifically a regional centre would:

- Study and make available specialized and detailed information regarding iron and steel raw materials, products, processes and equipment, taking into account the particular needs and conditions existing in the area;
- Initiate, maintain and develop systematic research aiming at the solution of technical problems;
- Investigate new technological developments and possibilities that could be put to use;
- Perform testing, examination, analysis and other specialized services;
- Act as consultant to industry and to governments in the study of specific projects or problems;
- Provide specialized training;
- Assist in the study of specifications and norms whenever specialized knowledge is required;
- Prepare, design and build specialized materials or instruments for experimental use;
- Provide technical and scientific support of exploration and eventual patenting of processes or materials;
- Study the application, behaviour and fabrication of steel products;
- Study problems of efficiency, data processing and automation in relation to the iron and steel industry;
- Stimulate the co-operation of national organizations on matters of common interest.

The establishment of such a regional centre could make a great contribution to Latin America's transition to the final stage of development.



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