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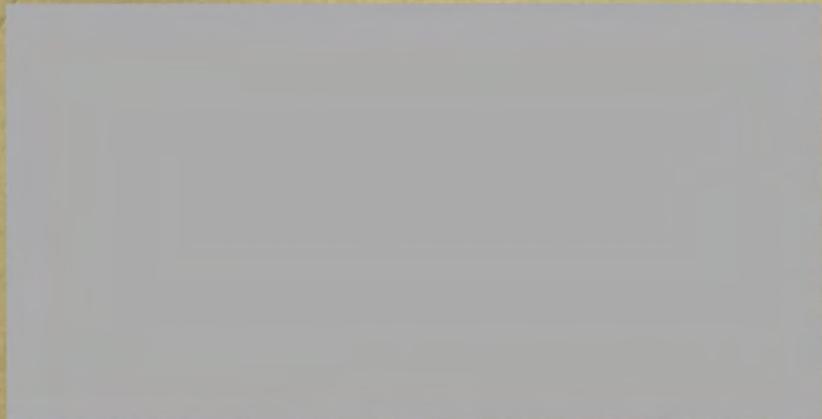


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THE ROLE OF RESEARCH IN INDUSTRIAL DEVELOPMENT

Address delivered Dec. 11 before the Finnish Foreign Trade Association by Dr. Francis Godwin, Chief, Technical Research Institute Program, International Bank for Reconstruction and Development.



This is my first visit to Finland; but, with your permission, it certainly will not be my last. There is so much of interest here, so much that I want to see, and so many more of you that I want to meet.

Before coming I have had an opportunity to study briefly some of your recent economic and technical problems. Many of these problems are the same ones which face other nations in these times -- and some are very special ones which Finland has had to bear alone. But in a field of work that has taken me to 34 countries over the past ten years, I am frank to say that there have been very few examples to match the realistic approach and determination of Finland's people - individually and collectively - to progress over difficult economic obstacles. What you have been able to do in these unusual circumstances can be a lesson to all of us. For years I have looked forward to an opportunity to say this personally to somebody in Finland, and I say so now.

You have invited me to discuss with you for a few minutes some aspects of industrialization - a topic of equal interest to you, to me and to my institution. But industrialization is a big word and a big subject, and I do not propose to cover it. Being human, I shall probably indulge in a few deathless generalities; but mainly I would rather deal with one small but essential thing - what the biologist would call the "hormone" - that makes industry grow. I would like to talk about applied industrial research.

Perhaps it is natural to ask why and how this relates to the work of an international financial institution. One answer becomes clear when we examine

the growth of the most highly industrialized countries: in the United States today, fully half of the national employment can be traced directly to the research laboratory. For a more specific connection, however, we need only to review just what the World Bank is and what it is doing. Most of you, I am sure, are already acquainted with it.

First of all, it is your Bank. You in Finland, and the banks, governments and private investors of 54 member countries subscribe the capital. Its offices are in Washington and Paris, for convenience and because they have to be located somewhere. But the World Bank is not an agency of any single country, nor of any other organization. It is an independent international lending institution, directed and staffed by people from its various member nations.

It is the job of the World Bank to help to finance, in its member countries, projects of various kinds which are productive and which can contribute materially to raised standards of living, commerce, trade and economic growth. Primarily this is done by providing the necessary foreign exchange for such projects, in whatever currency may be required. Last month, for example, Finland borrowed 18,000,000 Swedish Kroner to improve her woodworking industry, making possible the purchase of certain necessary Swedish equipment.

In the seven years since the Bank was formed it has made some 75 loans, in various currencies equivalent to one and one half billion dollars. These loans are helping to finance more than 250 projects in 28 countries. As a result new factories, farms, irrigation projects, electric power plants, ports, ships and railroads are already running today in many parts of the world, and even more such projects are in preparation.

These are not the projects of idealistic dreamers. They are accomplishing practical work. They are not political projects. The loans are good, sound ones and are being repaid. The capital is being returned to finance still other projects. The Bank has not lost money - it has made it. We are proud of the

record, but there is much more to be done.

We are doing this with your money. It is our duty to see that it is done in a sound, businesslike manner so that your investment will be secure, useful and profitable. To do this successfully requires constant and careful technical economic study; and in the industrial phase particularly, somewhere in the line there must be direct contact with the frontiers of technological research to insure a flow of new ideas and continuous modernization.

Again, the full name of the Bank is the ~~the~~ International Bank for Reconstruction and Development. While immediately after the war its activities naturally emphasized reconstruction, today the emphasis is on development. And in the end, economic development means production.

Production, of course, means ideas, tools and work. There is no need to remind ourselves that there is no shortcut through legislation, controls, coordinating bodies and bureaus. Neither is there any shortcut through the mere provision of capital. Good governmental policies help to smooth the path, but by themselves they will not produce so much as a sandwich. And the most abundant financial capital is useless without human ideas and action. None of us have found any substitute for the ingenuity, courage, initiative and productive work of the individual citizens who make up every country.

Industrialization is one - but only one - of the several important avenues for this work. Pursued with realism, it can be a genuine contributor to local progress. Under other circumstances it can also be very expensive - particularly if its development is forced into unnatural channels in any unwarranted attempt to parallel too closely industrial growth somewhere else. Yet if we keep in mind that the objective is better production, and the trade that goes with it, we shall continue to recognize that industrialization is not an end in itself, but merely a means to an end.

Occasionally, too, we have to recall that the objective of sound industrialization is not primarily to keep people busy, but to create more goods. I mention this because we often hear it argued that such-and-such an industry should be established artificially to furnish employment to an increased population. Obviously, by this line of reasoning, we would next conclude that to provide the maximum employment we should seek the least efficient industries. The effect of such a policy upon a country's foreign trade would be interesting.

Actually, we know that the course of ever-greater efficiency creates the most employment in the end. And it certainly creates the most goods for better living. So, for each set of circumstances, we must build the most efficient industrial plant that is feasible at the time.

It is worth noting that we cannot plan an entire pattern of future industry for a country. Those who would try it could use their energies to better advantage. For industrial development means continual change - now and forever. We may build the most modern and efficient industrial plant today, but even before its opening ceremony our neighbor may have laid the foundations for a better one. We must match his research with our own. Not once, to catch up- but continuously, to stay head.

If we care to question this, we shall have no difficulty in finding proof close to home. Last Thursday the newspapers announced the decision of the Dominican Republic to build the first factory to make newsprint from waste sugar bagasse - which until now has generally been considered impractical. Since most sugar-producing countries do not grow pulpwood, they have always been markets for foreign newsprint. What then may this new development mean to Finland?

To be sure, in this illustration there are some technical questions not covered in the news announcement. It is reasonable to expect that some percentage of conventional wood pulp will be needed to give the paper the proper strength. Also, the supply of bagasse is not as great as would appear, for most sugar mills

must burn the greater part of it as fuel. On the other hand, with good efficiency a 15% excess is not uncommon. Indeed, the real problem in making paper from sugar bagasse has not been the process (certain kinds of paper have been made from it in Peru for several years) but the storage of the bagasse. In most areas the sugar harvest is highly seasonal, and to store bagasse over the dead season without harmful fermentation has been difficult and expensive. Until this problem is satisfactorily solved, the cost of newsprint from bagasse on a year-around basis may prove much higher than the recent optimistic announcements. All of this might suggest that the wood pulp producers could view the news with complacency.

But if research has solved the manufacturing problems in this case, may it not soon solve the bagasse storage problem as well? I think so. Excess sugar bagasse is a waste product, and the sugar-producing countries are just as anxious to use it profitably as Finland is to utilize her wood waste.

Such developments presage no tragedy for the wood-producing countries, unless it should be of their own making. In Finland your Industrialization Committee has in fact already shown the importance of diversifying production - not only to reduce the heavy economic dependence upon wood products, but to prevent depletion of your forest resources. The Committee has pointed out the need for directing a somewhat greater percentage of your scientific research toward the other natural resources of the country.

Where there is a tradition of applied research, it is not too difficult to channel it into new lines; but to implant the spirit of this kind of research where it has not existed before is a very special problem. Many of the countries of the world are only now beginning their era of industrial development and have no such research of their own.

Some years ago - before the World Bank was formed - a group of us were invited by the Bank of Mexico to make a technical field study of opportunities

for industrial improvement and expansion in certain lines of Mexican production. We found numerous opportunities for new industries, but some of them needed research to make them practical projects. We then looked for ways to get this research done in Mexico.

What we found was that Mexico had some excellent scientists and learned scientific institutions, but that by tradition they were primarily interested in theoretical studies and had little or no background in what we may call applied research: that is, actual development of commercial products, manufacturing methods and the like.

We saw this as one of the principal reasons why Mexican industry had not developed as rapidly as her resources would suggest. True, there were other reasons too, such as shortage of skilled labor and problems of mobilizing capital; but these were not insoluble, and progress was already being made in these directions. Yet many local industries, from the technological standpoint, were unchanged from the days of their original establishment and were fast finding it difficult to survive in a world of competitive advance, and new opportunities were too often unseen.

As a stop-gap we tried sending some of the technical problems abroad (in this case to the United States) for solution. But in doing so we recognized two significant facts: firstly, there were some such problems which could not be sent abroad in any case, because for technical reasons their work had to be conducted under local conditions; and secondly, exporting problems for solution abroad offered no permanent answer for Mexico, but would have to be continued forever unless there were some provision made for solving them at home.

To meet this situation we set about creating a Mexican applied research institution. This meant, first of all, training Mexican personnel with the help of imported specialists. While the training was going on, over a period of five years, we undertook to solve some of the local industrial problems. A few

examples will show what happened.

Mexico's important tanning industry had been dependent upon cascalote - a tannin obtained from the seed-pod of a common tree. But no method was known for concentrating the material, and tanners had to make their own crude extracts; this was detrimental to their leather. Moreover, since crude cascalote could not be shipped economically, there was no export market for it despite the growing world demand for natural tannins.

Unlike the fast-diminishing Argentine quebracho (whose tree must be cut down to obtain the tannin) cascalote is an annual crop. But this advantage was useless unless it could move in commerce. The laboratory solved the problem by developing a commercial extraction process. At the same time, tests made in Texas oilfields showed cascalote to be an excellent substitute for quebracho in stabilizing drilling-muds - - - a use accounting for 60% of the \$40,000,000 worth of quebracho annually imported by the U.S. A Mexican factory, understood to be backed by the Nacional Financiera, is now preparing for large-scale production of cascalote extract.

Studies made to help the sagging henequen fiber industry disclosed a high grade wax obtainable from the enormous decorticating wastes. A commercial process for production of the wax was developed, and samples from the pilot plant were sent to potential users. Even at this stage, one firm offered to buy \$40,000,000 of the wax for European sale. The supply of this product available annually is worth between \$20 and \$50 million - as much as the value of the main fiber crop. Factory plans are now being made for Yucatan; a U.S. firm has offered a dollar royalty for rights to use the patented process in Haiti.

In the face of a world shortage of vegetable oils, field work disclosed 15 promising but unexploited types of oil seeds native to Mexico. Laboratory studies determined their properties and economic utility. Several proved to be good drying oils for paint manufacture, other suitable for making soap, margarine or cooking fats. Publication of the technical data brought purchasing agents of

leading companies to Mexico at once, providing the stimulus that was needed to create interest in local planting. One oil is already in use by a local paint factory, and others are being tried by the Mexican subsidiary of a major U.S. soap concern.

Since days of the Aztecs the tortilla, staple item of the Mexican diet, has been made by a primitive method which contributed to maldistribution and waste of maize, uncleanliness, and nutritional problems. A dry flour was seen as the solution; but ordinary ground maize flour would not produce the traditional tortilla. Research found that, in grinding, the corn must undergo a mechanical process analogous to the milling of rubber, giving a certain molecular arrangement which the Aztecs achieved unknowingly. Pilot plant tests found large-scale equipment which would do this rapidly and economically, and a new manufacturing process was born.

Predicting that this may become a substantial industry for Mexico, Nacional Financiera formed a company, Maiz Industrializado, S.A., which is now building the first large factory. Meanwhile a well-known cereal company has purchased United States rights on a dollar royalty basis. Income will go to repay the Banco de Mexico for its research expenditure and to support further research.

Similar examples could be given in banana flour to extend the wheat supply, low-temperature coke to replace domestic charcoal and preserve the forests, development of national fluorspar resources, improvement of local private industries in glass, textiles, salt, corn products and others, help in establishment of other local laboratories, advice on projects proposed for financing, and selection of outside technical aid for various purposes.

Probably the most important achievement of all has been creation of a staff of practical Mexican research technologists, willing and eager to roll up their sleeves and get their hands dirty; local tradition originally held this

to be degrading to a trained man, effectively blocking progress. Also, the institute provided a place for immediate utilization of trained Mexican specialists until newly-created industries were ready to receive them.

Today the institute trains some of its own men, and has 19 research projects in progress for Mexican private industries and official agencies. Among these are studies of various by-products, processing of low-grade soals, spray drying of coffee, retting of kenaf fiber, extraction of candelilla wax from the arid regions, problems of the canning industry and others.

Beyond question, Mexico's experience with research has demonstrated both the practicability and the importance of implanting this growth factor in any area bent on development of national productive facilities. While it is not quite as easy as my simple description may suggest, and despite some dangerous pitfalls which undue haste or misunderstanding can create, we believe that a similar course can bring equal benefits to other parts of the world.

As confirmation of its faith in applied research, the World Bank has recently launched a pilot program - now co-sponsored with the United Nations Technical Assistance Administration - whereby it will aid a limited number of member countries to establish practical research institutes. To these countries, upon request, the Bank will supply experienced persons who will organize and direct these research institutions for a period of at least five years, during which time they will train a complete local staff to carry on successfully in later years. In general, the pattern to be followed will be an adaptation of the well-tested procedure used in Mexico. And in most cases, as in Mexico, these institutes will be closely associated with central banks or development finance corporations, providing a direct link between the source of new technology and the finance necessary to transform it into productive enterprises.

We at the World Bank have learned, as every financial institution concerned with development must eventually discover, that a fund of money does not by itself produce ideas for productive projects and that a marriage of technology and finance, through sponsored research, is essential.