

STATEMENTS AND SPEECHES

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INDUSTRIAL RESEARCH AND INDUSTRIAL DEVELOPMENT

An address by Mr. O.J. Firestone, Economic Adviser, Department of Trade and Commerce, delivered to the Annual Conference of the Provincial Governments Trade and Industry Council, Lindsay, Ontario, September 23, 1952.

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... I wondered a little at first why a group as eminently practical as your Trade and Industry Council wanted to hear a talk on and discuss the subject of research as it affects industrial development. Perhaps there are two good reasons for your interest in this subject.

The first is that industrial development is getting more complex in Canada and basic and applied research are becoming prime requirements of economic advance. The second reason might be the changing pattern of your own responsibilities - the shift in emphasis from salesman to technician and business adviser.

Rate and Diversity of Canadian Industrial Expansion

For the first half-century after Confederation, agriculture and other primary industries were the main source of income and employment in Canada. But two World Wars, a stepped-up rate of accumulation of domestic capital, development of low-cost sources of power, a rapid advancement of managerial and technical skills, and significant engineering and technological progress have changed the structure of the Canadian economy profoundly. By the end of the First World War, the dominant role of manufacturing industries in terms of output was well established. They continued to grow by fits and starts until now manufacturing industries are Canada's

principal source of employment and income. In fact, but for the high level of industrial activity we would not be enjoying a standard of living which is one of the highest in the world.

But the development of Canadian industries has involved more than simply an expansion in output providing more jobs and incomes. Equally important, they are ever extending the range of their products and turning out many existing articles with much greater efficiency.

Canadians have come to take the rate and intensity of their industrial progress pretty much for granted. They have grown accustomed to the idea that they are able to keep pace with the manufacturing expansion going on in the United States, the world's most industrialized nation. They take in their stride the fact that industrial production in their country, as in the United States, has doubled in a little over a decade. Perhaps we are sometimes not as conscious of the fact that this rapid progress puts North America rather into a category by itself. Countries like the United Kingdom and France have been able to increase their industrial output only by about one-quarter. And this has been an uphill struggle all the way, achieved in an atmosphere of intermittent crises. In the same period, Sweden's industrial output expanded by two-thirds, Holland's by about one-half, Western Germany's by one-third and Belgium's by one-seventh.(1)

Factors Contributing to Industrial Development

Now the question arises, "Why have Canadians been so fortunate? You may have come across a number of answers which are cited frequently: the abundance of natural resources; the industriousness of the Canadian people; their willingness to save and thus provide the wherewithal to pay for the development; the enterprise of Canadian businessmen; the establishment of foreign branch plants and the inflow of foreign capital.

These answers all have a bearing on why Canada is growing so rapidly industrially. There are, however, two other points I should like to mention. As Canada's domestic market grows and industry expands, this process by itself breeds new industries. First, an assembly plant may be established. Then it might become profitable to move into the manufacture of component parts and ultimately into production of the basic material from which the parts are made. The evolution of aircraft production in Canada is a case in point. Canadian firms produced airframes first, then they started to manufacture a great deal of the equipment that went into aircraft. More recently Canadian industry has passed another milestone by going into the production of jet aircraft engines, which is one of the most complicated engineering feats that modern technical genius can conceive. Then only last week the production in Canada of magnesium alloys required in the manufacture of jet engines was initiated, when the new plant of Light Alloys Limited, a Dominion Magnesium subsidiary, was opened at Haley Station, Ontario. In the chemical field, when nylon was first produced in Canada it was made from imported nylon salt. A few years ago, C.I.L. built facilities at its Kingston plant for making nylon salt out of two imported constituent chemicals. Now they are building a big plant at Maitland to manufacture the chemicals out of Canadian materials.

(1) Based on the industrial production index for the period 1937 to 1951 taken from the Monthly Bulletin of Statistics of the United Nations.

The interesting point about this phase of Canadian industrial development is that some of it takes place even though the necessary raw material are not found in this country. In fact, Canada is a growing importer of raw materials, not just bananas from the West Indies and oranges from California, but bauxite from British Guiana, natural rubber and tin from Malaya, manganese oxide from the Gold Coast of Africa, and coal from Pennsylvania. You may be interested to hear that out of every dollar spent on imports, 25¢ goes for the purchase of raw materials. This is not very different from the proportion in the case of exports. Food-stuffs and basic materials in unprocessed form account for only 30¢ out of every dollar's worth of goods we sell abroad.

The implication of this is that the momentum in Canada's industrial development program is so strong that its progress is rarely inhibited by the lack of this or that raw material. In fact, because we have some raw materials in great abundance we find it comparatively easy to trade our surpluses against the surpluses of other countries. In saying this I am not unmindful of the unsettled trade situation in the world - but the fact remains that industrial nations must have raw materials in order to survive.

Why Is Industrial Research Important for Industrial Development?

The second point I have in mind relates to the effect of industrial research on industrial development. Industrial research narrowly defined covers scientific activity in the physical and natural fields. But I gather from some of you that you interpret this term more broadly and that you would consider economic research and market analysis as part of the process of placing scientific techniques at the service of industry.

Why is industrial research so important to a country's economic development? There are many reasons, and I might mention just three.

First, by bringing forth new and improved commodities, industrial research contributes to the bettering of national living standards.

Secondly, by raising the efficiency of the production and distribution mechanisms of modern society, industrial research reduces costs to the consumer. Export-wise, it makes Canadian producers more competitive. Domestically, it frees resources for use in other tasks and makes possible a gradual increase in leisure and the pursuit of non-material interests.

Thirdly, by developing substitute materials and products industrial research creates competition within competition. It thus represents one of the greatest safeguards of the responsible private enterprise system that we are in the process of evolving on the North American continent. To illustrate: the Canadian steel producer not only competes against other domestic steel producers and foreign manufacturers but he also has to meet the invasion that aluminum might make into fields hitherto almost exclusively reserved for steel. Synthetic fibres are giving the producers of silk, wool and cotton a great battle. Plastics are bidding fair to replace leather, wood and metals for many purposes.

There is another important implication of the development of substitutes. Frequently it is possible to manufacture substitute materials from what would otherwise be waste from another industrial process, thus contributing to the conservation of our natural resources.

Applied research in Canada has for a long time played a great role in some of our primary industries - agriculture, forestry and mining. The development of new strains of rust-resistant wheat by our Experimental Farm Service is perhaps one outstanding example. For this development has greatly reduced the hazards of farming and has facilitated the general application of mass production methods to agriculture. It is only in more recent years - not much more than the last three decades - that basic and applied research as it affects the development of our secondary industries has begun to assume importance.

Complaints about Canadian Dependence on Foreign Research

Canadians, even though they may not talk much about it, have become understandably proud of their industrial achievements. They have grown more conscious of the responsibilities which go with being one of the world's leading industrial nations.

But I find in some places a feeling of diffidence when it comes to comparing Canadian achievements in the field of industrial research with those of others. It is not that the Canadian scientist is any less capable than his colleague in the United Kingdom or the United States. Nor is it the absence of specific dramatic achievements. But most people that I discuss industrial research with talk about how relatively little we are doing and how much we continue to depend on other countries for research and technical development. They are confirmed in this attitude by visiting industrialists and scientists from abroad who point to the many branch plants of foreign companies in Canada which for their development depend a great deal on the research and experimental work done by their parent companies. Only a few weeks ago an outstanding British scientist, in commenting on Canada's great dependence on foreign industrial research, is reported to have said that this meant in effect that a great deal of the brain work, the creation of new ideas and techniques, was being carried out elsewhere while only the "donkey work" was being done in Canada.

Now I agree, we all want to see more industrial research done in Canada. We also are very much interested in making sure that the most effective use is made of whatever scientific genius may create. But I wonder a little about two things.

First, is there really any need for Canadians to feel inferior to any other country when it comes to comparing research achievements, bearing in mind the varying state of development and the different kind of problems we are facing? Secondly, if Canadian scientists are making good progress - I shall make this point shortly - and we are sharing these results with other countries should we really feel that it is not good for "the spirit and intellect" of Canada to benefit from research and development work done outside our borders?

Progress of Canadian Industrial Research

I hope you will bear with me if for the next few minutes I draw for you a sketch of some of the major achievements in the industrial research field made in Canada in recent years. In considering these achievements, let us bear in mind that Canada is a country with a population one-quarter that of the United Kingdom and less than one-tenth that of the United States. Against two centuries of United Kingdom industrial history and one century of phenomenal economic growth in the United States, Canada's industrial development is of comparatively recent vintage.

In the highly competitive forest products industry greater efficiency and less waste have resulted from the intensive research that has been carried on in Canada in the last quarter-century. A number of basic changes have taken place in the methods of bleaching pulp and these developments have not only increased the efficiency of operations but have resulted in such new products as vanillin, yeast and industrial alcohol from the sulphite liquor, and certain plastics from the lignin. Considerable attention has been given to improving forest-operation practices and to finding means of utilizing the waste products. There has been a great improvement in logging and lumbering methods as well as mill processes, and much of what was formerly waste material is now being used to advantage. Two pulp mills in British Columbia are now operating solely on waste products of other phases of forest operations and other similar mills are planned. A large number of uses for saw-mill waste have been found also.

The mining industry in Canada has benefited greatly from research and owes much of its present prosperity to the improved processes and to the new uses for its products that have come from industrial research. For example: when the whole nickel industry faced a grave situation after the First World War (the chief use of nickel at that time was for the manufacture of armaments, and disarmament was the order of the day) research developed new alloys with important commercial use and put the nickel industry on a sound peacetime basis. The recovery of selenium as a by-product of the smelting of certain copper ores away back in 1931 has become an important industry itself and has made Canada a major producer of this element. Sulphuric acid for use in making fertilizer was first produced from waste smelter-gases some years ago and a new plant to produce liquid sulphur dioxide for use in the pulp and paper industry from smelter gases of the Copper Cliff refinery is being built at present. A process of electrolysis developed at the Trail smelter some time ago enabled zinc to be produced at a lower cost while a method of selective flotation developed to handle the complex lead-zinc ore of the Sullivan Mine was so successful that its use is now widespread in the concentration of similar ores.

A separation process developed jointly by the Federal Department of Mines and Technical Surveys, the National Research Council and the Eldorado Gold Mines Company made possible the development of Canada's radium industry. Work done in the laboratories of the Federal Bureau of Mines led directly to the establishment of the mineral wool industry in Canada, which, in 1951, comprised 14 plants, provided employment for about 1,000 persons and produced goods valued at \$11 million. This bureau also developed a process for recovering magnesia and hydrated lime from mineral deposits at Wakefield, Quebec, which resulted in the establishment of a plant there to produce these materials for fertilizer and chemical uses. Research found a way of obtaining magnesium from Canada's abundant supplies of dolomite, thus paving the way for a commercial development. More recently, the Department of Mines and Technical Surveys, has devised processes for using a special shale in the manufacture of building blocks and for using a local silica deposit in the making of glass. In both cases commercial development will probably follow.

Many of the chemicals now being produced in Canada or scheduled for production in the near future are the direct results of industrial research. For example, the \$1-3/4 million lignosol plant at Quebec City opened last June is the result of the discovery of a process to produce lignosol - which is used as a soil stabilizer, a binder and a plasticizer - from the spent sulphite-liquor

of the pulp and paper industry. Another example is the \$35 million titanium-dioxide industry recently established at Sorel to extract titanium-dioxide slag and iron from the ilmenite deposits near Allard Lake. Although titanium metal itself - owing to its light weight and great strength - has a very large market potential, no really good process is available at present for extracting it from ilmenite. However, large expenditures have already been made in an attempt to find such a method and good progress has been achieved. If and when a efficient commercial process is discovered, the value of the Allard Lake deposits will be immensely enhanced. New products have also been derived from phosphoric acid, acetylene and petroleum, and plants under construction will produce many others. The development of such important Canadian industries as synthetic rubber, plastic and nylon and synthetic textiles was initially largely based on foreign research. But now Canadians are playing their full part in the further development of these fields.

The Atomic Energy pile at Chalk River is making a substantial contribution to industrial research with its pile-produced isotopes. You have all heard about the "cobalt bomb" and its contribution to the fight against cancer. Canada is in the forefront of research into the medical applications of atomic energy. In fact, our country is the only nation in the world now manufacturing cobalt bombs on a commercial scale. We are not keeping these discoveries for our own exclusive use. One of the first cobalt bombs we produce will go to the States, and as more become available we should be able to meet some of the many requests that have come to Canada from all over the world. There are many other Canadian contributions to medical science, foremost, perhaps, being the discovery of insulin.

Research carried out by the National Research Council is helping Canada to maintain her leading position in the production of electronic equipment, as in many other fields. A compact and cheap radar set suitable for the use of small vessels has been developed by the Council and is being manufactured in Canada under license by the R.C.A. Victor Co. The development of a simple and inexpensive micro-wave aid to navigation intended for ships too small to have their own radar was announced recently by the Council and is expected to be produced commercially also.

Now these are just some of the things that have been done in Canada. They justify us in saying, I believe, that Canadian scientists have fulfilled remarkably well the trust put in them. The point I want to emphasize has been put very well by Dr. O. M. Solandt, the Chairman of the Defence Research Board: "Experience has shown that we in Canada do first class research and development in almost any field, provided we limit the scope of the job to the scale of our resources." (1)

The Growing Interchange of Industrial Research

To turn now to the second question I raised concerning Canada's dependence on foreign research: does it really sap our own initiative and sense of national achievement to have the benefit of research done elsewhere?

(1) Address to the Professional Institute of the Public Service of Canada, Ottawa, March 22, 1952.

Of course, it is true that in the early days of Canadian development, most firms depended on European industry for their basic information to improve production methods and produce new commodities. Later this dependence shifted to the United States, which, after the turn of the century, made particularly rapid strides in the field of scientific discoveries and broadly organized industrial research. But the situation in Canada has been undergoing a rapid change. As my Minister, Mr. Howe, put it only recently: "In the last twenty or thirty years, and in particular since the last War, Canadian industry has been largely developed, until we have become one of the leading industrial nations of the world. Along with this has come the gradual development of Canadian industrial research. As a result we now have a research effort in this country of no mean proportions." These remarks were part of a welcoming address which Mr. Howe offered to an O.E.E.C. mission interested in Canadian industrial development and progress in Canadian research. Apparently Europeans are more keenly aware of Canadian progress than are Canadians themselves. In welcoming the Mission to Canada, Mr. Howe emphasized the reciprocal character of industrial research when he said: "It is a pleasure...to try to show you that we now have something to offer to you in return for the information which we have received from Europe over the years." (1)

It seems to me that the benefits we are deriving from industrial research carried out abroad are in a category similar to that of the advantages that accrue to us from the inflow of foreign capital. The latter speeds up our industrial development to a greater extent than is possible with our own resources. But the investing country also benefits through larger dividend receipts and greater exports to us. The same is true for research. Canadian firms are paying royalties, results of Canadian scientific work go to other countries, and when foreign research makes possible more efficient extraction of Canadian resources, these become available to other countries in increasing quantities and at lower prices than would otherwise be possible.

This is the point I want to make - if we welcome foreign industries to Canada, why not also welcome the large amount of scientific information and technical "know-how" that these firms are able to bring with them and draw on in the future? As long as Canadians concentrate on problems that are most appropriate to their own resources, climate and needs, there will be forthcoming a continuous flow of scientific information of the highest calibre. Canadians will gladly continue to share with other countries the increasing contribution to knowledge which their distinguished scientists are making. A healthy interchange of scientific information and the benefits from applied research is already one of the features of our international relations and there are signs pointing to further growth in this interchange.

Canadian Problems Relating to Industrial Research

What I am saying then is that perhaps the time has come for Canadian research workers to stop playing the wallflower. So much has been achieved that it has become increasingly difficult to support the notion that Canadian development depends largely

(1) At a reception given to the O.E.E.C. mission by the National Research Council, Ottawa, May 27, 1952.

on help from abroad. In making this point I will be the first to admit that Canadian industry and Canadian research workers are confronted with many problems that are not easily solved. Many of our industries are small-scale and do not have the means to do the necessary research and laboratory work individually and independently. Where branch plants are involved, served by the research organization of their parent companies, insufficient attention is frequently given to specific Canadian needs. Many of our scientists are finding that employment opportunities for persons with their abilities are unsatisfactory at home and so prefer to move on to greener fields. The government may not have done enough to encourage more industrial research in Canada. If that is the case, what should be done? But it might be more constructive to find answers to such specific problems rather than to continue bemoaning our dependence on foreign research and development work.

Economic Research and Market Analysis

Now I have dealt largely with research in the physical and natural sciences. I shall be brief in talking about economic investigations and market research, for I dealt with part of this subject when I spoke to you last two years ago.

Scientific discoveries by themselves have little economic value. It is only through their application to meet human wants that scientific discoveries achieve economic significance. Economic research and market analysis then are designed to explore benefits that might accrue to an individual, a business firm or the nation from the adoption of new production techniques, the use of new materials, and the expansion of markets for existing commodities.

There has been a growing recognition in the last three decades or so that economic analysis and market investigations can make a significant contribution to industrial expansion. The shock of the depression of the 'thirties' made people ask: "Why is this happening to us and what can we do about it?" Almost overnight, people started seeking the advice of economists, statisticians and other business analysts.

The Second World War posed new problems of maximizing our resources while at the same time minimizing the dislocations which were the inevitable consequence of large-scale military operations. The task led to the Federal Government's employing the largest number of economists ever assembled in the public service. The end of the War saw an exodus of many of these men, some going back to universities, some joining international organizations but most taking up positions with business. This move was facilitated by the growing realization of industry that running a modern business in an efficient and far-sighted manner was getting to be a more and more complex operation requiring more than engineering skill and a sixth sense that makes for business success. What was needed was professional people who could interpret to business the state of the economy, its problems and its course. Frequently a businessman might not accept professional advice, preferring to trust his sixth sense. But often he would find that by discussing problems with his professional adviser he was better able to make up his own mind on the course to take. As with physical and natural scientists, only large firms in Canada are able to employ professional economists and market analysts. But many firms have been able to get easy access to professional advice through either their trade association or business organization or from firms providing a professional service or through governments.

Governments and Economic Research

And this brings me to the concluding part of my remarks. The Federal Government, through its Bureau of Statistics, has been making available comprehensive statistical information on the operations of Canadian industries and the growth of domestic as well as foreign markets. We of the Department of Trade and Commerce, in carrying on the work of the former Department of Reconstruction and Supply, have done and continue to do a certain amount of work analysing economic trends in Canada and assessing what they may mean for business in general and for government policy formulation in particular. While Trade and Commerce acts as a service agency in this respect, many other government departments do important work in specific fields. You have just to look at the Budget White Papers, the Monthly Statistical Summary of the Bank of Canada, the quarterly issues of "Housing in Canada", prepared by Central Mortgage and Housing Corporation, and the various publications of the Departments of Labour, Agriculture, Fisheries, Resources and Development and Mines and Technical Surveys, to realize that Canada has come a long way in making available to the public both basic data and the results of economic analysis.

A most encouraging feature has been the development of statistical and analytical agencies in various provincial governments. Greater interest is now taken in the nature of the economic development taking place in each province and what it means to the people living in each region, city or area.

Research in the Service of Provincial Development

While economic and statistical units have been established in provincial governments in more recent years, organized research in the physical and natural sciences on a provincial level dates back much further. The first such organization was the Research Council of Alberta which was set up in 1921. It was followed by the Ontario Research Foundation established in 1928. Other provinces followed the example, and now every province either has a formal organization or takes an interest in industrial research in conjunction with universities and business groups.

The creation of provincial facilities in the field of industrial research has made it easier for many of you concerned with industrial development to provide the service you felt was needed to assist local industrialists and foreign manufacturers trying to establish a plant in your region. You learned that bright phrases and liberal use of expense allowances are not enough to persuade a man to locate his industry in your province. You realized pretty quickly that what businessmen wanted were facts, not just one or two but a multitude, which only a well organized group with wide contacts can provide by drawing on its own resources and those of others. Partly by building up such organizations in your own units and partly by getting help from other departments in your governments of the Federal Government, from municipalities, from institutions and business groups, most of you have reached the stage where you can provide the service that the public appears to expect and in fact gets from its provincial governments. Thus, as I said at the beginning, you have come a long way. The days have gone when you were simply trying to sell a commodity, and today you are providing a highly skilled service. Yours is a function which has been progressively modified to meet efficiently the changing needs of Canadian industry. This is indeed true public service.