

national research newsletter council of canada

INDUSTRY RESEARCH UNIVERSITY

VOL. 2, No. 2

SUMMER, 1970

The Use of Scientific Research

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Research, whether it is carried out in a university, industrial or government laboratory, is of very little value until it has been applied for the benefit of mankind or for a better understanding of his world. The real problem in Canada is that many of the research results being produced are not being utilized for economic benefit.

How should we ensure the proper use of research results? In industry there is an economic incentive and a need to make use of research by taking the required steps from the conception of an idea or invention, through the research and development engineering stages, to commercialization.

This innovation process results in goods and services to fulfill human needs and wants, a profit for the company concerned, and money and jobs for Canada and its citizens through exports and new tax revenues.

In academic laboratories the research work usually ends with a publication of the knowledge acquired. Knowledge for the sake of knowledge is desirable from a cultural point of view, but is only the first step in the innovation process and may have little practical use. Therefore, the real question is how much can Canada, a small country by international standards, afford to spend on knowledge which it makes available to the people of the world, but may not be able to utilize itself?

Government research is a special case which lies somewhere between university and industrial research. The mission-oriented research laboratories, supported financially by various government departments, are becoming more successful. They must continue to maintain good liaison with industry if their research is to be put to profitable uses for the country.

Some management people in Canada, who are responsible for allocating funds for research work,

have a lack of belief in research and do not understand why it takes so long to do, why scientists find it difficult to set deadlines and meet them, and why research is so expensive. On the other hand, many scientists have not yet learned how to explain to these important people the nature of the research process and the real value of their research efforts.

Scientists must try to develop a language that everybody can understand. They must establish a "selling-buying" relationship between themselves and the people who need the results of research. This will lead to improved communications. At present, the only language that is understood by everyone is "dollars and cents". In industrial research, expenditures are explained by means of a cost-benefit balance sheet. In government and university research this is difficult, but there is still a need to express research results in terms of value to the people who pay for it. One way to do this is to establish clear-cut goals for research.

Before we can establish research goals, however, it is necessary for society to document real and clear goals that contain the main aspirations of most Canadians. Once these goals have been established, then the contributions made by each branch of knowledge (science, law, economics, sociology, etc.) towards attaining them can be set. Obviously, science then becomes an effective tool in the pursuit of national, academic and industrial goals.

To my knowledge Canada, as a country, has never documented clear, specific national goals. The Economic Council of Canada, in its First Annual Review in 1964, did outline five basic social and

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economic goals for the Canadian economy to 1970 and the Science Council of Canada, in its Report No. 4, issued in October 1968, listed six national goals "to enable the Council to construct sound policy for the use of science in Canada".

If the citizens of Canada believe that the goals suggested by the Economic and Science Councils of Canada are worth attaining in the next five years, then all scientists and engineers in Canada will have plenty of work to do. It is not important in which type of laboratory or place Canadians carry out their research work, but it must be done and done well by competent scientists and engineers. Also, the results from this high quality research must be utilized, if Canada is to attain its goals.

In an industrial company, corporate and operating department goals, strategies, plans and priorities must be clearly outlined before its research department can establish specific goals, strategies, and project priorities and costs. It is not sufficient for a company to say that its major goal is "to make a profit". Such general or vague statements are of little value, especially to its research department. Lack of specific goals in some companies is why it has been said that corporate life is sometimes strewn with vague purposes, pious hopes, amorphous objectives and simple omissions.

Many universities in Canada are trying to answer the question "What should be our main academic goals?" There is general agreement that universities should concern themselves with higher education, but are not their real goals to maintain and expand knowledge, to develop their students, and to service the needs of society by helping students acquire skills and do research useful to society? If these are their general goals, then obviously they need clarification and expansion. The amount of scientific research to be done in Canadian universities will depend not only on their goals, but on how much they can afford to do. This is also true for a company and a country.

It is unfortunate that the lay public and some academic researchers are under the misconception that important discoveries and so-called good "basic" scientific research only emanate from universities and other pure research institutes, while industrial laboratories are mainly concerned with process and product research of a low grade, often called "applied" research. This may have been true 50 years ago, but it is not so today. Industrial laboratories are continuing to make major contributions in all fields of science, as

well as technology. In fact, in many industrial areas, scientific research follows rather than leads the development effort.

Canada must develop techniques for improving collaboration between its various types of research laboratories. I am convinced that better results and value from scientific research in the seventies can be obtained, once closer and more intensified relations and communications are established between these differently motivated approaches to research. Let us stop any sterile and futile quibbling as to which type of laboratory has made the greatest contribution towards solving our important scientific problems, because each approach compliments the other. Let us conscientiously work towards creating an atmosphere which will promote better understanding between the scientists in industry, government and university laboratories and the general public.

It is generally accepted that creative people are the ones who made research successful. This is only partly true. There is another, much smaller, group of people in research who are responsible for directing it and for encouraging the use of the results by others. These are the research directors or managers. Canada is short of people who can manage research efficiently, productively and profitably.

The development of scientists and engineers into good research managers, who can direct major research expenditures properly, is a job which industrial, government and university laboratories must undertake. The means used cannot be discussed in a short paper of this nature, except to say that the characteristics of a good research manager must be: breadth, leadership ability, good human relations, excellent judgment, an economic understanding of the cost and value of research, ability to determine whether the research being done is important and timely, and salesmanship.

This short paper has attempted to look at scientific research in Canada from an objective point of view. What most research people want is more money to carry out their work. What the people who pay for research want is more value and positive achievements for their money. Scientists must educate the public and themselves to the fact that research is not just a popular symbol of progress, or that it is being done for the sole interest of the scientist. It is an important and effective tool for assisting universities, industry and our country to attain their goals for the good of the people of Canada.