

well as a past president of the National Research Council, all of these gentlemen acting, of course, as individuals, and not in their corporate capacities.

I have in these notes covered six points that I wanted to make. Whether you discuss them as I go through them one by one, or when I am finished, is completely open. I do not mind a bit. But, I shall start with the first point.

1. The Place of Research in the Innovation Process:

The basic objective of a science policy, and the reason for the Government's interest in it, I assume, is to provide a stimulant to economic growth with all that such growth makes possible for the country. Of itself, research does very little to enhance economic growth. It is only when the results of successful research are actually translated into better products and things, or better ways of producing things, that the real benefits are felt. So, it seems to me that the first fundamental in approaching the subject is to get a perspective of the part that research plays in the whole process of technological innovation or technological development—sometimes called the total innovation process—from which process comes the real contribution to our welfare.

First of all, it can be demonstrated that the countries of the world that show the best economic growth rates, by whatever form of measurement, are the countries that by one means or another direct an important effort into research and development. Japan is, perhaps, an exception, but it seems to me that Japan is so different in so many ways that I do not think it spoils the general argument. That is not to say that all one has to do is to devote effort to research, and something good is bound to come out of it, but a sound research effort seems to be the *sine qua non* to a satisfactory economic growth.

But, it takes much more than just a research effort. A recent study in the United States entitled "Technological Innovation—Its Environment and Management" published by the United States Department of Commerce in 1967, at page 9, gives the following break-

down of the typical costs involved in successful product innovation:

Research and Development ..	5%-10%
Engineering and Design	10%-20%
Tooling, Manufacturing Engineering (getting ready for manufacturing)	40%-60%
Manufacturing Start-up Expense	5%-15%
Marketing Start-up Expense ..	10%-25%

In other words, research and development as such comprises between 5 and 10 per cent of the total cost of bringing in a new product.

The study then goes on to say:

We need to bear in mind that the path between an invention (or idea) and the market place is a hazardous venture, replete with obstacles and substantial risks. It is ordinarily a very costly, time-consuming and difficult task that the innovator faces...

It seems to me that this must be continuously borne in mind in framing a national scientific and research policy. If the subject is approached from the point of view that successful research is of itself the objective, we are likely to be disappointed in the end results. Presumably we in Canada are not putting hundreds of millions of dollars into our atomic research programmes just for the sake of increasing our basic knowledge. We must plan to develop something from it that will be of use to us in our daily lives, and, indeed, in our ability to trade with the rest of the world. I am not here talking of the original research, or its early development. But once the basic work is done, the further development must be toward some economically viable objective, and the carrying through to that stage is the really expensive part of the process. It is also the part of the process that most importantly calls for the setting of priorities—the balancing of the expected costs against the economic viability of the expected results. I shall come to the need for priorities in the next section of this memorandum, but I would like to add a further comment about the relationship between the early stages of the innovation process.

Let me draw your attention to one aspect of some of the regulations that have been set up in the past concerning assistance for industrial research. It is, of course, necessary to define what is meant by industrial research, and various and differing definitions are found in