12.7 National expenditures on R&D

The activity of research and development (R&D) is defined as creative work undertaken on a systematic basis to increase the stock of scientific and technical knowledge and to use this knowledge in new applications. Expenditures on R&D are an important indicator of the effort devoted to creative activity in science and technology. This effort is associated with the ability to develop new products and processes, necessary for economic and industrial growth. This is particularly true of R&D in the business enterprise sector but the level of R&D expenditures in other sectors is also useful as an indicator of Canada's contribution to world science, of the intellectual activity in Canadian institutions, and of the search for solutions to Canadian problems.

The GERD, or "Gross Domestic Expenditure on Research and Development", total R&D expenditures represent all R&D performed in a country's national territory during a given year. The GERD includes R&D performed within a country and funded from abroad but excludes payments sent abroad for R&D performed by others. It is calculated by adding together the intramural expenditures reported by institutions which performed R&D, grouped into appropriate sectors and sub-sectors.

Research and development expenditures in 1988 were expected to amount to about $8 billion, an increase between 4% and 5% over the estimated total for 1987. The revised estimate for 1987, $7.6 billion, represented an increase of 6% over 1986.

In Table 12.8, GERD statistics are presented in two forms. Besides its value in current dollars, the GERD is compared to Gross Domestic Product (GDP) from 1971. The GERD/GDP ratio is used to show the R&D effort in proportion to total economic activity. The figures for 1987 and 1988 are estimates and may be expected to be revised.

The GERD is made up, as noted above, from data supplied by the institutions performing R&D, grouped into sectors and sub-sectors. One of the questions asked of the performers is the source of funds for the R&D they carry out. By combining the responses of the performers, a matrix can be formed of expenditures by performing and funding sectors.

A shift in activity between different sectors of the economy is apparent. The federal government has become less important both as a performer and as a source of funds, while the importance of the business sector in both areas has grown.

12.8 Research and development in Canadian industry

While R&D is carried out by other sectors, such as the government and universities, industrial R&D is most clearly linked to technological innovation and therefore, to economic growth. Canada does not rely only on domestic R&D for new ideas and innovation. A great deal of information comes from abroad in the form of information embodied in new machinery and equipment, in the research and developments of scientists and engineers, in scientific and technical journals and in designs, drawings, tooling and manufacturing specifications.

In many ways it is more efficient to acquire the results of R&D performed by others since the cost of securing such information is usually less than the cost of duplicating it. However, some indigenous R&D is necessary not only to ensure that new inventions are appropriate to Canadian manufacturing and marketing conditions, but also to ensure that foreign R&D can be properly assimilated into our production processes. Domestic performance of R&D is, therefore, necessary, even to become effective imitators and adaptors.

Of the five R&D performing sectors: federal government; provincial government; business enterprise; higher education; and private non-profit, the business enterprise sector is the one identified with industrial R&D expenditure. It includes not only private enterprises, such as Northern Telecom, but also public enterprises such as Ontario Hydro and industrial research institutes such as the Pulp and Paper Research Institute of Canada.

Total expenditures on research and development in Canadian industry were expected to reach their highest level ever in 1988, at almost $4.5 billion or 55% of all Gross Domestic Expenditure on Research and Development (GERD). The business enterprise sector's participation (natural sciences and engineering only) in GERD has increased from 33% in 1971 to 53% in 1986, whereas the federal government and higher education shares fell correspondingly from 29% to 20% and 34% to 23%, respectively.

Since R&D is generally not productive in the short term, it can be considered as a burden on industry rather than a direct production cost. The simplest way of measuring the effort that industry is making is to monitor the amount of self-financed R&D. In 1986, this sector funded 41% of GERD, up from 27% in 1971. Canadian industry has replaced the federal government as the major funder of R&D in Canada.