

NEW WORLD

Elusive Pulse of US Science

by our Washington Correspondent

SCIENTISTS throughout the United States, who have been complaining bitterly in the past few years about budgetary cutbacks and unemployment, need little reminding of the fact that money for science is relatively more scarce now than it was in the mid-1960s. The figures speak for themselves. But how true are the dire predictions of a decline in science? And, in particular, has the financial squeeze seriously damaged the fabric and overall quality of science in the United States?

The National Science Board, the 25-member council which provides policy direction for the National Science Foundation, has been trying for the past year to develop the tools with which to take the pulse of the scientific effort in the United States, and to pinpoint warning signals which could indicate whether its health is in decline. The preliminary fruits of the endeavour, published last week*, provide a mine of information, and bring out some potentially alarming trends. But the board is the first to admit that there is little in its analysis so far that can be used to measure the overall quality and effectiveness of the scientific and technological effort.

The problem is, as Dr Herbert E. Carter, chairman of the National Science Board, points out in a covering letter to President Nixon, that the paucity of data has limited the report chiefly to dealing with resources—funds, manpower and equipment—and there are few measures of outputs from these resources. The budget makers in the Nixon administration, who like to run the country along the lines of a giant corporation are, however, more concerned with productivity and they are thus more likely to be influenced by figures that show that the output of US science has declined as a result of funding cutbacks since 1968.

Nevertheless, as far as resources are concerned, the board notes the following: ● Although total expenditures on science and technology show a steady increase from 1958 to 1972, when inflation is taken into account, there was a 6% decline between 1968 and 1971. Moreover, expressed as a proportion of the gross national product, total outlays on research and development dropped from 3.0% in 1964 to 2.5% in 1972.

● The most marked decline in spending after 1968 was in the federal govern-

**Science Indicators 1972*. \$3.00. Available from the Government Printing Office, Washington DC 20402. Stock no. 3800-00146.

ment's science budget which, if inflation is taken into account, shrunk by 12% between 1968 and 1972. The chief drop was in expenditures for space research, and the combined total for defence and space declined from 86% of the federal science budget in 1963 to a mere 73% in 1972.

● The numbers of active scientists and engineers in the US grew by about 50% between 1960 and 1971, reaching some 1.75 million. Unemployment, however, increased steadily after 1969, peaked at about 2.6 and 2.9% for scientists and engineers respectively in early 1971, and began to decline again in 1972.

The National Science Board also took a look at what has been happening in other countries, but found little coherent pattern. For example, spending on research and development expressed as a proportion of gross national product declined in France and the UK between 1963 and 1971, but increased in the USSR, Japan and West Germany. As for the number of scientists and engineers engaged in research and development per 10,000 population, the proportion declined in the United States after 1969, but continued to increase in the USSR, France and West Germany—by 1971, the number had reached 37 in the USSR, 25 in the United States and Japan, 15 in West Germany and 12 in France.

In an attempt to measure whether these various trends have affected the international standing of United States science, the board examined the volume of literature produced by United States scientists in eight scientific disciplines

(physics and geophysics, chemistry and metallurgy, systemic biology, molecular biology, mathematics, engineering, psychology, and economics). In seven of the eight disciplines, the board found that more literature is produced by scientists in the United States than in any other major developed country; the one exception was in chemistry and metallurgy, in which the USSR came top of the pile. Moreover, the survey also showed that in every field except for systematic biology and mathematics, United States publications receive more citations on average than those produced in other countries. For the two exceptions, UK scientists led the field, and in fact, they were also runners up to the United States in the other six areas of science.

The board intends to expand and refine the indicators in the next few years, and hopes that they will "assist in setting priorities for the (scientific) enterprise, in allocating resources for its functions and in guiding it towards needed change and new opportunities". Nevertheless, the board is quick to point out that "quantitative indicators, no matter how useful, are not a substitute for the experience and judgment of the scientific community". In view of that comment, it is perhaps worth noting that the report was put together in January, when the new arrangements for science policy had been announced, the President's Science Advisory Committee had been scrapped, and there was no provision for formal, independent scientific advice from the community to the makers of United States science policy.

RESEARCH SPENDING

More is Less

by our Washington Correspondent

THE latest set of figures on the federal government's spending on research and development, published last week by the National Science Foundation, confirm and extend the trends noted in the report of the National Science Board (see accompanying article). Based on estimates for the 1973 fiscal year and projected outlays in 1974, the figures show that when inflation is taken into account, the total science budget has remained static for the past 3 years. And, in spite of assurances to the contrary by Administration officials, there has been a marked shift in spending away from basic research towards applied research and development.

The figures show that basic research

received an increase of 2.7% in 1973 (a decrease of 1.0% if inflation is taken into account), and an absolute decrease of 2.0% is estimated for 1974, when the total is expected to be \$2,400 million. Development, on the other hand, is expected to get a 3% increase in 1974 and applied research an increase of about 5%.

The NSF's figures also show that the share of the total federal budget devoted to research and development dropped from 12.6% in 1965 to 7.2% in 1972, and has continued to decline to an expected 6.5% in 1974. Another trend which was noted by the National Science Board and which has been extended by the later NSF figures is that the greatest increases in spending have been devoted to the life sciences, which in 1973 and 1974 for the first time ever received more federal funds than engineering.