22 April 1966, Volume 152, Number 3721 **SCIENCE**

EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Phone: 202-387-7171. Cable: Advancesci, Washington. Copies of "Instructions for Contributors" can be obtained from the editorial office. ADVERTISING CORRESPONDENCE: Rm. 1740, 11 W. 42 St., New York, N.Y. 10036. Phone: 212-PE 6-1858.

Cost of Research

The cost of doing research has climbed uninterruptedly since 1940, but the rate of increase has recently slackened. The average increase was about 7 percent a year from 1940 through 1955, and 8 percent a year from 1956 to 1960. Since 1961 it has averaged about 4 percent a year. These rates are averages derived from records kept by 17 research organizations which represent, in approximately equal numbers, industrial, private nonprofit, university-contract, and federal organizations. They take account of salary increases, the greater cost of increasingly expensive and powerful equipment, and all other costs (except capital expenditures) involved in hiring a research scientist or engineer and providing him with what he needs to get on with his research. The data are reported in an updated version* of a study by Ellis A. Johnson and Helen S. Milton of the Operations Research Office (now the Research Analysis Corporation) which was the subject of a *Science* editorial on 26 August 1960.

The unit used in the calculations is the "technical man," who is defined as "the professional scientist or engineer, together with his supporting technical, administrative, and housekeeping staffs, and his machines and equipment, i.e., the man plus the overhead costs." If 1950 is taken as a base year and the cost of one "technical man" in that year is set at 100, the cost of a technical man was 138 in 1955, 201 in 1960, and 242 in 1965.

These index numbers facilitate comparisons of the amount of research effort that different amounts of money purchased in different years. For example, a dollar spent on research in 1965 purchased 82 percent as much technical effort as a dollar spent in 1960, or 57 percent as much as one spent in 1955, or 41 percent as much as one spent in 1950. In 1965 the nation's expenditures for research and development were 8 or 9 times as great as in 1950, but, according to the cost-of-research index, the research effort was only 3 to 4 times as great. The level of effort may now have reached a temporary plateau. The budgeted increase of 5 percent, from 1966 to 1967, in federal expenditures for research is barely more than the 4 percent needed to keep pace with the current rate of increase in research costs, and the budgeted increase for all federally supported research and development will be less than enough to match the increased cost.

The cost-of-research index provides a useful refinement in translating dollar units into units of effort. But research effort measured in this fashion should not be equated with research accomplishment. The 1965 technical man with a computer cost more, and probably accomplished more, than the 1955 technical man with a desk calculator. For some kinds of work with some kinds of equipment, it would be possible to make reasonable estimates of the different costs and accomplishments. These estimates, like the cost-of-research index, would help to focus attention on some of the more difficult judgments that will have to be faced. What are the comparative scientific, practical, and social values of different kinds of research, in different fields, at different stages in the development of a research area, and with different degrees of closeness of relationship to useful application or to the formulation of more penetrating scientific generalizations? There is much need for thoughtful judgment in assessing what we are accomplishing and in deciding what we should try to accomplish.—DAEL WOLFLE

* Helen S. Milton, "Cost-of-Research Index, 1920–1965," *Technical Paper RAC-TP-209*, Research Analysis Corporation, McLean, Virginia (March 1966).