

Government-University Financial Arrangements for Research

A change is essential.

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The U.S. government, through its official spokesmen and offices, has proclaimed in many instances the importance of research in colleges and universities to the country's security, progress, and prosperity. The estimated obligation to universities and colleges for research and development (R & D) was \$2.4 billion in fiscal 1971 (1). There is no doubt that these funds aid colleges and universities in fulfilling one of their major objectives for the advancement of knowledge. However, government practices and policies covering the spending of these funds require a diversion of institutional resources from other important educational obligations, including creative and far-ranging research that is of no immediate interest to the government. Little encouragement is provided for investments in badly needed buildings and equipment. Probably no other segment of the American economy would have agreed to undertake work for the government on these terms. Colleges and universities have been impelled by their devotion to research and public service, without regard to financial return.

Institutions of higher learning still have as a primary goal education and the dissemination of knowledge. But, as is well known, there are tremendous financial pressures on these institutions just to keep existing programs going. Many reports and conferences have emphasized the imperative need for improvements in the quality of education of those who must solve the increasingly difficult problems of this complex world. Yet the government's practices and policies, requiring colleges

and universities to share the costs of government-sponsored research, are a financial drain and detract from the achievement of these educational goals.

The Importance of Research in Universities and Colleges

The 1947 report to the President on science and public policy stated the importance of research in science and engineering (2).

The security and prosperity of the United States depend today, as never before, upon the rapid extension of scientific knowledge. So important, in fact, has this extension become to our country that it may reasonably be said to be a major factor in national survival.

Total expenditures for scientific R & D in the United States were expected to be approximately \$15.6 billion in 1970 to 1971, more than ten times the amount spent in 1947, and more than 40 times the amount spent in 1937. The importance of R & D for national security and defense hardly needs to be emphasized. Its contributions in such areas as the cure or prevention of disease and the improvement of agricultural methods and products are also well known. The implications of R & D and its impact on the national economy are perhaps less well known, but are fully as important.

For any nation, an effective program of R & D, unless it is to consist merely of the reorientation of facts and previously acquired knowledge into different patterns that may be interesting but hardly of great significance, must be based upon new knowledge and improved understanding of the world. Universities and colleges are the most important source of this kind of knowl-

edge. Among the many quotations that could be cited, the following, written in December 1958 by the President's Science Advisory Committee, is one of the most impressive (3).

Among public and private research institutions receiving Government support, those making the broadest contributions to society are the universities, traditional home of basic research. To a lesser extent they also make notable contributions to applied research and they provide a unique atmosphere for research. The teacher-scientist of the university is responsible for handing on scientific skills and knowledge from one generation to the next, and for nurturing new scientists and scientific ideas. Participation in research is an essential part of the education of scientists, and without vigorous university research the Nation's capacity to educate future scientists would certainly be reduced and the quality of scientists trained seriously impaired.

The importance of integrating research with education and the contributions that each makes to the other were emphasized by one of the eminent scientists of this century, the Russian physicist P. L. Kapitsa, who expressed his views on this subject some years ago (4).

As you grow older, only your young students can save you from a premature hardening of the brain. Each student working in his field is also a teacher. Who else teaches the teacher but his own pupils? Thanks to his experience, the teacher guides the work's direction, but in the final analysis the pupils teach the teacher—they deepen his knowledge and broaden his horizon. Without his disciples a scientist usually perishes very quickly as a creative unit; he ceases his forward movement. Never will I forget the words of my great teacher Rutherford. "Kapitsa," he used to say, "you know that only thanks to my students do I keep on feeling young." And as I myself approach my old age, I feel that being with young people must be that *modus vivendi* which safeguards you from fading and which guarantees a preservation of alertness in you, of your interest in everything new and front-rank in science. After all, conservatism in science is for a scientist worse than premature death; this is a brake on the development of science.

What has happened before and since the President's Science Advisory Committee report in December 1958 and a number of similar reports issued at about that time? The statistics in Table 1 are particularly pertinent with regard to R & D paid for by the federal government (5). These statistics seem to indicate that the glowing statements of the late 1950's were borne out by appropriations for research in subsequent

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Table 1. Recent trends in federal R & D (all dollars expressed in millions).

Year	R & D paid for by the federal government			Basic research paid for by the federal government		
	Total (\$)	To colleges* and universities (\$)	To colleges and universities (%)	Total (\$)	To colleges* and universities (\$)	To colleges and universities (%)
1953	2,759	259	9.4	234	106	45
1958	6,791	547	8.1	460	256	56
1963	11,219	1,290	11.5	1,310	769	59
1968	14,972	2,291	15.3	2,344	1,544	66
1971	14,735	2,275	15.4	2,450	1,545	63

* Includes funds paid to federally funded R & D centers administered by universities.

years until sometime around 1968, when a brake was suddenly applied. Today research, expressed in 1968 dollars, is probably worse off than it was then. Whether or not there will be a reversal is hard to predict, but one clear-cut fact has emerged—as federal dollars have leveled off, federal agencies have increased their pressures on institutions to *share* the costs of federally sponsored research. This comes at a time when many of these institutions are in dire financial straits.

On the one hand, a plethora of measures have been introduced in Congress over the last several years, each year with increasing vehemence, to help solve in general terms the financial problems of institutions of higher education. And there is no doubt that some kind of assistance is needed. On the other hand, the financial arrangements that the government offers when these institutions perform research of interest to some government mission are such that funds which might otherwise be used to solve the problems at which general federal assistance is aimed must be used instead to share costs in the government research project.

The problem has at least five important aspects, which, although closely interrelated, can be separately identified.

Mutuality of Values and Obligations

The estimated \$2.4 billion in federal obligations for R & D done by universities and colleges during 1970–71 are covered by agreements of various sorts between the government and the particular institutions involved. Some of these agreements are called grants, others are called contracts. However, no matter how these arrangements are designated, both the nation, as represented by its government, and the in-

stitution expect to receive something of value from the arrangement, and both assume obligations in connection with it. There is clearly a *quid pro quo*. In fact, many of the labored and unsound distinctions that have been made between grants and contracts for government-sponsored projects should be eliminated by the adoption of a new form of federal agreement, which would incorporate the better features of both grants and contracts and which is now under consideration by the Commission on Government Procurement (6).

What is the nature of the values received by the nation and its government? Obviously, when the government sponsors a search for knowledge, it does not expect the delivery of a concrete item or device upon completion of the work. The values that the nation and its government expect include reports and publications describing the research performed and the results achieved, to be additions to the country's knowledge and scientific and engineering strength. The government also expects a share of the talent and time of those members of the faculty and staff who will perform the research. It expects, as well, a share of the institution's management (which must recruit and retain a competent staff and provide the myriad services and the environment necessary for creative work), a share of the services used (ranging from machine shop to library assistance), and a share of the buildings and facilities needed for the research.

The obligations that the government assumes when it sponsors research include, obviously, payment of the funds agreed to when the contract or grant was awarded. However, another important obligation was the determination, before making the award, that the research would probably be worth the cost. No government agency can legitimately avoid this determination except

in those cases where the Congress has prescribed the distribution to be made (for example, funds distributed for agricultural research).

For the universities and colleges that accept government-sponsored research, the primary values include the opportunity and funds to pursue one of their basic and essential aims—namely, the advancement of knowledge. They may also expect that such research will assist, or at least not detract from, the fulfillment of two other primary aims—the education of students and the dissemination of knowledge. The institutions are obligated to provide the talent and time of those who will carry the work forward, management services, and the environment and facilities that make it possible. They are also obligated to comply with the terms and conditions of the contract or grant, to prepare reports and publications, and to disseminate the results.

To some people it seems improper, or perhaps even degrading, that the government should expect value in return for the money spent on research at a university—as if the university were a shoe manufacturer making and selling shoes. There is certainly a difference, and a significant difference, between a manufacturer selling a specific product to the government and a university performing research under a contract or grant from the government. However, the difference is not one of principle, but one that involves the nature of what the government, representing the nation, expects in return for its expenditure. This difference should be recognized, but it does not alter the fact that both parties expect to receive something of value and to assume obligations.

If the government expects, and should expect, that it and the nation will receive equivalent value from research it sponsors at universities and colleges, and if it fulfills its obligation to determine that the costs involved are commensurate with the value to be derived, why should it not be willing to pay these costs adequately and equitably?

Compulsory Cost Sharing

Many federal agencies have policies or practices that compel, or at least exert strong pressures on, educational institutions to share the costs—even those costs that are recognized by the

government—of federally financed research. This kind of cost sharing takes a variety of forms: the Office of Management and Budget has a widely implemented circular (7) on such cost sharing, and Congress has insisted on cost sharing in many cases. Particularly apparent are pressures exerted on institutions to make no charge for the time devoted to government-sponsored research by professors and other members of their faculties during the academic year, even though these individuals are generally the key idea men and leaders of the research. The Department of Health, Education, and Welfare and the National Science Foundation, the two federal agencies that sponsor a major share of the research in educational institutions and that, by their very nature, should be most understanding of these institutions' financial stringencies, probably account for the largest proportion of costs that institutions are unable to recover in connection with government-sponsored research.

Whatever the arguments in favor of required cost sharing or pressures for cost sharing, and many have been advanced, one or more of the following unhappy consequences is already apparent.

- 1) The quality of instruction has been degraded by diverting funds in order to share the costs of government-sponsored research.

- 2) Student tuitions have been increased to help balance the institution's budget.

- 3) The salary structure of the institution's faculty and staff has suffered as they, in effect, help subsidize the government.

- 4) Independent research that is not of immediate interest to the government—research that may be the lifeblood of future extensions of knowledge—has been curtailed.

- 5) There are fewer incentives and less money for the desperately needed expansion and modernization of university and college buildings and capital facilities.

In the final analysis, if the federal government is actually interested, as it professes to be, in the welfare of institutions of higher learning and the continuation of creative research by these institutions, one of the most important steps it could take to prove its interest would be to eliminate all requirements or pressures for cost sharing in government-sponsored research.

The Problem of Overhead

Overhead (more accurately called indirect costs) is frequently a dirty word to many who have to deal with sponsored research, even to many professors who do not understand the financial operations of their own institutions. The indirect costs of research are just as real, however, as any other costs. They must be paid from an institution's own funds, unless they are reimbursed. To explain these costs, a memorandum was prepared a number of years ago for circulation to the faculty of Princeton University (8):

The question as to which types of costs involved in any university—or for that matter, business enterprise—are treated as direct costs, and which ones as indirect expenses (or overhead) is answered almost completely by the methods used to account for all of the costs involved in operating the organization. Indirect expenses are those costs which are considered too difficult, or too costly, in terms of the necessary paper work and accounting required, to charge to any particular undertaking. They are therefore prorated to all undertakings on the basis of some equitable and agreed formula.

What kinds of costs are often treated as overhead rather than being billed directly to a particular research project? First, there are administrative costs, ranging a gamut from the amount of time a president or other officer must devote to the proper management of research obligations the institution has assumed, through costs for accounting and legal services (which are always more complicated when spending government funds), telephone and insurance expenses, on down to secretarial services for the letters and reports that must be written. Then there are operation and maintenance expenses—the light and power needed for experiments that frequently run night and day, water for the dehumidification required whenever complex electronics are involved, janitorial services, and so forth. A continually up-to-date library is essential in order that the researcher may build upon, rather than unnecessarily repeat, the work of others. Depreciation must also be included if worn-out or obsolete laboratories and equipment are to be replaced. There are also personnel benefits such as social security, retirement plans, medical assistance, and many others that educational institutions try to build up to at least partially offset the lower salaries they offer in comparison to other

kinds of organizations. All of these costs, and many more, are frequently charged as overhead; many of them, depending upon the accounting system used at a particular institution, are also charged directly, rather than through an overhead rate. Thus, the overhead rate of a particular institution bears little or no relation to the total costs of any research project it performs, but is merely a reflection of the method it uses to allocate costs to research. Far too many scientists and representatives of government agencies do not or cannot understand this fact. Pressures for reductions in computed and government-audited overhead rates are just one more form of cost sharing.

Before World War II, there was little need for, and therefore practically no attention devoted to, accounting procedures to determine the indirect costs of research in educational institutions. During the war, when many universities undertook vital R & D, some rough approximations were developed to reimburse universities for indirect costs. When it became evident after the war that government-sponsored research would continue on a significant scale at universities and colleges, the first formal document setting forth principles for the determination of overhead was negotiated. Commonly called "The Blue Book" (9), this document has undergone several revisions in the last 24 years, with the Blue Book being replaced by Bureau of the Budget circular No. A-21 in 1958 (10) and revisions being made as recently as last year. By and large, circular No. A-21 is now a reasonable document to work with. However, there are still two major inequities in it that are worthy of discussion.

Capital Facilities for Science

In order that science and technology may continue to advance, it is essential that expanded capital facilities and new types of capital facilities be provided. But it is widely recognized that the construction of such facilities at universities and colleges is lagging behind the needs and is handicapping the national scientific effort.

Direct financing of capital facilities by the government is one obvious solution, but, although some direct financing has been done, the amounts made available for it are decreasing. Furthermore, there are many problems involved, in-

cluding the need for legislation and special appropriations, the widely held concept that recipients of federal funds for capital facilities must provide equal or more than equal matching amounts from their own resources, the red tape and restrictive requirements involved in obtaining and spending the money, and so forth.

An additional means of assisting with the provision of capital facilities, and one that is also more consistent with the American philosophy of individual initiative, is the adoption of policies to provide universities and colleges with greater incentives for financing some of their own facilities. This could be done by revising the principles for determination of costs under government research contracts and grants.

Both the Blue Book and circular A-21 provide inadequate allowances for depreciation of capital facilities.

The so-called "use charges" are based on the assumption that laboratory buildings have a useful life of 50 years, and equipment 15 years. Even during World War II, when institutions had much less awareness of or interest in recovering costs, government research contracts provided for a use charge on buildings of 4 percent per year, compared with today's 2 percent.

Nevertheless, the government's cost principles do at least recognize depreciation. They do not recognize, nor reimburse for, interest costs, so that universities must absorb as a loss either the interest they would otherwise have earned on their own funds that were advanced to pay for capital facilities, or the interest they actually pay on funds borrowed to construct such facilities. Yet the trend of government policies in the last several years has been in the direction of giving loans, either

direct or guaranteed, for capital facilities instead of granting outright all or part of the capital required; therefore, some provision must be made for the payment of interest.

As an example of the inequity of present government policies with regard to depreciation rates and interest costs, a university can, if it rents a large computer to assist with government-sponsored research, charge the full rent against the contracts or grants involved. The rent paid to the company furnishing the computer includes a much higher allowance for depreciation than the university itself could obtain and also includes a profit that compensates the company not only for the funds invested in the computer, but also for the business risks it incurs. On the other hand, if the university buys a computer, it will receive a much lower allowance for depreciation and no recognition whatsoever of the income it might have realized had the funds to purchase the computer been invested.

What happens when the shoe is on the other foot? What does the government consider a reasonable allowance for the use of its facilities? Certain so-called "facilities contracts" issued by the Department of Defense to cover the use of government-owned property in possession of a contractor may require payment to the government of the rental charges given in the accompanying box if the property is used for work not sponsored by the government (11). These charges obviously include more rapid depreciation rates than those allowed an educational institution, as well as a recognition of interest costs.

If use charges comparable to those the government considers reasonable for use of its own facilities were paid to educational institutions, there is little doubt that many institutions would have the incentive to use their own funds or even to borrow funds to expand and modernize their laboratories and research equipment.

Independent Research

It is essential for the advancement of knowledge and an understanding of man and his environment that universities and colleges have independent funds to support research of their own choosing. There are at least six reasons that this should be so.

Rental Rates

The following rental rates are the rental rates referred to in the clause of this contract entitled "Use and Charges":

(i) For land and land preparation, buildings, building installations, and land installations other than those items specified in (ii) below, a fair and reasonable rental shall be established, based on sound commercial practice.

(ii) For industrial plant equipment of the types covered by the following federal supply classes:

Federal supply classes	Description
3405, 3408, 3410, 3411 through 3419	Machine tools
3441 through 3449	Secondary metalforming and cutting machines

The following rates shall apply:

Age of equipment	Monthly rental rate
0 to 2 years	3%
Over 2 to 3 years	2%
Over 3 to 6 years	1.5%
Over 6 to 10 years	1.0%
Over 10 years	.75%

The age of each item of the facilities shall be based on the year in which it was manufactured, with an annual birthday on 1 January of each year thereafter. On 1 January following the date of manufacture, the item shall be considered one year old; and on each succeeding January 1st, it shall become one year older . . .

(iii) For personal property and equipment not covered in (i) or (ii) above, a rental shall be established at not less than the prevailing commercial rate, if any; or, in the absence of such rate, not less than two percent per month for electronic test equipment and automotive equipment; and not less than one percent (1%) per month for all other property and equipment.

1) There are many areas of research and scholarship that are now of little interest to the government and for which few funds are available. This is particularly true in the humanities and social sciences, which may well hold the key to how men and nations can live together in harmony and happiness.

2) Even in science and engineering, where substantial funds are available, research considered a long shot and proposals involving radically new concepts suffer in comparison with more pedestrian proposals. The gauntlet of complex reviewing panels, committees, and criteria that government agencies have established almost automatically makes this so. The proposals on specific research topics that some agencies request before letting contracts cannot take into consideration the idea that might lead to a breakthrough of major importance. Independent research funds controlled by the universities and colleges are the only answer.

3) One of the criteria that government agencies are almost forced to apply in judging the merits of a research proposal is the stature and past achievements of the individual who will lead the work. Young men and women who have not yet had the opportunity to prove their abilities must, by and large, rely on research funds from their own university or college, or submerge their own ideas as assistants to more distinguished colleagues.

4) Many promising explorations of new concepts can be carried out with a very modest expenditure of funds. The cost and time involved in preparing and submitting a formal proposal to a prospective sponsoring agency are hardly justified; moreover, a small budget engenders the feeling that the work is of little importance—it is frequently and truly said that the \$100,000 proposal is easier to sell than the \$1,000 proposal.

5) When the idea for a new research project is first conceived, those individuals involved are full of enthusiasm and

drive. The 6 months or more usually required for the preparation and submission of a formal proposal, which must then be reviewed and acted upon, dampen both the enthusiasm and the drive. Furthermore, preliminary research is often necessary to obtain the data and information necessary for preparing a convincing proposal. As a result, institutions must have independent research funds, even for those projects that may ultimately be of great interest to the government.

6) Finally, the people of this nation and, in response to their desires, the Congress and the executive agencies are emphasizing the direct expenditure of tax dollars for research projects that may help meet society's immediate needs (12). A scientist's motivation to search for truth, wherever that truth may lie, is little understood and even less appreciated in terms of federal expenditures for the direct costs of research projects.

The government's fiscal policies and practices for research contracts and grants to colleges and universities are a hindrance rather than a help. When institutions must share the costs of government-sponsored research, they have less money available for independent work. If they do manage to reserve some dollars for research of their own choosing, that research must bear indirect costs at a substantially higher rate than government-sponsored research. On the other hand, for industry, which is generally reimbursed full costs plus a profit for government work, Defense Department regulations provide for actual reimbursement of the costs of independent research as part of the overhead paid on government contracts. Why should universities and colleges not receive similar treatment? One of the best ways would be to provide an educational allowance in addition to reimbursement of all allowable costs. This could be particularly helpful in interdisciplinary research, as a means by which several

participating departments could receive some funds as an incentive for cooperating in an interdisciplinary project.

In conclusion, then, the government's professed interest in research at universities and colleges and in the welfare of the institutions themselves are accompanied by fiscal policies for sponsored research that act to the detriment of these interests. Requirements and pressures for institutions to share the costs of government-sponsored research, inadequate compensation for indirect expenses associated with this research, provisions that discourage investment in buildings and equipment, and handicaps rather than assistance to independent research are all evidence to this effect. It seems time for a change.

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