Getting R & D
Out of Orbit

by Amitai Etzioni

The concentration of federal Research and Development in defense and space activities, contrary to popular belief, does not act as a stimulant to economic growth and does not effectively provide work for unemployed men and resources. Professor Etzioni, of Columbia University, concludes that a meaningful start in the war on poverty requires the "de-orbiting" into the welfare sector of a substantial amount of space and defense R & D funds.

Until recently most Americans thought that "prosperity depends on investment, investment on technology and technology on science." Ergo, prosperity depends on science." Joseph Schumpeter pointed out that the economy will not run out of new things to produce, as long as science keeps feeding it with new ideas of new things it can manufacture. According to Leonard Silk, Senior and Economics Editor of Business Week, "there can be little doubt that the most important element in economic growth is in expansion of scientific and technological knowledge.... In our own time some economists have reached the conclusion that technological advance has accounted for about 90 per cent of the rise in productivity--output per man-hour--in the United States since the latter part of the 19th Century." The amount a country invests in research and development was, and still is in many places, viewed as a measure of its scientific and hence economic vitality.

R & D, Economic Growth, and Unemployment

Britain was one of the first countries to note that this is not necessarily the case. Its expenditure on R & D increased by almost 60 per cent in five years between 1953 and 1963, but its economy in the same period did not grow as much. It grew much less, in fact, than that of most Western European countries and many underdeveloped ones. Similarly, the American government's expenditure on R & D increased by about 50 per cent between 1953 and 1963; and the total expenditure on R & D in the United States grew from $5.1 billion in 1954 to $16.9 billion in 1963. However, the rate of economic growth remained smaller than in the earlier period when R & D expenditures were below $5 billion a year.

Economist Robert A. Solo put the science-equals-growth formula to a statistical test and found that "after 1953, while expenditures for R & D skyrocket, the rate in increase in output per man-hour slumps." At the same time, Solo found no positive association between levels of national expenditure on R & D and the rate of economic growth, or other economic indicators, including the rate of increase in the Gross National Product.

Seeking to explain this unexpected lack of propelling power of American R & D, Solo separates R & D into two kinds: one goes into civilian industry and seeks better production techniques or new products ("growth-oriented R & D"); the other goes into defense and space, and need not raise productivity and accelerate economic growth, since orbiting objects or miniaturizing atomic warheads does not have an automatic stimulant effect on the production of consumer goods.

Barriers have sprung up between the defense and space R & D—which constitutes more than two-thirds of the federal R & D—and the civilian economy. Since these are not surmounted, there is little spill-over and an actual drag on the economy occurs as space and defense R & D drains creative manpower from productive use. Five out of eight American R & D scientists and engineers work for space or defense enterprises; and as many as eight out of every ten graduated in 1963 were expected to end up working in these non-growth oriented sectors.

By Solo's calculations, since 1955, the growth-oriented R & D has been below the 1953 level. During this same period, the non-growth R & D increased by 233 per cent! The civilian economy gained little from this monumental growth, while it may have lost a lot. The Western European societies, with small defense and next to no space R & D, have invested their R & D funds and manpower mainly in civilian development. This is widely viewed as one of the major secrets of their continued and high economic boom, which has lasted more than fifteen years.

NASA particularly tends to stress the "astronautical fallout" its R & D work has for the economy, in the form of new materials, fuels, production, and even administrative techniques. Closer examination of
these claims has shown that (a) many are expected to be reaped in the future but cannot, at the present time, affect the economy or be demonstrated, simply because they have not yet taken place; (b) others are still in the experimental or developmental stage, and again it cannot be determined, now, what value they may have for the economy; (c) still other claims are overstated and may have for the economy; (c) research contracts and many thousands from commercial contractors and had authorized patent applications on only 23 developments.

By 1963, of the nearly 1200 prime research contracts and many thousands of subcontractors, NASA had received only 159 invention-disclosures from commercial contractors and had authorized patent applications on only 23 developments.

There are many reasons why the spill-over from defense and space research to the private industrial sector is that limited. They have been reviewed often and hence shall be listed only briefly here: (a) Much of the research, including space research, is classified and hence, as a rule, inaccessible; the difficulty in finding out what is and what is not classified or in obtaining a “clearing” is in itself a barrier between the main sectors of federal R & D and any other usage of its findings. (b) Most of the federal R & D expenditure goes to engineering, some to applied research, and little to basic research. However, the communicability of the findings is in the opposite order: it is highest for basic research, lower for applied research, and lowest for engineering. (c) Defense and space R & D is “esoteric”; it deals with hostile environments—either of an enemy or outer space—having quite different specifications than the consumer industry, which aims at the living room, the swimming pool, etc. (d) The question of the patent rights to findings made in government-sponsored research, especially in space research, has not been cleared and might have some inhibiting effects on their commercial usage.

In short, because of the segregation of the sectors, it seems that by far the largest federal R & D divisions, and the largest American ones, do not—contrary to widely held beliefs—serve to spur the economy to higher levels of activity and growth. Hence, by taking talent away from other R & D divisions, such as private industry and those of the campus—who are less segregated from the private economy, the defense and space R & D actually serves as a drag on the economy. It reduces the flow of new knowledge into the society from private and campus sources.

However, even if much of the federal R & D does not contribute to economic growth, it still might serve the economy by providing work for unemployed men and resources. A short excursion into economic theory is necessary before this value of federal R & D can be assessed.

Federal R & D, Priming, and Unemployment

The 1960-64 period provides an unusually interesting case for the debate between the cyclical economists and the structural ones. The question at hand is how best to treat unemployment: through elevating the economy to higher levels of activity by increasing federal expenditures without increasing taxation (i.e., by increasing the deficit or national debt), or by spending funds directly on re-development of areas in which unemployment is concentrated and to retrain the unemployed. The cyclical approach assumes a “filtering down” process through which the increased economic activity (in whatever sector of the economy that initially gained the added federal funds) filters to the unemployed sectors. The structural approach believes that direct treatment of the unemployed sectors is necessary.

The two viewpoints are not mutually exclusive. Unless the economy is in high gear, the structuralists concede that re-training of the unemployed will not help, because there will be no jobs to be filled. Cyclical economists tend to recognize the need for some “structural” effort. However, they believe that this will be undertaken largely by the industries in which employment will be increased; they will seek new laborers, and hence, re-train the unemployed. Therefore, the difference between the two approaches is, in part, one of degree—how much of the federal funds should go into cyclical and how much into structural efforts. Moreover, the difference is also, in part, one of assumptions concerning the nature of the economy—the degree to which adjustments take care of themselves as against the degree to which governmental initiative is required.

To further complicate the matter, the two approaches have different applications under different economic conditions. The more depressed an economy and the more widespread the unemployment the more that can be achieved through “cyclical” measures. The success of the “cyclical” measures in the late thirties can thus be explained. However, the closer the economy is to full employment, the harder it is to hit pockets of unemployment by increasing general demand (the cyclical approach).

Finally, there is a political consideration. Congress will more readily appropriate funds to defense and space than to re-development and retraining. This was one major reason why President Kennedy increased space and defense expenditure early in his term of office. After his first four months in office, he realized that he probably would not gain rapid approval for any of his social legislation (or structural) bills. Moreover, the 1960-61 recession, accompanied by high unemployment, continued. Creating work was by no means the only motive; other considerations, such as international prestige, real or imaginary security needs, and efforts to get indirect congressional support for graduate education, were all factors. However, creating work played an important role. As Arthur Krock wrote: “This [space] program is assured of powerful support in Congress for another reason also, and Khrushchev could announce the reversion of the USSR to the most minimal exploration of space without diminishing that support at all. This reason is alluded to only privately by Administration officials. But members of Congress and their constituents do
not need a public airing to make them actually and favorably aware of it. For viewed from the aspect of economic policy, the NASA program is the biggest public works and employment operation ever instituted in this country.”

James Reston, reaching the same conclusion, topped his column with the following quotation from then Vice President Johnson, who acted as the Chairman of the Space Council, the highest authority over all United States space efforts: “The Vice President added that the space program was not only helping in the economy of Texas, which is undoubtedly true, but that it has brought about a major rejuvenation to New England . . . is generating new growth and prosperity in the Deep South and Southeast and will be an increasingly important source of contracts and jobs for the Great Lakes, the Northwest and the Rocky Mountain states.”

Between 1960 and 1964, much of the increased federal expenditure was in R & D. For instance, while the total civilian space budget amounted to $8534 million in fiscal 1960, the R & D of the civilian space budget alone was about $4 billion in fiscal 1964. This branch of federal R & D alone gained at least three and one-half times more new funds, during this period, than all the structural programs of direct treatment of unemployment put together. What effect did this have on economic activity and on unemployment?

Increased federal spending coincided with an increase in the general level of economic activity. However, only a small decline of unemployment occurred. The economic picture improved slowly from 1961 to 1964 in terms of the rising level of economic growth and the level of economic activity, although it still was not satisfactory by late 1963. Hence, most economists felt in 1963 that a tax cut was necessary to maintain a high and growing level of economic activity and for the employment of still large amounts of unused capacities. That is, an increase in federal expenditure in general, and in R & D in particular, had not done the trick. Estimates of the billions lost in 1963, in terms of the GNP level that would have been reached if the economy had been on a higher level, vary from $30 to $70 billion. Above all, unemployment did not fall significantly. It was about the same in mid-1963 as it was in mid-1960. It declined somewhat in late 1963 as compared to early 1961.

There are no conclusive facts as to why the economy moved up more than unemployment declined. However, several of the reasons seem to lie in the sector of the economy from which the increase in federal expenditure came, namely, in the R & D industry.

The space and defense industry is what economists call “labor intensive,” that is, it creates many jobs for the amount of capital involved. In the missile industry (which is still less labor intensive than the whole space works) every investment of $11,000 creates a job as compared to $22,000 or about twice as much, in construction equipment, and $99,500 in petroleum refining (which is highly automated). The space industry will require about a million workers in the near future in direct employment, 20 per cent more than the whole automobile industry directly employs.

However, the manpower needed for these tasks cannot be supplied by what is now available in such sorry abundance. Neither the idle miners of West Virginia nor the discharged railroad workers can work in the space laboratories. While the total research and development costs of intercontinental bombers was below 20 per cent and that of intercontinental missiles above 60 per cent, the research and development of space work hovers close to 90 per cent! That is, most of the million employees needed will be professionals and professional manpower is, and will be, scarce.

An economy (spurred by tax cuts and increased federal expenditures) can have a large number of unfilled jobs and unemployed people simultaneously, if the job specifications and those of the people seeking employment do not meet. There seem to be various reasons why the automatic (i.e., without government action) adjustment of the two specifications to each other does not take place.

Once the assumptions of the cyclical "filtering down" theory are spelled out in detail, the sociological and economic factors that limit its effectiveness come into focus. However, we must emphasize that much of the data needed to verify our analysis is not available, and that which is available is fragmented and often unreliable.

(a) Part of the people involved are untrainable for the jobs at hand. They lack the educational background (26 percent are functionally illiterate and cannot read a newspaper), the personality characteristics that are often acquired at a younger age (e.g., the ability to concentrate), and the necessary IQ (higher IQs have already been "skimmed" out for jobs and lower IQs are left behind).

(b) Training is expensive and troublesome. Industry is reluctant to train even those who can be trained. The people who need to be trained often are not in the same state or area as the new sources of employment. They tend to create labor troubles because they are not accustomed to disciplined work, and to have more sickness than average since they are older than average. They tend to be unemployable in certain parts of the country in many kinds of jobs because as many as two thirds of them are Negroes. (This is true not only in many skilled and semi-skilled positions in the South but also in many unionized jobs in the North.)

Hence, industry tends to buy additional machines or design new ones to reduce the need for new workers. The resulting increase in purchase of machines somewhat increases employment in machine tool industries. However, this often leads to more automation in these industries and creates new work mainly for the professional employees, who design the new machines or supervise their operation. In short, an increase in the purchase of machines does not significantly absorb the unemployed.

(c) Most of the expenditure of the increased R & D sector is for professional brainpower whereas little of
the unused resources such as steel and coal are employed. Hence, increased R & D expenditures create very limited indirect employment in those sectors in which industry works below full capacity and workers are unemployed as well as in industries related to these industries, the railroads for instance.

(d) The increased income of professionals and R & D industries, which largely goes into salaries, increases the consumption of services, from increased sales of lobsters in Boston restaurants to greater use of Japanese gardeners in Los Angeles. However, these services tend to be consumed in the immediate ecological environment of the R & D industry. The laundry of Cape Kennedy is not washed in West Virginia, and the executives of Route 128 do not lunch in Kentucky. Services also tend to become automated (e.g., dishwashers) rather than substantially increasing employment.

(e) Even when jobs for unskilled workers are available in one area, the unemployed of another area are difficult to move. The costs of moving are large, and the government rarely covers the cost fully. Included in the cost, for instance, is the loss of old, self-owned shacks in which many of the unemployed live and which have next to no market value. Also, information about available jobs in other areas is often poor and unreliable. The experience of a worker who travelled to the other end of the country to find no work, deters many others from even trying.

Furthermore, there are irrational fears of new environments and of moving. These fears are greater the older a person, the less educated he is, and the less he has travelled, all other things being equal. Lack of initiative, a general apathy, a belief in blind luck, and a tendency to rely on relief, unemployment compensation, and food stamps also characterize a segment of the group under discussion. Hence, re-training, if not accompanied by a major social-work effort, is in part lost, because the re-trainables refuse to move.

The federal and state agencies engaged in re-training are under pressure to prove their value. Thus, the agencies tend to focus their efforts on those who are most readily trained. This creates a misconception concerning the difficulties, costs, and methods involved in re-training or training those who are left. The closer we come to full employment, the more difficult this will become. However, the next million unemployed are just as deserving of our assistance as the first one million.

All this leads to two conclusions: (a) that increased federal expenditure in the R & D sector, particularly in space and defense, cannot be relied upon to significantly reduce the number of unemployed, either directly or indirectly; (b) that considerably larger amounts of federal funds and professional manpower—tied up by the space and defense R & D sector—will have to be devoted to direct attacks on unemployment if it is to be reduced to an "acceptable" level.

In the next decade, the advancement of technological knowledge and methods of production, especially automation, will probably increase the demand for highly trained people and reduce the number of available jobs for the less trained ones. Therefore, it is more important than ever for the American society to learn the difficult task of transferring people from one sector of the economy or the country to another. If this is not successfully marshalled, the cost will be higher than unacceptable unemployment. There will be a shortage of manpower in the expanding sectors, adamant featherbedding and long strikes as unions try to protect their members' jobs in the declining sectors, and a lower level of activity for the economy as the purchasing power of segments of the population is kept low.

The latter point is of special importance because it applies to both the poor and the unemployed. Although there is some overlap, these two groups are not identical. There are more poor (defined by the government as a family of four or more who live on $3,000 or less, per annum) than there are unemployed; about 5.6 per cent of the labor force are unemployed, but about 20 per cent of the American people are poor. Moreover, many of the poor are under-employed rather than unemployed and hence receive no unemployment compensation.

The poor have little to sell and buy little, thus they are largely "out" of economy, as they are out of the political community, because of their poor ability to organize themselves, articulate their needs, and press for their fulfillment. Hence, the increased level of economic activity—through cyclical measures—tends to leave the poor out.

More generally, the modern sectors of the economy (e.g., electronic industries and jet airliners) tend to trade with and enrich each other much more than with the obsolescent sectors (e.g., coal and the railroads). This is somewhat similar to the fact that the United States and Western Europe trade more with each other than with the under-developed countries. Hence, increases in general economic statistics—such as in the level of the GNP, industrial profit, and the stock market—can go hand in hand with unemployed capacity and low profit in less modern sectors of the country.

As our Western European allies have long recognized, the relationship between the various economic sectors, especially the shrinking or obsolescent ones, cannot be left to the blind forces of the market; it must be guided. This does not require central or totalitarian planning, which has proven to be full of its own pitfalls. It implies the need for higher, voluntary forms of public guidance, similar to the kind now used in France and by the Executive Commission of the European Economic Community and usually referred to as "indicative planning" or "programming."

Political Feasibility

Suggestions to shift federal funds and professional manpower from space and defense R & D to programs needed for the shifting of Americans from obsolescent to modern sectors of the economy run into two kinds of criticism: (a) it is said that we are rich enough to do both; (b) it is believed Congress would not allow

OCTOBER, 1964
the funds spent in one sector (eg., space) to be used in others (eg., re-development).

The United States is indeed the most affluent country in the world. However, the wealth of the American people should not be confused with that of the federal government. Actually, the federal sector of the economy is rather small and federal spending is highly committed. About half of the federal budget goes to defense ($56 billion out of $122 billion appropriated for 1964), and other parts are committed to veterans ($6.0 billion), farmers ($6.4 billion), interest on the national debt ($8.1 billion), etc. Devoting $5.1 billion of the remaining sum for civilian space budget, more or less, exhausts most of the new, uncommitted federal funds available.

Secondly, while federal expenditure can be increased on short notice by lifting the level of national debt or taxation, professional manpower needed to plan and run the re-development and re-training is scarce. Moreover, increasing the professional manpower available will take a long time. It is true that the manpower used in space and defense programs is not identical with the manpower needed for a big and imaginative attack on unemployment and poverty. However, there is more overlap than is usually recognized. Engineers, for instance, could be readily used in both. In other situations, more complicated "chains" exist through which the use of manpower in one sector affects that of the other. For instance, the use of teachers for research moves potential social workers into teaching; these social workers are then missing in re-development projects.

The ability to shift federal funds from "national" causes, such as arms and prestige races, to "social" causes, such as welfare programs is limited, to be sure. However, it is not a "yes" or "no" proposition. In part, the absolute level of the deficit affects the conservative vote. Thus, bills requesting increased welfare expenditure have a better chance for approval if tied to reduction of expenditures in other areas. The amount of presidential leadership given to various programs, and the related factor of public support, also should not be too easily dismissed. Even the difference between non-election and election years and between the increase and decrease of tensions in American-Soviet relations must be taken into account. All in all, de-orbiting $2.5 billion from space and defense for a meaningful start in the war on poverty and unemployment—which will have the same if not better cyclical effects on spurring the economy than R & D spending on space and defense— is not beyond what can be expected from the present Congress. To give up without trying is to write off American democracy as rigidly conservative and heartless.

REFERENCES
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Psychology and International Relations
by James T. Tedeschi and E. F. Malagodi

The relevancy and the adequacy of psychology as applied to the study of international relations is set forth. Problems of generalization from the individual to the nation, laboratory experiments, and psychological reductionism are discussed. The authors, members of the Department of Psychology at the University of Miami, are firm in their belief that psychology has much to contribute to international relations on a variety of levels.

In recent years discussion has evolved among political and other social scientists concerning the utility of the concepts, methodologies and experimental results of psychological science for making important contributions to solutions of critical international problems. Questions of the relevancy and the adequacy of the discipline of psychology for the study of international relations have been raised. Relevancy has been challenged because of the problem of generalizing from results of experiments on the behavior of individuals to the behavior of larger entities such as nations. The "artificiality" of laboratory conditions has also been pointed out as causing problems for the would-be predictor of "real-life" events. Adequacy has been challenged on more tenable grounds—that other units of analysis exist apart from those susceptible to the investigative procedures of the psychologist. It is our position that psychology is necessary but not sufficient for the understanding and prediction of international behaviors.

The Need For Theory
There can be no question that psychologists have been prone to fall into the fallacy of treating large units of analysis analogously to smaller units. Generalizing findings on the