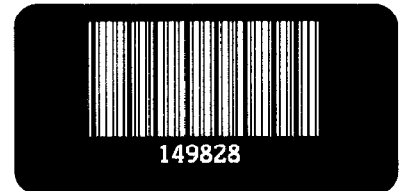


July 1993

# FEDERAL BUDGET

## Choosing Public Investment Programs



---

---

**Accounting and Information  
Management Division**

B-252627

July 23, 1993

The Honorable Bill Bradley  
United States SenateThe Honorable John Conyers, Jr.  
Chairman  
Committee on Government Operations  
House of Representatives

This report responds to your request that we (1) identify key questions that should be addressed when choosing and implementing public investment programs and (2) discuss the application of these questions to public investment opportunities, including examples of how they can be applied. It provides a way to think about investment that may help the federal government select programs that enhance long-term economic growth. In developing national budget priorities, decisionmakers can also use this report's framework to identify programs that—whatever their other merits—are not likely to contribute to increasing private sector output and economic growth. This report contains no recommendations.

In this era of fiscal constraints, increasing federal investment will require difficult tradeoffs with other spending priorities. Therefore, to advance a credible investment agenda, it is crucial that public investments be linked to long-term economic growth, be carefully designed, and be evaluated so that future policymakers can learn from inevitable mistakes. Rigorous analysis is necessary because federal investments are not subject to private market discipline. Thus, it will fall upon the political leadership and bureaucracy to apply the careful judgment and discipline necessary to ensure that federal investments lead to economic growth and higher living standards for the American public.

---

**The Federal Role in  
Investment Policy**

Much of recent political debate has centered on whether the nation is investing wisely and sufficiently to increase private sector output and provide for long-term economic growth. There is little consensus on the "ideal" split between national investment and consumption. However, few would disagree that more investment—including public investment in cases where the market fails to deliver desired goods and services—would enhance the nation's future economic growth. But disagreement persists regarding the federal role in raising national investment levels. Should that role be limited to reducing the budget deficit, thereby increasing the

---

capital available to finance private investment? Alternatively, should the government take a more direct approach by increasing its own investment spending, potentially at the expense of deficit reduction?

Because the federal budget deficit consumes savings that might otherwise be productively invested, reducing the budget deficit would increase national savings and expand domestic capital available for private investment. Given the current large fiscal deficits, there should be a strong presumption against accepting a deficit increase to finance federal investment. However, within a given fiscal policy, shifting from spending for current purposes to spending for well-chosen public investments can play an important role in increasing private sector output and economic growth.

If the federal government were to shift its resources toward investment, how should it do so? What types of public investments hold the most promise for increasing private sector output? What measures can be taken to ensure that the chosen programs succeed, and which factors need to be considered and measured to determine success? Although these questions have no decisive answers, considering them can help Members of the Congress and other policymakers form judgments about the relative merits of public investment programs.

---

## Investing to Enhance Productivity

Productivity growth is central to maintaining and improving the nation's economic capacity and, thus, its standard of living. Labor productivity gains are achieved by reducing the amount of labor needed to provide a given level of goods and services or by increasing the goods and services produced by a given amount of labor. Historical evidence indicates that labor productivity gains in the private sector are the primary contributor to the nation's economic growth. Because higher labor productivity growth rates are so important to our national economic future, public investments that focus primarily on labor productivity growth in the private sector will contribute more than any other source to raising future living standards and making more consumption possible. Accordingly, we have focused our analysis on the types of public investments that most enhance the private sector's long-term labor productivity.

The term "investment" can refer to any private or public spending that creates a stream of future benefits, whether it enhances future productivity or not. A manufacturing firm may consider any asset with a productive life of a year or more an investment. A business may consider

---

employee training or research to be investment, even if these costs are treated as annual expenses in an income statement. The National Income and Product Accounts (NIPA)—the basis for producing economic statistics for the United States—defines investments very narrowly and does not count any government spending as investment.<sup>1</sup> Although each of these definitions is useful for its intended purpose, much of the current economic policy debate is focused on how to raise long-term economic growth, hence our focus on productivity-enhancing investment.

Some federal investments affect how productively government provides services, but are not directly instrumental in increasing private sector economic productivity. Examples include programs that spend money now to reduce federal costs later, such as improvements to systems that would enable collecting taxes more efficiently or distributing benefits at lower costs. While these investments do not generally result in direct private sector productivity gains, these investments do produce savings that could be used to reduce the deficit.

An even broader view of investment might include programs designed mainly to improve the quality of life, such as spending on health care and nutrition. Such initiatives are often important and worthwhile. However, economic productivity is not typically their primary objective. Rather, they serve broader social objectives, such as equity and opportunity. Moreover, the investment component of such programs is difficult to separate from the consumption component.

This is not to say that federal investment programs should not contribute to broader social goals as well. In fact, we recognize that increasing productivity is not the sole purpose of all public investment programs. Most public programs appropriately address additional questions, such as income distribution, environmental quality, and equity. Ideally, one would want to address all of these factors in developing a public policy. But if investment is a goal and justification for the program, then it is important to evaluate the program's success in achieving this goal using investment criteria—more specifically, the net effect on private sector output. Thus, this document is intended to highlight the contributions well-designed and well-managed public investment programs can make to private sector labor productivity—the key element of long-term economic growth.

---

<sup>1</sup>NIPA's definition of gross private domestic investment includes (1) fixed investment—nonresidential investment in structures, producers' durable equipment, and residential investment—and (2) changes in business inventories.

---

## Public Investments That Contribute to Productivity

A better-trained work force, new technologies, improved production equipment and processes, and well-chosen infrastructure development all contribute to increasing productivity. Productivity-enhancing public investments generally can be classified into three categories: human capital, research and development (R&D), and infrastructure. Human capital is increased by the education and training that improves work force skills; research and development produce new technology that leads to innovative products and production processes that lower costs; and infrastructure includes roads, airports, and telecommunication systems and other facilities that lower the private cost of producing goods and services.

Comparison of the benefits of these three investment categories is hampered by difficulties in precisely determining the relative returns. This is due to differences in available information, the ability to measure returns on investment, and the time frames in which benefits accrue. Although it is difficult to make comparisons across categories, investment in all three areas is thought to be important. A classic economic study indicates that 90 percent of labor productivity growth can be attributed to technological advances (41 percent), growth of capital stock (28 percent), and education and training (21 percent).<sup>2</sup> Other studies generally support these results. Therefore, a diversified approach is likely to be preferable to concentration of all investment in one category.

---

## Using This Document

Our purpose is to provide decisionmakers a way to think about federal investments that increase economic productivity. This document is organized around four main questions that can help policymakers consider proposed investments and their potential effects. The discussion after each question is designed to help readers think about the question's applications. These questions focus on (1) whether a proposal may be a productivity-enhancing investment, (2) the value or worth of an investment, (3) whether its design would contribute to or detract from its effectiveness, and (4) how to plan to evaluate the results of the investment. Under each question are a number of related questions and discussions that explain the issue and provide examples of how the questions can be applied to public investment proposals.

Many of the investment issues that we address in this report could, in principle, be assessed in quantitative terms within the framework of

---

<sup>2</sup>Edward F. Denison, *Trends in American Economic Growth, 1929-1982*, The Brookings Institution (Washington, D.C.: 1985), p. 30. Although Denison's analysis does not focus on federal infrastructure, economists agree that public infrastructure complements the growth of private capital stock.

---

cost-benefit analysis, but sufficient data and objective analysis are often not available to address some of the major questions. For example, it is typically difficult to place a monetary value on intangible benefits. Thus, this document cannot be used to develop an index that objectively ranks the value of investments. Nor does it represent a process for generating absolute answers: users answering these questions could realistically come to different conclusions regarding the same program.

Nevertheless, we believe that application of this document's criteria for effective federal investments can improve decisions; even with limited data, the document can be useful in identifying programs that are not likely to contribute to productivity either for economic reasons or as a result of shortcomings in program design. Considering potential investments in this way can provide a screen to eliminate deficient proposals and identify those public investments most likely to contribute significantly to productivity growth.

---

## Scope and Methodology

We prepared this document by synthesizing research conducted by experts on investment issues and evaluation methodologies in the fields of economics, policy sciences, and program evaluation. We also consulted with investment and evaluation experts in the federal government, the private sector, and academia. We received and incorporated their comments where appropriate.

---

Copies of this report are being sent to the Majority and Minority Leaders of the Senate; the Speaker of the House of Representatives; the Minority Leader of the House of Representatives; the Chairmen and Ranking Minority Members of the Senate and House Budget and Appropriations Committees, the Senate Committee on Finance, the Senate Committee on Governmental Affairs, the Senate Committee on Environment and Public Works, the House Committee on Ways and Means, the House Committee on Government Operations, the House Committee on Public Works and Transportation, and the Subcommittee on Economic Development, Committee on Public Works and Transportation; the Director, Office of Management and Budget; and other interested parties. Copies will be sent to others upon request.

---

Please contact me at (202) 512-9573 if you or your staffs have any questions. Major contributors to this report are listed in appendix I.



Paul L. Posner  
Director, Budget Issues





# Contents

<b>Letter</b>		1
<b>Is the Program Designed to Produce Long-term Economic Growth?</b>	Which Types of Programs Could Increase Long-term Productivity Growth?	10
	How Can Productivity-Enhancing Programs Be Distinguished From Other Types of Spending Programs?	11
<b>Is the Program Worth Implementing?</b>	Have the Program's Benefits and Costs Been Adequately Measured?	13
	Have Costs and Benefits Been Discounted to Account for How Quickly They Will Accrue?	17
	Are the Problems the Program Seeks to Address Well Defined?	17
	Is Government Intervention Justified?	19
	Does the Problem Merit Federal—as Opposed to State and Local—Intervention?	20
	Have Alternatives for Addressing the Problem Been Considered?	21
<b>Is the Program Well Designed?</b>		24
	Can the Program Work as Designed?	24
	Is the Program Well Targeted?	25
	Will Other Factors Hinder Its Success?	26
	Is the Investment Program Coordinated With Other Federal Programs and With State and Local Governments?	27
	Is the Program Designed to Ensure That Federal Funds Supplement and Do Not Supplant Nonfederal Funds?	28
<b>How Should the Program Be Evaluated After Implementation?</b>		29
	Are the Means for Evaluating the Investment's Effectiveness Provided?	29
	Can Alternate Measures Assess the Program's Merit?	30
	What Approaches Can Be Used to Assess a Program's Effect on Outcomes?	31
<b>Appendix</b>	Appendix I: Major Contributors to This Report	32

---

**Abbreviations**

CBO	Congressional Budget Office
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FHWA	Federal Highway Administration
JOBS	Job Opportunities and Basic Skills Training
IDB	Industrial Development Bond
ISTEA	Intermodal Surface Transportation Efficiency Act
NASA	National Aeronautics and Space Administration
NIPA	National Income and Product Accounts
R&D	research and development

---

# Is the Program Designed to Produce Long-term Economic Growth?

---

Considering these questions can help identify programs that could contribute to increased private sector productivity and long-term economic growth.

---

## *Which Types of Programs Could Increase Long-term Productivity Growth?*

The federal government undertakes many programs, only some of which are investments that increase private sector labor productivity and economic growth. Identifying these programs is an important step in devising a federal investment strategy. A productivity-enhancing investment's contribution to economic growth is best demonstrated by estimating its national economic returns. However, calculating a return on investment is often difficult because of the lack of reliable economic data and measurement techniques that form the basis of an accurate return estimate.

In practice, certain types of public investment programs—infrastructure, human capital, and research and development—have been found to increase productivity. Highway construction and repair programs, for example, may increase productivity by lowering travel time and vehicle operating costs. In addition, some government R&D programs—in areas as diverse as agriculture, aviation, and advanced engineering programs—have contributed substantially to productivity growth.<sup>3</sup> According to the Office of Technology Assessment, numerous studies found that federal R&D in agriculture has resulted in a rate of return of between 33 percent and 66 percent per year; that federal R&D for commercial aviation has resulted in a rate of return of about 27 percent per year; and that spinoff technology from National Aeronautics and Space Administration (NASA) research has provided substantial national economic returns in the development of products such as the cardiac pacemaker, the nickel-zinc battery, and other products.<sup>4</sup>

Human capital programs are generally considered to contribute to higher productivity, even though return on investment is difficult to calculate. Data limitations and difficulties in measuring outcomes have prevented

---

<sup>3</sup>Research Funding as an Investment: Can We Measure the Returns?—A Technical Memorandum, U.S. Congress, Office of Technology Assessment (OTA-TM-SET-36, April 1986), pp. 22-24.

<sup>4</sup>For many federal R&D programs, especially programs designed to accomplish a mission such as landing a person on the moon, rates of return are not well documented. In fact, some studies of total federal R&D have shown insignificant or even negative returns. Two examples are: Frank R. Lichtenberg, "R&D Investment and International Productivity Differences," National Bureau of Economic Research Working Paper No. 4161, September 1992, and Nestor E. Terleckyj, "Measuring Economic Effects of Federal R&D Expenditures: Recent History With Special Emphasis on Federal R&D Performed in Industry," paper presented to the National Academy of Sciences Workshop on "the federal role in research and development," November 21-22, 1985, p. 5.

researchers from calculating a precise relationship between public spending on education and the nation's economic performance. Despite the lack of exact calculations, however, most economists agree that investment in human capital is important to our future economic growth.

---

*How Can  
Productivity-  
Enhancing Programs  
Be Distinguished  
From Other Types of  
Spending Programs?*

The questions raised in this document are intended to help decisionmakers (1) distinguish productivity-enhancing programs from spending programs with other goals such as stimulating or redistributing economic activity and (2) evaluate the programs which primarily aim to improve the long-term potential of the economy. Other programs should be evaluated on terms more appropriate to their particular goals and benefits.

For example, some spending programs are undertaken largely to create jobs immediately. Although, in the short run, such programs may help move the economy's performance up closer to its potential level, over the long run, they do not generally expand the economy's potential by improving the productivity of those who are hired. Fiscal stimulus programs can include investment programs, but many fiscal stimulus initiatives increase consumption and do not enhance the long-term potential of national economic output.

In evaluating an investment program, it is also important to ensure that the program increases overall national economic growth and that its primary effect is not just to redistribute economic benefits from one region or sector to another. Although redistribution programs may meet important social or national goals, they do not generally increase total private sector output.

Likewise, programs that may generate a stream of future benefits and contribute to worthy social goals may not directly raise labor productivity and thus are not likely to increase private sector output. For example, while increased health care expenditures can result in employees working more hours, they may not directly increase the amount of output employees produce per hour. Some environmental programs preserve resources, raise aesthetic values, or preserve public health, but many of these have no direct effect on increasing worker output per hour. Similarly, investments in housing increase the future consumption of housing services, but they do not directly increase the output of private sector workers. Productivity can be enhanced in the housing, health, or environmental sectors of the economy—often through technological

---

**Is the Program Designed to Produce  
Long-term Economic Growth?**

---

improvements—when there are improvements in materials or improvements in processes that create better housing, health care, and environmental cleanup with less labor and resources.

Although these types of social programs may not directly contribute to economic productivity, policymakers must appropriately weigh productivity enhancement with other important goals served by these programs. Policymakers will be concerned about investment programs that promise to improve productivity at the expense of other objectives, such as environmental protection. Policymakers will also be pressed to make choices to promote multiple goals—long-term investment as well as other social goals, such as environmental protection or energy conservation. As we discuss in the next section, cost-benefit analysis can help policymakers sort out the effects of competing investment proposals on other social goals.

---

# Is the Program Worth Implementing?

---

Not all investment programs are equally valuable. Some programs will contribute more than others to increased productivity and economic growth or other national needs. Following are questions to help guide decisionmakers' assessments of competing investment programs.

---

## *Have the Program's Benefits and Costs Been Adequately Measured?*

Estimating a program's net benefits to the nation's economy is the most important indicator of an investment's value. The net benefits can be calculated as the increased benefits resulting from an investment, less the cost. At a minimum, benefits and costs should be expressed in terms of net present value. Present value adjusts costs and benefits to account for the opportunity costs of money—the returns from alternate uses of the money foregone by making the investment. For government programs, such alternatives typically include the net present value of alternative public investments as well as private investments that public spending implicitly displaces. Generally, productivity-enhancing investment programs with the highest expected economic net benefits—if estimated correctly—will contribute the most to increasing national economic output. However, the choice of an economic program requires considering the tradeoffs between economic growth and other social objectives.

Cost-benefit analysis—which estimates the costs and benefits for a given program—is the most frequently used way of estimating a program's net benefits to the nation's economy. It focuses on specific programs and includes economic and all other program benefits, including those not priced in the market, such as improved environmental quality. Cost-benefit analysis is most appropriate for very specific and limited scope projects; measures of both costs and benefits become more uncertain as the scope of the analysis becomes broader.

In principle, cost-benefit analysis can be used to determine which spending proposals will provide the greatest net output gains to the nation's economy. In practice, policymakers should use considerable caution when reviewing justifications that are based on cost-benefit analysis. These types of analyses can suffer from limitations such as a failure to include all benefits or costs, inability to measure all benefits or costs, and treating the transfer of economic activity within the nation as a benefit. The following questions are designed to help decisionmakers evaluate program proposals justified on a cost-benefit basis.

(1) Are all the costs and economic benefits identified?

Some analyses may fail to account for all of the required costs or benefits associated with the program. For example, it is difficult when beginning a program to assess how it will affect more fundamental operations of business production and logistics. While the benefits of highway improvements on time savings and vehicle operating costs may be captured, it is often difficult to predict how major infrastructure improvements over time may influence firms to make major productivity improvements by restructuring their distribution networks or reducing inventory.<sup>5</sup>

(2) How are intangible benefits valued?

Valuing tangible economic benefits, though often difficult, is often less controversial than assigning values to intangible social benefits, such as water project recreation benefits or the socialization of children through education. The value assigned to these benefits can be highly debatable, significantly altering the outcome of cost-benefit analysis. Consequently, to improve a decisionmaker's ability to judge among competing programs, it is better to have summary information on both of these types of costs and benefits presented separately.

(3) Is the analysis based on reliable data?

Lack of appropriate data makes it difficult to estimate returns for human capital and R&D programs, and even estimates of infrastructure benefits are subject to debate. For example, there are no reliable data on private sector training for employees, and the outcomes of other human capital programs, such as the Job Corps, are difficult to quantify. Similarly, there are few direct measures of research successes or benefits in R&D programs. Instead, most benefits must be estimated from indirect indicators of questionable validity, such as the number of publications resulting from a particular research endeavor. Even for transportation, benefits must be calculated using uncertain assumptions about how to value savings of time, lives, and injuries.

---

<sup>5</sup>David Lewis, *Primer on Transportation, Productivity and Economic Development*, Transportation Research Board, National Research Council (Washington, D.C., September 1991), p. xiii.



(4) If the proposed investment is a component of a larger system, has adequate consideration been given to the analytic complexities this adds?

Reliably estimating a program's total economic return may be difficult when that program affects one component of a complex system. For example, while it is possible to compare the lifetime incomes of people with 6 years of education to those with 12 years, it is far more difficult to calculate the benefits of a federal program designed to influence one phase of education, such as preschool. Although measuring techniques are available to analyze components of large systems, they can be controversial. Thus, extra care should be given to the methodological approach and the presentation of the results.

(5) Does the analysis address the investment's effect on other national priorities?

As discussed in the preface to this document, investment programs often have mixed goals, which means that maximizing the net benefits to the national economy is only one of several program objectives. The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), for example, was designed to couple improvements in public transportation with national goals for air quality, energy conservation, international competitiveness, and a variety of social concerns. Under this type of policy structure, programs with the highest net benefits will not always be chosen—those that address all of the policy goals are more likely to be received favorably.

Cost-benefit analysis can help policymakers weigh these competing goals. As noted above, the program's analysis should include all program effects, including the negative effects on valued social objectives. Decisionmakers may decide on social goals that must be satisfied before an investment program can be funded, whatever its investment benefits. Alternatively, decisionmakers may fund investments that have lower positive net benefits than alternate investment programs on the basis of social objectives, but only if the decisionmakers judge that the social objective is worth more than the foregone investment benefits.

---

(6) Are the cost-benefit analyses of different programs comparable?

Comparisons of net benefits among and within investment categories can be difficult. The net benefits for infrastructure, human capital, and R&D programs—all necessary ingredients for economic growth—cannot be easily estimated and compared because the reliability and validity of the estimated benefits for each type of investment varies so much. For example, transportation projects have relatively well accepted methods for estimating prospective net benefits, but education projects do not because they are more difficult to measure. Consequently, choosing to invest only in projects that have a well-documented prospect of positive net benefits would tend to favor transportation projects rather than education, even though, in practice, particular education programs may actually result in higher net benefits.

In addition, comparisons of programs within the same category may be complicated by different assumptions used by analysts to do cost-benefit analysis. For example, using different discount rates or wage rate assumptions in analyzing two separate highway programs can lead to different results.

---

Production function analyses can also be used for estimating the effects of national investment programs, but the technique has substantial limitations. A production function analysis estimates economic outputs based on the historical relationships among private capital, public capital, and labor. For the public sector, such techniques are often used to (1) establish whether overall levels of public investment spending are sufficient to achieve goals for economic growth and (2) suggest the quantitative significance of different forms of investment. The technique is limited, however, because it relies on aggregate macroeconomic data that are not well suited to assess the potential effect of specific programs. It also relies on historical data which are often incomplete. Although this technique measures the historical connection between public investment and economic growth, the extent to which public investment causes growth, as opposed to being its consequence, is debatable.

In situations where cost-benefit and production function analysis are not practical or have produced unreliable or uncertain results, alternative methods may be used to provide information for evaluating the prospective costs and benefits of proposed investments. For example, we have recently developed a new methodology—called prospective evaluation synthesis—for evaluating the outcomes of programs before

they are implemented. It involves a careful analysis of the implied program goals and assumptions about what will work to reach them, an analysis of what is known already about similar programs, and summary judgments of the likelihood of success given a similar future context. Because they rely on studies already conducted on similar programs, prospective evaluation syntheses may allow early evaluation of likely outcomes before investments are made.<sup>6</sup> Although cost-benefit analyses are usually more comprehensive tools for evaluating potential investments, prospective evaluation synthesis can be used as a supplement to inconclusive cost-benefit results or as a lower-cost alternative for evaluating some investments.

---

*Have Costs and Benefits Been Discounted to Account for How Quickly They Will Accrue?*

A program's worth depends on how quickly benefits and costs will accrue. A dollar of benefit realized sooner is worth more than a dollar of benefit later. This is a function of opportunity costs—the idea that the longer funds are invested in one program, the greater is the cost in terms of foregone alternative uses. Analysts account for differences in timing by calculating an investment's present value—the stream of costs and benefits discounted to account for the opportunity cost of the funds.

The actual discount rate used should reflect the opportunity cost of the funds being invested. The opportunity cost will depend upon the attributes of the particular investment program. The use of improper discount rates can bias the results of a cost-benefit analysis and change the relative ranking of proposed investments. Therefore, it is important to understand what rate was used and why it was used.

Comparisons of investments with short-term payoffs to investments with longer term payoffs may be complicated if more reliable quantitative information is available for short-term payoffs. In such cases, overreliance on measurable payoffs could bias outcomes toward short-term investments. One should weigh carefully the extent to which all long-term benefits have been accurately captured.

---

*Are the Problems the Program Seeks to Address Well Defined?*

Defining a policy problem as explicitly as possible can help identify programs that are best suited to deal with that problem. For example, airport congestion indicates a mismatch of supply and demand. Such a problem definition would lend itself to a variety of solutions, including a mix of actions, such as new runway construction, establishing high speed

---

<sup>6</sup>Prospective Evaluation Methods: The Prospective Evaluation Synthesis (GAO Transfer Paper 10.1.10, November 1990).

rail as an alternative, and congestion pricing (charging higher landing fees during peak periods). In contrast, viewing a multifaceted problem as solely a lack of airports (a supply problem) or only as too much peak hour congestion (a demand problem) constrains the range of alternatives, leading to a simplistic problem statement and a less effective solution. Therefore, specific, accurate, and well-documented analysis of the problem and the associated solution can help ensure that a program is worth implementing.

For example, we found that some federal small business manufacturing technology programs defined the technological needs for small businesses inappropriately. The programs promoted the development of new technologies, while small businesses actually needed proven, readily available technologies. Better problem definition can help ensure higher returns on the federal government's investment.<sup>7</sup>

Public investment shortfalls are often characterized by such indicators as "needs" statements—a list of proposed public investments—that are often based on lists of desired projects or declining trends in public investment spending. Needs statements alone may not point the way to the most appropriate solutions, particularly if they do not consider alternatives and costs or if they fail to measure the broader outcomes that are intended to be achieved by federal investment programs.

In developing its 1991 needs assessment, the Federal Highway Administration (FHWA) concluded that vast sums were needed to construct new highway lanes to relieve congestion. Many economists, however, have argued that lack of capacity is not central to the issue. They believe that new lane construction may be the least effective way to relieve congestion and that alternatives, such as higher user fees and congestion pricing, may achieve similar results at lower costs, making scarce funds available for other productive investments. According to the Department of Transportation, some Department needs assessments prepared in 1993 will focus more clearly on how transportation programs affect the economy by including highway users' benefits.

Needs assessments are also based on standards—either explicit or implicit—that can vary widely and may not be the most appropriate ones to use in seeking productivity-enhancing investments. For example, FHWA's standards for assessing deficient bridges includes bridges that are

---

<sup>7</sup>Technology Transfer: Federal Efforts to Enhance the Competitiveness of Small Manufacturers (GAO/RCED-92-30, November 22, 1991).

structurally sound but do not meet current standards for lane width or angle of highway approach. Although these bridges are classified as functionally obsolete, they are not in any imminent danger of collapse. Moreover, FHWA's rating approach is not effective for setting priorities among deficient bridges. The methodology does not adequately consider a bridge's location, traffic volume, and detour length—important measures of how well a bridge meets needs. As a result, many local bridges that are structurally sound and adequately serve existing traffic conditions are eligible for federal funds.<sup>8</sup>

Spending trends can also be a misleading indicator of problems if they do not account for external factors or events that may justify changes in spending. For example, proponents often justify increased investment spending by pointing to reductions in public infrastructure for more than a decade. However, these trends might not be relevant if they reflect the completion of major projects, such as the completion of the Interstate Highway System or the school buildup required by the baby boom.

---

### *Is Government Intervention Justified?*

A well-defined problem should include a strong rationale for government involvement, including reasons why the private sector does not fill this need. Normally, one would expect private entrepreneurs to make investments if sufficient returns are anticipated. However, other factors often arise that inhibit private entrepreneurs from risking their capital. In these circumstances, collectively known as market failures, federal intervention is common. The three types of market failures that are relevant to public investment are the undersupply of public goods, existence of externalities, and excessive risk.

Public goods produce benefits that cannot be completely captured by their owners—commonly known as the “free rider” problem. For example, river dredging to improve shipping navigation generally reduces the costs of shipping. However, private investors would not dredge a river (if they did not control access to the river) because they could not charge the users of the river and recapture their costs. Therefore, the public sector usually undertakes these types of programs.

Externalities occur when producers or consumers do not bear the full costs or benefits of producing or consuming products, and these external costs or benefits are borne by others. An externality where producers do not assume the full costs of their activities could occur in arid areas where

---

<sup>8</sup>Bridge Infrastructure: Matching the Resources to the Need (GAO/RCED-91-167, July 22, 1991).

a farmer drills a well on his property, which in turn depletes the water table. Such actions could limit the water available to nearby wells. A public works water supply program might provide at least as many benefits as individual wells, yet eliminate the costs associated with excessive well drilling that are not borne by the well drillers themselves. In contrast, an externality where producers do not receive the full benefits of their activities occurs when private firms provide training for their employees. Firms may be unwilling to incur the expense of training due to the fear that trained staff will become more marketable and transfer to other companies which will reap the benefits. Accordingly, a public job training program could correct for this market failure.

A third type of market failure is associated with the level of risk accompanying some investments—especially for large scale R&D projects where risk of failure is high. Often, these investments' expected rates of return can also be very high, but the large risk and the relatively large investment required to pursue these returns may deter private firms from undertaking them. When this is the case, and expected benefits are large enough, government intervention may be useful.

The market system's primary solution to high risk is diversification. By investing relatively modest amounts in the securities of many companies, investors can assure themselves of an average return that is much less variable than the returns of individual projects and companies. In the case of risky investments in R&D, the venture capital market plays an important role by placing to market the securities of promising high technology companies and providing investors with the advantages of portfolio diversification. From a social point of view, however, the venture capital market may still under fund highly innovative R&D because of impediments to information flow between innovators and investors. Also, in some cases, an innovator may capture only a fraction of the social gains from an innovation because intellectual property protection is far from perfect. Some level of government involvement in the financing of R&D is widely considered to be an appropriate policy response to these market failures.

---

*Does the Problem  
Merit Federal—As  
Opposed to State and  
Local—Intervention?*

The federal government does not need to address all public investment problems. Many public investments—especially those whose benefits apply to a limited geographic area—are more appropriately carried out by state and local governments. Consequently, federal investment is most often justified for programs yielding economic benefits that extend beyond a specific area or state. These would include R&D spending and

programs—such as road and waterways—where out-of-state residents are likely to also benefit. In these situations, economists agree that states and localities would provide lower levels of funding than they would if their residents received all the benefits. Federal intervention in education and training is often justified with an increasingly mobile work force because state and local governments tend to underinvest when the benefits are more likely to be captured by other states and localities.

Historically, when state and local government investment efforts for certain objectives were considered insufficient, federal policymakers often established grant programs to promote investment by these jurisdictions. Proponents of the need to stimulate national productivity have argued for increases in many of these types of public investment programs.

On the other hand, some opponents argue that the federal government has become overextended in funding investment and other social programs that have traditionally been carried out by state and local governments; these observers argue for a devolution of many of these federal investment programs to the states. Since these programs were established in the 1960s and 1970s, the federal government's ability to finance them has become constrained while the managerial and fiscal capacity of states has grown with the modernization of revenue systems and upgrading of staff qualifications and public accountability processes.<sup>9</sup> Opponents have argued that states and localities might be more successful in tailoring and targeting these programs to suit unique local investment needs if freed from the burdensome array of federal categorical funding requirements and mandates. They suggest that investment might fare well if devolved to the states, pointing to the support that investment has traditionally enjoyed at the state and local level and the recent resurgence of state and local efforts to enhance the development of their economies through innovative education, training, and transportation programs.<sup>10</sup>

---

*Have Alternatives for  
Addressing the  
Problem Been  
Considered?*

Public sector investment objectives can be achieved by a variety of alternative methods. A comprehensive review of different solutions to market failure may uncover cost-effective alternatives. Many of these alternatives, such as user fees, price restructuring, regulation, or employing market forces can achieve investment policy objectives with little new or additional government spending. For example, a higher level

---

<sup>9</sup>Alice M. Rivlin, *Reviving the American Dream*, The Brookings Institution (Washington, D.C.: 1992).

<sup>10</sup>David R. Beam, "Reinventing Federalism: State-Local Government Roles in the New Economic Order," paper prepared for the 1988 annual meeting of the American Political Science Association.

of fees imposed on users of congested segments of inland waterways could encourage more efficient waterway use and reduce the need for new construction to alleviate congestion. Similarly, some analysts have suggested that charging airlines variable fees for landing slots based on time of day could help reduce congestion at airports, possibly alleviating the need for expensive expansion or construction of new airports.

Price restructuring can also realize large efficiency gains. For example, one of the primary causes of road damage is not just from the vehicles with the heaviest total weight, but from the vehicles that have the heaviest weight per axle. On some roads, however, user fees are based on how many axles the truck has. This factor encourages some truck companies to maximize the amount of weight per axle rather than add more axles, resulting in excess road damage. Charging trucks a user fee based on the weight per axle could provide an incentive for truckers to use less damaging equipment.

Also, ISTEA's shift in priorities from new construction to major repairs and preventive maintenance can also increase productivity at lower costs. The Congressional Budget Office's (CBO) analysis indicates that increasing highway maintenance efforts, including major repairs, would achieve a 75 percent rate of return for urban systems (16 percent for rural systems), while the return on carefully selected new urban construction programs would be only 10 to 20 percent.<sup>11</sup>

In some cases, regulation can contribute to increased economic efficiency. For example, government regulation of the radio spectrum through Federal Communications Commission (FCC) licensing activities has enabled commercial and other private use of radio and television. Without government intervention of some type, the absence of assigned property rights over frequency bands would have made access to the spectrum so uncertain that it is unlikely that commercial uses, such as television and radio, would have been possible.<sup>12</sup>

Public managers could also use private markets to allocate resources more efficiently. For example, instead of assigning rights to use the spectrum through its regulatory licensing activities and lotteries, the FCC could

<sup>11</sup>Based on How Federal Spending for Infrastructure and Other Public Investments Affects the Economy, Congressional Budget Office (July 1991), pp. 38-39, and GAO's analysis of CBO data.

<sup>12</sup>Laurence F. Schmeckebier, The Federal Radio Commission: Its History, Activities and Organization, The Brookings Institution (Washington, D.C.: 1932), pp. 24-25. See also Barry Cole and Mal Oettinger, Reluctant Regulators: The FCC and the Broadcast Audience (Reading, Massachusetts: Addison-Wesley Publishing Company, 1978), p. 4.



auction or charge royalties for use of specific frequencies on the radio spectrum. Proposals to use this type of market pricing to allocate the spectrum (with government receiving the revenues)—in conjunction with some residual regulatory authority—could lead to a more efficient use of the radio spectrum. However, in any “privatization” plan, such as airline deregulation, efficiencies are often accompanied by an industry “shakeout” in which relatively weak companies are acquired by others or eliminated.

---

# Is the Program Well Designed?

---

An investment program may effectively address a well-defined problem but still fail to contribute to private sector output and economic growth because of design flaws. Also, many critical management decisions that can affect a program's results must be made after a program is approved. Thus, even a program with a potentially high rate of return may fail due to poor implementation. The following questions can help one judge whether a program is well designed and likely to be implemented effectively.

---

## *Can the Program Work as Designed?*

A federal investment program will not succeed if it cannot be implemented effectively. Policy analysts suggest that three factors contribute to successful program implementation.

First, are the assumptions and theory underlying a program valid? For example, the Federal Aviation Administration's (FAA) modernization program initially called for a consolidation of air traffic control facilities from over 200 to 23. After we raised concerns, FAA acknowledged that at least another 30 facilities would be needed.<sup>13</sup> In an earlier assessment, FAA did not take into consideration the potential effect on the air traffic control system if any of these consolidated facilities experienced a catastrophic failure. FAA vulnerability studies indicated that if a consolidated facility failed, adjacent facilities could not adequately manage the airspace, increasing aircraft delays and the risk of accidents.

Second, does the program have all the resources necessary for it to succeed? A program that does not have sufficient staffing, managerial expertise, financial support, information, or legal means, will probably produce disappointing outcomes. ISTEA, for example, encouraged the flexible use of funds among various modes of surface transportation. But early results indicate that state and local governments did not have sufficient data and analytical tools to analyze and select among the different modes. These deficiencies contributed to the minimal use by state and local governments of flexible federal aid highway funds in the program's first year.

Third, has the program been compared with similar programs? Have these programs succeeded? What weaknesses exist? Evaluations of similar programs operated by state or local governments or other federal agencies can provide an early assessment of a federal program's prospects for success. For example, our assessment of state and local dislocated worker assistance programs identified two characteristics of successful

---

<sup>13</sup>Transition Series: Transportation Issues (GAO/OCG-93-14TR, December 1992).

programs—tailoring programs to meet participants' specific needs and reaching dislocated workers at or near the time of layoff.<sup>14</sup> However, we found that in contrast to successful state programs, federal dislocated worker assistance programs were not tailored to address specific worker needs and were slow in reaching dislocated workers.

---

### *Is the Program Well Targeted?*

Targeting programs to areas or populations where the highest net benefits can be achieved can enhance private sector productivity and economic growth. Targeting is important for human capital investments, which provide the greatest returns when they are targeted to populations with the greatest potential for increased productivity.

The importance of targeting is highlighted by a study of an aspect of the Job Opportunities and Basic Skills Training (JOBS) program. This study of welfare-to-work initiatives associated with JOBS showed that only one of three categories of participants—the “moderately disadvantaged” workers—achieved consistent and large gains from the program. The “most employable” and the “least employable” achieved little or no benefit from the program.<sup>15</sup> From a targeting point of view, evaluation could identify program changes necessary to benefit the entire targeted population. Alternatively, if the program cannot be fixed to help the “most employable” and “least employable,” then the program could maximize its return by targeting only the “moderately disadvantaged” workers who have benefited from the program.

For many human capital programs, however, the goal of targeting benefits to particular groups often must be balanced with other goals. These programs often have mixed objectives—while trying to raise productivity, they also have social or political objectives that may conflict with increased productivity. For example, welfare-to-work initiatives, in addition to providing worker training, are intended to provide more equitable opportunities for long-term welfare recipients. Programs that are only partially concerned with economic growth—such as welfare-to-work initiatives—are harder to evaluate using investment criteria only.

Targeting can also enhance productivity growth when distributing investment grant funds among states and localities. States and localities vary both in their needs for programs as well as their fiscal capacity to

---

<sup>14</sup>Transition Series: Labor Issues (GAO/OCG-93-19TR, December 1992).

<sup>15</sup>Judith M. Gueron and Edward Pauly, *From Welfare to Work* (New York: The Russell Sage Foundation, 1991) pp. 30-31.

provide for those needs. Jurisdictions with a limited tax base and fiscal resources often provide lower levels of infrastructure, education, and other investments than more advantaged communities. A well-targeted federal aid program can help compensate for these disparities by directing a greater share of aid to places with the greatest needs, the lowest fiscal capacities, and the highest potential for private sector growth. Conversely, a poorly targeted program can exacerbate these disparities; moreover, aiding places that can provide services on their own is not likely to be a cost-effective use of scarce federal funds.

---

### *Will Other Factors Hinder Its Success?*

Success is often affected by factors considered external to an investment program. For example, studies have indicated that the Head Start program improves the readiness and cognitive skills of participants. But the studies also show that the advantages students gain begin to dissipate after they leave the program to enter grade school, primarily because the students' learning environment has changed. However, programs can be designed to counteract these effects. For example, supplemental instruction for Head Start graduates could be used to sustain program achievements.<sup>16</sup>

In another example, uncontrollable external factors, including fluctuating oil prices, have hindered the success of alternative fuel development programs. For alternative fuel production programs—where managers cannot control the price of oil—a relatively low oil price makes commercial viability doubtful. Being aware of the effect of external factors, such as price risk, on returns can help decisionmakers make better judgments about whether to make investments.

Investment programs can also lead to unforeseen consequences that undercut a program's ultimate success. During the 1960s, the U.S. Corps of Engineers rerouted the Kissimmee River in Florida to improve flood control and enable use of surrounding land. Although accomplishing its limited objectives, the program unintentionally contributed to the degradation of the entire South Florida wetlands ecosystem. The Corps is now trying to restore the ecosystem by routing the Kissimmee River more closely to its original path. Consideration of environmental consequences when the program was conceived could have saved both the original and restoration investment costs.

---

<sup>16</sup>"The Impact of Head Start on Children, Families, and Communities," *Final Report of the Head Start Evaluation, Synthesis, and Utilization Project*, CSR Incorporated (Washington, D.C.: June 1985), chapter 3, p. 8.

*Is the Investment Program Coordinated With Other Federal Programs and With State and Local Governments?*

A federal investment program that is not effectively coordinated with other federal policies can limit investment returns. For example, the Department of Interior's Inspector General reported that "the Department of Agriculture paid farmers enrolled in its commodity programs up to \$50,000 per year to limit production of surplus crops." At the same time, the Department of Interior's Bureau of Reclamation provided these farmers irrigation water at reduced prices under a program that promotes agricultural production. The Inspector General concluded that eliminating payment of the irrigation subsidies to farmers who received agriculture subsidies would result in annual savings of \$66 million.<sup>17</sup>

Coordination with state and local governments is also important when federal investments are implemented through those governments. Programs of this type must rely on incentives in grant formulas and matching requirements to induce state and local governments to support federal priorities. A well-designed federal investment grant program to state and local governments will provide incentives for the other levels of government to invest where the highest economic rates of return would be realized. However, there are limits on federal influence over project selection. Some federal grant programs, such as Community Development Block Grants, minimize federal influence over program priorities and implementation in an effort to devolve decision-making and management authority to states or localities. Other federally funded intergovernmental programs rely on mandates, regulations, and funding formulas that can result in lower returns. For example, until recently, federal highway policy encouraged new highway construction and major repairs, but prohibited use of federal funds for preventative maintenance even though this use could prove to be cost-effective. Some of this distortion was corrected by ISTEA, which increased flexibility in using federal highway funds for state and local governments.

<sup>17</sup>Testimony of James R. Richards, Inspector General, Department of the Interior, before the Subcommittee on Oversight and Investigations, Committee on Natural Resources, House of Representatives (January 26, 1993).

*Is the Program  
Designed to Ensure  
That Federal Funds  
Supplement and Do  
Not Supplant  
Nonfederal Funds?*

Federal investment programs will only add to total investment, and thus stimulate economic growth, if they supplement—not supplant—investments by states, local governments, and the private sector. However, a Department of the Treasury analysis<sup>18</sup> of economic studies shows that a large portion of federal aid to state and local governments is used to replace state and local funds. This included a study of federal road assistance (excluding interstate highway funds) that showed that states reduced their spending by 62 cents for every dollar received from the federal government.

Similarly, we have found that some federal programs designed to encourage investment through tax credits and deductions actually only supplant private funds. For example, in our work on Industrial Development Bonds (IDB), we found that in three states with high dollar IDB volume, 60 percent of the developers using these tax-exempt financing instruments would have done their projects had the IDBs—and the public subsidy they bring—not been available.<sup>19</sup>

Even the mere proposal of federal investment assistance may result in large reductions of state, local, or private investment. One study suggested that a \$2 billion federal stimulus proposal in 1976 for state and local capital investment may have prompted state and local governments to withhold funding of \$22 billion in capital investments in anticipation of receiving the federal funds.<sup>20</sup>

<sup>18</sup>Federal-State-Local Fiscal Relations: A Report to the President and the Congress, Department of the Treasury (September 1985).

<sup>19</sup>Industrial Development Bonds: Achievement of Public Benefits Is Unclear (GAO/RCED-93-106, April 22, 1993).

<sup>20</sup>Edward M. Gramlich, "State and Local Budgets the Day After It Rained: Why Is the Surplus So High?" in Arthur M. Okun and George L. Perry eds., Brookings Papers on Economic Activity, Vol. 1, (Washington, D.C.: 1978), pp. 208-209.

---

# How Should the Program Be Evaluated After Implementation?

---

Even if investment programs are worthwhile and well designed, success is never guaranteed. Priorities and external conditions may change so that even a well-conceived program, over time, may have disappointing outcomes. To improve the federal government's ability to invest wisely in the future, more must be learned about public investments already made. It is therefore important that all public investment programs include, at the time of their implementation, provisions for evaluating program outcomes—especially, where applicable, the effects on national productivity.

---

## *Are the Means for Evaluating the Investment's Effectiveness Provided?*

Evaluating the effectiveness of new and existing federal investment programs could provide decisionmakers with valuable information for determining the most productive investments. Outcome data are needed for such an evaluation. Initially, investment programs are justified on estimates of returns and other factors. Later, however, program data should become available to determine whether estimated outcomes have been achieved. However, these data must be collected and evaluated if a judgment as to the investment's effectiveness is to be made. Thus, investment programs should include mechanisms to ensure that outcome data are collected and analyzed.

To ensure that the nation is investing for high economic growth rates, policymakers must ensure that ongoing investment programs continue to be worthwhile and well designed under changing circumstances; otherwise, the nation should undertake other, more productive, investments. Data should be collected and analyzed for the life of the investment program's expected returns and should reflect the most up-to-date data collection and evaluation technology whenever possible. For example, better methods of measuring highway use—which were not available when a program was approved—can be used to better assess alternatives for relieving highway congestion and determine if the program is still a good investment. Reevaluations of this sort can lead to mid-course corrections or changes in priorities.

Evaluating the implementation of investment programs is an important element of determining why a program succeeds or fails. As observed above, proper implementation of the program helps ensure its success. Because each investment program depends on the effectiveness of many micro-level implementation decisions, implementation evaluation is crucial to improving future investment effectiveness by incorporating "lessons learned."

A major impediment to evaluation of investment programs, however, is the reduction of resources devoted to evaluation by federal agencies since 1980. We have found that professional staff in program evaluation units decreased substantially in the 1980s (by 52 percent between 1980 and 1988 in 15 evaluation units active in both years) and that evaluation budgets declined 37 percent between 1980 and 1984 (in constant 1980 dollars) and another 6 percent between 1984 and 1988. Moreover, the types of evaluations being conducted have evolved from complex evaluations giving more precise measures of program effects to less complex studies and nontechnical reports. Further, there has been a growing reliance on external professionals to conduct even small-scale studies. Finally, reports are increasingly written for internal use rather than for congressional oversight and public scrutiny.<sup>21</sup>

---

*Can Alternate  
Measures Assess the  
Program's Merit?*

The benefits and costs for many programs cannot be measured directly. Returns on human capital and R&D investments are especially difficult to measure because they often have no direct link to market transactions. Despite these measurement difficulties, decisionmakers need to be able to make informed judgments about program effectiveness using available program outcome data.

Determining a program's return may require the use of substitute measures (also known as proxy measures). For example, the percentage of high school graduates enrolling in college can indicate an education program's effectiveness, which, among other factors, can be used to form a judgment of the program's relative net benefits.

Although a proxy measure can be extremely helpful in determining a program's investment potential, it can be misleading if it is not closely related to net benefits. For example, one R&D proxy measure often used for research grants is the number of scholarly publications produced. But counting the number of publications does not closely correlate with the quality or effectiveness of the research. While evaluators now measure the research by, among other techniques, counting the number of times a publication is cited, measurement problems persist. Improved proxy measures for investment programs can help accurately assess the rate of return for investments.

Assessing a program's success as an investment is even more difficult when the program is intended to achieve more than one goal. For

---

<sup>21</sup>Program Evaluation Issues (GAO/OCG-89-8TR, November 1988).



example, the Community Development Block Grant Program was designed primarily to increase community investment, but a 1983 amendment required that 51 percent of the funds for 3 years be used to benefit low and moderate income persons. Subsequent amendments raised this requirement to 70 percent. Because of this requirement, the success of the program must include an assessment of effects on both redistribution and economic productivity.

---

*What Approaches Can  
Be Used to Assess a  
Program's Effect on  
Outcomes?*

To determine whether a program succeeded requires information on the program's direct effects. However, establishing a causal link between an investment and a particular outcome can be very difficult—especially for human capital programs. Many unanticipated factors can influence outcomes. Techniques that control for the influence of outside factors can provide information to evaluate program effects that could not be determined otherwise. For example, the Job Training Partnership Act is viewed as a relatively successful program because most of those who enrolled got jobs. However, after control group studies were completed, analysts found that some groups fared better without the program.

In some cases, evaluations that are planned before program implementation can use “true” experimental designs. The true experiment uses random assignment of individuals to treatment and control groups. This can be a useful way to demonstrate the effectiveness of a given program since it compares outcomes in cases where it was implemented to essentially identical cases where it was not implemented. A major impediment to employing experimental designs in evaluating public programs is that it generally is not practical to determine randomly who gets to participate. Moreover, the results of experiments may not provide results that reflect on the entire program. Often, more practical, alternative designs are available. For example, in quasi-experiments, treatment and control groups are self-selected, and statistical procedures are used to explain the differences between them.

Program evaluations can often be improved in three general areas. These include (1) clarifying evaluation questions early in the process, (2) formulating and testing the evaluation design for its usefulness in answering the questions, and (3) selecting the appropriate data-gathering methods, such as case studies, sample surveys, field experiments, or other available data.

---

# Major Contributors to This Report

---

**Accounting and  
Information  
Management Division,  
Washington, D.C.**

Barbara D. Bovbjerg, Assistant Director  
Jeffrey Itell, Assignment Manager  
Bruce L. Baker, Evaluator-in-Charge  
Daniel G. Williams, Senior Economist  
Maureen M. Berner, Evaluator  
Julia H. Doherty, Evaluator  
Elizabeth A. McClarin, Evaluator  
Kevin P. Hans, Presidential Management Intern

---

**Program Evaluation  
and Methodology  
Division**

Patrick G. Grasso, Assistant Director

---

**Office of the Chief  
Economist**

James R. White, Assistant Director

---

### Ordering Information

The first copy of each GAO report and testimony is free. Additional copies are \$2 each. Orders should be sent to the following address, accompanied by a check or money order made out to the Superintendent of Documents, when necessary. Orders for 100 or more copies to be mailed to a single address are discounted 25 percent.

**Orders by mail:**

U.S. General Accounting Office  
P.O. Box 6015  
Gaithersburg, MD 20884-6015

**or visit:**

Room 1000  
700 4th St. NW (corner of 4th and G Sts. NW)  
U.S. General Accounting Office  
Washington, DC

Orders may also be placed by calling (202) 512-6000  
or by using fax number (301) 258-4066.

---

United States  
General Accounting Office  
Washington, D.C. 20548

Official Business  
Penalty for Private Use \$300

First-Class Mail  
Postage & Fees Paid  
GAO  
Permit No. G100

---