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Policy analysis at OTA

A STAFF

ASSESSMENT

This is an internal report of an OTA working group to OTA management. The views expressed in this report are not necessarily those of the management, the study advisory panel, the Technology Assessment Board, the Technology Assessment Advisory Council, or individual members thereof—May 1993.

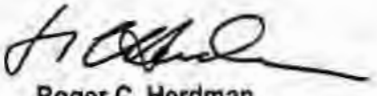
FOREWORD

This past year, the Office of Technology Assessment (OTA) celebrated its 20th anniversary—providing an opportunity to reflect on how well the agency has been serving the U.S. Congress and on how it might improve. OTA was established in 1972 to provide Congress with "competent, unbiased information related to the physical, biological, economic, social, and political effects" of technology.

In the fall of 1992, former Director John Gibbons authorized a brief staff assessment of policy analysis in full OTA reports. The hope was that this internal exercise would yield insights that could improve OTA's ability to provide the Congress with information it needs to grapple with controversial policy issues involving science and technology.

The five OTA staff who performed the assessment over the past several months were asked to take a critical look at the agency's past endeavors. In addition to reviewing a sample of 18 OTA reports, the project team solicited opinions about OTA's policy analysis from outside observers, including a bipartisan group of former and current House and Senate staffers who have used OTA's work (see study plan in app. A). The project team was assisted by a 14-member advisory panel composed primarily of senior OTA staff.

This document presents the findings of the assessment, along with options for OTA management and suggestions for OTA project directors. While not confidential, the document is intended for internal use, and as such, was not reviewed or approved for release by the Technology Assessment Board. It is being distributed to OTA staff in the hopes that it will stimulate efforts to improve OTA's policy analysis by building on the successes and failures of the past.



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The project team appreciates the help and support of the advisory panel and of many of their OTA colleagues, including John Gibbons, former OTA Director; Roger Herdman, Acting Director; John Andelin, Assistant Director; all nine Program Managers; several first-time project directors; and others who offered insights and assistance. The team also would like to extend special thanks to the current and former congressional staff, former OTA staff, and workshop participants who contributed significantly to the project.

CONTENTS

Findings and Options

The Office of Technology Assessment (OTA) is a small analytical support agency of the U.S. Congress. Its purpose is to provide thorough, objective information and analysis to help Members of Congress understand and plan for the short- and long-term consequences of the applications of technology, broadly defined.

The agency's authorization by the Technology Assessment Act of 1972 was something of an experiment. Never before had such an agency existed, in the United States or elsewhere. OTA's bipartisan governing board, the Technology Assessment Board (TAB), has 12 Members of Congress—six Senators and six Representatives divided equally by party affiliation. By design, the in-house analytical staff of the agency is quite small, numbering only about 130 people at the end of 1992. To prepare reports for Congress, the agency relies not only on its multidisciplinary analytic staff (about 70 percent of whom hold advanced degrees) but also on input from advisory panels, workshops, and outside contractors representing a broad range of interests and expertise. Each report undergoes several rounds of external review, involving a vast number of people with diverse backgrounds and perspectives.

OTA was funded in 1973, so the agency has now been writing reports and serving Congress in other ways for two decades. During this time, OTA has developed considerable analytical and political credibility. In the past 20 years, congressional committees have asked OTA to provide in-depth analyses of controversial, complex, and sometimes little understood national policy issues involving science and technology. OTA has responded by issuing reports on topics that include—to name but a few—energy efficiency and conservation, global climate change, national and international security needs, unconventional cancer treatments, AIDS research, U.S. competitiveness in high-technology industries, infrastructure needs, the implications of revolutionary changes in telecommunications and computer technologies, the disposal of nuclear and chemical wastes, and the sustainability of natural resources. In many instances, OTA reports have helped frame congressional debate on a topic or provided options to help resolve the debate. In other instances, OTA reports have provided policy-relevant technical information that has helped illuminate the debate. OTA reports are intended primarily for use by Congress, but they often have a wider applicability and audience, including the executive branch, state and local governments, industry, academia, and the public.

Despite the agency's accomplishments, this is no time for OTA staff to be complacent. Rather, the occasion of OTA's 20th anniversary is an auspicious time to consider how the agency might improve the quality of its work. The country has just entered a new

phase—marked by events that include the election of a new President and a new Congress, profound changes in the global political and economic realm, and an ever-present need to grapple with difficult policy issues involving applications of science and technology. If we are to help our national leaders meet the difficult challenges of the next decade and of the next century, we at OTA must continually strive to improve.

In September of 1992, responding to widespread interest within OTA, then-Director John Gibbons[1] authorized a small internal assessment of OTA policy analysis—the OTA Policy Project, with a staff of five and an in-house advisory panel. This brief assessment was limited to an examination of policy analysis in full OTA reports.[2] The goal of the assessment was to produce a document that could help OTA staff—new staff and even "old hands"—improve the agency's policy analysis. This report is the culmination of that effort.

The OTA policy project team decided at the outset of this study not to get bogged down in the effort to define policy analysis. Rather, we decided to use the same approach Percy Bridgman used in defining science as "the activity of scientists"—we simply defined policy analysis as the "activity of policy analysts." We started out by looking at OTA reports. The project team found that, despite their great diversity, OTA reports typically have two major components:

- analysis of the policy problem, including discussion of the policy context, findings, and issues; and
- identification and analysis of potential solutions, i.e., goals and options for congressional consideration (see box 1-A).

Identifying these two components of OTA reports was the closest the team came to defining OTA policy analysis.

Other key findings of the OTA policy project team regarding policy analysis in OTA reports are summarized in this chapter. Also presented here are a set of options for OTA management (the director, assistant director, and program managers) and suggestions for project directors and analysts to consider as means of moving OTA toward a higher level of excellence.

Chapter 2 of this report provides further details on the purpose, scope, and methods of this assessment (the study plan for this assessment is reproduced in app. A). In essence, the OTA policy project consisted of two major tasks. The core task was the review by the policy project team of a sample of 18 OTA reports (see box 2-A in ch. 2). The 18 reports, selected by program managers, were equally distributed among the nine OTA programs. A second task was to look beyond OTA reports to the following for insights:

1. written evaluations of the policy analysis in a sample of 12 OTA reports by four former congressional staff (using their own criteria for good policy analysis), followed by a meeting with the project team that all four attended (app. A-3);
2. telephone interviews with 13 current congressional staff to learn their views regarding the strengths and weaknesses of OTA reports (app. A-4);
3. essays on the strengths and weaknesses of OTA policy analysis by five former OTA project directors (app. A-5);
4. a workshop with 10 outside experts in different fields, each of whom was familiar with some aspect of OTA's work (app. A-6);
5. interviews with a dozen recent first-time OTA project directors

[1] OTA's Director John Gibbons resigned in January 1993 to accept a position with the Clinton administration as Science Advisor to the President and Director of the White House Office of Science and Technology Policy.

[2] Full OTA reports contain "major policy content" and are produced with the assistance of an advisory panel. Although the focus of this assessment was on policy analysis in full OTA reports, it is important to recognize that the publication of full reports is only one type of OTA activity. OTA also publishes background papers, briefs congressional staff and answers their inquiries, provides testimony before congressional committees, etc. This assessment did not consider how to improve other OTA products or activities.

Box 1-A. Components of policy analysis in OTA reports

Identifying two components typically found in OTA reports was the closest the policy project team came to defining policy analysis. OTA reports typically have two major components: 1) analysis of the policy problem, including discussion of the policy context, findings, and issues; and 2) identification and analysis of potential solutions, i.e., goals and options for congressional consideration. Part of the art of OTA policy analysis is making sure that the policy options flow from the information and arguments advanced elsewhere in the report and that the options are thoughtful and reflective of an understanding of what policy can achieve. If a report is well crafted, there is a clear and logical link between the two components.

The policy problem: context, findings, and issues

This part of an OTA report includes a description and analysis of a policy problem or issue, or in the case of an assessment of a technology, a description and analysis of issues associated with the development or use of the technology. It can be thought of as an explanation of what the present looks like, how we got there, and where we might end up if no changes are made. Some OTA reports address a very narrow policy context, while others attempt to relate the policy context to social welfare or other much broader contextual areas.

In addition to highlighting the relevant aspects of science and technology, this part of the report may include discussions of the people who are most directly involved, laws, institutions, and economic and social concerns. The people involved include both the "stakeholders" (e.g., the American public and specific groups who are most affected) and "decisionmakers"—Congress, the executive branch, the states, and private entities. Relevant laws and regulations are discussed, as are the institutions that implement the laws and are affected by them. All aspects of Federal involvement are likely to be considered. Economic and broad social concerns, including ethical concerns, are also likely to be included, as appropriate.

At some point, an OTA report must explicitly identify key items for congressional consideration. In the words of one congressional staffer, a report provides "touchstones" that allow staff to go quickly from one key issue or problem to the next. OTA reports provide touchstones in many forms. Presenting "findings," "issues" (areas of controversy or conflict), "problems" to be solved, or "congressional decisions" that must be made are among the approaches some reports use for highlighting the most important concerns. Depending to a certain extent on the topic, some reports highlight very broad philosophical issues, and others focus on far more narrow issues.

Potential solutions: goals and options

This part of an OTA report moves from the craft of policy analysis to high art, from analyzing the status quo to envisioning possible policy changes and evaluating the effects of changes. Through methods that include brainstorming, soliciting outside views, etc., the project team identifies potential goals and concrete options for Congress.

In some cases, OTA has to propose and evaluate the implications of pursuing alternative goals. In other cases, the goals are established by the congressional request, and the primary focus of the OTA assessment is on developing and analyzing options for achieving a goal. Depending in part on the topic of the assessment, the goals and options may reflect basic philosophical disagreements (e.g., regarding regulatory approaches vs. market mechanisms) or be technical options that give numbers appropriate for legislation (e.g., tons of emissions of CO_2).

As one might imagine, options can be organized in many ways. The challenge is to choose the approach that seems to fit the assessment topic best. Organizing options by "problem to be fixed" or "goal" are two approaches that often work. Organizing options by technology fails to highlight the specific matters of concern to OTA's congressional clients and is therefore typically less helpful. Especially if there are many options, it is often helpful to organize them into "strategies" or packages. Sometimes options can be organized by "values" or prior beliefs (e.g., "less government is better government"; "we do not give a healthy environment to future generations, we borrow it from them"; "all men are created equal, that they are endowed by their Creator with certain inalienable rights...," etc.). Sorting options by other criteria can also be helpful. Thus, for example, it might be helpful to sort options into near-term and longer term decisions or by extent of governmental intervention, cost, or some other measure of size of the program.

to learn what types of information they would have liked to have had available to help learn the craft of policy analysis; and

6. reviews of the literature on policy analysis and earlier examinations of OTA (see ch. 2 and app. A for further details).

Findings from interviews and evaluations of OTA reports by congressional staff are summarized in chapter 3. Chapter 4 summarizes statistical data obtained by the policy project team's review of 18 reports. Chapter 5 offers narrative descriptions of especially good policy analysis in the sample of 18 OTA reports. Finally, chapter 6 turns to a discussion of the culture of OTA and the implications OTA's culture has for the transfer of policy analysis methods and "know-how" (for lack of a better term) throughout the agency.

FINDINGS

A central finding of the OTA policy project team is that **policy analysis in OTA reports is often good—and frequently regarded as better than that of other policy organizations—but there is considerable variation in the quality and methods of policy analysis from report to report, even within programs.** Furthermore, there are some specific ways in which OTA reports could be improved to better serve the needs of OTA's congressional clients.

Nearly all the individuals with whom the policy project team talked gave a very positive overall assessment of OTA's work. The information that follows should not obscure the near-universal agreement that OTA is either the best, or nearly the best, policy shop that deals with technological issues. OTA ranks extremely high in reliability, objectivity, and completeness. The high esteem in which the agency's work is held is reflected in the following rather effusive comments by outside observers who attended the project's policy workshop:

OTA is, and has been for a decade or more, the best policy analytic group in the U.S. Government. Its reports are the most balanced, even-handed, broadly based, and reliable.

Over the past two decades, OTA has come to occupy a leadership role in a special and increasingly important form of policy analysis. Countless state, national, and international policy organizations look to OTA for high-quality, unbiased, comprehensive analysis of difficult science, technology, and policy issues.

This praise is echoed in a set of comments by minority and majority congressional users of OTA reports:

OTA is the "most effective" [of a set of similarly tasked organizations] . . . OTA reports do the "best job of policy analysis."

OTA is "by far the best" [of similarly tasked organizations].

OTA is "analytically more satisfying" than others.

Apart from this praise, however, some criticisms emerged from discussions with current and former congressional staff, OTA alumni, and outside policy analysis experts (see ch. 3 and 4). Some of the criticisms were heard infrequently and perhaps should be taken with appropriate amounts of salt, but others were quite common. Congressional staff noted problems with the readability of some reports and difficulty in finding conclusions and backup arguments. Many reports take too long to digest. Congressional staff also mentioned the long time needed to produce full reports from OTA when pressures for legislation were looming. And a few observers detected lapses of objectivity in some of OTA's work that concerned them. Some of the outside policy experts, perhaps viewing matters from an academic perspective, were of the view that OTA's institutional analysis, stakeholder analysis, and inclusion of international aspects of issues were occasionally deficient.

The OTA policy project team took all of these critiques into account and examined them in light of the 18 OTA reports and what team members know about OTA from personal experience. While disagreeing with some of the assessments, the team found others to

be justified. What follows is a discussion of problems that affect some OTA reports and suggestions for addressing those problems by means that include improving the transfer of policy analysis skills and know-how throughout the agency.

Needs of OTA's congressional clients

At OTA's request, four former congressional staff specified what they considered minimal and ideal criteria for good policy analysis in an OTA report (see box 3-A in ch. 3). The three criteria on which there was the greatest degree of unanimity among the four were as follows:

- reader-friendliness,
- objectivity, and
- timeliness from a congressional perspective.[3]

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The consensus among current and former congressional staff was that OTA reports generally do well in terms of objectivity—with some lapses—and less well on accessibility/reader-friendliness and timeliness.

Reader-friendliness of OTA reports. Former and current congressional staff interviewed by the OTA policy project team underscored the importance of reader-friendliness in OTA reports (see ch. 3). A number of staff said that if an OTA report is difficult to read, they may put it aside in favor of one of the many other documents that comes across their desk instead. Or, if they use the OTA document, they may not be able to get the full benefit of what it has to say. Most of the current staff said they typically have time to read only the summary of an OTA report; others said they use the summary to point them in the direction of a specific chapter in which they are interested. Committee staff preparing legislation on a particular issue like to refer to the rest of an OTA document as needed to find more detailed information on topics or arguments found in the summary. For that reason, they said, it is extremely important to be able to track points raised in the summary through the rest of the report. Many of the staff interviewed stressed the importance of an index.

Former congressional staff reported that one-third of the 12 OTA reports they were asked to evaluate had major problems in organization and format that made the reports extremely difficult to use (see ch. 3). The OTA policy project's evaluation of a sample of 18 OTA

[3] Other criteria included accuracy, key assumptions identified, comprehensiveness/thoroughness, apolitical, historical context given, strategies fro improving status quo well-analyzed, contains sound bites for members (see box 3-A in ch. 3).

reports confirms that some OTA reports are not reader-friendly for congressional staff pressed for time. The team judged just over half the reports (10) to be very good or excellent in terms of reader-friendliness; they judged the other reports to be okay or worse (see ch. 4 and app. C). In some of the reports, the findings and options were so buried that it was almost impossible to find them. In many reports, it was difficult to find details on material presented in the summary. Some reports took hours to assimilate; others literally required days. Nearly half (8) of the 18 reports did not have an index.

The OTA policy project team believes that broader use of techniques such as those used in the most reader-friendly OTA reports (see ch. 5) would raise the average level of reader-friendliness in OTA reports, thus making the policy analysis more accessible to congressional readers. A summary chapter with the major findings, issues, and options is essential. Clear labeling of the findings and policy options is essential. Parallel construction of at least part of the summary and the rest of the report can help make it easier to track points raised in the summary in the other chapters of the report. The most reader-friendly reports have a coherent chapter organization that outlines the story being told in the report. In many cases, the intelligibility of a report can be enhanced through the use of techniques such as callouts or boldface type, boxes, or tables to summarize clearly important elements of the work, findings, or options. Especially for long reports, but probably for all reports, an index is essential.

Objectivity and recommendations in OTA analysis. A great majority of the former and current congressional staff interviewed by the OTA policy project team noted that objectivity and independence are prime elements of OTA's credibility (see ch. 3). The importance of objectivity applies both to the analysis of the policy problem and to the analysis of goals and options.

Overall objectivity—In general, congressional staff and policy workshop participants credit OTA with a reputation for maintaining a high level of objectivity and balance, but they did find some lapses. The former congressional staff asked to evaluate a sample of 12 OTA reports generally judged the level of objectivity in these reports to be quite high. In five of the 12 reports, however, these staffers identified major—or, more typically, minor—lapses of objectivity. Some reports had lapses in the "policy" context, findings, and issues" part of the report, some had them in the "goals and options" part, and some had them in both.

The OTA policy project team found major or minor lapses of objectivity that it considered a problem in seven (40 percent) of the 18 reports it reviewed (see ch. 4 and app. C).

What is meant by a "lapse of objectivity" in an OTA report? As one OTA program manager explains, there are "several different possible meanings of objectivity in an OTA report, and. . . the meaning has evolved over time and in different programs and issue areas to the point where we now need to think through what we mean by the word. . . . [O]bjectivity is important for OTA: it is our market niche."

Absolute objectivity in an OTA report is virtually impossible,[4] so the important question to be considered is: What constitutes an acceptable level of objectivity in an OTA report? Objectivity has several aspects. Some types of lapses in objectivity are clearly unacceptable in an OTA report. It is generally understood, for example, that an OTA report should not be partisan in the sense of consistently advocating positions supported by Democrats or Republicans. The OTA policy project team found no criticism of OTA in this regard.

A related but separate aspect of objectivity is ideological bias. One workshop participant criticized OTA for typically presenting op-

[4]As noted by one workshop participant, normative choices are made in every step of policy analysis, "... in making choices among analytical methods, among data, and more important, among alternative options or recommendations."

tions involving increased Federal intervention rather than market solutions or greater delegation of responsibility to state and local governments. The OTA policy project team did not examine the extent to which this criticism is justified; however, it did find that only a few of the 18 reports included options for reduced Federal intervention (see app. C). Given the agency's purpose and mandate, the nature of many issues it studies, and the fact that OTA's primary audience is the U.S. Congress, a preponderance of options involving action by the Federal Government may not be unreasonable. It is important for OTA staff to recognize, however, that the omission of non-Federal solutions to problems as alternatives can lead to the perception of ideological bias.

A third aspect of objectivity is in the selective use of evidence to point to a controversial conclusion or to a policy option. The OTA policy project team found one OTA report among the 18 it reviewed in which the arguments seemed so one-sided or so lacking in support that the report seemed open to the charge of outright advocacy (though, of course, it is not possible for the policy project team to ascribe intent or motive). In a few other reports, the objectivity appeared questionable because the rationale for the report's controversial basic premise was not explicitly stated (e.g., a report considered how to implement a policy that it apparently assumed was worthwhile but neglected to state any basis for that assumption). In some cases, there seemed to be "errors of omission," perhaps due to blind spots resulting from analysts' (and reviewers') values or prior beliefs. A few instances of concerns about objectivity stemmed from a report's making recommendations (see discussion below).

Even though OTA is generally credited with high marks for objectivity, the task of maintaining the agency's reputation requires eternal vigilance. Congressional staff interviewed by the OTA policy project team noted that some other institutions that perform policy analysis have lost their credibility by repeatedly sacrificing their independence and objectivity. As one workshop participant noted, "It only takes a couple of 'bad apples' to cast doubt on OTA's reputation for reasonably bias-free analysis." To preserve OTA's reputation for objectivity, OTA staff need to become conscious of and explicit about the normative choices they make in doing policy analysis.

Options and recommendations in OTA reports—A finding that was surprising to members of the policy project team was that seven (about 40 percent) of the 18 OTA reports the policy project team reviewed included what might be considered explicit or implicit recommendations or policy prescriptions in the options (see ch 4 and app. C).

From the policy project team's reading of reports, it is hard to discern a consistent pattern or rationale for when OTA reports do or do not make recommendations in options. Furthermore, there seems to be considerable confusion among OTA staff concerning the agency's policy about recommendations or policy prescriptions within options (see ch. 3). Contrary to in-house folklore, the Technology Assessment Act does not prohibit OTA from making recommendations (see box 1-B). The policy project team was unable to locate any Technology Assessment Board (TAB) or OTA director's policy explicitly prohibiting (or otherwise restricting) recommendations in OTA reports.

Several views on whether recommendations in options in OTA reports are appropriate were provided by congressional staff interviewed for this assessment (see ch. 3). Most, but not all, said that OTA staff should recognize that they are treading on thin ice when making recommendations. On the other hand, many of the staff said that there will undoubtedly be a few cases in which available evidence is overwhelmingly in favor of a particular option to reach a specified goal; in these cases, they said, OTA might be obligated to present its "empirically based policy prescriptions" accordingly.

Box 1-B. Technology Assessment Act of 1972

An Act

To establish an Office of Technology Assessment for the Congress as an aid in the identification and consideration of existing and probable impacts of technological applications...

Findings and Declaration of Purpose

. . . [I]t is necessary for the Congress to —

(1) equip itself with new and effective means for securing competent, unbiased information concerning the physical, biological, economic, social, and political effects of such applications; and

(2) utilize this information, whenever appropriate, as one factor in the legislative assessment of matters pending before the Congress, particularly in those instances where the Federal Government may be called upon to consider support for, or management or regulation of, technological application.

Establishment of the Office of Technology Assessment

. . . The basic function of the Office shall be to provide early indications of the probable beneficial and adverse impacts of the applications of technology and to develop other coordinate information which may assist the Congress. In carrying out such function, the Office shall:

(1) identify existing or probable impacts of technology or technological programs;

(2) where possible, ascertain cause-and-effect relationships;

(3) identify alternative technological methods of implementing specific programs;

(4) identify alternative programs for achieving requisite goals;

(5) make estimates and comparisons of the impacts of alternative methods and programs;

(6) present findings of completed analyses to the appropriate legislative authorities; and

(7) identify areas where additional research or data collection is required to provide adequate support for the assessment and estimates described in paragraph (1) through (5) of this subsection[.]

The policy project team concluded, after hearing from congressional staff, former OTA staff, and others, that when implicitly or explicitly prescribing congressional action, OTA analysts must take special care in justifying their position with very solid backup data and analysis, because it is precisely in such cases that OTA will find itself vulnerable to the charge of bias. Unless solid support for such policy prescriptions is provided, the policy project team believes that OTA runs the risk of losing its hard-won—and vitally important—reputation for objectivity. The project team judged that "empirically based policy prescriptions" (sometimes labeled options) were present and well supported in three of the 18 reports in its sample (see ch. 5).

Timeliness of OTA reports. Timeliness is vital for the effective use by Congress of OTA's policy analysis: From the congressional perspective, a report with solid analysis that comes too late may not be useful.[5] Congressional staff interviewed for this project said that timeliness in the delivery of OTA reports was a problem they sometimes encountered in OTA's process, if not its policy analysis (see ch. 3).

An OTA report may be late for several reasons. Sometimes the agency commits to a schedule that it is unable to meet, either because the necessary staff are unavailable or because the time needed to complete an assessment was underestimated. In other cases, the responsibility may lie with the requesting committee. The committee may not anticipate its needs early enough to allow OTA adequate time to complete a full-scale assessment. The

[5]Sometimes, though, an OTA report issued too late to be of use by one Congress may be useful to a later Congress; there have been several instances in which legislation has been enacted five years or so after an OTA report and has borne many markings of the earlier OTA work.

average 24-month time frame for an OTA report may be too long to satisfy some pressing legislative needs. It is under the latter circumstances that several staff expressed frustration that OTA could not undertake a more modest assessment, complete with policy options.

A few high-quality OTA reports have been produced quickly. *Exploring the Moon and Mars* and *Improving Automobile Fuel Economy* are examples from the 18-report sample. Both were directed by long-time OTA project directors with at least some familiarity with the topic. The existence of such reports supports the proposition that OTA need not always invest 18 to 24 months to produce vital, high-value work.[6]

Specific weaknesses or criticisms of OTA policy analysis

The analysis of options was identified as a weak point in some OTA reports by elements of all information sources used for this assessment, including the policy project team's review of 18 OTA reports, the one-day policy workshop, discussions with former and current congressional staff, and essays by former OTA project directors. There were more mixed signals on the adequacy of the following aspects of OTA policy analysis:

- stakeholder analysis,
- international context/comparisons,
- institutional analysis, and
- "technology-driven" reports' policy analysis in comparison with "problem-driven" reports' policy analysis.

Analysis of options. From its review of 18 OTA reports, the policy project team concluded that policy analysis in the "context, findings, and issues" (the policy problem) part of a report is typically better than that in the "goals and options" (potential solutions) part (see ch. 4 and app. C). Some of the reports did a fairly good job of analyzing the options. About eight of the 18 reports in the sample, however, had little or no analysis of the options (e.g., estimates of effectiveness, cost, possible unintended consequences, and a comparison among competing options) that were presented. Virtually all of the project directors of the 18 reports said that they and their project staffs had devoted more time, effort, and resources to analyzing "context, findings, and issues" than to analyzing "goals and options."

Opinion among current congressional staff on which of the two major components of an OTA study—analysis of the policy problem or analysis of potential solutions—should receive more emphasis was closely divided (see ch. 3). Interviews with some staff suggested they sometimes prefer that an OTA report emphasize analysis of the policy problem. Interviews with other staff suggested they considered the identification and analysis of options the most critical component of an OTA report. Some staff were of the opinion that there should be equal weight given to analysis of the policy problem and to analysis of potential solutions.

On one point former and current congressional staff were virtually unanimous: In reports where it is important for OTA to present options, it is essential that the options be analyzed (see ch. 3). An inference may be that in OTA reports where the requesters really want OTA to present options, the analysis of options should receive more attention than OTA project teams typically give it today.

Interviews with OTA project directors of the 18 reports indicate the methods most commonly used for developing and analyzing options were "brainstorming by OTA staff" or "project director sitting and thinking" (see table 4-1 in ch. 4). The term "common sense" came up frequently. For the analysis of some

[6] While recognizing that OTA's role is to serve Congress, one policy workshop participant strongly urged OTA's leadership to resist the tendency of Congress to ask for short-term issue analysis, noting that "each assessment of an issue that has a relatively short time line diverts staff and consultant resources away from OTA's central organizing principal—to be the one place in the Federal Government that CAN sit and think about longer term issues, particularly those where actions taken precipitously can lead to irreversible changes in society." This sentiment was strongly endorsed by one other participant.

options, common sense may be sufficient. In many cases, however, more rigorous analysis of the effectiveness and effects of options is clearly warranted.

Stakeholder analysis. To facilitate stakeholder analysis in OTA reports, project teams rely on means such as the broad composition of advisory panels, the solicitation of a variety of perspectives through workshops, and an extensive external review process for all full reports. Some of the participants in OTA's one-day policy workshop, however, were of the view that OTA's stakeholder analysis should be improved (see ch. 5). Congressional staff interviewed for the project said they are typically very interested in what the effects of options on interested parties—including the general public—will be. Several congressional staffers interviewed for the policy project said they would like to see more stakeholder analysis in OTA work.

The policy project team found that about one-third (5) of the 18 reports in the sample did a very good or excellent job of analyzing the positions of different stakeholders in the analysis of "context, findings, and issues," but another third (6) of the 18 reports did a poor or fair job in this area (see ch. 4 and app. C). In the analysis of "goals and options," about half (8) of the reports included some discussion of the support for options by, and the effects of options on, the stakeholders (including the American public).

International context/comparisons. The project team had conflicting signals on the adequacy of international analysis in OTA reports. A few of the policy workshop participants said OTA should try to do a better job of considering the international context of certain problems, especially problems (e.g., climate change) that cannot be addressed without international cooperation.

The policy project team found that inadequate attention to the international dimensions of problems did not appear to be a major deficiency in the 18 reports in its sample. Perhaps the workshop participants who cited this as a problem were reacting to reports that exhibited this deficiency more than the reports in the sample.

Institutional analysis. The project team also had mixed signals on the adequacy of institutional analysis in OTA reports. Most of the 18 reports in the sample did a good job on institutional analysis, which includes describing the roles of governmental and other organizations—both as part of the problem and part of the solution. The team's fairly high ratings of the sample of 18 reports in this area conflicted with the perceptions of some participants at the policy workshop.

"Problem-driven" reports versus "technology-driven" reports. The OTA policy project team classified 13 of the reports in its 18-report sample as "problem-driven" (i.e., focused on how to fix a problem, usually specified in the congressional request letter). The five remaining reports were classified as "technology-driven" (i.e., considering the implications of the development, refinement, or use of a technology or class of technologies). The policy analysis received higher ratings in the problem-driven reports than in the technology-driven reports (in both "context, findings, and issues" and in "goals and options") (see ch. 4). The significance of this finding, especially given the small size of the sample, is not clear. Perhaps it is simply easier for analysts to get a handle on today's problems than to anticipate tomorrow's.

Policy analysis methods and know-how throughout the agency

The assumption by many OTA analytic staff and program managers that the way their program or they personally do something in an assessment is the way it is done throughout the agency is typically not correct. **The culture of OTA is highly pluralistic (see ch. 6), and OTA reports reflect this.** Different OTA programs, and even different projects within a single pro-

gram, have different styles and ways of approaching and conducting an assessment.

The policy project team's review of 18 OTA reports revealed striking variation in the methods and quality of policy analysis from report to report, even within OTA programs (see ch. 4).

All of the members of the policy team learned a great deal from reading and analyzing the sample of 18 OTA reports and talking to project directors from outside their programs and divisions. **Team members agreed that critically reading OTA reports outside their normal purview and talking to the project directors of those reports led them to new insights and ideas for policy analysis with applicability to their own future OTA work.** There were "policy analysis gems"—methods of analysis, overall conceptual frameworks, ways of making values explicit, ways of organizing and analyzing options, institutional analysis, stakeholder analysis, legal analysis, etc.—to be found in reports done by each of OTA's nine programs (see ch. 5 and app. E).

Transfer of methods and know-how across programs and divisions. The collective skills of OTA project staff and program managers in different parts of the agency represent a cornucopia of policy analysis skills and knowledge—but the culture of OTA is widely perceived as not facilitating the transfer of policy analysis methods and skills across programs and divisions (see ch. 6). Policy analysis appears to be seen as embedded in the "technical" knowledge of subjects treated in program reports; thus, policy tools are viewed as irrelevant to others and not transferable across program, project, and problem boundaries.

One former OTA project director commented:

> *There is no incentive in OTA and strong disincentives for cross-program: planning, project review, report evaluation, collegiality... The organization is without any internal program for cross-learning. As a result, there is no cross-over of policy generation, no cross-over of creativity....*

The perception that OTA's culture is not conducive to the transfer of policy knowledge was echoed in the following comment by one of the policy workshop participants:

> *Internally, the agency manifests a fragmentation and lack of organizational learning that is a concern. This governs not only the culture of communication and learning about how to do policy analysis, but also procedural issues, e.g., how could stakeholder analysis—who gains and who loses from the creation, application, or location of a technology—be improved?*

Some OTA staff who have felt a yearning for the opportunity to learn more about policy analysis from their colleagues in other programs have turned to the creation of informal groups such as the Project Directors' Peer Group (1989) and the Research Assistants in Search of Empowerment (RAISE) (1991). Each met on an irregular basis to discuss issues of mutual interest.

It is a maxim that any group will try to act to fill needs not addressed by the formal organization. Informal efforts alone, though, may be neither efficient nor particularly effective when it comes to transferring policy analysis skills.

Recently, informal efforts of a similar nature have been undertaken by individuals from among another group at OTA—new project directors. Interviews with new project directors suggest that many of these individuals feel somewhat adrift when they start a project and would like to have more guidance, especially during the early phases of their studies (see ch. 6). Many new project directors expressed the desire for a mentoring program.

Methods of analysis typically used by OTA. For developing the policy "context, findings, and issues," the methods most often used in the 18-report sample were the following:

- workshops (used in half of the sample),
- literature reviews (half of the sample),

- case studies (about 40 percent of the sample),
- contractor reports (about 30 percent of the sample),
- legal analysis (about 20 percent of the sample), and
- quantitative analysis (about 20 percent of the sample) (see table 4-1 in ch. 4).

The overwhelmingly most often used methods for developing policy goals and options were "brainstorming by the staff" and the project director "sitting and thinking" (about half the sample used each). Other methods of developing and analyzing options that were used less frequently included quantitative analysis, advisory panel comments, scenarios to evaluate options, talking to lots of people, case studies, contracts, historical reviews, literature reviews, and surveys.

Backgrounds of OTA's analytical staff. As of the end of 1992, OTA's analytical staff numbered 131. About 70 percent of the staff hold advanced degrees.[7] OTA's analytical staff come from a broad variety of academic disciplines (see ch. 6). In all, 45 percent of OTA's analytical staff have, as their highest degree earned, a natural science or engineering degree, 25 percent have a social science degree, and 8 percent a policy degree.[8] The other 22 percent have degrees in the humanities (e.g., history, philosophy, English literature), business, and other miscellaneous subjects (e.g., communications, education, and social work).

OTA's analytical staff typically work in teams of two to six people. About three-fourths of the 18 studies reviewed by the OTA policy project team had a mix of natural scientists and social scientists on the project team. Such diversity was viewed as a plus for good policy analysis by outside experts and former OTA project directors.

Life experiences may be just as important as educational background in affecting policy analysis. Few OTA staff come to the agency with exposure to the Hill, so most of the staff have much to learn about writing reports that are responsive to congressional needs. The lack of exposure to the Hill was cited by some former OTA project directors as a flaw in the recruitment of staff to OTA; such experience, one former project director suggested, could help reduce the "academic" aspect of the OTA culture. New project directors who have typically gained most of their experience in policy analysis while at OTA nearly unanimously said they would like to have had more contact with congressional staff and more guidance on how to deal with them when interviewed by the OTA policy project team.

OTA's analytical staff includes few U.S. minorities (e.g., African-Americans, Hispanics). The lack of racial and ethnic diversity on OTA's staff (which, among other things, may affect the composition of OTA advisory panels and selection of contractors) is viewed by some as a stumbling block to insightful policy analysis in certain areas.

OPTIONS

The "Findings" presented above suggest that, despite its many strengths, OTA policy analysis could be improved. To help move the agency's policy analysis toward a higher level of excellence, the policy project team offers a set of options for consideration and possible implementation by OTA management (see box 1-B). Each of the options is discussed and analyzed further below.

Even without action by OTA management, there is some potential for improvement of OTA policy analysis at the grassroots level. If OTA project staff were more sensitized to some of the agency's most

[7] About 28 percent of the staff hold, as highest degree earned, a B.S. or B.A. degree; 25 percent hold an M.S. or M.A.; 37 percent have a Ph.D.; and 10 percent either an M.D. (3), a J.D. (9), or both (1).

[8] Natural science and engineering disciplines are most prevalent at all degree levels, accounting for 55 percent of the Ph.D.s, 42 percent of the M.S.s, and 36 percent of the B.S./B.A.s. Social science expertise (including psychology) is found among 20 percent of the Ph.D.s, 39 percent of the M.S./M.A.s, and 19 percent of the B.S./B.A.s. A "policy degree" (e.g., technology and policy) is held by 12 percent of the Ph.D.s and 15 percent of the master's degrees. Staff with M.D.s and J.D.s are categorized by their next highest degree.

common deficiencies in policy analysis, they might make greater efforts to overcome them. With that notion in mind, the policy project team also offers here a set of "peer-to-peer suggestions" to help project directors and other project staff improve their policy analysis.

OTA's program managers have an important role to play in improving OTA's policy analysis. Their styles permeate their programs and connect staff with a set of expectations and practices. Implicit in the discussion of options is the enormous discretion that program managers can exercise in advancing the cause of policy analysis as carried out in their respective programs. Furthermore, the suggestions presented at the end of this chapter can serve as guidance to program managers about the types of weaknesses they should be looking for, and skills they may want to help strengthen, among their analytical staff.

Options for OTA management

One way for OTA management to improve the agency's policy analysis would be to institute better quality assurance procedures by program managers and assistant directors. OTA project staff look to OTA's director, assistant directors, and program managers for explicit clues about what is appropriate and needed.

Even with improved quality assurance procedures, though, additional assistance to OTA's analytical staff seems warranted. Several options that OTA management might consider to provide such assistance are discussed below. The options fall, with some overlap, into three areas that correspond with the three general categories of "Findings" of the OTA policy analysis project:

- options to improve OTA's responsiveness to the needs expressed by congressional staff,
- options to address identified weaknesses in OTA policy analysis, and
- options to facilitate the transfer of policy analysis methods and know-how across the agency (see box 1-C).

In keeping with OTA tradition, the options that grow out of this analysis are choices. Each choice is proposed as an experiment. Whatever experiments are tried, of course, should be evaluated. Then the evaluative information can be disseminated throughout the agency, so that new choices may follow.

Options to improve OTA's responsiveness to the needs expressed by congressional staff. Congressional staff interviewed by the policy project team stressed the importance of reports that are reader-friendly, objective, and timely. These are, of course, criteria for usable and useful reports and thus stray well beyond the narrower topic of policy analysis, the subject that the project team was asked to address. However, given the importance of each of these as expressed by our clients and the opportunities for improvement noted in the "Findings" section above, we begin with options to address each of these three areas.

***Option 1:** Provide increased assistance to projects to improve reader-friendliness.*

If a report cannot be easily read by congressional staff, even the best policy analysis may go unnoticed and unused. The policy project team found—through its own reading and interviews with congressional staff—that there is considerable room for improvement in this area (see ch. 3). Four former congressional staff who participated in the policy project identified major weaknesses in the reader-friendliness of one-third of the 12 reports they read. The project team's evaluation was somewhat better; nevertheless, it judged 3 of the 18 reports in its sample as "fair" or "poor" in reader-friendliness, and another 5 were judged as just "okay."

As discussed further below, OTA management could provide increased assistance to projects to improve reader-friendliness by 1) hiring a "managing editor" to read all OTA draft assessments and

Box 1-C. Options for OTA management

Options for OTA management—including the director, assistant directors, and program managers—are presented in three major categories that correspond to the categories in which the findings of the assessment were presented. The options are not mutually exclusive; one or a few could be chosen from each category to good effect. Within each of the three categories, the options are presented in descending order of likely effectiveness, as judged by the project team.

Options to improve OTA's responsiveness to the needs expressed by congressional staff.

Option 1: Provide increased assistance to projects to improve reader-friendliness.

- Hire a "managing editor," or a managing editor plus an additional senior writer/editor, to read all OTA draft assessments and advise project teams on how to make the report more accessible to congressional clients; and/or
- Give one individual the responsibility for collecting information on, and advising project staff about, freelance writers, editors, and indexers who have worked for OTA, so that such information can be used to facilitate the selection of good freelancers by project staff.

Option 2: Clarify OTA's policy regarding "recommendations" and "policy prescriptions" in options.

Option 3: Appoint a standing panel of senior staff upon which the director can call when the objectivity of a report is called into question.

Option 4: Encourage experiments with shorter assessments and with policy-relevant interim products and services.

Options to address identified weaknesses in OTA policy analysis.

Option 5: Establish a bimonthly or quarterly "Issues in Policy Analysis" lecture series on specific topics using people from outside OTA.

Option 6: Contract for the development of "sourcebooks" with key literature on specific topics in policy design and evaluation.

Options to facilitate the transfer of policy analysis methods and know-how across the agency.

Option 7: Assign staff from outside the program in which an assessment is being done to help with that assessment through one or more of the following methods:

- Designate one or two senior staff people as "project kibitzers," or
- Expand use of modified "shirtsleeves policy sessions," or
- Establish "shadow advisory panels" composed of OTA staff for some assessments.

Option 8: Give new project directors or all project directors a few weeks to read reports from other programs.

Option 9: Establish a program to provide mentors for new project directors.

Option 10: Institute OTA staff-run seminars intended to facilitate the transfer of policy analysis skills and knowledge across the agency.

- OTA staff-run "Tips for OTA Project Directors" seminar series.
- Biweekly or monthly seminars by OTA staff to present the results and methods of OTA assessments.

Option 11: Reinstitute the OTA Congressional and Public Affairs Office's lectures on how Congress works.

to advise the project teams on how to make the report more accessible to congressional clients; and/or 2) giving one individual the responsibility for collecting information on, and advising project staff about, freelance writers, editors, and indexers who have worked for OTA, so that such information can be used to facilitate the selection of good freelancers by project staff.

A single managing editor, who also helps to coordinate the selection and use of freelance writer/editors, is an approach used by several other policy research organizations.

- *Hire a managing editor, or a managing editor plus an additional senior writer/editor, to read all OTA draft assessments.*

A managing editor, or a managing editor plus an additional senior writer/editor, could be hired to read all OTA draft assessments, beginning with the earliest available final draft. The managing editor would be an in-house resource, consistently available to project teams, to help the teams improve their reports.

A managing editor (or editors) would read drafts of assessments for tone, organization, and clarity of presentation. He or she would serve in an advisory capacity to project teams and program managers, leaving final judgments with the project director or program manager. A managing editor could also develop and maintain a database or inventory of OTA writers, editors, and indexers and could advise project directors on the hiring of writers and editors for specific tasks (e.g., composing a summary or copy editing).

It is the policy project team's understanding that all three of OTA's sister agencies have some form of centralized review, all more rigid than envisioned in this option. Many other think tanks—e.g., Brookings, National Research Council, Institute of Medicine, World Resources Institute—have a managing editor or an equivalent position. Whether adding another level of centralized review at OTA is desirable is an open question. Because of concerns that such review will impose additional time burdens and be yet another bureaucratic hurdle, this option is likely to meet with at least some resistance from current OTA project directors, program managers, and other OTA staff. With the right skills and personality, and enough time to actually help rather than merely critique reports, a managing editor (or editors) might come to be regarded as a benefit rather than hindrance by OTA staff.

Given the uncertainties about how this option would work in practice, the project team believes that OTA management might consider this option as an experiment to improve the reader-friendliness of OTA reports. It could hire a senior-level writer/editor for a six-month to one-year trial period. The first month or so would probably be needed for the person to become familiar with OTA and the new position; ideally, then the person could assist several assessments from an early draft seen by the advisory panel through final publication.

If the experiment is deemed a success and a managing editor is hired, each project could anticipate, on average, a week or two of the managing editor's time. This would be enough time to read most reports, allow hands-on involvement with a few, and provide assistance lining up freelance editors for the rest. Adding a second senior writer/editor would allow the opportunity to offer significant assistance to most full assessments in house. Again, the intent is to involve the senior writer/editor as early as possible to help shape the final report. Each senior writer/editor is equal to about 1.5 percent of the staff resources at the level of senior analyst and senior associate.

- *Give one individual the responsibility for collecting information on, and advising project staff about, freelance writers, editors, and indexers.*

Good writers, editors, and indexers who might help improve the reader-friendliness of OTA reports are not always known to project staff or program managers.[9] To help remedy this problem, OTA management could assign one person the task of keeping track of the performance of freelance writers, editors, and indexers so that other project directors could easily find out who might be available and their strengths and weaknesses. If a managing editor is hired, this could be one of his or her responsibilities.

[9] OTA's experience with editors has been mixed. An April 1987 survey by the OTA Writing Task Force found that about half of the OTA projects that had hired an editor were happy with the editor's performance and half were unhappy. Interestingly, about half of the projects that did not hire an editor regretted not doing so.

Otherwise, the responsibility might logically be given to the Publishing Office.

The individual assigned this task could compile a list of writers, editors, and indexers that OTA has actually used, with information that might include such things as 1) a list of the projects on which they worked, 2) what they actually did for each project, and 3) the project director's evaluation of what they did. The individual might also periodically solicit new resumes (e.g., through an ad), go through old and new resumes and pull out the ones that look the most promising (e.g., those with experience most pertinent to OTA), get writing or editing samples, check references for the individuals selected, and keep all the information on file.

Option 2: Clarify OTA's policy regarding "recommendations" and "policy prescriptions" in options.

Seven (about 40 percent) of the reports in the 18-report sample included implicit or explicit recommendations or directives (see ch. 4 and app. C). Some of the recommendations or directives in the seven reports seemed empirically based—i.e., supportable with data and analysis in the report and not significantly dependent on the decisionmaker's values or other prior beliefs. For lack of a better term, the project team decided to call these "empirically based policy prescriptions." The project team judged that "empirically based policy prescriptions" were present and well supported in three of the 18 reports in its sample.[10] Some of the recommendations or directives in the seven reports did not appear to be empirically based; instead, they seem to reflect preferences of OTA staff for reasons unstated. These the project team refers to as "recommendations." "Recommendations" may pose some risk to OTA's hard won and vitally important reputation for objectivity (see ch. 3).

There is considerable confusion among OTA staff concerning the agency's policy about the inclusion of "recommendations" or "empirically based policy prescriptions" as part of an OTA report's discussion of policy options. Some staff believe all types of such directives are prohibited. Others appear to believe that empirically based prescriptions, as defined above, are not only allowed but preferred. And individuals' judgments as to whether a particular directive is "empirically based" or a "preference" seem to vary widely.

The Technology Assessment Act is silent on this issue. Nor has the project team been able to locate either a Director's statement of policy or a TAB policy on OTA making recommendations or policy prescriptions.

The policy project team did not have the time to pursue this issue to the depth it would have liked, but believes consideration and clarification of OTA's policy (or lack thereof) deserves further thought. Each of the congressional agencies has its own policy on recommendations, from the Congressional Research Service's almost outright prohibition of recommendations to the General Accounting Office's policy of allowing recommendations to be made routinely. Both approaches have advantages and disadvantages that are beyond the scope of this exercise to address.

Option 3: Appoint a standing panel of senior staff upon which the Director can call when the objectivity of a report is called into question.

Congressional staff and others interviewed by the OTA policy project team stressed that it is essential to preserve OTA's reputation for balance and objectivity (see ch. 3). The OTA policy project team found lapses or apparent lapses of objectivity—primarily minor ones—in about one-third of the sample of 18 reports. Three of the four former congressional staff who participated in the study also identified lapses of objectivity in reports that they read.

[10] An example of such a report, *Transportation of Hazardous Materials*, is discussed in ch. 5.

OTA's reputation for objectivity is one of the agency's indispensable assets—so vital that the Director may want to appoint a standing panel of senior staff upon which he or she can call in those cases where concerns about objectivity have been raised. The panel would be used to carefully consider whether findings are well substantiated, whether a directive is empirically based, or other matters of objectivity in OTA reports. The panel would not routinely review all OTA reports but instead would be used at the Director's discretion only in those cases where there was disagreement within OTA.

Option 4: Encourage experiments with shorter assessments and with policy-relevant interim products and services.

Congressional staff interviewed by the policy project team said that timeliness in the delivery of reports was a weakness in OTA's process. This option is intended to respond to the needs that congressional staff may sometimes have for information that is provided to them in less time than the 18 to 24 months typically required to complete a full OTA assessment.

It is certainly possible to produce good small assessments. Two of the reports in the 18-report sample reviewed by the OTA policy project team were completed with considerably less staff time than the typical OTA report. About six person-months of effort went into *Exploring the Moon and Mars*, and about 15 person-months went into *Improving Automobile Fuel Economy*. (Note that *Fuel Economy* actually took about 15 months because only one person worked on the assessment. The project director estimates that the study could have been completed in less than a year if a second person had worked on it.)

Moon and Mars focused on framing the key policy issues; *Fuel Economy* was a detailed examination of a controversial option. Both approaches seem quite reasonable for satisfying the needs for faster, more focused responses. *Moon and Mars* and *Fuel Economy* were prepared by project directors who: 1) had directed several assessments before, and 2) had some experience in related areas. Both factors contributed to the project directors' ability to complete the assessments in less time.

Several other experiments with shorter assessments have been tried over the last several years, but the OTA policy project team did not have the time to collect and evaluate information on how well they worked. The project team also did not consider what mix of shorter, faster assessments and more typical assessments might be desirable. For shorter, faster assessments, OTA might have to use smaller advisory panels and pay for reviewers' time to meet the accelerated schedule.

Full assessments are not the only products and services that OTA provides for congressional committees. Other OTA products and services include policy workshops, informal communications, and bill analyses. Such products were not often mentioned by the congressional staff the project team interviewed, possibly because we focused on full assessments and did not explicitly ask about these other products or perhaps because they did not consider them important. Further examination of the types of information needed by congressional staff in a short time frame might shed light on what types of interim products and services might help satisfy the complaints the policy project team heard about timeliness of OTA assessments.

It is important to note, however, that interim products do not fit well with current procedures for advisory panel input and other forms of review. They also inevitably delay the final assessment and, if not carefully (and prudently) controlled, may involve substantial staff time. One assessment spent as much time on special responses (bill analyses) as on the full report.

Options to address identified weaknesses in OTA policy analysis. The policy project's review of 18 OTA reports and discussions with congressional staff and others revealed some specific areas in which OTA policy analysis might be improved

(see "Findings" above). A weakness that the policy project team believes merits special attention from OTA management is the analysis of the effects and effectiveness of policy options presented in OTA reports. Congressional staff interviewed by the project team said that OTA might as well not provide options if options do not analyze their likely benefits and costs. Another weakness, at least in some OTA reports, was stakeholder analysis. Some OTA reports were very good in this area, but others neglected it entirely. Several congressional staff mentioned that stakeholder analysis (which includes analysis of the public interest) was often very helpful to them. The policy project team got mixed signals on the adequacy of attention in OTA reports to international dimensions and to analysis of institutions and laws.

The two options presented below might help address specific weaknesses of OTA policy analysis. General options to improve the transfer of policy methods and know-how across the agency are described in the next section.

Option 5: Establish a bimonthly or quarterly "Issues in Policy Analysis" lecture series on specific topics using people from outside OTA.

A bimonthly or quarterly lecture series focusing on topics such as analysis of policy options, stakeholder analysis, international comparisons, and other topics applicable to OTA policy analysis could open the agency to creative ideas developed by think tanks, academic researchers, and others inside and outside of government.

Assuming the speakers are well chosen and the four to six one-hour lectures are well attended by OTA staff, this option might offer significant returns. One person would have to devote a modest amount of staff time organizing the series, soliciting suggestions for speakers, and arranging the seminars. Travel and costs of small honoraria could be kept under $5,000 per year. If the speakers are not well chosen or the lectures are not well attended, the returns obviously would be minimal.

Option 6: Contract for the development of "sourcebooks" with key literature on specific topics in policy design and evaluation.

The political science and public administration literature on policy design and evaluation is extensive, but the focus and orientation of the typical university researcher is often not quite right for OTA. Much of the literature is too theoretical, and that which is empirically based is often limited to one or a few case studies. OTA staff with little or no formal training in policy analysis often do not know where to begin. Properly focused sourcebooks with key literature on specific topics could be of great help if prepared by researchers who understand the more applied needs of OTA.

The OTA policy project team searched the literature and prepared a sourcebook of articles on policy analysis that seemed particularly relevant to OTA's work (see app. D for the preface and table of contents). The sourcebook includes information (with bibliographies) about 1) definitions of policy analysis, 2) framing issues, 3) use of OTA reports by and the impact on congressional and other users, 4) case studies and other study designs, and 5) specific topics in policy analysis, such as use of incentives and disincentives.

Sourcebooks with information relevant to the types of options OTA often presents might help improve analysis of the effects and effectiveness of these options. The sourcebooks might take the form of annotated bibliographies (with key literature reproduced) or more interpretive surveys of the field. Appendix D includes material that points to the type of product that might be helpful. First is a contractor task statement prepared as part of this study (but never awarded owing to budget constraints) for a sourcebook to help us evaluate one of OTA's more frequent options, "More funds for R&D." The sourcebook would include empiri-

cal studies on how funding levels have been adjusted in the past, priorities have been set, research agencies have been organized, and similar questions. The second is the summary from a recent review paper on "Reorganizing Public Organizations," prepared for the U.S. Department of Energy. It compares several structural alternatives for governmental organization (e.g., creating an independent agency, incorporating one into an executive branch department) and summarizes the rather scanty empirical studies of past reorganizations.

As a start, OTA management might want to try two contracting experiments on the order of $5,000 each to see whether in practice the idea has merit. Internal staff time to direct the effort would also be needed. At minimum, the results of these contracts would allow OTA analysts to make assertions, such as: "Remarkably few empirical studies have charted the intended and unintended effects of particular reorganizations."[11]

Options to improve the transfer of policy analysis methods and know-how across the agency. Increased information transfer across the agency could help broaden the use of good policy analysis techniques in reports. Five options to encourage sharing of successful methods and know-how across the agency are presented below.

Option 7: Assign staff from outside the program in which an assessment is being done to help with that assessment.

To help share lessons and expertise across the agency, management could urge or require some type of formal cross-program participation for most OTA assessments. Such participation could take many forms—extensive involvement of one or two people to more cursory involvement of up to eight to 10 people. The most appropriate type of involvement might vary by size and topic of the assessment and by the experience and personalities of the assessment staff. Participation is a two-way street: Both the project staff and staff outside the program are likely to learn and benefit from the interaction.

Below are three variants of cross-program participation; others are certainly possible. Again, the intent of these options is to encourage collegial relationships across the agency, with a focus on improving policy analysis skills, not just sharing substantive expertise.

- *Designate one or two senior staff people as "project kibitzers."*

Each assessment could be assigned, or allowed to choose, one or two senior staff people who would follow the assessment from its inception, attending all major events, such as panel meetings and workshops, and read all assessment drafts. The kibitzers would be chosen to offer advice on methods and fresh insights rather than for their knowledge of the topic of the assessment. The kibitzers would be both offering advice to, and learning from, the assessment team. To be most effective for sharing lessons across the agency, the kibitzers should be chosen from outside the program.

The OTA policy project team estimates that this option might require 10 staff days per person per project. The costs of such a program must be carefully considered, however. If kibitzers are restricted to project directors (current and former), and two are assigned to each assessment, each project director would be devoting about 4 to 5 percent of his or her time to the effort. If all senior research staff—senior associates plus senior analysts—were involved, each would devote about 3 percent of his or her time. All senior staff would have the opportunity to be kibitzers on one or two other assessments. The intuitive judgment of the policy project team is that such a program would be worthwhile but should be

[11] See the summary of Craig Thomas' paper "Reorganizing Public Organizations: Alternatives, Objectives, and Evidence" in app. D.

carefully monitored if implemented.

- *Expand use of modified "shirtsleeves policy sessions" currently being tried in Division A.*

If the option above is deemed too intrusive or expensive, assessments might try an approach similar to the "shirtsleeves policy sessions" used in Division A to help improve their policy analysis and options. At the midpoint of an assessment, a "shirtsleeves policy session" would be scheduled. The session would involve five or 10 senior staff members, who would spend approximately one day each (including some background reading) offering policy advice on the assessment. The meeting itself might last several hours. The key to the success of this approach is to make sure that the session occurs at the point in an assessment when the staff knows enough to be able to prepare a preliminary draft of issues and options that seem worth pursuing, but not so far along that the direction cannot be modified.

If five senior associates each spent one day participating on each of four other assessments, on average, each would be spending about 2 percent of his or her time. If the policy session involved 10 senior staff—senior associates plus senior analysts—each would spend on average about 1.5 percent of his or her time. The OTA policy project team's judgment is that the more time-intensive approach above would in most cases work better than this option. On the other hand, this option would offer the opportunity for senior staff to be exposed to more projects. If all senior staff members participated about equally, each would be involved with three or four other assessments per year. Most, but not necessarily all, of the participants would be chosen from outside the program.

- *Establish "shadow advisory panels" composed of OTA staff for some assessments.*

Yet another variant for involving people from outside a program on each assessment is to establish a "shadow advisory panel" chosen from either senior staff or all project staff. Serving on a shadow panel might occupy five days per person, including time spent at panel meetings and reading drafts. A shadow panel of 10 senior associates and senior analysts for each assessment would require about 7 or 8 percent of each staffer's time. A 10-person shadow panel drawn from all analysts, senior analysts, and senior associates would use about 5 percent of each staffer's time. This option might exceed the amount of time one can reasonably expect from senior staff involved with other assessments. Of course, the amount of time could be reduced by limiting the number of assessments that have shadow panels. Large shadow panels might be limited to that subset of assessments that would most benefit from substantive expertise from many programs around the agency. Even then, the project team has doubts about whether "shadow advisory panels" of this size are an efficient way to build sharing of policy skills into the OTA process.

***Option 8:** Give new project directors or all project directors a few weeks to read reports from other programs.*

For learning how to design an assessment, there is no substitute for reading and analyzing OTA reports and talking to the project directors of those reports to find out what methods they used and what lessons they learned. It is one of the methods the OTA policy project team used to prepare this report.

Before beginning their first assessment, new project directors could be given several weeks to read and dissect five or so reports outside their program. The reports should probably be chosen from a carefully selected list, for example, a list of reports nominated by the program managers and senior associates. The reading and interview guides that the OTA policy project team constructed for this study would be a helpful adjunct (see app. B). The key to success is for the project director to become conscious of the varied aspects of policy

analysis that must be covered—describing and analyzing the policy context, constructing and analyzing options—so that they are incorporated from the beginning into the design of the new study. Allowing three weeks at the beginning of the study is equivalent to about 4 percent of a typical study. If the reading period is taken seriously, however, the improved feel for designing a study might avoid an equal or greater amount of time's worth of potential mistakes.

Rather than giving only first-time project directors a few weeks to read OTA assessments, management could offer this opportunity to all OTA project directors. The members of the OTA policy project team, though already quite experienced, all thought that they gained many insights from reading the 18 OTA reports selected for review in this assessment. It is remarkable how easy it is to identify mistakes that you made in your own reports by reading a report on a subject with which you are not familiar.

***Option 9:** Establish a program to provide mentors for new project directors.*

Many of the first-time project directors whom the OTA policy project team interviewed expressed great interest in having a mentor to help them with their first assessment. Help on the substance of an assessment is often available from the program manager and senior staff within the program. The role of a mentor would be to provide additional guidance to the project director on the assessment process and methods of policy analysis.

Mentors would have to be chosen for both their teaching and policy skills. They probably would be chosen from ranks of experienced analysts or project directors, although not all of these individuals are likely to be interested in serving as mentors. For the process to work, becoming a mentor must be voluntary. Mentors would probably spend on the order of a day a month or more helping the new project director—possibly as much as 10 percent of their time—so the commitment is substantial. The payoff for the new project director, however, is likely to be great. Probably not all first-time OTA project directors would need such intensive assistance, since many have been at the agency for several years and are already well prepared for the task.

***Option 10:** Institute OTA staff-run seminars intended to facilitate the transfer of policy analysis skills and knowledge across the agency.*

To help break down the barriers to transfer of policy analysis skills and knowledge throughout the agency, OTA management could initiate a series of staff-run seminars. As discussed further below, the seminars might be of two types:

1. a series of one- or two-hour seminars in which senior OTA staff present "Tips for OTA Project Directors"; and
2. periodic (e.g., biweekly or monthly) shorter seminars to present the methods used by individual assessments, both successes and failures.

- *OTA staff-run "Tips for OTA Project Directors" seminar series.*

A "Tips for OTA Project Directors" seminar series could include panels of OTA presenters, individuals lecturing on specific topics, or some combination of the two. Topics that the seminar series might address include the following:

1. What OTA "Findings" Are All About and How To Find Them,
2. Options: Their Relationship to Findings,
3. Forms of Data Collection: Workshops Versus Contractor Reports and Other Forms of Data Collection,
4. The Organization and Presentation of an OTA Report,
5. Relations With Requesting Congressional Committee Staff,
6. Planning an OTA Assessment,
7. Tips on How To Manage a Project Team.

The seminar series could be developed primarily to serve OTA project directors and soon-to-be

project directors or could be fashioned with a broader OTA audience in mind. The series would have to be repeated every few years to accommodate staff changes.

One of the primary advantages of having a seminar series run by OTA staff is that the seminars would be directly relevant to OTA's work. Experienced OTA staff are more familiar than anyone else with the constraints, demands, and idiosyncrasies of the OTA process, and many project directors and analysts have developed insights or techniques that could be useful to their peers. One disadvantage of this option, common to all seminars, is that it is relatively less "hands on" than the previous three options. In addition, organizing staff-run seminars would be yet one more task for busy senior staff. Nevertheless, this option would require considerably less time than options 7 or 9.

- *Biweekly or monthly seminars by OTA staff to present the results and methods of OTA assessments.*

In addition to the seminar series just discussed, biweekly or monthly seminars by OTA staff to present and evaluate the results and methods used by individual assessments, might be instituted by OTA management. One former OTA staffer asserts that OTA provides for less cross-program review and "constructive feedback" than any other policy research organization of which he is aware. Presenting the findings of an assessment to OTA staff is rare. Presenting the methods used to reach those conclusions or evaluate options—both the successes and failures—is rarer still.

Presentations on specific assessments could occur a month or two after completion of a study. Seminars could be quite brief: 30 minutes to briefly review the findings and highlight a few key methods with equal time for questions and discussion. Seminars could be held as lunchtime brownbags.

The purpose of the presentations would be to share good ideas and to help others avoid mistakes. It is important to note, however, that some people may be reluctant to present failures; others may not even recognize failures. Unless OTA staff are open and honest, the series will not be worth the effort. Biweekly seminars, especially if other seminars proposed in this report are adopted, may also be too frequent.

Option 11: Reinstitute the OTA Congressional and Public Affairs Office's lectures on how Congress works.

Both current and former OTA staff cited lack of Hill experience as a hindrance to understanding congressional processes and needs, with negative implications for the quality of OTA policy analysis. While it is difficult to determine exactly how the lack of Hill experience affects OTA's work, it is possible to educate staff through in-house lessons and lectures about how Congress works and how OTA can help. Though it may not be any substitute for the real thing, more information about the Hill's operations will certainly help clarify for OTA's staff how their own work fits into the process and better equip staff to deliver reports that meet congressional needs.

OTA's Congressional and Public Affairs Office has offered short courses on how Congress works. The courses, primarily aimed at new staff, instructed participants on the various functions of the Hill. Lectures included topics such as how a bill becomes law; roles played by various stakeholders, such as lobbyists and personal staff; and committee jurisdiction and activities. Guest speakers from the Hill provided an insider's view of congressional activities by providing commentary on their own experience as Hill staff.

Some mix of lectures and guest speakers in two- to three-hour "classes" over a period of four to six weeks was fairly effective and popular in the past. At minimum, lectures given by Hill staff with a focus on their own use of OTA reports would be helpful in educating OTA staff.

Suggestions for OTA project directors

In this section, the OTA policy project team offers 10 "peer-to-peer suggestions" to OTA project directors (and other project staff) to help them work toward the goal of producing high-quality policy analysis that is useful to, and usable by, OTA's congressional clients. These general suggestions are not intended to provide a template for OTA policy analysis—a template for all OTA studies would be overly constraining and rightly laughed out of the agency. Rather, the suggestions are intended to help project directors avoid some of the most frequent pitfalls that the policy project team observed in its reading of OTA reports. The suggestions are offered not as firm rules but as collegial advice that may be helpful to many assessments. They could all be boiled down to one suggestion for project staff: Consider each of the weaknesses or criticisms of OTA reports with an eye to improving your own skills.

Different project directors working on different topics will, of course, develop a variety of approaches to meet the minimal requirements implied by these suggestions. Program managers could encourage project directors to consider these suggestions.

***Suggestion 1:** Devote attention to policy analysis as early as possible.*

Identify key policy issues, frame findings and options, and get initial thoughts in writing as early as possible. Distribute early versions of findings and options for review and discussion by all members of the project team. Early drafts can be revised as the project progresses, resulting in a basis for final drafts well in advance of the last panel meeting. Several project directors reported that late attention to policy issues and options often requires a crash effort in the last few weeks of a study. Avoid this mistake. Allow as much time as you can for analysis of options, including costs, effects, and synergies of various packages of options.

Meet with requesting congressional committee staff to improve your understanding of the nature of the committee's request. An early meeting can be especially helpful in the identification of key policy issues. Invite congressional committee staff to workshops and panel meetings, and keep them informed of milestones and major changes in the assessment. Finally, consider with the program manager and assistant director whether it would be beneficial or harmful to have frequent meetings (e.g., quarterly) with committee staff during the assessment. OTA program managers have expressed different views on the advisability of frequent meetings.

Use early advisory panel meetings to help identify key policy issues, and devote later meetings, in part, to help frame and analyze key findings and options. Workshops—probably the most common research method used at OTA—can also help.

***Suggestion 2:** Give special attention to the summary chapter early on, keeping in mind the importance of reader-friendliness for congressional readers.*

Given the way the typical congressional staffer uses an OTA report (reads the summary only, uses the rest as a reference), a good summary chapter is essential. The summary should clearly and cogently present the report's major findings and options. It also should enable congressional staff to identify quickly and accurately related information in the rest of the report.

Consider the following for inclusion in the summary:

- A section that explains the fundamental purpose and scope of the assessment. Walking the reader through the purpose and scope in the summary will help avoid potential misunderstanding and confusion.
- An explanation of the context of the congressional request for the

assessment. Consider including the congressional request letters in the report as an appendix. This added information will help the reader understand the question you are answering.

- A section that outlines the overall organization of the report. Such a section will allow the reader to quickly understand what is included and where particular types of information can be found. At minimum, make your table of contents descriptive.

***Suggestion 3:** Do not bury your major findings and options by dispersing them randomly throughout the report in the middle of paragraphs.*

Major findings and options should all be easy to find. Options can appear in the summary chapter, in a separate chapter clearly labeled "Policy Options," or in several chapters, but the chapters should be clearly labeled as containing options. If the options appear in more than one chapter, consider collecting them in an easily referenced location (e.g., a box or table in the summary chapter) so that they may be read, assimilated, and used without demanding days of study by the reader. For an academic customer, ease of assimilation may not be vital. For congressional staff, it is.

For help, consider asking someone from another program who is unfamiliar with the topic to read your draft. How long does it take them to find and understand the "bottom line" of the report?

Seek out a good professional editor to help with the organization of the report early enough to be able to change it. Be very careful in the selection of an editor. Recognize that editors have different strengths (e.g., some can do substantial rewriting and reorganizing; others can copy edit for punctuation, spelling, etc.). To avoid the perils of choosing a bad editor, you might want to solicit recommendations from other OTA project directors who have used editors. Sometimes former OTA project directors, good ones, are good substantive and stylistic editors.

***Suggestion 4:** Try to be self-conscious about—and therefore more rigorous in analyzing—the normative choices you make in conducting assessments.*

OTA's reputation for objectivity is central to the agency's usefulness to Congress. Be aware of the values and assumptions you bring when you select research methods and data, when you create narratives about information, and when you choose your options. Be explicit about the basis for possibly controversial basic assumptions underlying your analysis.

***Suggestion 5:** Keep your eye on the legislative schedule.*

Make sure that you know when the committee will be having hearings or marking up legislation related to the topic of the assessment, so that you can be as responsive as possible to the committee's calendar.

***Suggestion 6:** Devote increased effort to analyzing the effects and effectiveness of any options you propose.*

Congressional staff interviewed by the policy project team staff said that presenting options without analysis was not useful to them.

***Suggestion 7:** Devote increased effort to stakeholder analysis.*

Congressional staff interviewed by the project team urged OTA to include discussions of stakeholders' points of view and likely reaction to options. Particularly consider the public's interest, which is typically not addressed by lobbyists. Seek, through the literature or direct solicitation of authors' views, the greatest diversity of perspectives you can.

Suggestion 8: *Consider the international aspects of problems as an integral part of the analysis of issues, where applicable.*

It is becoming increasingly difficult to treat many technology issues as uniquely American problems. Moreover, different perspectives may provide OTA with new insights in analyzing domestic issues. For some topics (e.g., climate change), discussion of the international context is clearly essential; for others, consideration of other nations' experiences and approaches may not be essential but may still be valuable for comparative purposes.

Suggestion 9: *Consider alternatives to more Federal intervention.*

OTA reports are replete with options for greater Federal intervention. Rarely do the reports suggest no action at all or less Federal intervention. In many of the studies that OTA undertakes, more Federal intervention may be the only feasible or effective option for dealing with an identified problem. In other cases, however, there may be roles for state and local governments or for the private sector. Given OTA's role as an adviser to the U.S. Congress, it may be appropriate to focus on options proposing greater Federal intervention. At a minimum, however, note that there are roles for state and local governments or for market solutions and outline them (if you do not fully analyze them).

Suggestion 10: *Learn about policy analysis from your colleagues.*

Read reports from other programs to broaden your knowledge of successful or creative approaches to policy analysis. You might learn lessons that are applicable to your assessment. Consider the policy analysis experience of other OTA staff, both inside and outside of your program. Identify other staff whose work you find particularly thoughtful. Pick their brains for ideas and techniques for improving your own policy analysis.

To those OTA staff who are approached by others: be collegial, your efforts will probably be reciprocated.

About this study

The Technology Assessment Act of 1972 (Public Law 92-484) created the Office of Technology Assessment (OTA) "... to provide early indications of the probable beneficial and adverse impacts of the applications of technology and to develop other coordinate information which may assist the Congress." Given little more guidance than that, the fledgling OTA embarked on an odyssey, confronting numerous tasks and seemingly insurmountable obstacles, in the service of the legislative branch. Early OTA analysts spent many hours delving into the complexities of technological issues that they were charged to understand and skillfully analyze in order to inform their demanding client. Over the years, an OTA process evolved to equip the analysts with some "tools" of the policy analysis trade; and overall, the agency has acquired an excellent reputation for competence and reliability in its work. The general belief within the agency is that OTA does better policy analysis than it once did but that it can still improve.

Responding to widespread interest within the agency, OTA's Director John Gibbons asked a small group of OTA staff to conduct an assessment of policy analysis in full OTA reports. Full OTA reports contain "major policy content" and are produced with the assistance of an advisory panel.[1] The hope was that the assessment would provide information about OTA policy analysis that would enable OTA's staff to improve their work. The project began in September 1992 and was completed in the early part of 1993. It involved five staff members; in addition, $20,000 was allotted for contracts and workshops. In essence, the goal was to discover how (and how well) OTA policy analysts transform the relevant facts regarding science, engineering, economics, political science, law, etc., into a written report that provides useful information to congressional committees about the problems the country faces and potential solutions.

Like other OTA assessments, this project enlisted the help of an advisory panel, in this case composed of senior OTA staff and chaired by a former OTA program manager, now a division director at the Congressional Research Service. The advisory panel members met twice over the course of the study, first to give advice on the project study plan, while the second meeting focused

[1] Although the focus of this assessment was on policy analysis in full OTA reports, it is important to recognize that the publication of full reports is only one type of OTA activity. OTA also publishes background papers, briefs congressional staff and answers their inquiries, provides testimony before congressional committees, etc. This assessment did not consider how to improve other OTA products or activities.

Table 2-1. Summary of information sources for the OTA policy project

Source	Methods of collection	Purpose
Task #1: OTA reports		
Sample of 18 OTA assessments	Content analysis	Characterize and judge various elements of OTA policy analysis.
Project directors of the 18 OTA assessments	Interviews	Inform the reviewers about the policy-relevant material in the report and methods used in the assessment process.
Task #2: Other views		
Former congressional staff	Contract papers and interviews	Identify "ideal" and "minimal" criteria for useful policy analysis; evaluate three OTA reports on the basis of the selected criteria.
Current congressional staff	Interviews	Comment on OTA policy analysis, especially areas where it is particularly strong and areas that need improvement.
Former OTA staff	Written response to a questionnaire and short contract papers	Comment on the OTA approach to policy analysis, especially the assessment process and how it shapes the policy analysis sections of reports.
Outside policy analysis experts	OTA workshop with brief follow-up memoranda	Provide additional insights into perceptions of OTA policy analysis and the OTA assessment process.
First-time OTA project directors	Interviews	Comment on their own experience with the OTA assessment process.
Policy analysis literature and early examination of OTA	Literature review	Identify relevant articles and reports from an existing body of literature on policy analysis and on OTA, and compile in a notebook for OTA staff use.
Advisory panel	Meetings and document review	Help shape project work plan and report writing.

on an initial draft of this report. Some advisory panel members also participated in the one-day workshop with a group of outside policy analysis experts.

To appraise OTA policy analysis in full reports, the project team developed a study plan with two major tasks. One was the examination and evaluation of a sample of OTA full assessments (Task #1). The second task was the solicitation of views on OTA's policy analysis from a broad range of individuals familiar with OTA's work, in-

cluding current and former congressional staff, former OTA staff, and a special group of outside observers (Task #2). These two tasks are described in the next two sections of this chapter. Information sources for the two tasks are briefly summarized in table 2-1. The full study plan for the project is reproduced in appendix A.

Examination of a sample of OTA full assessments (Task #1)

Eighteen OTA reports identified by the OTA program managers as examples of "good policy analysis" were read and evaluated by the OTA policy project team (see box 2-A). In the selection of reports, program managers were asked to try to select reports completed since 1985, so that the project team would be able to interview the project director of each report. The project team decided not to consider the impact of a report (e.g., legislation, testimony, media coverage following a report's release) as a measure of the quality of its policy analysis, preferring instead to consider each assessment as a "stand-alone" document.

The process of evaluating the sample of 18 reports was extensive. At the beginning of the project, a questionnaire was developed as a guide to reading and characterizing the various elements of interest in the reports. The questionnaire, reproduced in appendix B, included questions covering two major components of policy analysis found in most OTA reports: 1) policy context, findings, and issues; and 2) goals and options (see box 1-A in ch. 1).

Each of the 18 reports was assigned to a pair of reviewers on the policy project team, a primary reviewer and a secondary reader. Using the first part of the questionnaire found in appendix B, the primary reviewer interviewed the project director to gain a quick orientation to the material and help identify the policy-relevant context and noteworthy features of the analysis. Following the interview, the report was read by both the primary and secondary reader aided by the second part of the project team's questionnaire. After reading a report, the primary and secondary readers met to discuss their evaluations and, where possible, to reach some agreement on the aspects of the policy analysis identified during the evaluation.

After the long questionnaire for each report was completed, the team wrote a one-page summary of findings for each report. In addition, the team devised a shorter questionnaire to rate each report on some specific "dimensions" or "elements" identified in the first round by the team (see app. C for the form and frequency distributions for each rated dimension). This second round of scoring served as the basis for a statistical analysis (see ch. 4). The longer form helped in the elucidation of the variety of analytic approaches found in OTA reports (see ch. 5).

The 18-report sample (equivalent to three-fourths of the full reports released in a typical year) was large enough to allow the project team to recognize general tendencies in policy analysis and report writing across the agency and identify a few patterns or themes that identify "problems" with OTA reports. Many of these were amplified by other kinds of data collected through interviews and retrospective accounts by participants in the OTA assessment process. The sample was not large enough to support conclusions at the program or division level.

Other views of OTA policy analysis (Task #2)

The second major task for the policy project team was to gain a systematic sense of the perceptions and expectations of OTA's work from a broad range of individuals. This task had six major components.

First, four former congressional staffers—who were from both Houses and parties of Congress and had handled a wide variety of issues while on the Hill—were given contracts to provide written evaluations of the policy analysis in a sample of 12 OTA reports (using their own criteria for good policy analysis) (see app. A-3). In the first paper, the former staff were asked to identify criteria they would use

Box 2-A. The sample of 18 OTA reports examined by the project team

The following 18 OTA reports—selected by the agency's program managers, using their own criteria, as examples of "good policy analysis"—were read and evaluated by the OTA policy project team.* Some program managers articulated the criteria on which they based their choices (e.g., "sorted complex issues," "defined a number of alternative scenarios," "written in remarkably good English," and one criterion which the policy project team had urged not be used, "greatest impact"); other program managers did not specify their criteria.

Reports From Division A (Energy, Materials, and International Security):

Energy and Materials Program
Nuclear Power in an Age of Uncertainty, February 1984
Improving Automobile Fuel Economy, October 1991

International Security and Commerce Program
Exploring the Moon and Mars, July 1991
Holding the Edge: Maintaining the Defense Technology Base, April 1989

Industry, Technology, and Employment Program
Serious Reduction of Hazardous Waste, September 1986
Making Things Better: Competing in Manufacturing, February 1990

Reports From Division B (Health and Life Sciences):

Biological and Behavioral Sciences Program
Mapping Our Genes: Genome Projects—How Big, How Fast?, April 1988
Ownership of Human Tissues and Cells, March 1987

Food and Renewable Resources Program
Enhancing the Quality of U.S. Grain for International Trade, February 1989
Enhancing Agriculture in Africa: A Role for U.S. Development Assistance, September 1988

Health Program
Preventive Health Services for Medicare Beneficiaries, February 1990
Indian Health Care, April 1986

Reports From Division C (Science, Information, and Natural Resources):

Oceans and Environment Program
Changing by Degrees: Steps To Reduce Greenhouse Gases, February 1991
Complex Cleanup: The Environmental Legacy of Nuclear Weapons Production, February 1991

Science, Education, and Transportation Program
Transportation of Hazardous Materials, July 1986
Power On! New Tools for Teaching and Learning, September 1988

Telecommunication and Computing Technologies Program
Finding a Balance: Computer Software, Intellectual Property, and the Challenge of Technological Change, May 1992
Critical Connections: Communication for the Future, January 1990

*NOTE: Initially, the nine program managers were asked to nominate three reports each, for a total of 27 (see app. A-2 for a list of the original 27 reports). Time constraints forced the project team to narrow the original sample of 27 reports to 18 reports (i.e., two reports per program). The reduction of the sample from 27 to 18 reports was done somewhat arbitrarily, but five reports were dropped on the basis of the observation that they were directed by a project director with another report the team would be evaluating. (Two of the three reports nominated by five program managers were directed by a single project director.)

to judge "good" policy analysis. In the second paper, they were asked to apply these criteria to the evaluation of three OTA reports, nearly all from the 18-report sample.[2] After they submitted their papers, the four former Hill staff came to OTA for a roundtable discussion to elaborate on their impressions of what was most and least valuable in the OTA reports they reviewed.

In a second, related effort, 13 current congressional staff were individually interviewed by telephone by members of the project team (see app. A-4). Each staff member was asked a series of questions designed to ascertain his or her familiarity with OTA reports and views regarding the strengths and weaknesses of OTA's policy analysis.

Third, five former OTA staff were given contracts to deliver two essays on the strengths and weaknesses of OTA policy analysis to the project team (see app. A-5). The first paper identified the distinctive features of OTA policy analysis based upon a questionnaire provided by the project team. The second, longer paper offered a personal retrospective of the OTA assessment process and how it shapes both the content and presentation of policy analysis in reports.

Fourth, the project team invited a diverse group of 10 outside experts who are familiar with one or several aspects of OTA's work to a one-day policy workshop to tap them for their perspectives on the strengths and weaknesses of OTA's policy analysis (see app. A-6). These outside experts represented a wide range of science and policy backgrounds. Some of them had served on past OTA advisory panels. At the one-day workshop, which was attended by the project team and other OTA staff members, the 10 outside experts discussed various aspects of OTA policy analysis and made a number of suggestions about how OTA might improve its work. After the workshop, participants sent a memorandum to the policy project team to convey their overall impressions of the workshop.

Fifth, 12 recent first-time OTA project directors were interviewed by the project team. Questions focused on recounting how the new project director conducted his/her work and what kinds of guidance they found helpful while working through the assessment process for the first time.

Finally, the policy project team conducted an in-house review of the policy analysis literature and previous analyses of OTA. A number of especially insightful articles and books were identified and organized in a separate loose-leaf notebook that will be made available to OTA staff (see app. D).

[2] Two of the reports reviewed by former congressional staff were among the nine reports dropped from the original list of 27 reports originally submitted by the program managers (see note in box 2-A) and were not reviewed by the OTA project team.

Responding to the needs of Congress

An important measure of OTA policy analysis is the degree to which the analysis in an OTA report is able to be assimilated and understood by Congress, usually through congressional staff. That measure, in turn, depends in part on how well an OTA report responds to the needs of both the committee that requested it and the rest of Congress.

The project team decided that the most straightforward way of discovering OTA reports' responsiveness to the needs of Congress would be to ask OTA's congressional clients. Thus, the project team turned for insights to a group of current and former congressional staff who are familiar with OTA's work and also have worked for committees that have requested OTA studies. To help counter concerns that some committee staff might be satisfied with OTA policy analysis for political reasons, the policy project team decided to solicit the opinions of a diverse, bipartisan group of 17 Hill staff. The team asked four former congressional staff to provide written evaluations of the policy analysis in a sample of 12 OTA reports (three reports each), using their own criteria for good policy analysis, and then to come to a followup meeting with the project team (see app. A-3). In addition, the team interviewed 13 current congressional staff by telephone to ascertain their views on the strengths and weaknesses of OTA reports (see app. A-4). The policy project team hoped to gain important insights concerning the way OTA is regarded by its congressional clients, while taking advantage of the heterogeneous nature of the sample, which was intended to ensure that any perceptions of serious deficiencies would surface.

To obtain a different perspective on how well OTA reports meet congressional needs, the policy project team also consulted five former OTA project directors ("OTA alumni") (see app. A-5). The team hoped that these views would draw on OTA experience and perspective but also be tempered by time and experience outside the agency.[1]

[1] The five former OTA project directors were also asked to comment on other aspects of OTA's culture and policy analysis. Additional findings on these topics are presented in ch. 5.

Box 3-A. Criteria identified by former congressional staff to judge "good" policy analysis.

Most often cited:

- Reader-friendly/usable/accessible:
  - useful summary/overview
  - request context given
  - purpose and objectives clearly stated
  - coherent/well-organized
  - contains an index
- Objective
- Timely from a congressional perspective

Also cited:

- Reader-friendly/usable/accessible:
  - parallel structure between summary and report
  - descriptive table of contents up front
  - not too long
- Comprehensive/thorough
- Accurate
- Key assumptions identified
- Commonly accepted methodology used in performing analysis
- Historical contexts given
- Alternatives presented in reaching any recommendations
- Apolitical
- Strategies for improving status quo well-analyzed
- Contains sound-bites for members

At OTA's request, four former congressional staff specified what they considered criteria for "good" policy analysis in an OTA report. The three criteria on which there was the greatest degree of unanimity among the four were as follows:

- reader-friendliness,
- objectivity, and
- timeliness from a congressional perspective.

Individual staffers also specified a number of other criteria (see box 3-A), but on these points, there was less unanimity. As discussed further below, the consensus among former and current congressional staff queried was that OTA reports generally do well in terms of objectivity—with some lapses—and less well on reader-friendliness and timeliness.

READER-FRIENDLINESS

The former congressional staffers consulted for this assessment were in strong agreement that OTA should give considerable attention to structuring of OTA reports to make them more reader-friendly (i.e., quickly digestible) for congressional staffers and other lay persons with a short amount of time to assimilate information. The overall document should be clearly organized to steer the reader to the important ideas and conclusions. The reader-friendliness of a report can make a huge difference in the usefulness of an OTA report to a congressional staffer.

The views expressed by one former congressional staffer on these points are typical of those expressed by several others:

In my experience, very few staff read a major report in its entirety. If it is well done, it will be used as a reference document: if it is not easy to use, it will be used very little, if at all. Ease of use will depend, in the first instance, on how the overall topic to be addressed is defined and refined. . . Ease of use will also depend on how well the document is organized and visually presented to make finding particular information or answers to specific questions relatively easy. Creative use of tables, graphs, and other displays of data is highly desirable to provide quick access to complex material. Any temptation on OTA's part to slight attention given to the presentation of ma-

terial in order to put more emphasis on content should, in my opinion, be resisted. The best analysis in the world will not be used if it is buried in pages of unbroken prose.

The importance of good summaries in OTA reports was stressed repeatedly by congressional staffers. Most of the staffers interviewed for this project said that they typically read only the summary chapter of an OTA report, so the summary should include all the most important items—i.e., clearly defined policy issues, summary conclusions, action recommendations clearly separated in the text for easy location and identification. In addition, the staffers said, they like to be able to track the summary's findings and conclusions in the body of the report. For that reason, they said, the summary of an OTA report should summarize the important parts of the analysis and provide the reader both a quick overview and a guide to digging deeper. In the words of one former staffer:

Summaries that are as concise as possible without sacrificing clarity are the ideal, with backup material for any particular point easily referenced in the body of the report.

One staffer mentioned the importance of a full table of contents at the front of the report, and several stressed the need for an index (missing in nearly half of the 18 OTA reports in the policy project's sample).

The former congressional staff asked to evaluate 12 OTA reports reported that one-third of the 12 reports they reviewed had major problems in organization and format that made them difficult to use.[2] Some reports were criticized because the major findings and options were buried. Some reports were criticized because the summary did not fully represent the contents of the report or did not facilitate the tracking of arguments in the rest of the report. These and other difficulties, congressional staffers said, detracted from the reports' usefulness and value to them because they need to be able to assimilate a report quickly and easily. The absence of indexes in OTA reports was criticized on similar grounds.[3] One former congressional staffer suggested that OTA make its work available on disk as well as in print. OTA recently began an experiment to make the full text of our reports available through the House Information Systems (HIS).

OBJECTIVITY

Many congressional staff interviewed for this project stressed that one of OTA's chief assets is its reputation for objectivity, noting that if the agency were to lose that reputation—as it could do very quickly if a few biased OTA reports surfaced—OTA would be of little use to Congress. One former congressional staffer put it this way:

On the whole, I believe that OTA produces objective reports. Nevertheless, continuing that tradition of objectivity is critical to the stature, and future, of OTA. In fact, it is probably the most important aspect of an OTA report. Without a reputation for objectivity, the agency will lose the intellectual support of their [sic] colleagues, and the quality of the members on advisory panels and the Technology Assessment Advisory Council will suffer. Moreover, without a reputation for objectivity, the agency will certainly lose support in Congress... Because the agency is dependent on the support of TAB [the Technology Assessment Board] and the Legislative Branch Appropriations Subcommittees, serious allegations of bias could undermine the agency.

[2] Such problems were also encountered by the policy project team in the sample of 18 OTA reports. The policy project team judged just over half the reports (10) to be very good or excellent in terms of reader-friendliness; they judged the other reports to be okay or worse (see ch. 4 and app. C).

[3] Nearly half (8) of the 18 OTA reports in the sample read by the policy project team did not have an index.

What is meant by objectivity in an OTA report? Judgments about OTA's objectivity are themselves highly subjective. As one OTA program manager explains:

> *[There are] several different possible meanings of objectivity in an OTA report, and . . . the meaning has evolved over time and in different programs and issue areas to the point where we now need to think through what we mean by the word.*

Although three of the four former congressional staffers asked to give criteria for good OTA policy analysis explicitly cited objectivity as one criterion, it is not clear that they always meant the same thing by the term. One staffer elucidated what he meant as follows:

> *Objective: Is the analysis unbiased? Does it, intentionally or unintentionally, favor the position of any particular advocate party involved in the issue?*

Another staffer who said that objectivity was "essential" for an OTA report gave this interpretation of the term:

> *Objective: Reliable valid data, scientifically based is critical. Current literature review coupled with advice from a spectrum of qualified experts must be evident.*

In any event, the former congressional staff asked to review and evaluate a sample of 12 OTA reports generally judged the level of objectivity of these reports to be quite high.

However, three of these staffers identified five reports with lapses of objectivity (lapses in the "context, findings, and issues" part, or in the "goals and options" part, or in both).[4] A few of the examples the former staff pointed to in these reports seemed to be major. One of the OTA reports in the sample of 12, for example, was severely criticized by the staffer who criticized it for unsubstantiated advocacy. This criticism applied to both the "context, findings, and issues" part of the report's policy analysis and to the "goals and options" part. Most of the complaints voiced by congressional staffers about objectivity in the policy analysis in OTA reports were less serious. Some complaints stemmed from specific findings in the report that did not seem adequately supported.

Other complaints about objectivity by staffers stemmed from a report's making explicit or implicit recommendations rather than presenting options.[5] Some options were perceived as recommendations because the report presented them in a way that seemed to favor a particular course of action; some were perceived as recommendations because the report identified only one general course of action. Thus, for example, one staffer complained about one report:

> *The policy options . . . are not really options at all but recommendations hidden under another name.*

Another former staffer specifically noted the risk of making implicit recommendations by presenting only one general course of action rather than presenting a range of alternatives:

> *It is through the use of clearly stated alternatives that the reader can be impressed that OTA hasn't just derived "an answer" and is now trying to figure out how to derive the right question to fit the answer.*

[4] The policy project team and the former congressional staff read 10 of the same OTA assessments. Both the project team and the former staffers found what they considered lapses of objectivity—either real or apparent—in five of the 10 reports. The two groups differed, however, in their judgments of which five reports had these lapses. Both groups agreed that there were lapses of objectivity in two specific reports. They also agreed that there was no problem with objectivity in two other specific reports. For the remaining six reports, the two groups came to opposite conclusions about the reports' objectivity. Given the lack of agreement about the meaning of objectivity in an OTA report and the possibility of subjective interpretations, it is perhaps not surprising that people come to different judgments about the level of objectivity in specific OTA reports.

[5] Seven (40 percent) of the 18 OTA reports the policy project team reviewed included what might be considered explicit or implicit recommendations or policy prescriptions in the options (see ch. 4).

Another staffer, in viewing a report's apparent lack of objectivity in the presentation of an option, perceived the problem primarily as an error of omission rather than of commission:

> *I found the basis for suggesting such a change intuitively defensible, but not intellectually so.*

Should OTA reports make recommendations in options, either explicitly or implicitly (e.g., by presenting one set of possible courses of action more strongly than others)? Contrary to in-house folklore, the Technology Assessment Act does not prohibit OTA from making recommendations. Furthermore, the policy project team was unable to locate any Technology Assessment Board (TAB) or OTA Director's policy explicitly discussing recommendations or other types of policy directives in OTA reports.

Several views on whether recommendations in OTA report options are appropriate were provided by congressional staff interviewed for this assessment. Most, but not all, of the congressional staff said that OTA staff should recognize that they are treading on thin ice when making recommendations, either explicitly or implicitly. Several congressional staffers were of the opinion that OTA should never recommend or prescribe a particular path, but should present options with supporting analysis comparing their effectiveness. One current staffer made this argument on the grounds that, unlike Congress, OTA is not "accountable" for its pronouncements (except indirectly through TAB).

On the other hand, many congressional staff consulted for this assessment said that there will undoubtedly be a few cases in which available evidence is overwhelmingly in favor of a particular option to reach a specified goal. In those few cases, they said, OTA owes the Congress an honest statement to that effect and may present its "empirically based policy prescriptions" accordingly. If a report does present an "empirically based policy prescription," however, there should be extraordinarily solid analysis and arguments in support of the directive.[6] Otherwise, OTA will run the risk of losing its hard-won—and vitally important—reputation for objectivity.

There seems to be considerable confusion among OTA staff concerning the agency's policy about recommendations or policy prescriptions in options. As an example, the views on this topic among former OTA project directors were polarized. At one end of the spectrum was a project director who felt that OTA should never make recommendations. OTA had no reason to exist if it fell into the trap of advocacy:

> *Congress has little need for advice from another advocacy organization. . . . On this reasoning, no OTA report can be too even-handed.*

At the other end of the spectrum was one who found fault with OTA for not being activist enough in advocating viewpoints. He asserted:

> *The one stylistic tendency that should be avoided, or minimized, is an orientation and priority to be factually correct, balanced, fair, objective, comprehensive, and academically correct, with little explicit strategic design to be effective as an agent of change.*

The policy project team did not have the time to pursue this issue to the depth it would have liked but believes consideration and clarification of OTA's policy (or lack thereof) is required.

TIMELINESS

On another issue, timeliness, many congressional staffers felt that OTA has often fallen short. Reports often take too long to produce and their usefulness may thus be diminished. Timeliness has two aspects. First,

[6] The project team judged that "empirically-based policy prescriptions" (sometimes labeled options) were present and well supported in about three of the 18 reports in its sample (see ch. 4). One of these, *Transportation of Hazardous Materials*, is discussed in ch. 5.

there is the overall length of time it takes to produce an OTA study, which averaged close to two years for the studies read by the project team—coincidentally the lifetime of a Congress.[7] This gives rushed staffers the impression that OTA cannot be relied upon to produce useful answers within the main timeline of interest. However, it should be noted that the policy project team found several cases where an OTA report provided important input to legislation passed up to five years after the report release date. Second, complaints were heard that OTA reports are often not available in time for important mark-ups. There is a mitigating argument here, too: that the report release date is partially determined by the request date, which is the province of committee staff.[8] Nevertheless, staff would generally be pleased if at least some OTA reports were produced more rapidly, knowing full well that their scope or depth would have to be reduced.

In fact, the policy project team found that at least two reports of the 18 were produced relatively quickly: *Exploring the Moon and Mars* (six months) and *Improving Automobile Fuel Economy* (15 months). In both cases, the project director had substantial experience at OTA and had some knowledge of the topic in general, which made the quick turnaround possible. The two reports were considered good and useful reports, both by OTA personnel and congressional staff, leading to the conclusion that, in some cases, by calling on experienced project directors who have worked on related topics, it is possible for OTA to do analytically sound and useful work for Congress in considerably less than two years. The other reports read by the project team ranged up to over 36 months in length of time to complete and averaged 26 months.

"CONTEXT" OR "OPTIONS"?

In the course of reviewing OTA reports, the OTA policy project team found that OTA reports typically have two components:

1. analysis of the policy problem, including discussion of the policy context, findings, and issues; and
2. identification and analysis of potential solutions, i.e., goals and options for congressional consideration (see box 5-A in ch. 5).

These two components are referred to below in the shorthand "context" and "options."

The policy project concluded from its evaluation of 18 reports that OTA reports typically devote more time, effort, and pages to analysis of the context than to presentation and analysis of options (see ch. 5). Thus, an important question to be asked is whether, in the views of congressional requesters, OTA tends to allocate the correct fraction of energy to each. The opinions of current requesting staff vary, perhaps indicating that hard and fast generalities on this topic are impossible to make. Of 13 individuals queried, four felt that analysis of options was more useful to staff (with some emphasizing technical analysis). Four felt that analysis of context was more important. The other five wanted both, but three of them thought that options were more important.

Although congressional staffers interviewed by the policy project team disagreed on the importance of including options in reports, there was one point on which they were virtually unanimous: namely, that *OTA should analyze the options that it presents*. Some stated this sentiment even more strongly: Do not bother providing a list of options unless the report analyzes their effects and effectiveness. An inference may be that in OTA reports where the requesters really want OTA to present options, the analysis of options should receive more attention than OTA project teams typically give it today.[9]

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[7] Two years was the average length of time required to produce an OTA study, based on the periods reported as being required to complete the 18 reports read by the project team.

[8] This difficulty might be avoided by closer contacts between OTA and requesting committee staff, both preceding the issuance of the request letter and during the study.

[9] The policy project team judged the analysis of policy options to be deficient in about half of the reports in its 18-report sample (see ch. 4).

A profile of 18 OTA reports

The core of the OTA policy project, at least in terms of person-hours devoted to analysis, was a review of a sample of OTA reports. Eighteen OTA reports identified by the nine OTA program managers as examples of "good" policy analysis were read and evaluated by the OTA policy project team (see box 2-A in ch. 2). The process used to evaluate these 18 reports took shape only as the project got underway. The process involved the use of two forms developed by the project team (see box 4-A). A rather long questionnaire was used to interview project directors and to characterize aspects of policy analysis in the reports (see app. B); this resulted in the elucidation of, among other things, the variety of analytical approaches found in OTA reports (see ch. 5). A second, shorter form allowed the numerical rating of each report on some specific "dimensions" or "elements" of policy analysis. The ratings from this shorter form, which is reproduced in app. C, are the basis for the statistical analysis in this chapter.

The policy project team's focus on 18 OTA reports allows for several characterizations of how OTA reports present the results of an assessment. The diversity of what OTA does is indeed reflected in its reports: scope, style, length, and a host of other dimensions that the policy project team developed inductively are presented below. The sources were many: suggestions by advisory panel members, criteria suggested by former committee staff, and debate among the policy project team about their own suppositions and experiences with the OTA process. In general, the policy project team seeks in this chapter to reduce patterns observed in the contents of the report sample to a set of summary statistics. Such numerical representation misses detail and nuance alike. Nevertheless, it provides an overview that can orient the reader to dimensions of OTA's policy analysis. In the discussion that follows, these errors of omission and commission are discussed in the aggregate (i.e., without citing report titles). Emphasis on positive features of OTA reports, with attribution, is given in the next chapter on ways OTA tells a story (or parts of a story) well.

It is important to note that the nonrandom, "purposive" sample of 18 OTA reports read and rated for this study makes any statistical analysis more heuristic than definitive. The policy project team cannot generalize to the program or division level, but can present a picture of agency tendencies in policy analysis and report writing. (A project team joke is that this is a sample of 18 statistical "outliers" on which we comment at our peril.) Thus, our findings focus on a few

patterns or themes that identify "problems" with OTA reports. Many of these are amplified elsewhere in this report by other kinds of data collected through interviews and retrospective accounts by participants in the OTA assessment process.

FINDINGS FROM THE STATISTICAL ANALYSIS

Statistical data from the sample of 18 OTA reports indicate that the average report is 254 pages long (with a range of 104 to 395 pages), organized in eight chapters with three appendices. Only about half (8) of the reports in the sample had an index.

Two-thirds of the 18 OTA reports in the sample were requested by a single congressional committee, and the rest were requested by multiple committees.[1] The list of requesters for the 18 OTA reports reviewed by the policy project team encompasses 19 different congressional committees. These committees represent a fairly good cross-section of OTA's congressional clientele. Since 1985, 19 House and 16 Senate committees have asked for OTA assessments. Topping the agency list of House requesters of studies since 1985 are the House Energy and Commerce Committee and the House Science, Space and Technology Committee; these same committees also topped the list of requesters of the 18 reports in the sample (requesting five reports each). The Senate requesters of the 18 reports were more varied, originating from eight different committees. The Senate Labor and Human Resources Committee and the Senate Commerce, Science, and Transportation Committee are the agency's most frequent Senate requesters since 1985 but requested only one and two reports, respectively, in the 18-report sample. Two other Senate committees that requested two reports each were the Senate Energy and Natural Resources Committee and the Senate Armed Services Committee.

The dimensions on which the policy project team gathered statistics on the 18 OTA reports in the sample form clusters of themes and issues of varying prominence (see app. C for the frequency distribution of reports or mean scores for each rated dimension). These are reviewed below. In most instances, average values for the entire report sample are reported. It is important to point out, however, that there was significant report-to-report variation.

Scale of effort and disciplinary makeup of project teams

Two indicators of project scale of effort are budget and average size of the project staff. Almost two-thirds (11) of the 18 reports in the sample cost from $300,000 to $600,000; the remaining one-third cost less than this (4) or more (3).

The 18 projects in the sample had an average staff size of four, including the project director. Half of the 18 assessments were directed by a natural (physical or biological) scientist or engineer. The other nine assessments were directed by an economist, by a social scientist or a person with a "policy degree," or by a person from some other discipline. Two-thirds of the projects included a social or policy scientist (by degree) on the staff; and two-thirds included a natural scientist or engineer. One-third of the projects included a lawyer; and one-sixth of the projects included an economist.[2]

Reader-friendliness of the 18 OTA reports

The preceding chapter noted the importance to congressional staff of being able readily to grasp the central findings, issues, and options in an OTA report and being able to track the points made in the summary chapter through the rest of the report. Various features of a report enhance a report's accessibility/reader-friendliness for congressional readers—a good summary chapter (e.g., useful summary/overview), request context given, purpose and objectives clearly stated, coherent and well organized,

[1] One of the 18 reports was requested by six committees (two House committees and four Senate committees).

[2] For information on the disciplinary composition of OTA's entire research staff, see ch. 6.

Box 4-A. A note on methods for the statistical analysis of the 18 OTA reports.

The process used for reading and evaluating the 18 OTA reports nominated by program managers evolved over the course of the policy project. At the beginning of the project, a questionnaire was developed as a guide to reading and characterizing the various elements of interest in the reports (see app. B). The questionnaire included questions covering two major components of policy analysis found in most OTA reports: 1) policy context, findings, and issues; and 2) goals and options (see box 1-A in ch. 1). Each of the 18 reports was assigned to a pair of reviewers on the policy project team, a primary reviewer and a secondary reader. The primary reviewer interviewed the project director to gain a quick orientation to the material and help identify the policy-relevant context and noteworthy features of the analysis. Then both the primary and secondary reader read the report, using the second part of the questionnaire. Subsequently, the two readers met to discuss their evaluations and, where possible, to reach some agreement on the aspects of the policy analysis identified during the evaluation.

After completing the long questionnaire for each report, the primary and secondary reviewer wrote a one-page summary of findings. That summary proved only slightly less cumbersome than the long questionnaire, however, so the policy project team devised a shorter questionnaire to rate each report on some specific "dimensions" or "elements" identified in the first round by the team (see app. C). This "statistical tabulation form" was drafted, pilot tested, and revised several times and served as the basis for a statistical analysis of particular dimensions of the policy analysis in the sample of 18 OTA reports. The primary and secondary readers used the form independently and then discussed their ratings and agreed upon a single combined (consensus) rating for each question. Many of the questions required assignment of a numerical rating on a 1 to 5 scale, with 1 being "poor," 2 being "fair," 3 "okay," 4 "very good," and 5 "excellent."

Once the ratings for all 18 reports were done, the team produced frequency distributions and mean scores for each rated dimension (see app. C for the report frequency distribution, mean scores, or other measures of each rated dimension). The team also generated a series of scattergrams to inspect how the ratings on policy and context varied by: broad field of project director's training, type of assessment (e.g., narrow vs. broad), and primary reviewer on the project team. There were almost no systematic variations and very few identifiable clusters (which is why none is reproduced here). In other words, what was cause and what was effect remained murky.

contains an index, effective use of typography, graphics, etc. (see ch. 5).

On a scale of 1 (poor) to 5 (excellent), the policy project team gave the 18 reports in the sample an average rating of 3.4 (between okay and very good) for reader-friendliness (see app. C). The team gave just over half the reports (10) a score of 4 or above (very good or better) for overall reader-friendliness; the other eight reports fell below this level.

The details are sobering. In some of the reports, the findings and options were so buried that it was almost impossible to find them. The ease of locating issues and findings was another dimension of reader-friendliness the team considered in each report; the mean rating was 3.4 (with less than half of the sample garnering a 4 or 5). In many reports, it was difficult to find where in the report details on material presented in the summary could be found. Some reports took hours to assimilate; others literally required days.

The team found close parallelism between the organization of the summary and the rest of the report in only seven of the 18 reports; four reports had no parallelism at all. The absence of parallel construction of the summary and other chapters often makes it difficult for a reader to use the summary as a guide to the rest of the report. Ten of the 18 reports included no index.

Objectivity and recommendations in the 18 OTA reports

OTA's reputation for objectivity is viewed by some as one of its chief assets (see ch. 3). If OTA were to lose this reputation—as it could do very quickly if a few reports with serious problems in objectivity surfaced—the agency would be in serious trouble.

The OTA policy project team found lapses of objectivity that it considered a problem (major or minor) in one-third of the 18 reports it reviewed (see app. C). Some reports had lapses in the "policy context, findings, and issues" part of the report, some had them in the "goals and options" part, and some had them in both. In one report among the 18 the team reviewed, the arguments seemed so one-sided or so lacking in support that the report seemed open to the charge of outright advocacy. In a couple of other reports, the objectivity appeared questionable because the basis for a report's controversial basic premise was not explicitly stated (e.g., the report considered how to implement a policy that it apparently assumed was worthwhile but neglected to state any basis for the assumption that the policy was worthwhile). In some cases, there seemed to be "errors of omission," perhaps due to blind spots resulting from analysts' (and reviewers') values or prior beliefs.

A few instances of lapses of objectivity stemmed from a report's making recommendations or policy prescriptions rather than presenting options. Seven of the 18 reports included, either explicitly or implicitly, at least some recommendations or policy prescriptions. In three reports, these were judged by the project team to be "empirically based policy prescriptions" supportable with data and analysis in the report and not significantly dependent on the decisionmakers' values or prior beliefs, and thus not open to criticism as a breach of objectivity.[3] The implicit or explicit recommendations in the remaining four reports were questionable, sometimes because OTA's unsubstantiated preference seemed apparent and sometimes because reasonable alternatives just were not presented.

Timeliness of the 18 OTA reports

The OTA policy project collected data on the time required to complete each of the 18 reports. The team found that the average number of months was 26.[4] Unfortunately, though, information on elapsed time from approval of request by the Technology Assessment Board (TAB) to report release is unreliable because of imprecise recordkeeping and other reasons (e.g., delays in project startup after requests have been received, and the production—in response to a single letter—of a series of reports over many years whose initiation and completion cannot be accurately determined). Number of fiscal years spanned for each delivered OTA report would at best be a crude approximation. There were no alternative data sources, however, to cross-check on this dimension that was included in the statistical tabulation form.

Policy analysis in the "context" vs. "options" part of the 18 OTA reports

The policy project team rated each of the 18 reports in the sample on their presentation of the two major components of policy analysis in an OTA report:

1. analysis of the policy problem, including discussion of the policy context, findings, and issues; and
2. identification and analysis of potential solutions, i.e., goals and options for congressional consideration (see box 5-A in ch. 5).

For the sake of brevity, these two components are referred to below in the shorthand "context" and "options."

[3] For further discussion of "empirically based policy prescriptions" in an OTA report, see ch. 5.

[4] Congressional staff complained that two years was often too long to wait for an OTA assessment (see ch. 3). A report in the 18-report sample that was completed in six to seven months, *Exploring the Moon and Mars*, is discussed in ch. 5.

To rate these two components, the policy project used a scale of 1 (poor) to 5 (excellent). For the description of "context" overall, the team gave the 18 reports a respectable overall score of 3.8 (almost very good) (see app. C). In addition, the team scored some specific aspects of "context." Three aspects—treatment of current Federal policy and activities, the legal and regulatory context, and the institutional context—were rated around 4.[5] It is important to note, however, that there was significant variation from report to report. A fourth aspect of "context"—analysis of stakeholders/affected parties—was rated decidedly lower, 3 (okay). The policy project team found that about one-third (5) of the 18 reports in the sample did a very good or excellent job of analyzing the positions of different stakeholders.[6] Six of the reports did not do a particularly good job (i.e., were rated 1 or 2) in this area.

In considering "context," the team also judged the quality of "explanation of the status quo" in the 18 reports. It considered one-third of the reports to be "very good," another third "fair," and another third either not very good in treating the current state of affairs or excluding such a discussion altogether. On a final dimension of context—consideration of international context—the policy team found that in five of the 18 reports, the international context was critical to an understanding of the issue; these reports received an impressive 4.8 score for the discussion of the international context.[7] Six reports out of the 18 noted the international context but did few comparisons, and seven reports focused solely on the national context.

The policy project team found that while the 18 reports on average did a fairly good job of analyzing the "context," many of them faltered on the presentation and analysis of "options." For the description of "options" overall, the team gave the 18 reports an overall score of only 2.8 (less than okay) (see app. C). Nearly two-thirds (11) of the reports provided from six to 20 options; and nearly one-third (5) provided more than 20 options. Nearly half (8) of the 18 reports included options creating a new governmental institution. Three reports had options involving a reduced Federal role (e.g., options relying on market or other mechanisms). About half included an option that advanced the deployment of people/human factors as a policy solution.

Since congressional staff interviewed for this project said OTA analysts should not bother presenting options without analysis of the effects and effectiveness of the options (see ch. 3), the policy team specifically rated the 18 reports on whether the options presented were analyzed. More than half (10) of the 18 reports included analysis of options (e.g., in terms of their effectiveness of achieving specified goals, costs, and impacts on and likely reactions by stakeholders).[8] The bad news is that analysis of options was lacking in the other eight reports. Furthermore, only nine of the 18 reports contained analysis that actually compared options and/or strategies.

The project team also estimated that the proportion of the report measured in pages devoted to options in the sample of 18 reports averaged about 15 percent of the report (with a range of less than 5 to 40 percent, calculated as a fraction of chapter pages only, not appendices). In terms of the dimensions of ease of finding the options and relating the options to the rest of the report, the ratings were 3.3 and 3.1, respectively. More telling, only two of the 18 reports received scores of 4 or 5 on both of these dimensions.

[5] A couple of OTA reports from the 18-report sample that did a good job of legal and institutional analysis are discussed in ch. 5.

[6] One of the 18 reports that did a good job of stakeholder analysis, *Power On*, is discussed in ch. 5.

[7] One of these reports, *Enhancing the Quality of U.S. Grain for International Trade*, is discussed in ch. 5.

[8] A couple of OTA reports from the 18-report sample that did a good job of analyzing options are discussed in ch. 5.

In search of differences by "type" of OTA assessment

The policy project team struggled to devise a taxonomy of OTA reports that might help us interpret some of the results about the strengths and weaknesses of OTA policy analysis. The team considered and discarded several taxonomies. It had expected glaring differences in the scope (wide-ranging vs. well-circumscribed) of reports in the sample, but such differences were not readily apparent. The team also considered a taxonomy based on whether the focal issues of a report were emerging issues or mature and whether they were closely linked to the immediate legislative agenda or more long term. Though plausible in the abstract, these distinctions are impossible to make for a whole report (i.e., they either are not mutually exclusive or cannot be ascertained).

After a great deal of effort, the best taxonomy of OTA reports the team could come up with was *"problem-driven reports"* (which focus on how to fix a problem, usually specified in the congressional request letter), and *"technology-driven reports"* (which consider the implications of the development, refinement, or use of a technology or class of technologies).

Table 4-1. Methods cited by project directors of 18 OTA reports

To identify policy context, findings, and issues

Methods	*Frequency:*
Workshops	9
Literature review	8
Case studies	7
Contracts	5
In-house legal analysis	4
Quantitative analysis	4
Executive branch discussions	3
Site visits	3
Historical reviews	2
International comparisons	2
Panel identifies issues	2
Survey	2
Talking to lots of people	2
Session at conference	1

To formulate goals and options

Methods	*Frequency*
Brainstorming by staff	9
Project director sitting and thinking	7
Quantitative analysis	5
Advisory panel	3
Scenarios to evaluate options	2
Talking to lots of people	2
Case studies	1
Contracts	1
Historical reviews	1
Literature review	1
Survey	1

The policy project team found that the policy analysis in the problem-driven reports was generally better than that in the "technology-driven" reports, though there were variations within these categories. For their treatment of "context," the problem-driven reports got an average score from the project team of 4.1 (very good) vs. an average score in the technology-driven reports of only 3.1 (okay). On the "options," the problem-driven reports got an average score of 3 (okay), while the technology-driven reports got an average score of only 2.3 (a little better than fair). The significance of these findings, if any, is not clear. Perhaps it is easier for OTA analysts to get a handle on today's problems than to anticipate tomorrow's.

Finally, the team took a second look at the two categories of reports. The 13 problem-driven reports were assigned to three subcategories (though four of the 13 could not be assigned in a mutually exclusive way):

1. problem-technical (the search for technical fixes, either the use of a new technology or the application of an existing one to solve a problem, e.g., to improve fuel economy);
2. problem-organizational (how to organize for the management of a problem, e.g., the defense technology base); and
3. problem-legal (evaluation of a problem to ascertain, e.g., that questions of ownership of human tissues and cells cannot be handled by the current body of law).

The five "technology-driven" reports typically asked about a technology (e.g., sequencing the human genome): What can it do for us or will it do to us? The project team's interpretation of these differences is guarded at best: Something systematic may be going on, but the sample size, especially in the subcategories, is too small to warrant generalizations.

Methods of assessment in the 18 OTA reports

Finally, the policy project team was curious about the methods used by the staff responsible for the 18 assessments in the sample. In the interviews with the project directors for the 18 reports, team members asked them to identify the major methods they used, first in developing "context" and then specifically for formulating "options." In addition, when team members were reading the reports, they noted specific methodological tools that were apparent. A list of assessment methods was also identified in the sample of 18 reports. A frequency distribution of methods is presented in table 4-1.

The methods most commonly cited as being used for framing the "context" part of a report were workshops and literature reviews (half of the sample); case studies, legal analysis, and quantitative analysis each were cited for no more than one-third of the sample. Methods such as site visits, historical reviews, issue identification at an advisory panel meeting, or conducting a survey are reportedly much less common.

For developing and analyzing "options," the most common methods by far were "brainstorming by the staff" and the "project director sitting and thinking" (about half the sample used each). The term "common sense" came up frequently. Other methods (e.g., using the advisory panel or scenarios to evaluate options) were mentioned infrequently.[9] The conclusion of the OTA policy project team is that common sense and collective rumination prevail in the transformation of research findings to policy options. The project directors, with and without other team members, muddle through solo rather than depend on particular tools or other people—inside and outside of OTA—in drafting policy options.

Missing from this inventory of methods is the extensive reviewing of contractor reports and draft chapters. On such review (both external and in-house), project directors depend religiously. But chapter review occurs near the end of the process, not in its formative stages.

IMPLICATIONS OF THE ANALYSIS

Quantitatively and qualitatively, the sample of 18 OTA reports exhibits some notable tendencies that include the following:

- a mix of natural scientists/engineers and social scientists on most project teams;
- room for improvement in the reader-friendliness of a substantial portion of OTA reports (e.g., improvements in the ease of locating the findings and options, inclusion of an index, more parallelism between the summary and the rest of the report);
- occasional lapses in objectivity (e.g., arguments so one-sided or so lacking in support that the report seemed open to the charge of outright advocacy) and other instances in which objectivity appeared questionable (e.g., be-

[9] If the policy project team had first presented to the project director the items in table 4-1 and asked which were part of the assessment resulting in a particular report, the frequency distribution of methods might have been different from that shown.

cause the basis for a report's controversial basic premise was not explicitly stated);

- less even-handedness in the presentation of options than OTA folklore would lead one to suspect;
- a typically better job of policy analysis in the "context, findings, and issues" part of the report than in the "goals and options" part, but significant variation from report to report;
- little analysis of the effects and effectiveness of options in a substantial portion of OTA reports, but significant variation from report to report;
- a generally good job of treatment of current Federal policy and activities, the legal and regulatory context, and institutional analysis in the context part of most OTA reports, but variation from report to report;
- a less than satisfactory job of stakeholder analysis in many OTA reports, but significant variation from report to report;
- little attention to market solutions (as well as the role of nongovernmental organizations and international bodies) as an alternative to Federal intervention, but some reports in which market solutions were considered; and
- the use of "brainstorming" and the "project director sitting and thinking" more than any other methods to develop policy options in OTA reports.

Some of these tendencies depart from the "folklore" (probed in ch. 6) about what OTA reports do—and do better than documents produced by other policy organizations. Are they causes for concern? That depends.

If one believes that each OTA report can be judged only in the context of a specific request and the expectations that the client brings to the document (and its scale of effort), then the findings of this overview may not raise concerns. Perhaps the contents of each report can be highly variable and still responsive to congressional committee needs. On the other hand, if one believes that every OTA report should satisfy some minimal set of minimal criteria (e.g., those specified by congressional staff in ch. 3), then this statistical overview has uncovered some deficits.

One sure implication of this overview is that OTA satisfies its congressional clients in many ways and disappoints in others. OTA reports do many things well, some things not so well, and a few things not at all. In the context of a specific request, some of the apparent deficiencies and omissions in a report may not actually be problems. In many cases, however, the apparent deficiencies and omissions probably reflect problems that can be addressed through heightened sensitivity and better time-management and allocation of time to different tasks in the assessment process.

With these preliminary findings in mind, we need to illustrate the dimensions of good OTA storytelling as found in the 18-report sample. That is the task of the chapter that follows.

Telling a good story and telling it well

What is policy analysis in an OTA report? The OTA policy project team decided at the outset of this study not to get bogged down in the effort to define policy analysis. Rather we decided to use the same approach Percy Bridgman used in defining science as "the activity of scientists"—we simply defined policy analysis as the "activity of policy analysts." We started out by looking at OTA reports.

In reading a sample of 18 OTA reports judged by program managers to have "good policy analysis" (see box 2-A in ch. 2), the policy project team found that each of the 18 reports tried, more or less successfully, to "tell a story." The stories were very different, but despite their diversity, all of the 18 reports typically had two major components:

- analysis of the policy problem, including discussion of the policy context, findings, and issues; and
- identification and analysis of potential solutions, i.e., goals and options for congressional consideration (see box 5-A).

Part of the art of OTA policy analysis is making sure that the policy options flow from the information and arguments advanced elsewhere in the report and that the options are thoughtful and reflective of an understanding of what policy can achieve. If a report is well crafted, there is a clear and logical link between the two components.

TELLING A GOOD STORY

Only a few of the 18 reports in the sample reviewed by the OTA policy project team were judged to be consistently good in telling and linking the two parts of the story. Three of these reports are summarized below:

- *Critical Connections: Communication for the Future;*
- *Nuclear Power in an Age of Uncertainty;*
- *Making Things Better: Competing in Manufacturing;*

All of these reports were fairly big budget (around $500,000) assessments. *Critical Connections* took about three years; the other two took 18 months or so to complete.

Some congressional staffers interviewed by the policy project team said that the development of options was sometimes or often less important to them than having OTA provide scientific and other information related to the policy issues at hand (see ch. 3). Thus, in some

cases, an OTA report that concentrates on the problem-identifying part of its story may sometimes be quite acceptable to congressional staff. One such report, *Ownership of Human Tissues and Cells*, which is discussed below, is an exception to the rule that an OTA report should tell a good story from beginning to end. Most memorable stories do have a plot that unfolds from beginning to end, but an author can occasionally get away with leaving the ending up to the reader. The policy project team concluded that the same is true of certain OTA reports. When congressional requesters are primarily interested in learning about the context, findings, and issues, it may be desirable for project staff to devote most of its energies to this aspect of the report.

The story told in *Critical Connections*

Critical Connections is an example of a very broad, forward-looking report that takes a strategic look at rapidly changing communications technologies and their implications for U.S. society, institutions, and policymakers. *Critical Connections* is a "technology-driven report" in the sense that it considers the implications of the development, refinement, or use of a technology or class of technologies. It is a creative report that generates several potential goals and a large number of options to attain those goals.

This report is extremely well written and superbly organized. The structure of Ch. 1: Summary closely parallels the structure of the rest of the report, making it easy for the reader to find further details on points made in the summary. The body of the report has three major parts.

- Part I: Changing Communications Infrastructure, Goals, and Policymaking (with three chapters, including a conceptual framework for analyzing communications issues);
- Part II: Opportunities and Constraints Provided by New Communication Technologies (with four chapters on opportunities and constraints in four specific areas in which communication technologies are used); and
- Part III: Crosscutting Communication Issues and Alternative Policy Strategies for their Resolution (with five chapters, in a uniform format, that deal with five major policy areas and present numerous options in each area).

The problem-identifying part of the report's story is told in Parts I and II, which consider how recent advances in communication technologies are transforming the U.S. communications infrastructure. Part III, which is devoted to the discussion of potential solutions, identifies crosscutting issues engendered by these technologies and evaluates alternative strategies and options to address these issues.

Problem identifying—*Critical Connections* begins its story in Part I by noting that revolutionary advances in information storage, processing, and transmission technologies are rapidly reconfiguring the U.S. communications infrastructure. The lines that have historically divided domestic and international communication systems and markets are gradually disappearing, the report says, so decisions concerning communication systems and industries must increasingly reflect a global perspective.

The U.S. communication infrastructure is defined broadly in the report as the underlying structure of technical facilities and institutional arrangements that support communication via telecommunication, broadcasting, film, audio and video recording, cable, print, and mail. Most of the U.S. communications infrastructure, the report notes, is currently held by private individuals and firms. Historically, Federal involvement in developing policy in this area has been minimal. Whether that historical pattern should continue is a central question that remains to be answered.

The report suggests that technological changes in communication technologies and their socioeconomic impacts are "unraveling the

Box 5-A. Telling a story: components of OTA policy analysis

Each OTA report tries to "tell a story." We can think of OTA stories as having two parts, beginning with problem identification and ending with discussion of potential solutions. The first part of the story presents and analyzes the policy context and identifies key findings and issues for Congress. The second part presents alternative congressional goals, options to achieve those goals, and an analysis of the options. If a report tells a good story, there is a clear and logical link between these two parts.

The policy problem: context, findings, and issues

This part of an OTA report includes a description and analysis of a policy problem or issue, or in the case of an assessment of a technology, a description and analysis of issues associated with the development or use of the technology. It can be thought of as an explanation of what the present looks like, how we got there, and where we might end up if no changes are made. Some OTA reports address a very narrow policy context, while others attempt to relate the policy context to social welfare or other much broader contextual areas.

In addition to highlighting the relevant aspects of science and technology, this part of the report may include discussions of the people who are most directly involved, laws, institutions, and economic and social concerns. The people involved include both the "stakeholders" (e.g., the American public and specific groups who are most affected) and "decisionmakers"—Congress, the executive branch, the states, and private entities. Relevant laws and regulations are discussed, as are the institutions that implement the laws and are affected by them. All aspects of Federal involvement are likely to be considered. Economic and broad social concerns, including ethical concerns, are also likely to be included, as appropriate.

At some point, an OTA report must explicitly identify key items for congressional consideration. In the words of one congressional staffer, a report provides "touchstones" that allow staff to go quickly from one key issue or problem to the next. OTA reports provide touchstones in many forms. Presenting "findings," "issues" (areas of controversy or conflict), "problems" to be solved, or "congressional decisions" that must be made are among the approaches some reports use for highlighting the most important concerns. Depending to a certain extent on the topic, some reports highlight very broad philosophical issues, and others focus on far more narrow issues.

Potential solutions: goals and options

This part of an OTA report moves from the craft of policy analysis to high art, from analyzing the status quo to envisioning possible policy changes and evaluating the effects of changes. Through methods that include brainstorming, soliciting outside views, etc., the project team identifies potential goals and concrete options for Congress.

In some cases, OTA has to propose and evaluate the implications of pursuing alternative goals. In other cases, the goals are established by the congressional request, and the primary focus of the OTA assessment is on developing and analyzing options for achieving a goal. Depending in part on the topic of the assessment, the goals and options may reflect basic philosophical disagreements (e.g., regarding regulatory approaches vs. market mechanisms) or be technical options that give numbers appropriate for legislation (e.g., tons of emissions of CO_2).

As one might imagine, options can be organized in many ways. The challenge is to choose the approach that seems to fit the assessment topic best. Organizing options by "problem to be fixed" or "goal" are two approaches that often work. Organizing options by technology fails to highlight the specific matters of concern to OTA's congressional clients and is therefore typically less helpful. Especially if there are many options, it is often helpful to organize them into "strategies" or packages. Sometimes options can be organized by "values" or prior beliefs (e.g., "less government is better government"; "we do not give a healthy environment to future generations, we borrow it from them"; "all men are created equal, that they are endowed by their Creator with certain inalienable rights...," etc.). Sorting options by other criteria can also be helpful. Thus, for example, it might be helpful to sort options into near-term and longer term decisions or by extent of governmental intervention, cost, or some other measure of size of the program.

existing U.S. communication system," creating new opportunities, players, and problems and raising new questions about the goals of the communication system, as well as about how, and by whom, future communication policy decisions should be made. Thus, Congress now has the opportunity to make a number of choices. If Congress fails to act decisively, the report warns, "the opportunity to make deliberate choices about new communications technologies—and about the nature of American society itself—will be overtaken by rapid technological advances, the hardening of stakeholder positions and alliances, and the force of international developments and events."

To determine the role that government might play in the realm of communication, the report notes, Congress will need to consider the opportunities that new communications technologies offer society, as well as the obstacles that prevent those opportunities from being realized. Part II of *Critical Connections* has four chapters that identify "opportunities and constraints" provided by new communications technologies in four realms of life: 1) the business world, 2) the political arena/democratic process, 3) the shaping and development of culture, and 4) individual efforts to achieve personal autonomy and self realization.

Potential solutions—The five chapters in Part III of *Critical Connections* identify and discuss five "crosscutting communication issues" engendered by changes in communication technologies:

1. issues involving equitable access to communications opportunities,
2. issues related to the security/survivability of the communications infrastructure,
3. issues entailed in achieving interoperable communication systems,
4. issues related to modernization and technological development in the U.S. communication infrastructure, and
5. jurisdictional issues that are likely to arise in formulating and implementing a national communication policy.

A full chapter is devoted to exploring factors contributing to problems in each of these areas and to identifying and evaluating alternative policy strategies and options to address the problems. This organizing approach works very well.

One of the most innovative and distinctive features of *Critical Connections* is that it deals with differing values in the selection of goals and options by making them explicit. Potential goals for policymakers are the elimination of specified problems in one or more of the five aforementioned areas. The report provides extensive background information for understanding the importance of each of these policy areas. Furthermore, it repeatedly emphasizes that policymakers will not be able to maximize goals in all five areas simultaneously; rather, they will have to make tradeoffs between the various goals (e.g., between maximizing security/survivability of communications systems and maximizing access to communications technologies). The choice of options, therefore, depends in part on which of the five areas policymakers think should be emphasized.

Critical Connections identifies more than 50 options—roughly 10 options in each of the five issue areas. The options presented really seem to be alternative approaches; there is no sense that they are recommendations. Most of the options presented are foresight options that were new to this assessment, perhaps because of the cutting-edge character of this report. In each issue area, an effort is made to suggest strategies and options that range from minimal amounts of Federal intervention to greater amounts. To encourage modernization of the communication infrastructure, for example, the report identifies three general strategies: 1) direct government involvement; 2) provision of tax credits or other indirect incentives to the private sector; and 3) creating a regulatory environment that is more conducive to the modernization.

Several options are presented under each strategy. Figures summarizing the options in each of the five major issue areas appear in the summary chapter and are duplicated in the five chapters of Part III; these figures greatly aid comprehension.

Apart from presenting options that span a spectrum from minimal Federal intervention to greater intervention, *Critical Connections* identifies which strategies/policy options in different issue areas are consistent with what the report calls "three alternative visions of communication": 1) the market vision, i.e., communication as a market commodity; 2) the economic vision, i.e., communication as a springboard for economic growth and development; or 3) the social vision, i.e., communication as a basic societal infrastructure. The report notes that the choice of congressional policy strategies and options will depend primarily on how Congress views communication in 21st century America. "If Congress can agree on a consistent vision of communication goals," the report notes, "many policy choices will follow."

Finally, this report admirably features extensive discussion of the many options it presents. Most of the discussion focuses on historical and legal precedents for the options. Also, the analysis of options focuses on how the options will be viewed by stakeholders and other affected parties (the industry, the Federal Communications Commission, universities and individual users of communications technologies, etc.).

The story told in *Nuclear Power in an Age of Uncertainty*

Nuclear Power in an Age of Uncertainty is another example of a report that is equally strong in describing the policy context and exploring options available to Congress. Moreover, it is another example where the organization of the report leads one directly to the options presented at the end. More important, for those readers who start by reading the policy options and then need to know the analytical support for the option, this type of organization allows one to locate readily the desired detail.

Nuclear Power in an Age of Uncertainty is organized using six "factors that affect nuclear power's future"; four congressional goals; and 15 options to help realize the goals. The 15 options are also grouped into three "strategies," which correspond to level of governmental intervention. In the summary, the six "factors" organize the report's findings (though the term "finding" is not stressed.)

Problem identifying—The policy problem is stated briefly in the very beginning of *Nuclear Power in an Age of Uncertainty*: For a variety of reasons, the United States may want to preserve nuclear power as a viable energy option. Nuclear power "has advantages that may prove crucial to this Nation's energy system in the coming decades, but at present is an option that no electric utility would seriously consider." Without improvements in a number of areas, this situation will not change and the nuclear industry will not survive. Keeping the U.S. industry alive while it is decided whether nuclear power's benefits outweigh its costs becomes the premise, or overall goal, of the assessment.

Again, the report tells the story through a focus on six "factors that affect nuclear power's future": 1) financial and economic conditions, 2) prospects for new technologies, 3) management of construction and operation of nuclear power plants, 4) regulation, 5) viability of the vendors, and 6) public attitudes. In the summary, key findings are organized under these "factors," with good use of boldface type to help those readers who are just skimming. The report includes a chapter devoted to each of these factors, which accomplishes two things. First, if one desires more detailed explanation related to a specific factor than that presented in the summary, it is very easy to find. Second, the organization instills confidence in the report; the reader

knows that more detailed discussion and substantiation exists, regardless of whether he or she uses it. "Factors" is not an exciting word but is nonetheless an appropriate and helpful organizing concept. Note that these factors span a wide spectrum of policy-relevant considerations: whether new technologies can help solve the problem, strengths and weaknesses of current laws and regulations, government performance, human factors, the private sector, public opinion, and so on.

Even before the factors are presented, the report tells the story from the very different perspectives of the key participants in the "nuclear debate": the Nuclear Regulatory Commission, state regulators, utility investors, utilities themselves, the nuclear industry, critics of nuclear power, and the public. The discussion is brief, about two pages plus an excellent summary figure (reproduced as one of many OTA policy "gems" in app. E) but captures the differing needs and desires of each stakeholder group. It also identifies those objectives on which everyone agrees (e.g., no major accidents and a convincing waste disposal program). The debate is a harbinger of the six factors that organize the rest of the report.

Several research methods were used to gather the information presented. Three workshops were held to discuss several of the factors identified above. Two contracts were let on public acceptance. The staff also arranged a small workshop at an industry conference to understand better the views of industry executives.

The report includes a few other noteworthy devices to improve readability: a one-page "overview and findings" at the beginning of the report; a clearly labelled statement of "the policy problem"; and an explicit statement of the purpose of the study, the methods used, and its organization.

Potential solutions—The last chapter of *Nuclear Power in an Age of Uncertainty*, "Policy Options," makes the grand leap from the status quo to alternative, more desirable futures. It identifies four goals that should be viewed favorably by the stakeholders. The four goals are 1) reduce capital costs and uncertainties, 2) improve reactor operations and economics, 3) reduce risks of accidents, and 4) alleviate public concerns and political risks. Again these are not alternative goals, but components necessary to achieve the overall goal of preserving the nuclear option. Fifteen options are discussed under the four goals in the policy options chapter. The summary discusses only the most important seven options. The summary also does not attempt to force the options under a single goal.

Note that the organization of the policy options chapter in this report does not parallel the organization of the rest of the report. In this instance, the lack of parallelism is not a problem, because the options themselves correspond quite well to the factors (i.e., chapters) identified earlier. For example, technology options (primarily covered in ch. 4) are found under goal 1, reducing capital costs and uncertainties and goal 3, reducing risks of accidents.

The options are also organized into three strategies that reflect how actively one might want to intervene to keep the industry alive—a continuation of the status quo, removing a few obstacles to more nuclear orders, and providing a moderate stimulus to more orders. These strategies are uninformatively titled "base case," "strategy 1," and "strategy 2," but it is still quite easy for most congressional staffers to identify which strategy (i.e., package of options) his or her boss is likely to prefer, so the concept is quite helpful. These are, of course, the same options that are discussed by goal, just organized in a different, equally policy-relevant, form.

Nuclear Power in an Age of Uncertainty analyzes the effectiveness of the strategies under four plausible future scenarios. (These are combinations of electricity growth rate and industry success in solving their own problems—both key unknowns.) Because the effectiveness of the options in some

cases depends on unknown future conditions, the report is able to examine the robustness of the alternative strategies. The attempt is admirable, but owing to its complexity is not altogether successful. The analysis is mostly by appeal to common sense—very thoughtful, well reasoned, and thorough—but one is left with a desire for more data to support many of the assertions.

The story told in *Making Things Better*

Making Things Better is the second in a series of three OTA reports on the health of U.S. manufacturing in a world economy. It is a "problem-driven report" in the sense that it focuses on how to fix a problem (rather than on a specific technology or class of technologies). Problem-driven reports are the most common types of studies included in the sample of 18 OTA reports.[1]

The report is extremely well written and organized. These features, for the most part, overcome the report's almost total lack of other types of assistance to the reader (such as summary tables of findings or options). The foreword states the goal of the assessment: to identify "ways to promote the restoration of American leadership in manufacturing technology." Technology is defined in its broad sense as "not only new products and advanced manufacturing equipment but also efficient organization of work and effective use of people." With only the foreword to serve as an explanation of the purpose and scope of the assessment, the report jumps right into a very forceful, clear summary which begins, "American manufacturing has never been in more trouble than it is now. Its biggest challenge is from Japan . . . While some American companies and institutions have redoubled efforts to improve manufacturing, the government is dozing at the switch." And even the first paragraph makes it clear that the report will not shy from proposing alternatives: "As a nation, we owe it to ourselves to help with [the] solution."

Making Things Better establishes key themes early and uses these themes to organize the entire report. This type of highly parallel structure is of great advantage to the congressional client (see further discussion under "Telling a Story Well" section below).

Problem identifying—*Making Things Better* begins its story with a brief review of trends in the U.S. manufacturing economy since 1960. Seven figures illustrate productivity, trade balance, and other economic trends—plus comparisons to the country's major economic competitors—in as many pages. These are the manifestations of the problem (and the subject of an earlier OTA special report that was part of the series). The report then launches into its major themes—the root causes of these undesirable trends and unfavorable comparisons. These include deficiencies in 1) investments in technology, 2) investments in people, 3) cooperation among firms, and 4) technology transfer and diffusion. Chapters of the report (and sections of the summary) are devoted to explaining the importance of each of these factors and comparing the United States to its competitors.

According to the project director, the four themes that eventually emerged were by no means identical to the key issues the project team hypothesized at the beginning of the study. To understand "the story," the methods used by the team included a review of the extensive literature on the topic; in-depth comparisons with other countries, in particular Japan; several case studies (e.g., high-definition television); identification of key issues by their advisory panel; and open discussions with analysts in relevant executive branch agencies.

Potential solutions—The second half of the summary and the second chapter of *Making Things Better* are devoted to four somewhat overlapping "strategic targets" for

[1] For further discussion of "technology-driven" and "problem-driven" OTA studies, see ch. 4.

policymakers. Again, these flow almost directly from the policy context. These four strategic targets are as follows: 1) improving the financial environment for U.S. manufacturing firms, 2) upgrading education and training of the workers, managers, and engineers needed in manufacturing, 3) diffusing technologies throughout the sector, and 4) supporting research and development (R&D) for commercially important technologies (i.e, "strategic technology policy").

About one-quarter of the text is devoted to explanations of these strategies and the options that might constitute them. The scope of the options is extremely broad, ranging from expansive goals (e.g., balancing the budget and encouraging savings) to modest and very specific changes to existing antitrust law. Close to 50 options are discussed under three of the four strategies. (While education and training are flagged as one of the four strategic targets for improving manufacturing, the identification and analysis of specific options is left to another report in the series.) Unfortunately, finding the options is like going on an Easter egg hunt: Options are hidden in the middle of sections with no identifiers other than sentences beginning with the phrase "Congress could...." There are no summary tables or section identifiers to aid the hurried reader.

Most of the options presented in *Making Things Better* had already been proposed. Reviews of the literature, bills already introduced, programs in other industrialized countries, and discussions with executive branch staff and other knowledgeable people appear to be the source of most. The strength of the report comes from "knitting together a network of possible actions" in the four areas in greatest need of policy attention.

A common flaw in many OTA reports is that options are often identified but not analyzed.[2] *Making Things Better* endeavors to analyze many of the options proposed, primarily using three methods. In the section on financial policy, for example, the report relies on existing literature for estimating the effectiveness of such options as investment and R&D tax credits. Analogies to similar programs in other areas are also used to great advantage. For example, design of an industrial extension service relies heavily on the model of the Agricultural Extension Service and the concept of a civilian technology agency looks to the Defense Advanced Research Projects Agency (DARPA). Finally, the report considers policies in other countries as a source of insight on the effectiveness of several of the options proposed. (A comparison of industrial and trade policies in other countries is the focus of the last report of the series.)

Only some of the 50 options are analyzed, however, and little attempt is made to compare the options. Given limited time and resources, one must make a tradeoff between attempting a fairly complete list of options and analyzing and comparing a select few. This report opts for the former course. Policy project team interviews with Hill staff suggest that most of OTA's congressional clients would prefer that analysts choose the latter course (see ch. 3).

Exception to the rule: *Ownership of Human Tissues and Cells*

The policy project team found that, in rare cases, an OTA report concentrates on the first part of the story—with very little discussion of options—and is quite acceptable to congressional staff. *Ownership of Human Tissues and Cells*, which was done with a budget of about $150,000, may be such a report. A minuscule portion of this report (only five of the 168 pages) is devoted to "Policy Issues and Options for Congressional Action."

Ownership of Human Tissues and Cells analyzes the legal, economic,

[2] For a discussion of congressional views on the importance of analyzing options in OTA reports, see ch. 3. For a summary of how OTA reports in the 18-report sample fared in this regard, see see ch. 4.

and ethical rights of human sources of tissues and cells and also those of the physicians or researchers who obtain and develop these biological materials. The study describes the potential of three rapidly moving technologies (tissue and cell culture, cell fusion to produce monoclonal antibodies, and recombinant DNA) for manipulating human tissues and cells to yield commercially valuable products.

At the time of its release, in March 1987, this study was anticipatory. When the study was requested, a court case was pending over who owns a cell line—the human source of the original tissues or the scientist who developed the cell line. *Ownership of Human Tissues and Cells* alerted Congress that this case was not an isolated incident but rather involved a question that might arise again and again because of the uncertainty of how the courts would apply current law to the new and unforeseen products of biotechnology. The court ruled in 1990 and apparently in a manner that did not stimulate further congressional attention.

Problem identifying—*Ownership of Human Tissues and Cells* tells the story in a completely straightforward—almost textbook—manner. After a clear and quite concise summary, the report lays out a six-page introduction that describes some of the key issues by presenting four disputes over ownership of tissues and cells, including the one, still pending, that led to the study request. A 15-page chapter describing the technologies follows.

The policy context is then explained in two chapters. The first of these "The Interested Parties," is an 18-page discussion of the stakeholders: the sources of human tissues and cells, the research community, and the biotechnology industry. The chapter explains how an eventual commercial product results from the contributions of both the sources and researchers, and often, many sources and researchers. It is followed by the single longest chapter in the report, on "Legal Considerations." The report reviews the dozen or so areas under both the common law and specific statutes that are relevant, concluding that existing law does not provide definitive answers about ownership of the products of these new technologies. The report states that it is the uncertainty of how the courts might rule that is hindering the development of products using these new technologies.

The report then presents three chapters on the key issues: "Informed Consent and Disclosure," "Economic Considerations," and "Ethical Considerations." In the first, the report presents the arguments in favor and against disclosing to the donor the potential commercial gain from the use of his or her tissues or cells. Full disclosure would respect the right of the individual, but one might not want a subject to prefer any medical procedure because of what might be a slim probability of commercial gain. The report then devotes a chapter to the tensions between two important economic considerations. Concerns for equity argue in favor of paying human sources; added costs of payments, and how this might slow down the development of beneficial technologies, argue against. The last chapter discusses ethical considerations, addressing topics often not included in OTA reports—such as religious perspectives—but which in this case are highly relevant for helping Congress understand the multifaceted problem they face.

The structure and organization of chapters for the report's discussion of the policy context and issues verges on the mundane—the technologies, interested parties, legal considerations, economic concerns, ethical issues—but is extremely successful. *Ownership* tackles what was then an emerging and thorny topic, explains who cares about it, and clearly states some important, policy-relevant bottom lines.

The identical structure is used to organize both the summary chapter and the body of the report. Such parallelism is very helpful to the typical staffer who reads the summary and uses the remainder of the report as a reference document. The summary does not have a separate

section on key findings but rather highlights these through effective use of boldface.

Potential solutions—*Ownership of Human Tissues and Cells* devotes only five pages to "Policy Issues and Options for Congressional Action" (as the last section of the summary). It is not one of the report's strengths. According to the project director it was prepared quite hastily. Along with the early stage of development of the issue, it is difficult to second-guess the staff's decision to allocate almost all of the time and resources to the policy context. Nevertheless, earlier and greater effort to developing and analyzing options would certainly have improved this section.

CHARACTERS AND SUBPLOTS

In the course of the OTA policy project, outside workshop participants, former OTA staff, and congressional staff identified some specific aspects of OTA policy analysis that they thought were important and, in some cases, might be improved:

- treatment of directives in policy options,
- analysis of options,
- timeliness (e.g., the preparation of reports that take less time than the typical OTA assessment),
- stakeholder analysis,
- international comparisons or aspects of problems,
- institutional analysis, and
- legal analysis (see ch. 3 and 4).[3]

The policy project team found that some of the 18 OTA reports did a particularly good job of dealing with one or another of these specific aspects of policy analysis. A few of the 18 reports that might be used as models for dealing with these types of problems are identified below.

Options as "empirically based policy prescriptions": *Transportation of Hazardous Materials*

The policy project team was surprised to find that many of the 18 reports in its sample included some type of policy directive in the policy options for Congress. In fact, seven (40 percent) of the 18 reports included implicit or explicit policy directives (see ch. 4).

Some of the directives in the seven reports seemed to reflect preferences of OTA staff for reasons unstated. These the project team decided to refer to as "recommendations."[4] On the other hand, some of the directives in the seven reports seemed empirically based—i.e., supportable with data and analysis in the report and not significantly dependent on the decisionmaker's values or other prior beliefs. For lack of a better term, the project team decided to call these "empirically based policy prescriptions." The policy project team judged that "empirically based policy prescriptions" were present and well supported in three reports (or about 15 percent of the 18 reports in the sample) (see ch. 4).[5]

An example of an assessment with "empirically based policy prescriptions" that seem reasonable to the policy project team is *Transportation of Hazardous Materials*. This report offers a number of such prescriptions, presented largely as findings or options. There are no alternative sets of options for Congress and other bodies, so by implication, they appear to be prescriptions that should be acted upon. However, the justification for these "options" is so straightforward—based on data, analysis, and a lot of

[3] Another aspect of OTA reports that was viewed as important and needing improvement was reader-friendliness (e.g., elements of organization and format that make reports easy to use). Reader-friendliness is discussed in the next section of this chapter entitled "Telling a Story Well."

[4] Concerns have been raised by congressional staff and others that including "recommendations" in policy options for Congress may pose some risk to OTA's hard-won and vitally important reputation for objectivity (see ch. 3).

[5] Most of the congressional staffers interviewed for this project indicated that in the small number of cases where the evidence is overwhelming in favor of a particular pattern of options, OTA would be justified in presenting what the team has called "empirically based policy prescriptions" (see ch. 3).

common sense—that the options seem neither controversial nor likely to get OTA in trouble. It is difficult to argue against them.

The options in *Transportation of Hazardous Materials* are divided into a number of categories: training (for emergency response and enforcement), regulatory consistency, databases, containers, and coordinating programs. Under training, the report presents as a finding the following:

> *OTA concludes that a national strategy to provide an appropriate level of hazardous materials emergency response training, either basic or advanced, to local personnel is an urgent priority.*

This "empirically based policy prescription" is based on data, including data supplied OTA by the International Association of Fire Chiefs and the Federal Emergency Management Agency. Cost estimates are made, but there seems to be little doubt that the training courses given by state, local, and Federal agencies were not available to large numbers of local emergency response personnel, particularly firefighters.

Another "empirically based policy prescription" is found later in the same section:

> *OTA concludes that an annual Federal funding level of approximately $5 to $7 million, added to $10 to $15 million derived from other sources and monies now being spent, could provide adequate assistance, if existing resources are reorganized and tightly managed.*

This is de facto the OTA-prescribed expenditure for training, supported by a cost analysis.

Under regulatory consistency, an option is found that "Congress could authorize the development of [a national truck driver's license requiring special training] with special certification requirements for all hazardous materials, including gasoline." Again, no alternative is presented. Nevertheless, the idea of providing at least nationally consistent licensing for drivers of trucks carrying hazardous material, appears dictated by common sense. In fact, a few years after the issuance of the report, such a requirement was put into Federal law.

As a final example, the section on containers includes the following "finding":

> *OTA finds that adoption of the proposed changes calling for stringent and more specific manufacturing standards, annual leak testing of all cargo tanks, and stronger manhole covers on gasoline tankers, will improve the performance of cargo tanks.*

There are similarly positive "empirically based policy prescriptions" in the section on coordination of Federal programs. Again, all are grounded in convincing argument and appear quite reasonable, but the format is clearly a collection of policy prescriptions rather than alternative options for action (or inaction).

Analysis of options: *Changing by Degrees* and *Mapping Our Genes*

Congressional staffers interviewed by the policy project team disagreed on the importance of including options in reports, but there was one point on which they were virtually unanimous: namely, that OTA should analyze the options that it presents (see ch. 3). Some stated this sentiment even more strongly: Do not bother providing a list of options unless the report analyzes their effects and effectiveness.

Analysis of policy options was a problem in about half of the 18 OTA reports in the policy project sample (see ch. 4). Little or no detail was presented on the effectiveness of the options for achieving the intended goals, the costs of options, unintended consequences, or who might support or object to the option. A few reports offered sets of options but gave so little information about their relative strengths or weaknesses that the reader was left wondering how to choose among them.

Thus, continuing on how OTA tells the story, this section looks at two aspects of analyzing options that are important to OTA's clients. The first aspect is analysis of the broad benefits and costs of options. Included here are estimates of effectiveness (e.g., improvements in environmental quality, health, industrial productivity, and delivery of services), costs and other economic consequences (e.g., job impacts), and other measures of what society gains and loses if the option is chosen. (Which groups might support and oppose each option was mentioned by several congressional staffers as another helpful facet to include.) The second aspect is analysis of the organizational and institutional facets of options. These include which agency or other organization might best implement the option, how the new option might affect other activities of the organization, necessary interactions with other organizations, and so on.

As discussed below, *Changing by Degrees: Steps To Reduce Greenhouse Gases* is an example of an assessment that spent considerable effort analyzing the effectiveness of a long series of technical options. *Mapping Our Genes: Genome Projects: How Big? How Fast?* is an example of a report that focuses on the second aspect, the choice of agency to implement the program.

Broad benefits and costs of options—Six congressional committees asked OTA: "Can the United States reduce carbon dioxide emissions in the near term?" *Changing by Degrees* answered by quantifying potential emissions reductions in six key sectors of the economy: buildings, transportation, manufacturing, energy supply, forestry, and food. In each sector, the assessment identifies the technical measures (e.g., more energy efficient products or use of lower carbon-emitting fuels), and estimates the carbon reductions achievable if Congress were to require or successfully encourage the use of the lower emitting product or practice.

Changing by Degrees evaluated and compared about 100 different technical options. These were grouped into two scenarios: All "cheap and easy" measures, whose increased capital costs were offset by fuel savings, were grouped into a "Moderate" scenario. A second scenario considered more aggressive "Tough" measures, i.e., those products and processes that are available, or close to being available today, but are more expensive or technically challenging. To put these two scenarios into context, a "Base Case" scenario, forecasting emissions under current laws and regulations and anticipated fuel prices, was also developed.

The study considered a 25-year time horizon and used a simple emissions model of the U.S. economy as a basis for consistently comparing the reductions achievable from, for example, auto fuel efficiency standards of 39 mpg by 2010, to stricter efficiency standards for residential furnaces and air conditioners, to a moratorium on coal use in industrial and utility boilers. The modeling was done in-house and consisted of several large, linked spreadsheets. Net costs of the more aggressive "Tough" scenario were estimated, but rather crudely.

Regulatory approaches are, of course, only one type of policy instrument that could be used to lower emissions. Other approaches, such as fuel and carbon taxes, financial incentives, information programs, and R&D were discussed in the report, but not evaluated. Results from literature reviews were presented for these other policy instruments, but the vast majority of the analytic effort went to evaluating technical measures that, with a few exceptions, could be implemented through regulatory approaches. Nevertheless, the report presented a large array of options for lowering emissions, with quantitative estimates of the potential of each. By assigning each of the measures to the "Moderate" or "Tough" category, *Changing by Degrees* gave at least a crude measure of the cost-effectiveness and difficulty of implementing each option.

Organizational and institutional facets of options—In *Mapping Our Genes*, the central issue addressed by one set of options was where in the Federal Government to locate the genome research effort and how to manage it. The following possibilities were identified:

1. designate a lead agency to coordinate work (the practical choices were the U.S. Department of Energy or the National Institutes of Health);
2. establish an interagency task force;
3. establish a national consortium, including private sector participation; and
4. rely on congressional oversight of interagency coordination.

Mapping Our Genes discusses each of these options in terms of potential advantages and disadvantages to existing agencies. A full chapter is devoted to analysis of the first option, the issue of which agency should take lead responsibility: chapter 6, entitled "Organization of Projects." In addition to describing the options in some detail, this chapter cites historical analogs and compares them with the proposed structure. It also presents possible scientific advisory structures. Further, the chapter outlines the issue of big science vs. little science in relation to a human genome project, together with the effect on this tension of the organizational structure selected to manage the effort. It treats the pros and cons of whether the genome effort should be a large, centrally managed science project, or a loosely organized effort by many small research groups. Altogether, several different options are compared and analyzed in some detail, allowing the policymaker to make a decision based on a coherent set of arguments.

Doing more with less: *Exploring the Moon and Mars*

One of the complaints that the policy project team heard most often from congressional staff was that two years was often too long to wait for an assessment (see ch. 3). Some Hill staffers expressed a desire for at least some fraction of OTA's work to be devoted to shorter, more focused assessments. Such assessments are possible, albeit with an inevitable sacrifice of breadth, depth, or both.

Of the 18 reports reviewed, *Exploring the Moon and Mars* was completed most quickly (about six to seven months), for the smallest budget (about $50,000, but a requested study, not one produced at the Director's discretion), and with a staff of one. Nevertheless, it presented what appears to be a pointed discussion of an ambitious proposal by President Bush for establishing a permanent lunar base and sending human crews to Mars. The report presents some alternatives to the original Bush proposal to land humans on Mars by 2019, at an estimated cost of $300 billion to $500 billion.

The OTA project director was quite experienced before undertaking the assessment, having worked on four related studies previously. He had also studied space issues for many years, though had no familiarity with the key issue of the report: manned missions versus use of automation and robotics technologies. His prior experience running assessments and his contacts in the field helped him successfully complete the assessment on a short deadline, as specified by the requesting committee.

Exploring the Moon and Mars is much shorter than the typical OTA assessment, about 100 pages. The project director relied on one workshop, literature review, and many interviews with experts in the field for information. The strength of the report lies in raising a wide range of policy issues, from the very broad societal benefits explicitly or implicitly ascribed to space exploration to the more focused question of humans versus robots. Its chief weakness (inherent in any months-long, solo effort) is that though these issues can be raised, they cannot be analyzed in great depth. The report was able to sketch three alternatives to the Bush administration proposal, which primarily involve stretching out the proposed

timetable and relying more heavily on robotics. The strengths and weaknesses of these options are analyzed in cursory fashion.

Given the time and resources devoted to the assessment, the report includes an impressive amount of policy analysis that would appear to be quite useful in the early stages of debate on the issue. Though OTA is unlikely to adopt this "small and quick" approach as the standard for its assessments, *Exploring the Moon and Mars* does illustrate that such an approach is possible—if a significant knowledge base (probably embodied by a single OTA staffer or program) exists in-house and when the congressional timetable demands expedience.

Stakeholder analysis: *Power On!*

Several congressional staffers and workshop participants interviewed for the policy project said they would like to see more stakeholder analysis in OTA work (see ch. 3). The policy project team found that about one-third (5) of the 18 reports in its sample did a very good or excellent job of analyzing the positions of different stakeholders in the analysis of "context, findings, and issues," but another third did only a poor or fair job in this area. In the analysis of "goals and options," about half (8) of the reports included some discussion of the support for options by, and the effects of options on, the stakeholders (including the American public) (see ch. 4).

Power On! is a report in which extensive stakeholder analysis—different perspectives on the same issues and on the effects of possible policy actions—is presented. This report had three main areas of emphasis: teacher training, software, and R&D. In the area of teacher training, the stakeholders discussed are teachers, local boards, and Federal education officials, students in general, and students with special problems. In the second area, software producers are added to the list. University researchers and Federal funding agencies are key actors in the R&D discussion.

Power On! is particularly concerned with teachers' problems in introducing computer-aided instruction; it analyzes the issue exhaustively. OTA surveyed all states to learn about state and local efforts in the field of teacher training for computer use in the classroom, and thus provided information on the issue from administrators' points of view. The leadership role of the Federal Government was also discussed. From the "demand" side, the role of teacher training in computers to meet the needs of elementary school students and of special (learning or otherwise disabled) students was presented in boxes.

Under software, a long discussion of the marketplace, copyright laws, and types of software produced provides a context for understanding the needs and concerns of the software producers. Similarly, the uses to which various types of software are put in the classroom are outlined from the teachers' and students' points of view. Pricing is discussed as a factor in acquisition decisions by local school boards and states. Costs play a significant role. In R&D, stakeholders such as the academic research community and the Federal funding structure (U.S. Department of Defense, National Science Foundation, U.S. Department of Education) are the principal actors. The issue of how well, if at all, computer-aided instruction actually can improve education is vital to determine; research and development constitute the vehicle for assessing the effect and designing improvements. The roles and needs of the various stakeholders are outlined, together with options for changing their interactions: increasing resources, transfer of R&D results, new initiatives.

International context/ comparisons: *Enhancing the Quality of U.S. Grain for International Trade*

Several outside experts who participated in the OTA policy analysis workshop noted that for understanding certain problems (e.g., global climate change), it is essential to consider the international context of those problems. More

and more problems, they suggested, will fall into this category. One participant thought that OTA's attention to international issues in its reports too often amounted to an "afterthought."

Enhancing the Quality of U.S. Grain for International Trade is an OTA report that dealt in great detail with the way other countries approached the issue. Although international comparisons in the first volume of the report took up just one chapter of 11, this chapter was essentially a summary of findings of a second volume devoted entirely to international comparisons. The OTA project staff contracted with teams that spent a few weeks in each of four countries (Argentina, Brazil, France, and Australia) and reviewed each country's system for assuring quality. The Canadian system was also reviewed. Technical and policy aspects (pricing, regulation, storage) were analyzed for all cases. Finally, the foreign examples were compared with the United States in terms of applied technologies and structures of policy and institutions. The purpose was not to recommend that one or another of foreign techniques should be adopted, but to present a variety of other approaches for dealing with similar export problems. The report notes that not all other approaches would be practical in the U.S. political and economic context, but some might be.

Institutional analysis: *Indian Health Care*

Analysis of institutions was identified by some outside experts at the one-day policy workshop as a weakness in OTA's policy analysis. The policy project team found in the sample of 18 OTA reports it reviewed, however, that the reports were generally strong in their institutional analysis.

One report that was strong in this area, for example, was *Indian Health Care*. This report first analyzes the legal history of the relationship between the Federal Government and the many Native American nations, including the provision of medical services. The report performs a comprehensive analysis of the structure and effectiveness of the Indian Health Service (IHS), which provides Native Americans with medical care. These institutional analyses, including a legally oriented historical discussion and then a detailed description and investigation of the institutional problems of IHS, constitute a significant portion of the entire study.

The chapter on the Federal-Indian relationship begins with a three-page review of the legal history. The emphasis is on health services, from the beginning of treaties between the United States and the tribes to the Indian Health Care Improvement Act of 1976. After this comes a lengthy discussion of how the Federal Government decides to recognize particular tribes and individuals as eligible for health services. The point is made that IHS is the residual health care provider for Native Americans—after care from other governmental and private providers for which an individual is eligible is exhausted.

The fifth chapter of the report is entitled "The Indian Health Service." Only IHS is the subject of this institutional analysis; no other governmental organizations are discussed. The description is devoted to the "context" half of policy analysis, with remarkable depth and detail of discussion. The programs for both direct care and contract care are described, with emphasis on eligibility, funding, staffing, service delivery, operations and major issues. In addition, urban health projects, apart from reservation projects, are outlined. Finally, there is a discussion of the IHS facilities construction program, even including discussion of methodologies for assessing the need for new and replacement hospitals and clinics.

Ample data on cost and types of services and demands, along with trends, are given. A large number of tables and graphs support the discussion, and an appendix is devoted to data on cost allocations by year, area, and category. In the summary chapter, overview data on IHS are given, including (to orient the reader) the agency's location in an organizational chart of the U.S. Department of Health and Human Services.

Institutional analysis is also central to options in *Indian Health Care*. Since the report's options all involve changes related to the behavior of IHS, the discussion of options forms a long series of institutional analyses. The first three options focus on eligibility requirements for access to IHS services and on a possible consequence: making the services "more of an entitlement program" than a residual source of health care. The next three options discuss means of reallocating resources within IHS to provide more uniform services across different areas served by IHS. There are three fiscal options to help IHS deal better with problems of high-cost care in the contract care program of IHS, one suggesting that services sometimes be provided non-Indians, and three options revolving around the occasional assumption of IHS responsibilities by tribes. The analysis of all these possibilities is the most extensive example of institutional analysis in reports reviewed by the policy project team.

Legal analysis: *Finding a Balance*

In most OTA reports, legal analysis is not a critical component. The policy project team's review of 18 reports found only a few that had extensive legal analysis. One of these was *Finding a Balance: Computer Software, Intellectual Property, and the Challenge of Technological Change*. It was part of a series of OTA reports exploring the intellectual property law challenges presented by new information technologies, including the move to electronic representation of information and the proliferation of digital means of transmission, adaptation, and copying.

Finding a Balance identifies three major policy issues: 1) the appropriate scope of copyright protection for computer software; 2) patent protection for software-related inventions and algorithms; and 3) complications facing libraries as well as commercial and private producers and users of digital information (including computer-based mixed media products). Given the focus of the first two issues, it is not surprising that several chapters of this report include legal analysis.

Chapter 2, entitled "The Law," gives an overview (goals, case law, statutory provisions, etc.) of three types of law in the United States that are potentially applicable to computer software and digital information:

1. U.S. patent law,
2. U.S. copyright law, and
3. trade secret law in the United States.

The chapter notes that most intellectual property protection for software has come through copyright and trade secret laws, and some through patent law. Software developers and users, the courts, and policymakers have been locked in a continuing effort to sort out what should and should not be protected (from a social perspective) and what is and is not protected (according to current law). The patent and copyright systems in the United States are both administered under Federal jurisdiction, while laws concerning trade secrets vary from state to state. For comparative purposes, the chapter includes three boxes that summarize patent, copyright, and trade secret law and their applicability to computer software in countries of the Pacific Rim, Western Europe, and Latin America. The chapter concludes with a section discussing relationships among patent/copyright/trade secret laws and their applicability to computer software.

Chapter 3, entitled "The International Arena," examines the nature of the global software industry, the issue of software piracy, and multilateral and bilateral negotiations and treaties entered into to provide protection for international property rights (e.g., the Berne Convention, the General Agreement on Tariffs and Trade, and the European Community's directive on legal protection for computer software). It also describes efforts to harmonize international intellectual property law.

Chapter 4, "Software Technology and the Law," outlines the application of existing intellectual property laws to each of four identified elements of a computer software program (program function, external design, user interface design, and the program code). It also discusses policy issues associated with the current level of protection and various policy positions advanced for maintaining or changing the scope of protection. The final section of the chapter summarizes legal arguments that have been used to support these policy positions and evaluates them in light of OTA's own analysis of software technology.

Chapter 5, "Digital Information and Copyright," reviews the growing field of digital information, points up differences between digital information and information in more traditional forms, and discusses copyright issues for digital information.

Much of the legal discussion in *Finding a Balance* is highly detailed and technical. Though not readily accessible to some educated lay readers, the legal discussion should be comprehensible to Members of Congress and their staffs, a high percentage of whom are lawyers. It is certainly more accessible to lay readers than law journal articles, digests, and the actual court decisions themselves.

TELLING A STORY WELL: THE IMPORTANCE OF READER-FRIENDLINESS

Even a good story may not be perceived as such if the story is not well told. In discussions with congressional staffers, a theme that consistently emerged was that OTA should work more on elements of presentation to make OTA reports more easily comprehensible (see ch. 3). Congressional staffers are inundated with information from a variety of sources, they said, and if an OTA report is too difficult to read, they may put it aside in favor of one of the other documents that comes across their desk. Or, if they use the OTA document, they may not be able to get the full benefit of what it has to offer. Several staffers said they typically read only the summary of an OTA report; others said they use the summary to point them in the direction of a specific chapter in which they are interested.

When asked to evaluate a sample of 12 OTA reports (three reports each), four former congressional staffers were very critical of many of the reports' reader-friendliness, reporting that that one-third of the reports had major problems in organization and format that made them difficult to use. The OTA policy project team's reading of a sample of 18 reports similarly found much room for improvement in this realm (see ch. 4). The team judged just over half (10) of the 18 reports to be very good or excellent in terms of overall reader-friendliness; the other reports were judged "okay" or worse (see ch. 4). In some of the 18 reports, the findings and options were so buried that it was almost impossible to find them. In many reports, it was difficult to find where in the report detail on material presented in the summary could be found. More than half (10) of the 18 reports did not have an index.

Three OTA reports in the 18-report sample that had numerous features contributing to reader-friendliness were *Critical Connections, Enhancing Agriculture in Africa: A Role for U.S. Development Assistance*, and *Exploring the Moon and Mars*. Examples of the types of elements that contributed to the reader friendliness of these reports and other are listed in box 5-B. Additional models are provided in appendix E.

Table of contents: an outline of the story

The foreword and the table of contents are often the first things a prospective reader of an OTA report consults. A good table of contents with sufficient level of detail at the front of a report gives the reader a general idea of the story the report is going to tell; a bad one leaves a prospective reader wondering from the outset what the

Box 5-B. Telling a story well: elements of reader-friendliness

Many features of an OTA report contribute to reader-friendliness. Some of the features that have worked well in previous OTA reports are noted below.

Table of contents at the beginning of the report

1. coherent chapter organization that tells the outlines of the report's story
2. sufficient level of detail presented

Summary chapter

Overall

1. a stand-alone document with a fairly high degree of parallelism between the summary and the rest of the report
2. clear and engaging prose (newspaper or magazine-style prose is especially important in the summary, which is intended for a broader audience than the rest of the report)
3. effective use of headings to tell a story
4. effective use of type, callouts, or other means to emphasize key points
5. effective use of graphics
6. good page layout

Problem identifying (context, findings, issues)

1. clear statement of the study's purpose and scope
2. clear statement of congressional context in which a request for the study was made
3. a section (or figure) that describes the organization of the report
4. effective use of callouts for type to emphasize key points
5. effective use of bold type to emphasize findings
6. clear identification of policy-relevant conclusions as "Findings"
7. box or table to summarize key findings

Potential solutions (goals/options)

1. organization of options under "issues" or "goals" rather than under technologies or congressional functions (e.g., oversight)
2. organization of options into strategies or other packages, especially when there are large numbers of options
3. box, figure, or table of options
4. effective use of bold or other type to present options
5. effective use of bold type or callouts to emphasize important points in the text
6. effective use of photo captions to emphasize important points in the text

Overall report

1. coherent chapter organization, with some degree of parallelism between the summary and other chapters of the report (or other techniques to facilitate the tracking of points in the summary to the rest of the report)
2. a chapter (or chapters) with the word "options" somewhere in the title to let readers know where the options appear
3. a summary at the beginning (or end) of each chapter
4. an introduction to each chapter that tells what the chapter is going to do
5. parallel construction of similar types of chapters
6. effective use of headings to tell a story
7. effective use of boxes
8. effective use of graphics
9. clear and engaging prose
10. good page layout
11. a method of the study appendix (this may include the congressional letters of request, a list of contractor papers, a list of workshops and participants, etc.)
12. a glossary of terms and abbreviations

Index

story is going to be about. Several of the OTA reports read by the policy project team had tables of contents that left an uninitiated reader frustrated or confused about the story the report was going to tell.

A good table of contents depends above all on coherent chapter organization. If there is no coherent story, the table of contents will reflect this. An example of a report in which the table of contents reflects coherent chapter organization is *Critical Connections: Communication for the Future*. Despite the report's length (400 pages, 12 chapters), a reader can quickly grasp the outlines of the story *Critical Connections* tells by looking at the contents. The table of contents uses "parts" to group similar chapters. Two other reports with coherent chapter organization reflected in the tables of contents are *Changing by Degrees: Steps To Reduce Greenhouse Gases*, and *Ownership of Human Tissues and Cells*.

The OTA Publishing Office has begun experimenting with changes in the format of the tables of contents of OTA reports. Recently, for example, some OTA reports have been published with a table of contents at the front of the report that includes not only the chapter titles but first level headings (see app. E for an example). In this new format, the individual tables of contents for each chapter are omitted.

Summary chapter: a synopsis of the story

The apparently heavy reliance on the summaries of OTA reports by congressional staffers (see ch. 3) underscores the importance of having a summary chapter that effectively communicates the key findings, issues, and options of an assessment. The summary also should give the context of the request for the assessment and clearly state the purpose, objectives, and scope of the assessment (see examples in app. E). According to congressional staffers, the clear labeling of policy-relevant findings and options in the summary (and elsewhere in the report) is a must (see examples in app. E). A section or figure that describes the organization of the report may be helpful in orienting readers to the report's contents (see examples in app. E).

The OTA policy project team concurs with the 1987 OTA Writing Task Force that each summary chapter should be a document that can stand on its own as a substitute for the full report.[6] It also agrees that each summary should contain the following:

1. enough background or introductory material to enable the reader to understand the subject matter and point of the report (usually less than in the full report);
2. the findings, plus enough of the logic to show those findings are supported, and
3. the options, plus sufficient rationale to demonstrate their credibility.

This material should be written in a style that is clear and engaging—more in the style of newspaper or magazine prose than in the style of technical or academic journals.

To some extent, the OTA policy project team differs with the OTA Writing Task Force on the structure of the summary. The OTA Writing Task recommended "a double structure—a cross-cutting discussion of the issues in addition to a straight summary of the report." The task force noted that a cross-cutting discussion often is "very difficult for the staff to produce, having worked within the structure of the full report for a least a year." The OTA policy project team believes that a double structure is acceptable but believes that—from the standpoint of making the summary reader friendly for congressional readers—effort is better spent trying to structure all, or at least a substantial portion, of the summary chapter to parallel the rest of the report. Congressional staffers interviewed for this project emphasized that it is extremely important for them to be able easily and quickly to track

[6] The "Report of the OTA Writing Task Force," headed by Audrey Buyrn, was issued in June 1987.

ideas and information in the summary in the rest of the report (see ch. 3). Parallel construction of the summary and the rest of the report is one of the best ways to facilitate such tracking. A "cross-cutting discussion" may be better policy analysis, but to the extent that it introduces a whole new conceptual framework and pulls things together in a way that the full report does not, it may very well detract from a report's reader-friendliness. When considering the benefits of writing a "cross-cutting discussion" for the summary, this is at least a point that should be kept in mind.

The technique of parallel construction of the summary and the rest of the report was used (to a greater or lesser extent) by all of the most reader-friendly OTA reports in the sample of 18 reports reviewed by the policy project team. One report that uses this technique is *Making Things Better*. This report establishes key themes early and uses these themes to organize the entire report. The parallel structure in the report first introduces the reader to the major themes in the summary and then explores them in greater depth and richness, first in the policy options chapter, and then again in the back chapters. The staffer who is primarily interested in one of the policy themes (e.g., technology transfer) can easily find the material he or she seeks. Because the options are organized in a way that corresponds to the rest of the report, the skeptical staffer who wants to know why his or her boss should bother with some of the options presented can directly find the answer. Not all reports, of course, can be forced into such a structure, but when it works, it seems to be worth the extra time, effort, and discipline that it takes. Perhaps the discipline of organizing the problem and possible solutions into a common format may even identify flaws or holes in the analysis!

Main body of the report: the whole story

For the main body of a report, one of the things that aids reader-friendliness is coherent chapter organization. *Enhancing Agriculture in Africa: A Role for U.S. Development Assistance*, for example, grouped similar chapters in two main parts:. Part I: Low Resource Agriculture and Development Assistance (with four chapters) and Part II: Promising Technologies (with six chapters). A report that took a rather innovative approach to organizing the chapters was *Critical Connections*. A "conceptual framework for analyzing policy issues engendered by new communication technologies" is depicted in a figure in chapter 2 (fig. 2-3 on p. 32) and is used to provide the rationale for the scope and structure of the report. The organization and the subjects of the chapters reflect the flow and logic of this model.

For congressional readers pressed for time, it is extremely important that a report's findings and options not be buried or hard to find. To help congressional readers find a report's policy options, one approach is to use "Options" or "Policy Options" in the title of any chapter or chapters that contain them. In most OTA reports, the options appear only in the first chapter. Examples of names for chapter 1, when the options are presented in that chapter, include the following:

- Summary and Options
- Summary, Issues, and Options
- Summary and Policy Options
- Findings and Policy Options

In reports in which policy options are presented and analyzed in detail in a chapter other than chapter 1, again it is helpful if the labeling of the chapter reflects this. Examples of names for such chapters include the following:

- Policy Issues and Options
- Policy Options for Enhancing Grain Quality
- Policy Initiatives To Improve Cleanup Prospects

Index: the nitty gritty details of the story

Many of the congressional staffers interviewed by the OTA policy project team indicated that an index was essential or extremely useful to them. Some OTA staff swear by them. Of the 18 reports reviewed in the policy project, fewer than half (8) had an index. *Serious Reduction of Hazardous Waste* and *Enhancing Agriculture in Africa* were among the reports that had an index.

One advantage of an index, if it accurately reflects the content of the report, is that the reader need not depend solely on the table of contents. Quirks in the organization of material can be overcome by locating key words and phrases in the index. In this sense, an index is another map to the report's contents. The reader with a specific need can probably locate details most quickly by consulting the index.

CHAPTER SIX

The culture of OTA

This chapter summarizes what the OTA policy project team has learned from a variety of sources about how OTA's culture—especially its formal and informal organization—shapes OTA reports.[1] The concern is for organizational clues that may help explain the strengths and weaknesses of the policy analysis found in individual OTA reports.

Previous chapters have illustrated the diversity of styles that characterize OTA reports. The culture of OTA is highly pluralistic, and OTA reports reflect this.[2] Notably, however, many OTA reports share certain features. Underlying all OTA policy analysis is something known as "the OTA assessment process." The OTA assessment process, which is familiar to participants in OTA's work and recognizable by those outside, transcends individual congressional committee requests for studies, programs, project staff, and reports. The process involves two general types of activities: 1) staff activities (e.g., planning a study, choosing contractors and an advisory panel, synthesizing various types of information, writing and revising, brainstorming about options), and 2) public activities (e.g., advisory panel meetings, workshops, external review).

Observations related to OTA's culture from a variety of sources—five former OTA project directors (see app. A-5), 10 outside observers who have participated in the assessment process as members of advisory panels and workshops, reviewers, and contractors (see app. A-6), and a dozen first-time OTA project directors—are summarized below. First, however, we offer a profile of OTA's analytical staff.

STAFF PROFILE

A snapshot of OTA's permanent analytical staff, at least in terms of disciplinary makeup, may provide some insights into OTA's capability for doing policy analysis. OTA's permanent and temporary research staff, including program managers, numbered 131 as of December 1992 (for a summary, see table 6-1).[3] The staff can be characterized first by degree and then by broad disciplinary field:

[1] The "culture" of an organization consists of its formal structure (e.g., the divisions and programs in which the organization does its work) and its climate. The "climate" of a culture refers to the mood, the in-house tensions, and the rumors of which folklore is made. Climate also captures the ways individual staff experience, negotiate, and accommodate the demands made by the organization.

[2] Many units of analysis—division, program, project—could help explain some of the agency characteristics discussed below. The scope and time frame for this study, however, precluded the policy project team from learning much about the various subcultures that thrive at OTA.

[3] This number excludes in-house contractors and detailees. The core research staff may differ significantly from other categories of staff, but it is also the segment with the longest tenure and experience with the OTA assessment process.

- About 28 percent of the staff hold, as highest degree earned, a B.S. or B.A. degree; 25 percent hold an M.S. or M.A.; 37 percent have a Ph.D.; and 10 percent have either an M.D. (n = 3), a J.D. (n = 9), or both (n = 1).
- Natural science and engineering disciplines are most prevalent at all degree levels, accounting for 55 percent of the Ph.D.s at OTA, 42 percent of the M.S./M.A.s, and 36 percent of the B.S./B.A.s. (Five of the 13 OTA staff with an M.D. or J.D. have their next highest degree in one of the natural sciences or engineering.)
- Social science expertise (including psychology) is found among 20 percent of the Ph.D.s at OTA, 39 percent of the M.S./M.A.s, and 19 percent of the B.S./B.A.s.
- Economics, long rumored as undervalued at OTA, is formally represented among 9 percent of OTA's staff in the following distribution: one Ph.D. economist, three other Ph.D.s with an economics baccalaureate or master's degree, and eight additional staff with a B.S. and/or M.S. in economics.
- A newer category of credential, which varies in the amount of natural science and engineering versus social science content, is the "policy degree." Policy degrees are almost always hybrids (e.g., technology and policy, health policy, and energy management and policy) and are typically not offered at the B.A. level. Twelve percent of the Ph.D.s and 15 percent of the M.S./M.A.s represented on the OTA staff are policy degrees.

In all, then, 45 percent of OTA's research staff have, as the highest degree earned, a natural science or engineering degree, 25 percent have a social science degree, and 8 percent a policy degree. The remaining 22 percent have degrees in the humanities (e.g., history, philosophy, English literature), business, and a myriad of other fields (e.g., communications, education, and social work).[4] The lesson to be drawn from these figures is that many courses of study lead to doing policy analysis at OTA. No doubt some of the dimensions identified as "excellent" in the sample of 18 OTA reports evaluated in this assessment can be traced to different ways of looking at the world.

OTA staff usually work on project teams of two to six people. Thus, it is the combination of backgrounds, talents, and experiences—what might be called "complementary strengths"—that is likely to be reflected in OTA reports. The project directors interviewed for this assessment, neophyte and experienced alike, often commented on the roles that individual staff play in an assessment. Individuals' roles depend on far more than degrees and disciplines. Yet degrees and disciplines are a proxy for some of the dimensions of the assessment process and report style that form the core of OTA analysis. About three-fourths of the 18 studies reviewed by the OTA policy project team had some mix of natural scientists and social scientists on the project team (see ch. 4). This mix was viewed as a plus for good policy analysis by outside experts and former OTA project directors.

The policy analysis in a given OTA report is shaped not only by the team members' educational backgrounds but also by things such as their life experiences, personalities, and roles on a project team. In view of the importance of life experiences, it may be important to note that few OTA staff come to the agency with exposure to the Hill. A lack of exposure to the Hill was cited by some former OTA project directors as a flaw in the recruitment of staff to OTA; such experience, one former project director suggested, could help reduce the "academic" aspect of the OTA culture. Some observers have also noted that OTA's research staff includes few U.S. minorities (e.g., African Americans and Hispanics). To the extent that racial and ethnic diversity extends networks, it may affect the composition of OTA advisory panels and selection of contractors. Furthermore, the lack of diversity is viewed by some as constricting novel policy insights in certain areas.

[4] Staff with M.D.s and J.D.s are categorized by their next highest degree.

Individual creativity, project group dynamics, and on-the-job experience mingle, through the OTA assessment process, to make each OTA report a unique document. A considerable amount of interpersonal transfer of skills and knowledge goes on in every project. Different members of a project team with expertise in certain aspects of the assessment (e.g., scientific or technical) learn from other members of the team, as well as other sources, about aspects of the topic with which they are less familiar (e.g., legal, ethical, or economic). OTA staff without training or prior experience in policy analysis may learn about doing policy analysis from colleagues on the project team. Staff without exposure to Capitol Hill may pick up tips from their colleagues about writing reports that are responsive to congressional needs. Most new project directors at OTA learn how to conduct an OTA policy analysis, and report the results in an option format, informally as members of OTA project teams. The contribution made by an individual depends on things such as whether the individual is the project director or a research assistant, how creative the person is, how good the person's interpersonal skills are, and what the person's life experiences have been.[5]

OTA has a core cadre of experienced research staff. The collective skills of OTA project staff, program managers, and assistant directors in the agency represent a cornucopia of policy analysis skills and knowledge. As discussed further below, however, some former OTA project directors, policy workshop participants, and new OTA project directors have suggested that the culture of OTA does not adequately facilitate the transfer of policy analysis methods and skills across programs and divisions. The policy project team's review of 18 OTA reports seems to lend credence to this observation (see ch. 4 and 5).

OTA ALUMNI

Former OTA project directors are "alumni" of the assessment process. Upon their departure, they typically join other policy organizations and are therefore well-positioned to view the comparative strengths and weaknesses of such organizations. As long-time participants in the OTA process, these alumni may be particularly perceptive of the agency's culture. Some of the five former OTA project directors consulted for this project (see app. A-5) suggested that the climate of OTA is not effective in transmitting policy know-how to those deep in the trenches of project work.[6] One former OTA project director put it this way:

> *There is no incentive in OTA, but strong disincentives, for cross-program planning, project review, report evaluation, collegiality. There is no significant incentive . . . to present briefings on completed or finished work, to relish or enjoy constructive feedback from one's colleagues. The organization is without any internal program for cross-learning. As a result, there is no cross-over of policy generation, no cross-over of creativity, and no significant pressures to orient the future into the work.*

In the words of another former OTA project director, "OTA policy analysis is often too 'safe' because OTA staff are not risk takers." A third OTA alumnus sees this as a tradeoff: "Look at hiring policies. Are there too many inexperienced people being brought in at the high

[5] One current OTA staff person asks pointedly: "Why doesn't OTA, like most other research and policy organizations, bring in experienced people, in their forties and fifties, who have worked at other centers? Why don't we try to recruit people who have retired after a lifetime of service in government, academe, or industry? I think in large part because they would not buy into the "culture" of how wonderful and smart we are and would raise questions that are embarrassing for the established order. . . ." The common reason given for not recruiting many senior people to OTA that the agency can't afford to pay their salaries.

[6] As discussed at the 1992 Senior Management Retreat, "people issues" pose challenges throughout the agency to develop staff competencies and facilitate interprogram cooperation. See the Rockwood Retreat Rapporteur Reports, especially by Phyllis Windle, Nov. 16-17, 1992, pp. 3-5.

cost of internal training and partial education?" Risk-taking or risk-aversion, one could argue, is a posture learned and reinforced by the environment in which it is practiced. Decisions to encourage or discourage risk-taking are doubtless project-specific but also become associated with the agency as a whole. Decisions made both at the program level and at the top of the agency will produce a climate that values certain intellectual characteristics and devalues others.

Tangible evidence of a desire of current OTA staff for greater sharing of policy analysis methods and skills is found in the creation of two voluntary grassroots organizations—the Project Directors' Peer Group (1989) and Research Assistants in Search of Empowerment or RAISE (1991). Each met on an irregular basis to discuss issues of mutual interest, i.e., to enlarge the community of staff whose responsibilities are unique. RAISE even issued a handbook for all incoming research assistants. It is a maxim that any group will try to act to fill needs not addressed by the formal organization. However, relying on this mechanism may be neither efficient nor effective when it comes to improving policy analysis.

Several former OTA project directors said there was a need for improving the transfer of policy analysis skills across the agency. Mentoring was mentioned as one possible approach. One former OTA project director commented:

> *[T]here is need for more mentoring of OTA analysts. One aspect of the OTA culture which is troubling is that the older, [or] wiser people do not seem to train and influence the younger staff effectively. For example, senior managers and the most experienced and successful policy analysts (possibly from different programs and divisions) should balance their concerns about liabilities which can sink the ship [with] more positive influences on staff doing policy analysis and writing reports.*

One current OTA staffer noted that one reason more mentoring does not occur is that OTA's existing organizational incentives do not encourage it.

The five former OTA project directors also made comments related to how the culture of OTA shapes the policy analysis in OTA reports. One former OTA project director commented:

> *The academic backgrounds of so many OTA staff and their lack of practical policy experience has shaped OTA's culture in general and especially its policy analysis.*

The lack of exposure to the Hill is seen by some former OTA project directors as a fundamental flaw in the recruitment of staff to OTA—with serious implications for the orientation of the agency's work:

> *. . . too many OTA staff have no real congressional experience or insights into the lives and needs of members and senior staffers. There should be opportunities to work on member and committee staffs. Such experience could greatly reduce the "academic" aspect of the OTA culture.*

Although the causal link may be challenged here, the concern that the academic mode of discourse differs significantly from the congressional mode is legitimate. It is the difference between writing for a scholarly (and typically, disciplinary) audience and writing for decisionmakers (and especially their staff) who want to act on what has been found through analysis.

WHEN OUTSIDERS LOOK IN

Knowledgeable outsiders provide a different mirror in which we can view the culture of the agency. In November 1992, 10 outside experts in different fields, each of whom was familiar with some aspect of OTA's work, participated in a one-day policy analysis workshop (see app. A-6). Much of the commentary from the workshop participants (some provided in memoranda after the event) centered on the current and future organizational struc-

Table 6-1. Distribution of OTA's research staff[a], by degree and broad field

	Highest degree		Natural science/ engineering	Social science	Policy science	Other[b]
	n	%	n	n	n	n
BS/BA	36	28	13	7	0	16
MS/MA	33	25	14	13	5	1
PhD	49	37	27	10	6	6
MD/JD	13	10	5	3	0	5
Total	**131**	**100%**	**59**	**33**	**11**	**28**
Column total as % of 131			45%	25%	8%	22%

[a]Permanent and temporary research staff, as of Dec. 1, 1992, numbered 131.
[b]This includes humanities, fine arts, business, and other array of disciplines not readily categorized as part of the three broad fields reflected in the columns of the table.

ture of OTA rather than on the particulars of policy analysis. The perceptions of these outside observers, who are most likely to focus on the outcomes of the assessment process, are certainly worth considering.

By and large, the workshop participants were of the opinion that what OTA does well (e.g., competent and objective analysis of the science or technology that may have economic, regulatory, or moral consequences), it does very well—and probably better than other policy organizations. Despite the many accolades for OTA, however, there were criticisms. For example, one participant observed that "the whole of OTA is less than the sum of its parts." Several workshop participants noted that OTA's structure may promote or inhibit the experiences and habits of mind that contribute to policy analysis:

> *Internally, the agency manifests a fragmentation and lack of organizational learning that is a concern. This governs not only the culture of communication and learning about how to do policy analysis, but also procedural issues, e.g., how could stakeholder analysis—who gains and who loses from the creation, application, or location of a technology—be improved? . . . In-house seminars will not suffice in addressing these needs and 'reinventing itself' in its third decade of service to the Congress.*

A few workshop participants were concerned that there was insufficient attention to racial and ethnic diversity. That view is reflected in the following comment:

> *I am concerned that there is not an appreciation of the intellectual reasons to make sure that staff and advisory committee [panel] diversity receive greater attention within the agency. Who the staff and AC [panel] members are make a big difference in the way arguments are framed, what networks are tapped, what research is accessed. I think OTA should be concerned as much with the present makeup of staff, for example, as with the lack of a process to affect that makeup.*

Most of the policy workshop participants, as well as the former OTA project directors consulted in this project, recommended broader thinking about:

1. what constitute the tools of policy analysis at OTA, and
2. how the agency's structure can introduce these tools formally to the staff.

Nobody doubts that policy tools are a valuable input to the assessment process. The concern is how the agency culture facilitates the learning that would benefit the staff, especially new analysts for whom both the process and OTA itself are still relatively abstract notions. One policy workshop participant highlighted the importance of finding a balance between opportunities for staff development and service to congressional committees:

> *. . . OTA should devote more resources to staff development. Staff feel that they are being "mined" and need time that need not be "billed" directly to a project so that they can catch up on progress in their fields. Among other things, this would allow staff more time to follow up on reports that have already been completed.*

Finally, workshop participants offered additional pieces of advice:

> *OTA should try to get new ideas/options into its reports. The options should reflect more creativity. This may involve, inter alia, more effective cross-disciplinary work.*
>
> *Staff should become more self-conscious about—and therefore more rigorous in analyzing—the normative choices they make when they select research methods and data and when they create narratives about information. . . . Staff would be more receptive to using the rigorous methods of the historical social sciences to assess the institutional, organizational, and political dimensions of the issues they are studying.*
>
> *OTA simply must direct more creative attention to the means and attitudes for taking advantage of its collective experience in a) attending to its responsibility to younger staff (who are thrown pretty much into the breach at present with little overarching OTA guidance), and b) its increasing obligation to show intellectual, as well as policy analytic, leadership in this field. . . . Activities taking smallish steps in that direction are those that strive to integrate association across groups, increase the willingness of junior staff to learn from (and question) each other and more experienced analysts, take the chance of appearing vulnerable, and testing half-formed, tentative analyses and conceptions well before they become crystallized (and ego bound).*

FIRST-TIME OTA PROJECT DIRECTORS

How well—or poorly—does OTA help staff become productive project directors? Asking some first-time project directors reveals some special sensitivity to the culture of the agency. The policy project team's interviews with a dozen recent first-time OTA project directors supports the impression by outside observers that OTA is not always adept at transferring analytic skills across its divisions, programs, and project teams.

New project directors become team leaders for various reasons. Most new project directors, however, have worked as project staff on at least one or two OTA studies before being given the opportunity to direct an OTA project themselves. Thus, becoming an OTA project director is usually a "promotion" within the organization—a promotion that can be based as much on need (there's no one else to do it) and a program manager's comfort (e.g., with the staffer's personality and style) as on the new project director's analytical or administrative acumen.

That first-time OTA project directors do as well as they do may be more a tribute to their bootstrapping capabilities and perseverance than

to an organizational culture that strongly encourages the sharing of policy analysis skills. After having worked on a project or two as team members and just learning by "osmosis," some new OTA project directors are left to fend for themselves in directing a project. It is no surprise if, during this ordeal of learning-by-doing-under-duress, some new project directors do not acquire the fine points of style. Many new project directors are very resourceful in seeking and getting advice and support from staff within and outside their program. Even so, a number of new project directors interviewed by the policy project team said that they would like additional help and support.

Directing an OTA project that produces good policy analysis is a challenge even for many old hands. For new project directors, the task is sometimes more daunting. It requires, among other things, that they figure out unwritten program norms,[7] overcome communication barriers, and shed inhibitions about appearing unprepared or ignorant of certain procedures and customs in the OTA process. Most new project directors observed that the teaching and learning of policy lessons is informal, haphazard, and ultimately dependent on personalities and a willingness on the part of experienced OTA staff to mentor staff with less experience. Some new project directors, typically those who are outgoing, reported that they had successfully sought out individuals within the agency (sometimes outside their own program) who had been extremely helpful to them, offering support and/or advice on techniques and methods for policy analysis. Other new project directors, however, reported feeling extremely isolated and unsupported. In the absence of other help, some project directors resort to "trusting the [OTA] process," hoping, for example, that the intensive OTA review process will keep them from getting too far off the track.

The new project directors interviewed by the OTA policy project team typically gained most of their experience in policy analysis while at OTA. With near unanimity they reported that they would have liked more contact with congressional staff and more guidance on how to deal with them. Congressional relations remain a bit of a mystery for some new OTA project directors; others complain that senior OTA staff "hoard" their connections with congressional staff. Some program managers restrict interactions with congressional staff to a few senior people in the program.

A number of new project directors interviewed by the policy project team said they felt somewhat adrift, especially during the early phases of their assessments. Many new project directors specifically expressed the desire for a more formal mentoring program.

IMPLICATIONS FOR POLICY ANALYSIS

OTA has a 20-year history and folklore about its staff and its process. The truism that one "hires the best people and then stays out of their way" is subscribed to by many at OTA. Indeed, the policy project team found that the in-house work environment is simultaneously collegial and insular. In general, OTA staff are not very reflective about the structure and climate of the agency. Most of the analysts move laterally from project to project, carried by the intellectual challenge. Thus, as much as OTA studies probe how technology works, the staff tends to be indifferent to asking how OTA works. Stepping back from the workaday process of "technology assessment" can help to clarify where the folklore differs from actual practice. Furthermore, it can aid intra-agency learning.

Collegiality at OTA is practiced in various ways. Intellectual interests—energy, environment, education and training—seem to define functional areas and also relationships that cross program and division boundaries. The power of personality and interactive style con-

[7] OTA programs differ in their unwritten program norms. An example of an unwritten norm in one program is that one should never use the word "should" preceded by the word "Congress" in a report; other programs observe an unwritten norm that prohibits making recommendations in any form.

nects staff informally, wherever they may be located in the agency. But the structure inhibits formal collaborations and even routine transfer of policy knowledge—methods, experiences, tools, etc. —across OTA's programs and divisions.

Insularity dominates collegiality when it comes to policy analysis at OTA. Staff capabilities are not easily tapped from the inside. Ironically, such capabilities are solicited—especially through advisory panels and workshops—from the outside. But OTA staff seldom get the benefit of hearing from experts beyond those participating in their own program's assessments. In other words, there are missed opportunities for organizational learning. As one former OTA project director stressed:

> *[T]here should be some cross-fertilization of projects. More discussion of each study being undertaken by a program needs to take place within the program and with other programs. I know these efforts have been tried at various times, but they still have merit, if the time constraints and lack of interest in doing such extra work can be overcome. My overall point is that the more discussion and review takes place, the better will be the policy analysis.*

Every organization seeks a manageable level of creative tension that propels its work forward. This level may vary by program and certainly among members of a project team, but it is healthy and, if properly marshalled, can have synergistic effects on many others in the organization's environment. Does OTA create such synergy? In pockets of programs, yes; during some stretches of time, yes. Can we do better? Probably. Certainly the climate can alter staff attitudes toward "doing a better job" in the assessment process.[8] The advice of outsiders familiar with the process (and OTA's history) reinforces many of the perceptions and experiences of the OTA culture by current and former staff conveyed to the policy project team.

This assessment of OTA culture leads the policy project team to ask: How willing is the agency to draw what is done informally into its formal organization to enhance the practice of policy analysis within and across programs and divisions? Although current OTA staff may disagree on the particulars, few would deny the following words of one of the agency's long-time outside observers: "Many things about OTA make cross-program work much harder than it ought to be . . . ." Indeed, many current and former OTA staff see the agency as suffering from:

- a staff constrained by an organizational culture steeped in its folklore and uncommitted to sharing—teaching and learning—the lessons of plying the policy analysis craft,
- work structured into niches that honor an historical division of program labor, and
- a climate that seldom supports mentoring of staff and experimenting with the formation of project teams (as was done in this project).

If these judgments are correct, then perhaps somebody should entertain alternatives to the way OTA's staff is organized. In OTA, as in any organization, the staff must look up, not down, for that "somebody." Perhaps the exhortations of the insiders and the outsiders should be interpreted as a need to "experiment."

As OTA enters its third decade, the job of policy analysis is not

[8] One person at the 1992 Senior Management Retreat (Peter Johnson) provided seven options, including term limits for OTA program managers, required rotation of program managers and senior associates, and designating one program to do cross-program work (Rockwood Retreat Rapporteur Reports, p. 4). Another approach is outlined in a recent proposal to establish an "OTA Institute" that would bring in, for short periods (weeks to months), experts of international stature in technology assessment and policy analysis. These experts would work, on a rotating basis, with senior OTA staff, providing stimuli in the form of seminars, collaborative analysis, and opportunities to prepare policy studies for joint publication. The cross-fertilization would be a two-way street—OTA influencing the audience of academic policy research practitioners, and OTA staff approaching the assessment process with additional perspectives and analytical tools. See Todd M. LaPorte, "OTA Institute" Memorandum, Dec. 12, 1992.

getting any easier. The expectations of congressional committees that request OTA studies keep rising. OTA staff are regularly heard to remark that they are expected to do more, better, faster—without compromising the integrity of the assessment process. They refer to it as a problem related to their current project, but it is more accurately an agency-wide issue. It will ultimately take the agency's collective will to act on it and, above all, some constructive management.

If the above criticisms are accurate, then OTA would continue to serve Congress in reliable ways, but get no better. Change, however, would require taking periodic critical looks at ourselves, our routines, and the people who perform policy analysis. It means being more reflective and receptive to OTA staff needs while effectively drawing on their skills. To do this assumes a culture that fosters staff satisfaction and team morale. That culture must resist inertia and self-satisfaction with what is done, how it is done, and who is doing it. Some of this energy can be sustained at the program level, but much of it originates at the top as a central value to be cherished and nurtured.

OTA policy project: goals and study plan

PROJECT GOALS

The OTA policy project's goal is straightforward yet ambitious: We hope to produce a document that can be used by OTA staff to improve their policy analysis skills. We hope to learn useful lessons from some of the better OTA assessments, as well as to gather insights from current and former OTA staff, congressional committee staff, and outside observers of OTA. We will not attempt to produce an agency "report card" on how well we are currently doing. Regardless of whether one believes we currently do a good job or not, clearly we can do better.

We do not aspire to define what policy analysis is. (Fortunately, we are not alone. Aaron Wildavsky, in the introduction of his text on policy analysis, *Speaking Truth to Power*, raises the question, "How can you write a book about a subject if you can't say what it is?" He does anyway, and so will we.) We will proceed pragmatically. Our focus is on the issues that we raise for congressional attention and the options proposed to address them.

We will not be focusing on those parts of our reports that examine whether a gizmo will fly, make sick people well, harm the environment, help us compete in world markets, and so on. These parts of our reports are often extremely policy relevant and vital to our work but are not the focus of this inquiry.

OTA reports inform Congress about what they can do to change something and in many cases, what and why they cannot. We will focus on how we transmute all that science, engineering, economics, political science, law, etc. into an assessment that tells Congress about the problems they face and potential solutions.

We will not consider whether our reports have impact; nor will we examine how to communicate our findings in ways other than reports. Obviously such questions are important, but they are beyond our charge. We want to know how we figure out the story and the ways we tell it in our assessment reports. Of special interest are the chapters and sections with "policy" in the title.

Although we will not attempt to define what policy analysis is, if coerced, we might draw from Percy Bridgeman's definition of science as "the activity of scientists" and say policy analysis is the activity of policy analysts—those who work at OTA and elsewhere. By looking inward for a brief, three-month period, we hope to find out what we actually do and share what we learn with the rest of the agency.

STUDY PLAN

The OTA policy project will run for three months and will be staffed by three full-time and two part-time OTA staff members. The assessment has a 14-member advisory panel composed of OTA program managers and senior research staff representing all nine OTA programs and the Congressional and Public Affairs Office (see app. A-1). The advisory panel is chaired by a former OTA program manager who is now with the Congressional Research Service.

The study will be divided into two complementary efforts explained in further detail below. The first effort (Task #1) will be an examination of 27 (or possibly 18) of OTA reports by the in-house project staff and interviews with the project directors of those reports. The second effort (Task #2) will be the solicitation of other views of OTA policy analysis through means such as short essays by former congressional and OTA staff, interviews with current congressional staff, a workshop with a carefully chosen group of outside experts, and reviews of the literature on policy analysis and earlier examinations of OTA. Slightly more than half of the staff time will be devoted to the first effort (see app. A-2).

Task #1: Examination of OTA reports (see app. A-2)

To get a list of 27 good OTA reports, the OTA policy project team has asked each program manager to nominate three of his or her program's reports that, in the program manager's opinion, were examples of "good" policy analysis. In selecting reports, the program managers were allowed to use their own conception of "good policy analysis" with the following stipulations. First, we asked them not to let their choices be influenced by legislative use of the report. Second, we said we preferred reports where we could easily interview the project director. Finally, to remove a possible source of bias in the review, we said that the reports named should not be ones for which the members of the OTA policy project team had had major responsibility.

Each of the OTA reports that is reviewed will be assigned to two members of the OTA policy project team: one person will have primary responsibility for the review; the other will act as backup reviewer and independent check of the conclusions of the primary reviewer. Tony Fainberg, Bob Friedman, and Kerry Kemp will be the primary reviewers for nine reports each, all of which will be outside their areas of expertise. Daryl Chubin, Tony Fainberg, Bob Friedman, and Kerry Kemp will be backup reviewers, with as much diversity in pairing as is possible. Backup reviewers will be chosen for their familiarity with the assessment subject matter where possible. Each report will be reviewed using a common set of questions as a guide.

Given the limited time available for this study, primary reviewers will spend two days reading the report; backup reviewers, one day. In the event that we decide that this amount of time is inadequate to the task, one assessment per program will be dropped.

The project director for every OTA reports that is reviewed will be interviewed prior to the review of the reports. If necessary, the project directors may also be interviewed after the review of their reports.

Task #2: Other views of OTA policy analysis (see app. A-3 through A-6)

We are soliciting other views through a series of contract and in-house research efforts:

Task 2-A: Evaluations of OTA policy analysis by former congressional staff

We have identified four former congressional staffers who were both 1) quite familiar with OTA, and 2) considered thoughtful about the policy analysis needs of the Congress (see app. A-3). The list includes critics as well as supporters, with staffers from both Houses and parties. The former staffers will be given several OTA reports (probably three from the list recommended by the program managers). We will ask them 1) to specify the criteria that they would use to judge "good" policy analysis, and 2) proceed to evaluate the reports. We expect short papers and will pay them a small honorarium for their services. Each former congressional staffer will be interviewed by two members of the project team after his or her short paper is submitted.

Task 2-B: Interviews with current congressional staff

Insights gained from task 2-A will be tested and explored further through interviews with current con-

gressional staff. We will interview at least 10 current staffers, chosen from committees that are frequent requesters and TAB staffs, with a good mix from both parties and Houses (see app. A-4).

Task 2-C: Retrospectives on policy analysis by OTA alumni

Former senior OTA staff now with other organizations that do similar types of analyses present a unique opportunity for this study. These individuals understand OTA yet have the benefit of some time away from the agency and experience with how analysis is done in another organization. For this part of the project we have chosen five former OTA staff members who directed OTA studies and are reputed to be among the most accomplished policy analysts who have worked at OTA (see app. A-5). We will ask them for their thoughts on how our policy analysis can be improved.

Task 2-D: Workshop on OTA analysis with outside experts

About 10 outside experts familiar with OTA assessments (see app. A-6) will meet with the policy project team and invited members of the advisory panel for a one-day workshop. Discussions at the workshop will provide a comparative basis for describing the diversity of OTA "styles" of policy analysis, as well as assessing the agency's analytical strengths and weakness as seen by policy scholars and practitioners.

Task 2-E: Interviews with recent first-time OTA project directors

We anticipate that first-time project directors will be among the primary users of the report prepared by our group. We will interview several recent first-time project directors to learn what types of information they would have liked to have had available to help learn the craft of policy analysis. We will also find out how they did learn their craft (e.g., read OTA reports, worked closely with another project director, or sought help from the program manager).

Task 2-F: Review of the policy analysis literature and previous analyses of OTA

Though agreement on what constitutes policy analysis—good or otherwise—is lacking, the scholarly literature continues to grow. This task is devoted to providing a window on the literature most relevant to OTA. Does our policy analysis reflect the "state of the art" (if there is one), lead it, or lag behind, and in what ways? Through a literature review, we have identified about 35 promising articles and books (out of about 500 items) that include discussions of how to think about, carry out, and interpret policy analysis.

This task, which will be carried out entirely in house, aims to distill what is known, and sometimes prescribed, as important dimensions of policy analysis. A preliminary set of dimensions to relate to styles of analysis is being developed from this literature. There is clearly both a richness and a diversity in the literature that will be of some help.

In addition, there have been a few doctoral dissertations and case studies about OTA, though little has been targeted to our policy analysis per se. These "outsider" analyses of the agency will also be reviewed and culled for insights.

OTA POLICY PROJECT ADVISORY PANEL

Members of the advisory panel for the OTA policy project, all of whom are current OTA program managers or senior staff, are listed below. The panel will be chaired by a former OTA program manager, Richard Rowberg, who is now Chief of the Science Policy Research Division of OTA's sister agency, the Congressional Research Service.

Division A—Energy, Materials, and International Security

Peter Blair, Program Manager
Energy and Materials Program
Gerald Epstein, Senior Analyst
International Security and Commerce Program
Katherine Gillman, Senior Associate
Industry, Technology, and Employment Program
William Keller, Senior Analyst
Industry, Technology, and Employment Program

Division B—Health and Life Sciences

Clyde Behney, Program Manager
Health Program
Michael Gough, Program Manager
Biological and Behavioral Sciences Program
Alison Hess, Senior Analyst
Food and Renewable Resources Program
Robyn Nishimi, Senior Associate
Biological and Behavioral Sciences Program

Division C—Science, Information, and Natural Resources

Nancy Carson, Program Manager
Science, Education, and Transportation Program
Emilia Govan, Senior Analyst
Oceans and Environment Program
Linda Roberts, Senior Associate
Science, Education, and Transportation Program
Joan Winston, Senior Analyst
Telecommunication and Computing Technologies Program

Congressional and Public Affairs Office

James Jensen, Congressional Affairs Director

TASK #1: EXAMINATION OF OTA REPORTS

The following OTA reports, selected by current program managers, will be reviewed by the OTA policy project team:

Reports from Division A:

Energy and Materials Program:

- *Electric Power Wheeling and Dealing: Technological Considerations for Increasing Competition*
- *Nuclear Power in an Age of Uncertainty*
- *Improving Automobile Fuel Economy*

International Security and Commerce Program:

- *Round Trip to Orbit: Alternatives for Human Space Flight*
- *Exploring the Moon and Mars*
- *Holding the Edge: Maintaining the Defense Technology Base*

Industry, Technology, and Employment Program:

- *Serious Reduction of Hazardous Waste*
- *Making Things Better: Competing in Manufacturing*
- *Worker Training: Competing in the New International Economy*

Reports from Division B:

Biological and Behavioral Sciences Program:

- *Losing a Million Minds: Confronting the Tragedy of Alzheimer's Disease and Other Dementias*
- *Mapping Our Genes: Genome Projects—How Big? How Fast?*
- *Ownership of Human Tissues and Cells*

Food and Renewable Resources Program:

- *Beneath the Bottom Line: Agricultural Approaches To Reduce Agrichemical Contamination of Groundwater*
- *Enhancing the Quality of U.S. Grain for International Trade*
- *Enhancing Agriculture in Africa: A Role for U.S. Development Assistance*

Health Program:

- *Preventive Health Services for Medicare Beneficiaries: Policy and Research Issues*
- *Health Care in Rural America*
- *Indian Health Care*

Reports From Division C:

Oceans and Environment Program:

- *Changing by Degrees: Steps To Reduce Greenhouse Gases*
- *Polar Prospects: A Minerals Treaty for Antarctica*
- *Complex Cleanup: The Environmental Legacy of Nuclear Weapons Production*

Science, Education, and Transportation Program:

- *Transportation of Hazardous Materials*
- *Power On! New Tools for Teaching and Learning*
- *Delivering the Goods: Public Works Technologies, Management, and Financing*

Telecommunication and Computing Technologies Program:

- *Global Standards: Building Blocks for the Future*
- *Finding a Balance: Computer Software, Intellectual Property, and the Challenge of Technological Change*
- *Critical Connections: Communication for the Future*

Note: This list includes 27 OTA reports. Time constraints may necessitate reducing the number of reports reviewed to 18 by dropping one report per program.

TASK #2: OTHER VIEWS OF OTA POLICY ANALYSIS

Task 2-A: Evaluations of OTA policy analysis by former congressional staff

Former congressional staff

- Katherine Y. Cudlipp, Former Counsel, Senate Environment and Public Works Committee, Republican; Currently Consultant.
- Anne Scott, Former Legislative Director and TAB Staffer to Rep. Morris K. Udall, Democrat; currently Legislative Representative, City of New York.
- William H. Smith, Former Staff for the Senate Armed Services Committee, Democrat; Currently Director of Federal Relations, Georgia Institute of Technology.
- David N. Sundwall, former Director, Health and Human Resources Staff (Majority), Senate Labor and Human Resources Committee, Republican; Currently Vice President and Medical Director, AmHS Institute.

Work statement

In support of the in-house assessment on policy analysis, OTA seeks the retrospective views of former congressional staff on key committees requesting OTA work. They will be asked to discuss the strengths and weaknesses of OTA policy analysis, as reflected in agency reports. While the concern is not the ultimate impact of a particular OTA report, staff perspectives provided in both written and oral forms on what constitutes useful policy analysis could yield important lessons.

Each former staff person, within his/her area of committee experience, would be asked:

1. to nominate and briefly explain an "ideal" and a "minimal" set of criteria that a useful policy analysis should include;
2. to apply the criteria through written evaluations of the policy sections of three to four OTA reports;
3. to describe, in an in-person interview with project team members, how the sample of reports satisfy the criteria used in the written evaluations, and to elaborate on impressions of what was most and least valuable in the policy sections of the OTA assessment reports.

Tasks—The contractor would be responsible for completing three tasks:

1. A brief (two- to four-page) memorandum describing the ideal and minimal criteria that any policy analysis should meet to satisfy the needs of a congressional committee. These criteria would be based on the ex-staffer's expectations of what serves as support for committees (i.e., legislation and oversight in various forms), as well as his/her experiences with OTA reports (and other policy documents, for that matter).
2. A report (ca. 15-page) that contains written evaluations of the policy sections of a sample of OTA reports. (The number of reports will vary with the substantive area and experience of the contractor, and the extent and form of policy treatment in the sampled reports.)
3. An in-person interview and discussion of the criteria for identifying a useful policy analysis, with emphasis on the features of the reports reviewed in task 2 that are deemed most and least valuable. (Questions to help structure the discussion may be circulated in advance of the interview, which would involve at least two members of the project team.)

Task 2-B: Interviews with current congressional staff

Current congressional staff

- Chris Aldridge, Majority staff, House Armed Services
- Ben Cooper, Majority staff, Senate Energy and Natural Resources
- Rick Counihan, Majority staff, House Energy and Commerce, Energy and Power Subcommittee
- Gary Ellsworth, Minority staff, Senate Energy and Natural Resources
- Dan Finn, Minority staff, House Foreign Affairs
- Dave Finnegan, Majority staff, House Energy and Commerce
- Jim Greene, Minority staff, House Science, Space, and Technology
- Judy Greenwald, Majority staff, House Energy and Commerce, Energy and Power Subcommittee
- Eric Hamburg, Majority staff, House Foreign Affairs
- Jimmie Powell, Minority staff, Senate Environment and Public Works
- Jack Riggs, Majority staff, House Energy and Commerce, Energy and Power Subcommittee
- Skip Stiles, Majority staff, House Science, Space, and Technology
- Len Weiss, Majority staff, Senate Governmental Affairs

Background

The policy project team will conduct individual telephone interviews with the 13 current congressional staff members will be listed above. Each staff member asked the following questions designed to ascertain their familiarity with OTA reports and their views regarding the strengths and weaknesses of OTA's policy analysis. The staff members were chosen from committees that are frequent requesters of OTA reports and are representative of both parties and Houses of Congress.

Questions for current congressional staff

1. How many (and which) OTA assessments did you play some role in requesting? How many other reports (and which) have you used in some way?
2. What do you typically read (summary only, summary plus options chapter, technical chapters, etc.)? Is this similar to what others on your committee typically read?
3. What do you find of greatest value in our reports? OTA policy analysis typically includes two components: 1) analysis of the "status quo" (policy context, findings, and issues), and 2) discussion of options for change (alternative congressional goals, options to meet those goals, and an analysis of the effectiveness and effects of the options). Where should we put the bulk of our time and effort?
4. What are the strengths and weaknesses of our reports in comparison to other organizations (CBO, GAO, National Academies, etc.)?
5. How should OTA staff interact with committee staff? Do you believe it is helpful to meet during the course of an assessment? If so, how often? Once an assessment is completed, what type of interaction would be most valuable?
6. How should OTA improve its reports to be of greater service to you/the committee? (Consider both the content and presentation of our assessments.)
7. Do you know of staffers who do not find our work to be useful that we might talk to?

Task 2-C: Retrospectives on policy analysis by OTA alumni

OTA alumni

- Joe Coates, Former Senior Researcher at OTA
  Currently President, Coates & Jarratt, Inc.
- Ronnie Goldberg, Former OTA Project Director, International Security and Commerce Program;
  Currently Senior Vice President for Policy and Program, U.S. Council for International Business
- Joel S. Hirschhorn, Former OTA Project Director, Industry, Technology, and Employment Program;
  Currently Consultant, Hirschhorn & Associates, Inc.
- Larry Miike, Former OTA Project Director, Health and Biological Applications Programs;
  Currently Professor of Medical Policy, University of Hawaii at Manao and Executive Director, Papa Ola Lokahi, Honolulu, HI
- Edith Page, Former OTA Project Director, Science, Education, and Transportation Program;
  Currently Manager of Federal Programs, Bechtel Group, Inc.

Work statement

In support of the in-house assessment on policy analysis, OTA seeks the retrospective views of former agency senior staff on the strengths and weaknesses of OTA policy analysis. The alumni would be asked to comment on the OTA style of policy analysis, as reflected in assessment reports, compared to reports on similar topics that are issued by other governmental (e.g., CRS) and non-governmental organizations (e.g., Brookings).

Each OTA alumnus/alumna would be asked to respond in writing to a brief set of questions concerning his or her chief impressions of how OTA approaches policy analysis. This will prime the alumni for drafting a short (ca. 10-page) paper describing the distinctiveness of the OTA assessment process and how it shapes the policy analysis sections of reports. The paper would be prescriptive as well as descriptive, and develop ideas introduced in the earlier written responses. For example:

1. What could OTA do better in preparing and presenting its policy analysis discussions? Should OTA rely more or less on certain literatures, analytical tools, or proposed options?
2. Is there something identifiable as an OTA style of analysis? Are there certain characteristics of OTA policy analysis that should be emulated or avoided?
3. Within the culture of the agency, how might one introduce change to the approaches taken or formats used in doing/presenting policy analysis?

Tasks—Each OTA alumnus/alumna would complete the following:

1. A brief written response to a set of questions that outline his/her impressions of the strengths and weakness of OTA policy analysis.
2. A 10-page paper comparing OTA's style of policy analysis with that of other organizations with which the alumnus is familiar. The paper would probe alumnus prescriptions for improving how OTA does and presents policy analysis.

Questions to OTA alumni—Based on your experience at OTA, we would appreciate your responses to the following questions. A memorandum containing your responses may serve as a preliminary outline for your paper, in which you may develop particular themes.

1. Is there something identifiable as an OTA "style" of analysis? What are the major characteristics of OTA policy analysis? Please describe one characteristic or stylistic tendency that more of the agency should (a) emulate and (b) avoid.

2. In general terms, what is the most salient thing OTA could do better in preparing and presenting its policy analysis discussions? For example, should OTA reports rely more or less on certain literatures or analytical tools, spend more time developing a few key options, present a broader range of options, devote more time to analyzing the impacts of options?
3. There are many elements of a policy analysis, e.g., research design/methodology, data collection, data analysis, interpretation of findings, and form of presentation of policy options. In your area of expertise, how does OTA policy analysis (not the impact of reports or their coverage in the media) compare with that of other prominent producers of policy reports? Please list the elements of a policy analysis that contribute, in your mind, to its quality and usefulness (especially to the congressional client).
4. Taking the elements of a policy analysis as listed in three above, which, if any, do you consider a particular strength or a particular weakness in OTA assessments? What is missing from the list above that OTA could do more or a better job of? In your view, is the oft-heard criticism that OTA reports are too even-handed warranted? Why or why not?
5. We have many congressional clients for our assessments: the specific requester(s), all committees of jurisdiction (both Houses and parties), the Congress as a whole, as well as future Congresses. How should we ascertain and address their diverse needs in our analyses?
6. Is there any other issue or theme absent above that you associate with OTA policy analysis, or the assessment process?
7. Since you know the OTA culture, do you have any top-of-the-head ideas on how change could be introduced in the approaches taken or formats used to conduct and/or present policy analysis in our reports?

Task 2-D: Workshop on OTA policy analysis with outside experts

Outside experts

- Philip H. Abelson, Consultant (former Deputy Editor for Engineering and Applied Science, *Science Magazine*)
- Claude Barfield, Director of Science and Technology Policy Studies, American Enterprise Institute
- Daniel M. Fox, President, Milbank Memorial Fund
- Edward M. Gramlich, Director, Institute of Public Policy Studies, University of Michigan (former Acting Director, Congressional Budget Office)
- Don E. Kash, Hazel Chair of Public Policy, Institute of Public Policy, George Mason University
- Todd R. LaPorte, Professor of Political Science, University of California, Berkeley
- Shirley Malcom, Head of the Directorate for Education and Human Resources Programs, American Association for the Advancement of Science (AAAS)
- Rodney W. Nichols, Chief Executive Officer, New York Academy of Sciences
- Norine Noonan, Vice President for Research, Florida Institute of Technology
- Charles Weiss, Global Technology Management, Inc.

Background

In support of the in-house assessment on policy analysis, OTA seeks the advice of a few experienced outside experts who have participated in the OTA assessment process. These senior policy experts will be familiar with OTA through their sustained contributions as members of advisory panels, chairmen of workshops, project contractors, and reviewers of draft report materials. They will serve as sounding boards for the project team, augmenting the suggestions of the advisory panel and offering commentary on assessment activities and findings.

Tasks

The tasks of each external expert will include:

1. critique, in the form of a brief memorandum, of the OTA project work plan;
2. attendance at a one-day workshop convened to solicit the views of external experts on various aspects of policy analysis; and
3. written reactions to the workshop, either in memorandum form or in response to specific questions posed by the project team.

Form for examination of OTA reports

Title of report _____

Program _____ Project director _____

Requesting committee _____ Date of release _____

Primary reviewer _____ Secondary reviewer(s) _____

A. Guide for interviews with OTA assessment project directors

1) Request for the assessment: When was the assessment requested? Did discussions with the requesting committee(s) after the letter was received significantly change the request?

2) Relations with congressional staff: Describe your interactions with congressional staff during the course of the assessment (e.g., What was the genesis of the request for the assessment? Which committee or other staffers did you work with? When/how often did you see them? What was their role?).

3) Size of the project: How long did the assessment take to complete (from request to release)? What was the size (in dollars) of the budget? What was the composition (e.g., project director, two analysts, and one research assistant) and size (in FTEs) of the staff? How much of the budget was for contracts? What types of products (e.g., policy analysis, technical background papers, surveys) did you contract for? What percentage of the total budget would you estimate was devoted to policy analysis?

4) Backgrounds and/or experience of OTA staff: What disciplines and/or experience were represented on the OTA staff that worked on the assessment? Did the staff's disciplinary composition or experience affect the policy analysis? How? (Note to interviewer: You may want to photocopy the staff page for this question.)

5) Organization of the report: Which chapters should we read to find the following: 1) policy context, findings, and issues (i.e., discussion of the policy context, identification of policy-relevant findings, and identification of policy issues); and 2) goals and options (i.e., identification of alternative congressional goals, identification of options to achieve those goals, and evaluation of options).

6. Course of the assessment:
   - At what point in the assessment were the major policy issues framed?
   - At what point in the assessment did you know what the findings would be?
   - At what point in the assessment were the major policy options framed?
   - Did the assessment ever take a major unexpected turn? What exactly happened and how did you deal with it?

7. What methods and data did the staff in this assessment use to ascertain the policy context, identify policy-relevant findings, and identify policy issues? Which methods did it find to be most helpful and why? (e.g., brainstorming, historical reviews, case studies, scenario building, modeling, policy workshops, synthesis of research)

8. How were the policy options developed?
   - What methods were used to develop policy options in this assessment?
   - Who had primary responsibility for developing them? The project director, certain members of the project team? What role did the advisory panel play? The program manager? The AD? What role did the advisory panel play? How important a role did outside contractors play? What about outside reviewers? Workshop participants or others?
   - How much time and effort were spent developing policy options as opposed to writing the rest of the report?
   - To what extent was political feasibility a consideration in developing/eliminating options?
   - For whom were the options intended? (e.g., Congress, executive branch agencies, other parties) Were they more options or recommendations?
   - How many of the options were already "on the table" and how many were new to this assessment?

9. How much time and effort were spent evaluating the effects and effectiveness of the options and their unintended consequences? What methods were used?

10. What do you consider the major strengths and weaknesses of the policy analysis and options in this report?

11. If you had to do the report over again, what (if anything) would you do differently?

12. How was the report used by Congress? (e.g., to structure debate on the issue; options were translated into law; used as the basis for oversight hearings) How was the report used by other parties that you know of?

13. What other comments or suggestions do you have?

B. Guide for staff review of assessments

1. Type of assessment: How would you characterize the assessment? (e.g., narrow vs. broad in scope; closely linked to an immediate legislative issue/agenda or more long-term; problem oriented vs. technology oriented; related to an emerging issue vs. a mature one; short-term vs. long-term)

2. Are the purpose and bounds of the assessment clearly stated?

3. Methods for analysis: What "methods" (e.g., brainstorming, historical reviews, case studies, scenario building, modeling, policy workshops, synthesis of research) does the report use 1) to ascertain the policy context, identify policy-relevant findings, and identify policy issues?; and 2) to identify alternative congressional goals, identify options to achieve those goals, and evaluating options)?

Part I: policy context, findings, and issues

4. Policy-relevant context and findings:
   a. Are the following clearly identified:
      1) current institutional framework; 2) affected groups; 3) decisionmakers?
   b. Are policy-relevant conclusions distinctly identified as "findings"?
   c. What are some interesting or unique features of the analysis that deserve comment?

5. Policy issues:
   a. Does the report clearly identify major policy issues? Are they logically linked to the technical analysis?
   b. Does the report address the request of the requesting committee(s)? To what extent does it go beyond the request?
   c. How many major policy issues for Congress — i.e., fundamental questions or areas of controversy or conflict of concern to Congress (e.g., how to clean up the environment and also promote a healthy economy) — does the report identify?
   d. How would you characterize these policy issues? (e.g., narrow vs. broad; closely linked to legislative agenda or more abstract; problem oriented vs. technology oriented; related to an emerging issue vs. a mature issue; short-term vs. long-term)
   e. Other comments

Part II: goals and options

6. Policy goals: Are alternative policy goals clearly identified?

7. Identification of policy options:
   a. Does the report identify many policy options or just a few?
   b. For whom are the options intended? (e.g., Congress? Executive branch? States? Others?)
   c. How closely do the options/suboptions seem to be related to the analysis that precedes (or in some cases follows) them?
   d. How are the options organized? (e.g., clustered around major issues; around specific goals by types of strategies for achieving specific goals; by actors; in rank order of preference)
   e. Does the set of the options presented encompass both multiple goals and multiple ways to achieve the same goal?
   f. How would you characterize the major options? For example,
      1) How many of the options are "fine-tuning" existing law or tinkering with existing mechanisms? (e.g., Many, A few)
      2) How many of the options require new laws/major changes in existing laws or major new programs? (e.g., Many, A few)
      3) Do most of the options favor more Federal involvement or less?
   g. Do the options seem to be recommendations or options? For example, are some options (including retaining the status quo) presented in such a way as to make them clearly not desirable?

h. How much detail is included in the policy options (i.e., could the options be easily translated into legislative language?)

8. Analysis of policy options:
   a. Is there a clear statement of evaluation criteria? Are consistent criteria used to evaluate the options?
   b. Are the institutional changes needed to implement the options identified and discussed?
   c. If monetary incentives (or new governmental programs) are proposed, are funding and other require ments estimated?
   d. Does the report evaluate the effectiveness of the option for achieving the goal(s)?
   e. Are the various options compared to one another?
   f. Does the report analyze any of the following types of common issues in a particularly creative way? If so please identify:
      1) R&D funding (e.g., how does one select a mechanism; how does one decide how much to spend?);
      2) Level of government (e.g., how does one decide where action is appropriate, Federal, state, or local government level);
      3) Federal institutions (who and why — new organization, choice among existing agencies, methods for interagency coordination, etc.)?
      4) Level of specificity of congressional directives (e.g., detailed, highly specific congressional mandates to the executive branch vs. broad congressional mandates with delegation of specific actions to the executive branch)
      5) [Identify other common issues as reviews proceed]
   g. How are values dealt with in the options? (e.g., different options presented to address different sets of values; "if one believes, then ____" constructions are used; other means—specify) Does the analysis of options seem even-handed? Does the even-handedness seem forced? Do the options seem to have any particular bias (e.g., liberal or conservative; more Federal intervention or less)? Please elaborate.

Mechanical aspects of presentation

9. Mechanical aspects of report:
   a. How long is the report (how many chapters and appendices/pages)? How much of the report is devoted to policy analysis (including options) as opposed to description? (e.g., two of five chapters, policy options at the end of each of 11 chapters, number of pages for policy analysis vs. description)
   b. How is the report organized?
   c. Are there any specific techniques used to enhance the presentation of the policy analysis and options in this report that might serve as a model for other reports? What are they? (For example, is there a box, table, or figure that summarizes policy options? Are headings used in an especially effective way? What about graphics or tables?) Please attach a copy of anything that you think might serve as a model for other reports.
   d. Comment on writing style (clarity, tone, journalistic vs. academic style, etc). Is the style in the summary at all different from that in the rest of the report?
   e. Other comments.

Summary statistics for the 18 OTA reports

	No. reports or other count	Average
GENERAL STATISTICS		
1. Total number of pages		254
Number of chapters		8
Chapter pages		209
Appendixes		3
Index _____ (yes)	8	
2. Reader-friendliness, rated on a scale of 1 (poor), 2 (fair), 3 (okay), 4 (very good), and 5 (excellent)		3.4
3. Taxonomy of report:		
____ Narrow scope	13	
____ Broad scope	5	
____ Problem-driven (all)	13	
____ Problem - technical	8	
____ Problem - organizational	7	
____ Problem - legal/regulatory	3	
____ Technology-driven	5	
4. Budget and time to complete:		
____ Under $300,000	4	
____ From $300,000 to $600,000	11	
____ More than $600,000	3	
____ Months to complete		26

5.	Staff (total number ____):		3.8
	A. Project director's background		
	____ Natural scientist/engineer	9	
	____ Social scientist/policy degree	3	
	____ Economist	3	
	____ Lawyer	0	
	____ Other (specify)	4	
	B. Disciplines on project team		
	____ Natural scientist/engineer	14	
	____ Social scientist/policy degree	13	
	____ Economist	3	
	____ Lawyer	6	
	____ Other (specify)		
6.	Percent of report devoted to policy analysis:		
	____ % on policy context/findings/issues		38%
	____ % on setting/analyzing goals, options		15%
7.	Organization of summary parallels rest of report:		
	____ Very closely	7	
	____ Somewhat	7	
	____ Not at all.	4	
CONTEXT, FINDINGS, AND ISSUES OVERALL—rated on a scale of 1 (poor) to 5 (excellent)			**3.8**
8.	Description of context, findings, and issues:		
	____ Current Fed. policy/activities (1 to 5)		4.1
	____ Legal and regulatory context (1 to 5)		3.8
	____ Institutional context (1 to 5)		4.1
	____ Stakeholders/affected parties (1 to 5)		3.0
	____ Ease of finding issues/findings (1 to 5)		3.4
9.	Explanation of the status quo:		
	____ Very good	6	
	____ Fair	6	
	____ Not very good or not included	6	
10.	Consideration of international context:		
	____ International context critical (1 to 5)		4.8
	____ International, but not critical	6	
	____ National context only	7	

GOALS/OPTIONS OVERALL—
rated on a scale of 1 (poor) to 5 (excellent) **2.8**

11. Goals/subgoals and options are:
    a) easily identified (1 to 5) 3.3
    b) related to rest of the report (1 to 5) 3.1

12. Number of options:
    ____ Up to 5 2
    ____ 6 to 20 11
    ____ Over 20 5

13. Options/strategies are analyzed in terms of:
    ____ Stakeholders' positions 8
    ____ Effectiveness achieving specified goals 8
    ____ Costs 7
    ____ Little analysis of options or strategies 8
    ____ Other (specify)

14. Options (and/or strategies) are compared:
    ____ Yes 9
    ____ No 9

15. Report considers reducing Federal intervent:
    ____ Yes 3
    ____ No 9
    ____ Not applicable 6

16. Report seems to strongly recommend:
    ____ Yes 7
    ____ No 11
    ____ What? (specify)

17. Options include creating new institution:
    ____ Yes 8
    ____ No 10

18. Options deal with people/human factors:
    ____ Yes 10
    ____ No 8

19. Questionable objectivity anywhere in report?:
    ____ Context 5
    ____ Options - "empirically based pol. prescriptions" 3
    ____ Options - "recommendations" 4

Sourcebook information and related materials

The policy project team conducted a review of the policy analysis literature and previous analyses of OTA to prepare a sourcebook with especially insightful articles and reports describing important dimensions of policy analysis most relevant to the work conducted at OTA. The "Sourcebook on Policy Analysis" now exists as a separate, loose-leaf notebook, available to OTA staff who wish to consult the literature on some aspect of policy analysis. The preface and table of contents for the "Sourcebook on Policy Analysis" are included in this appendix.

In addition to preparing the general policy analysis sourcebook, the policy project team had initially planned to develop a series of sourcebooks on specific policy issues that commonly appear in OTA reports. These ubiquitous or perennial issues, such as R&D funding and federalism, each have scholarly and policy literatures that provide both a history and an evaluation of "what works." As envisioned by the project team, the sourcebooks would represent a compendium of basic source material from which any project team could draw as it approached the formulation of actions based on the policy analysis featured in an assessment. Unfortunately, time did not permit the development of these sourcebooks by the project team. The team did prepare a contractor work statement for "The R&D Funding Option" sourcebook, and that work statement is included in this appendix. The agency might consider pursuing the development of this or similar sourcebooks in the future. Also included is an excerpt from an academic paper that examined another ubiquitous policy issue titled, "Reorganizing Public Organizations: Alternatives, Objectives, and Evidence."

SOURCEBOOK ON POLICY ANALYSIS

Preface: The OTA policy project team has assembled, in a separate loose-leaf notebook, a user-friendly starter kit for those who wish to consult the literature on some aspect of policy analysis. It contains bibliographic references and excerpts from a selection of the literatures on policy analysis dating to 1976. Over 500 items were retrieved through a keyword search done by the OTA Information Center (IC) and reviewed for inclusion in the sourcebook. In addition, the OTA document archive (also maintained in the IC) was scanned for items relevant to OTA as a performer of policy analysis.

Although there is no cookbook or a tried-and-true formula for the conduct of policy analysis, there have been several attempts to define it. The diversity of definitions attests to the "arts and crafts" status of the enterprise.

Certainly one of the distinctions between "policy research" and "policy analysis" is that the latter usually is performed for a client and is problem-centered. The former is generated from a disciplinary knowledge base and is limited by the interests of the researcher.

Policy analysis has a literature and vocabulary, but the audiences for it are so diverse that assuming shared meanings is perilous. For example, after evading the

issue of how to define "technology assessment," the OTA policy project team heard this simple, yet elegant definition: Technology assessment is policy analysis where technology is a variable.

Contents: The "Sourcebook on Policy Analysis" is organized as follows:

I. Select Bibliography (1980-Present) on Policy Analysis
II. Pre-1980 "Obscure Classics" in Policy Analysis
III. Exemplary Sources on OTA as Policy Analysis Performer
IV. Reprints:
    A. Defining Policy Analysis
    B. Orientations/Approaches/Frameworks/Frames of Reference
    C. Use by/Impact on Client and Other Consumers
    D. Case Studies and Other Study Designs
    E. Specific Topics in Policy Analysis
    F. Other Bibliographies and a Glossary

WORK STATEMENT FOR SOURCEBOOK ON R&D FUNDING

In support of the in-house assessment on policy analysis, OTA seeks to develop a series of "sourcebooks" on key policy issues that commonly appear in OTA reports. These ubiquitous or perennial issues each have scholarly and policy literatures that provide both a history and an evaluation of "what works."

The contractor would summarize what is known about the issue, append a bibliography of classic and recent sources, and discuss this "policy knowledge" relative to the kinds of policy considerations advanced in OTA reports. The project team would identify the candidate issues for sourcebook treatment. Each sourcebook would be a brief guide to the state of knowledge about and use of a particular policy option or tool. Taken together, these sourcebooks would represent a compendium of basic source material on which any project team could draw as it approaches the formulation of actions based on the policy analysis featured in an assessment.

Congressional attention to "R&D funding" is one issue addressed in the vast majority of OTA reports. For example,

a. "Congress could increase Federal research on the impact of work schedules on workers. This could include directing the pertinent Federal agencies to expand existing programs and to develop new programs, as well as increasing appropriations of funds to support these efforts. From *Biological Rhythms: Implications for the Worker*, OTA-BA-463, September 1991, p. 23.
b. "Continue funding and support for the NRC to evaluate the state of reliability of the U.S. communication infrastructure for purposes of national security and emergency preparedness. . . . Provide funding and support for studies of the security of communication systems." From *Critical Connections: Communication for the Future*, OTA-CIT-407, January 1990, p. 15.
c. "Congress could maintain the current emphasis of increased funds for competitive grants and level or decrease funding of formula and intramural funds. Implicitly, this would indicate that Congress places greater emphasis on basic research than on adaptive research, extension, and teaching activities. . . . Congress could award certain competitive grants to basic research that clearly shows ties to adaptive research. This would be a clear signal that Congress considers the original mission of land-grant universities to be appropriate today." From *A New Technological Era for American Agriculture*, OTA-F-474, August 1992, p. 30.
d. "Some technologies of great potential benefit to society do not get adequate private backing because the payoff for individual firms is too small, uncertain, and far in the future. The U.S. Government has sometimes given special support to R&D for commercially important technologies, but in an ad hoc

rather than proactive way. A coherent, strategic policy requires having an agency in charge that can set goals and choose technologies to support that fit the goals. . . . Any Civilian Technology Agency (CTA). . .would certainly start small, and might remain so. . . . After a few years' experience, a CTA might take over some technology projects of the National Science Foundation. . . ." From *Making Things Better: Competing in Manufacturing*, OTA-ITE-443, Feb. 1990, pp. 21, 76.

Scope of the contract

The R&D funding option, in other words, can take a variety of forms. But what do we know about each form? How are they treated in OTA assessment reports, and more important for this contract, in the policy and scholarly literatures? What analysis has been done of the use and effectiveness of variants on this option? What, in short, is the empirical wisdom on the following:

- *Adjust funding levels:* What are the rules of thumb on how much more (or less) R&D makes a difference? Is this determined by the magnitude of the problem, e.g., dollar increase as a percentage of the cost of Federal programs devoted to the problem?
- *Set priorities:* Since there is never enough money to do everything, how are agencies directed to emphasize certain types of research, development, demonstration, test, or experimentation? How specific or general are such options presented? Is a time frame specified? Accountability requirements suggested?
- *Reorganize the R&D effort:* Problems fall within the oversight of agencies. Sometimes this is seen as a strength, other times a weakness. How often does the funding option feature not dollar amounts, but rather changes in the management of the effort? Is cooperation between existing agencies or other organizations prescribed? The shifting of responsibilities from one agency to another? A change in an existing agency program? Creation of a new agency?
- *Focus on the performer:* The R&D funding option can also stress the virtues of the performer. Which institutions—universities, national labs, intramural labs, private companies—are noted for what advantages? Does analysis indicate that these virtues are manifested in expected ways? Are some performers seen as more expedient, efficient, or creative?

Implicit in the funding option are assumptions about how R&D represents a "solution" to a technology "problem." Actually, there are many solutions to a multidimensional problem that go beyond possible changes in dollar amounts, cognizant agencies, and funding mechanisms. How have the variations described above been discussed in the scholarly and policy literatures? What, if anything, do they add to OTA's knowledge base, confirm, or contradict OTA's tendencies in formulating the R&D funding policy option?

Tasks

The contractor shall, in consultation with the project team:

1. draft a memorandum that outlines in three to four pages generic issues to be addressed on the R&D funding policy option;
2. submit a final outline for the sourcebook, as described above (including its scope and likely sources);
3. deliver a draft of the sourcebook, including a bibliography (OTA will provide some source materials and discuss a format);
4. submit a revision of the sourcebook that takes into account comments by the project team.

EXCERPT FROM ACADEMIC PAPER

Reorganizing Public Organizations: Alternatives, Objectives, and Evidence

Craig Thomas
Institute of Governmental Studies
University of California, Berkeley

Prepared for

The Secretary of Energy Adv
U.S. Department of Er

August 1992

Conclusion

This paper emphasized the incompatibility of various values and the necessity of choosing between them when deciding whether and how to reorganize a public organization. Since these decisions are profoundly political and should be made by the political actors involved, it would be inappropriate at this point to suggest that certain values, and thus particular alternatives, are necessarily "better" than others. Moreover, even if the actors involved in a specific reorganization were to agree on value proprieties, no evidence exists to suggest that specific organizational designs would apply in all circumstances. As Herbert Kaufman (1977:402) noted:

> *Obviously, no reorganization is inherently right or wrong. No given administrative pattern will invariable increase efficiency, effectiveness, or responsiveness. In particular circumstances, identical organizational arrangements may produce diametrically opposite effects while radically different arrangements may produce identical effects.*

Despite the large volume of rhetoric surrounding reorganizations in general, remarkably few empirical studies have charted the intended and unintended effects of particular reorganizations. Table 1 presents a "quick and dirty" summary of this evidence and some of the logic behind organizational design theories.[1] Given the remarkable gaps in our knowledge or the effects of reorganization, any future attempt to reorganize which is driven by instrumental rather than symbolic purposes should seriously consider whether the benefits desired exceed both the political effort required as well as the unknown and unintended effects which will surely follow. Though actors often latch on to reorganization as a panacea for governmental ills, not all ailments require major surgery. In this vein, efforts short of grandiose reorganizations may be more likely to achieve certain desired outcomes.

[1] Table 1 does not summarize all of the issues, evidence, and speculations presented in this paper. It is intended solely as an aid to the reader, and is not intended to be conclusive.

Table 1

Reorganization Strategies in Theory and Practice: Alternatives, Objectives, and Evidence

	Economy (cost savings)	Efficiency	Effectiveness (achieves organizational goals)	Political Accountability and Control	Public Participation in Decision-Making Processes	Professional Autonomy	Safety and Reliability	Equity	Political Efficacy	Public Trust and Confidence
Centralize Hierarchical Relationships Within the Executive Branch	Theory discredited; evidence not supportive	Theory discredited; evidence not supportive	Unknown	Potentially increased for President	Potentially decreased	Potentially decreased	Unknown	Unknown	Popular with President; resisted by other actors	Unknown
Incorporate an Independent Organization into an Executive Branch Department	Unknown	Unknown	Unknown	Potentially increased for President	Potentially decreased	Potentially decreased	Unknown	Unknown	Resisted by committees and affected interest groups	Unknown
Create an Independent Agency or Commission	Unknown	Unknown	Unknown	Potentially decreased for President	Potentially increased	Potentially increased	Unknown	Unknown	Resisted by President	Unknown
Create a Government Corporation or Enterprise	Unknown	Relatively strong evidence in the case of "business-like" operations	Relatively strong evidence in the case of "business-like" operations	Depends upon the enabling legislation	Unknown	Potentially increased	Unknown	Unknown	Generally popular option	Unknown
Privatize Various Operational Components Through Contracting	Evidence mixed	Theory and evidence strong -- but requires competition and well-specified contracts	Theory and evidence strong -- but requires competition and well-specified contracts	Requires increased monitoring capacity in public organizations	Unknown	Unknown	May depend on oversight and monitoring capacity of public organizations	Unknown	Generally popular option	Unknown
Pursue Strategies Not Specifically Tied to Organizational Structure	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Generally elicits less resistance than structural strategies	Unknown

"Gems" of OTA policy analysis

Gems of OTA policy analysis, including effective or creative methods of presentation, have appeared in numerous OTA reports over the years. Some of the gems of policy analysis in the 18 reports reviewed by the OTA policy project team were discussed in chapter 5. This appendix includes a representative subset of several types of "gems" solicited from the entire OTA staff by the OTA policy project team. The examples selected for inclusion in this appendix typically illustrate or present information on one page in a report. These gems are by no means exhaustive of OTA's best work, but the project team believes they might serve as helpful models or sources of creative inspiration to OTA analysts.

The gems in this appendix are organized under five major categories:

- Category I: methods for summarizing key findings.
- Category II: tables and figures summarizing options.
- Category III: information that helps orient a reader to a report (e.g., text that describes the purpose, objectives, or context, etc., of the report).
- Category IV: methods for summarizing information about the types of questions OTA confronts in many of its assessments, (eg., stakeholder analysis, international analysis, and legal analysis).
- Category V: information about the methods used to conduct an OTA assessment.

Category I: Examples of methods for summarizing key findings

a. *Pharmaceutical R&D: Costs, Risks and Rewards*, Health Program, p. 1, February 1993.
b. *Nuclear Power in an Age of Uncertainty*, Energy and Materials Program, p. ix, February 1984.
c. *Complex Cleanup: The Environmental Legacy of Nuclear Weapons Production*, Oceans and Environment Program, p. 7, February 1991.

Category II: Examples of tables and figures summarizing options

a. *Adolescent Health, Volume I: Summary and Policy Options*, Health Program, p. I-47, April 1991.
b. *Critical Connections: Communication for the Future*, Telecommunication and Computing Technologies Program, p. 13, January 1990.
c. *Indian Health Care*, Health Program, p. 37, April 1986.
d. *Access to Space: The Future of U.S. Space Transportation Systems*, International Security and Commerce Program, p. ix, April 1990.
e. *Round Trip to Orbit: Human Space Flight Alternatives—Special Report*, International Security and Commerce Program, p. xi, August 1989.

Category III: Examples of information that helps orient a reader to a report (e.g., text that describes the purpose, objectives, or context, etc., of the report)

a. *Nuclear Power in an Age of Uncertainty*, Energy and Materials Program, p. 8, February 1984.
b. *Changing by Degrees: Steps To Reduce Greenhouse Gases*, Oceans and Environment Program, p. 4, February 1991.
c. *Technology and Handicapped People*, Health Program, p. 6, May 1982.
d. *Enhancing Agriculture in Africa: A Role for U.S. Development Assistance*, Food and Renewable Resources Program, p. 45, September 1988.

Category IV: Examples of methods for summarizing information about the types of questions OTA confronts in many of its assessments (e.g., stakeholder analysis, international analysis, and legal analysis)

a. *Nuclear Power in an Age of Uncertainty*, Energy and Materials Program, p. 7, February 1984.
b. *Rural America at the Crossroads: Networking for the Future*, Telecommunication and Computing Technologies Program, p. 22, April 1991.
c. *Changing by Degrees: Steps To Reduce Greenhouse Gases*, Oceans and Environment Program, p. 285, February 1991.
d. *Transportation of Hazardous Materials*, Science, Education, and Transportation Program, p. 8, July 1986.
e. *Enhancing the Quality of U.S. Grain for International Trade*, Food and Renewable Resources Program, p. 6, February 1989.
f. *Facing America's Trash: What Next for Municipal Solid Waste?*, Oceans and Environment Program, p. 8, October 1989.
g. *Federally Funded Research: Decisions for a Decade*, Science, Education, and Transportation Program, p. 261, May 1991.

Category V: Examples of information about the methods used to conduct an OTA assessment

a. *Indian Health Care*, Health Program, p. 352, April 1986.
b. *Grassroots Development: The African Development Foundation*, Food and Renewable Resources Program, pp. 23, 26, June 1988.

Category I: Examples of methods for summarizing key findings

Summary 1

In this assessment, the Office of Technology Assessment examined the costs of pharmaceutical research and development (R&D), the economic rewards from that investment, and the impact of public policies on both costs and returns. Below is a brief synopsis of the study's major conclusions:

SUMMARY OF FINDINGS

- Pharmaceutical R&D is a costly and risky business, but in recent years the financial rewards from R&D have more than offset its costs and risks.
- The average aftertax R&D cash outlay for each new drug that reached the market in the 1980s was about $65 million (in 1990 dollars). The R&D process took 12 years on average. The full aftertax cost of these outlays, compounded to their value on the day of market approval, was roughly $194 million (1990 dollars).
- The cost of bringing a new drug to market is very sensitive to changes in science and technology, shifts in the kinds of drugs under development and changes in the regulatory environment. All of these changes are occurring fast. Consequently, it is impossible to predict the cost of bringing a new drug to market today from estimated costs for drugs whose development began more than a decade ago.
- Each new drug introduced to the U.S. market between 1981 and 1983 returned, net of taxes, at least $36 million more to its investors than was needed to pay off the R&D investment. This surplus return amounts to about 4.3 percent of the price of each drug over its product life.

1

Source: *Pharmaceutical R&D: Costs, Risks and Rewards*, Health Program, p. 1, February 1993.

OVERVIEW AND FINDINGS

Without significant changes in the technology, management, and level of public acceptance, nuclear power in the United States is unlikely to be expanded in this century beyond the reactors already under construction. Currently, nuclear powerplants present too many financial risks as a result of uncertainties in electric demand growth, very high capital costs, operating problems, increasing regulatory requirements, and growing public opposition.

If all these risks were inherent to nuclear power, there would be little concern over its demise. However, enough utilities have built nuclear reactors within acceptable cost limits, and operated them safely and reliably to demonstrate that the difficulties with this technology are not insurmountable. Furthermore, there are national policy reasons why it could be highly desirable to have a nuclear option in the future if present problems can be overcome. Demand for electricity could grow to a level that would mandate the construction of many new powerplants. Uncertainties over the long-term environmental acceptability of coal and the adequacy of economical alternative energy sources are also great and underscore the potential importance of nuclear power.

Some of the problems that have plagued the present generation of reactors are due to the immaturity of the technology, and an underestimation by some utilities and their contractors of the difficulty of managing it. A major commitment was made to build large reactors before any had been completed. Many of these problems should not reoccur if new reactors are ordered. The changes that have been applied retroactively to existing reactors at great cost would be incorporated easily in new designs. Safety and reliability should be better. It is also likely that only those utilities that have adequately managed their nuclear projects would consider a new plant.

While important and essential, these improvements by themselves are probably not adequate to break the present impasse. Problems such as large cost overruns and subsequent rate increases, inadequate quality control, uneven reliability, operating mishaps, and accidents, have been numerous enough that the confidence of the public, investors, rate and safety regulators, and the utilities themselves is too low to be restored easily. Unless this trust is restored, nuclear power will not be a credible energy option for this country.

It appears possible, however, that additional improvements in technology and the way nuclear power is managed and regulated might be sufficient to restore the required confidence. Technological improvements, while insufficient by themselves, can nevertheless be very important in that effort. One approach would be to focus research and development (R&D) on improving current light water reactor (LWR) designs. The goal would be standardized designs representing an optimal balance of costs, safety, and operability. Private industry is unlikely to undertake all the R&D needed, so a Federal presence is probably necessary.

It is also possible, however, that even greatly improved LWRs will not be viewed by the public as acceptably safe. Therefore, R&D on alternative reactors could be essential in restoring the nuclear option if they have inherently safe characteristics rather than relying on active, engineered systems to protect against accidents. Several concepts appear promising, including the high temperature gas-cooled reactor (HTGR), the PIUS reactor, and heavy water reactors. Such R&D should also be directed toward design and developing smaller reactors such as the modular HTGR.

Improvements in areas outside the technology itself must start with the management of existing reactors. The Nuclear Regulatory Commission, as well as the Institute for Nuclear Power Operations, must ensure a commitment to excellence in construction and operation at the highest levels of nuclear utility management. Improved training programs, tightened procedures, and heightened awareness of opportunities for improved safety and reliability would follow. If some utilities still prove unable to improve sufficiently, consideration could be given to the suspension of operating licenses until their nuclear operations reflect the required competence, perhaps by employing other utilities or service companies. Similarly, certification of utilities or operating companies could be considered as a prerequisite for permits for new plants in order to guarantee that only qulaified companies would have responsibility. These are drastic steps, but they may be warranted because all nuclear reactors are hostage, in a sense, to the poorest performing units. Public acceptance, which is necessary if the nuclear option is to revive, depends in part on *all* reactors performing reliably and safely.

Source: *Nuclear Power in an Age of Uncertainty*, Energy and Materials Program, p. ix, February 1984.

Box A—Key Findings

- The waste and contamination problems at the DOE Weapons Complex are serious and complicated, and many public concerns about potential health and environmental impacts have not yet been addressed.
- DOE, other Federal agencies, and the States are trying to carry out their legally mandated cleanup responsibilities, but they presently lack the necessary personnel and infrastructure, and they have yet to develop an effective process for public involvement in setting priorities and making important decisions. Despite recent laudable efforts at changing the DOE culture, substantial credibility and public acceptance problems continue to hinder progress.
- The environmental program now underway at the Weapons Complex is in the very early stages, and little actual cleanup has been done. It may be impossible with current technology to remove contaminants from many groundwater plumes and deeply buried soils within reasonable bounds of time and cost. Many sites may never be returned to a condition suitable for unrestricted public access.
- Despite DOE statements about the lack of imminent off-site health threats due to the contamination, possible public health effects have not been investigated adequately. The current regulatory process is not sufficient to effectively identify urgent health-based remediation needs or to comprehensively evaluate possible public health impacts. Among the missing elements are a coherent strategy for evaluating potential off-site human exposure to radioactive and hazardous contaminants, a coordinated and scientifically sophisticated approach for evaluating potential health impacts from contamination, and an open process for public involvement in identifying risks and setting priorities for reducing risks.
- Because of the limitations of existing cleanup technologies it is prudent to invest in promising new developments; however, such efforts should not delay addressing situations in which containment and monitoring are warranted now. OTA finds that a technology development program will be most beneficial if it is focused on the most serious contamination problems identified by possible health risks.
- DOE's stated goal—to clean up all weapons sites within 30 years—is unfounded because it is not based on meaningful estimates of work to be done, the level of cleanup to be accomplished, or the availability of technologies to achieve certain cleanup levels. Neither DOE nor any other agency has been able to prepare reliable cost estimates for the total cleanup.
- DOE currently has large quantities of radioactive and hazardous waste in storage at all sites, often under marginal conditions. There will be an increasing need to store waste safely on-site for fairly long periods until disposal alternatives are available. Adequate and workable standards and criteria for improved storage and treatment on-site are urgently needed.

Source: *Complex Cleanup: The Environmental Legacy of Nuclear Weapons Production*, Oceans and Environment Program, p. 7, February 1991.

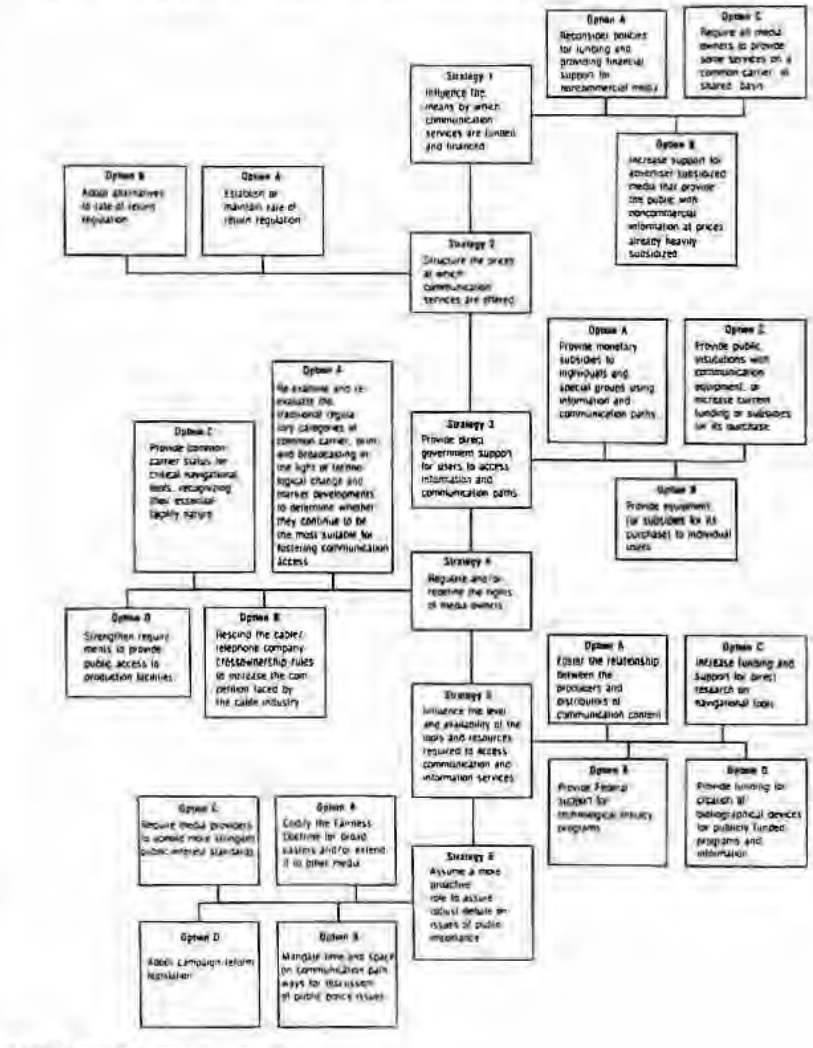
Table 5—Strategies for Major Option 1: Congress Could Take Steps To Improve Adolescents' Access to Appropriate Health and Related Services

Strategy	Access issue addressed					Time for expected impact	Rough estimate of (direct) cost to Federal Government
	Physical	Legal	Knowledge	Affordability	Approachability		
Strategy 1-1: Congress could support the development of centers that provide comprehensive and accessible health and related services specifically for adolescents in schools and/or communities.							
1-1a: Provide Federal seed money for the development of school-linked and other community-based centers that provide comprehensive health and related services for adolescents.	X	X	X	X	X	Immediate and long term	Could be high
1-1b: Provide Federal continuation funding for already established school-linked and community-based centers that provide comprehensive services for adolescents.	X	X	X	X	X	Immediate and long term	Could be high
1-1c: Reduce existing barriers to the delivery of comprehensive services in adolescent-specific centers.				X	X	Near term; study needed	Medium
Strategy 1-2: Congress could take steps to improve adolescents' financial access to health services.							
1-2a: Mandate an immediate expansion of Medicaid eligibility for adolescents.				X		Immediate	Depends on utilization
1-2b: Mandate that employers provide health insurance for their currently uninsured workers and those workers' dependents.				X		Immediate	None
1-2c: Directly fund or provide incentives to States for outreach to increase adolescents' use of Medicaid benefits.			X			Immediate	Medium
1-2d: Discourage or prevent private insurers from implementing current plans to limit coverage of adolescent dependents.				X		Immediate and long term	None
Strategy 1-3: Congress could take steps to improve adolescents' legal access to health services.							
1-3a: Encourage the U.S. executive branch or a nongovernmental entity to develop a model State statute to enhance adolescents' legal access to health services.		X				Medium term	Low
1-3b: Enact legislation that requires specific Federal or Federal/State programs to adopt particular substantive policies with respect to parental consent and notification.		X				Immediate	Low
1-3c: Enact legislation conditioning States' receipt of Federal funds for specific purposes on the States' having particular substantive policies on parental consent and notification.		X				Medium term	Low

Continued on next page

Source: *Adolescent Health, Volume I: Summary and Policy Options*, Health Program, p. I-47, April 1991

Figure 1-1—Congressional Strategies and Options To Address Access to Communication Opportunities



SOURCE: Office of Technology Assessment, 1990

Source: *Critical Connections: Communication for the Future*, Telecommunication and Computing Technologies Program, p. 13, January 1990.

Table 1-2.—Major Issues and Related Options

Eligibility and entitlement	Resource allocation and scope of services	Availability and adequacy of resources	Self-determination
Current situation: Persons of Indian descent, no blood quantum requirement. For services purchased by IHS from non-IHS providers, additional requirement that the individual must live on or near a federally recognized Indian reservation.	IHS does not provide the same health services in each of its service areas, and service area budgets are determined on a "historical" or "program continuity" basis. "Equity fund" of from $5 to $9 million per year (less than 2 percent of IHS's total clinical services budget) allocated on a needs-based formula to most-deficient service units; equity awards become part of future base budgets.	Minimal negotiations by IHS contract care programs with non-IHS providers on rates of payment.	Federal Government emphasizes its fiscal responsibilities for funds administered under 638 contracts. Indian tribes emphasize self-determination objectives and exceptions to Federal contracting rules. Major issue involves level of funding for tribes to provide the same level of services previously provided under IHS management, and to cover indirect costs such as liability insurance.
IHS proposed change: Eligible persons would have to be either members of federally recognized tribes and have at least one-quarter Indian blood, or other Indians of at least one-half Indian blood. In addition, eligible Indians must live on or near a federally recognized Indian reservation.	Equity fund approach would be applied to any future increases in appropriations.	Will initiate negotiations with IHS's contractors to accept payment at no more than the Medicare-allowable rate.	New tribal contractors would be provided indirect costs up to 14 percent; source of funds not yet determined.
OTA options: #1: IHS or Congress could develop a priority system for access to IHS services. #2: IHS or Congress could use blood quantum criteria to supplement rather than restrict eligibility criteria based on tribal membership. #3: If eligibility criteria are made more restrictive, Congress could make IHS services less a residual source of care and more an entitlement program.	#4: Continue with the modest, incremental approach to resource redistribution that IHS has implemented. #5: Accelerate the rate of reallocating funds among IHS service areas. #6: Work toward a common minimum services package for all IHS service areas.	#7: Negotiate payment rates with contract care providers instead of paying 100 percent of billed charges, and impose a rate structure on IHS contractors, such as use of Medicare DRG (diagnosis-related groups) rates. #8: Authorize IHS service units to carry over a percent of contract funds from one fiscal year to the next. #9: Provide greater IHS headquarters and area office support to service unit contract care programs in dealing with alternative resources, both public (especially State Medicaid programs) and private. #10: Explore the possibilities of developing long-term relationships with community facilities and of providing more services to non-Indians.	#11: Clarify the intent and purpose of the Self-Determination Act. #12: Develop a cost-accounting method that addresses the question of comparable funding when tribes take over services previously administered by IHS. #13: Revise the retrocession provision so that a year's notice, instead of the present 120 days, must be given before a tribe can return program management to IHS.

SOURCE: Office of Technology Assessment.

Source: *Indian Health Care*, Health Program, p. 37, April 1986.

Improving U.S. Space Transportation Systems

Whichever broad program goals are selected, if Congress wishes to continue to improve the safety, reliability, performance, and/or economy of U.S. launch systems, it has a number of possibilities from which to choose. Several are listed below; they are not mutually exclusive, nor is the list exhaustive. Congress could decide to proceed with one or more from each list of options. Because of the long lead times for the development of space transportation systems, some decisions will have to be made in the next year or two. Others can wait until the middle of this decade or later.

Near-Term Decisions

If Congress wishes to:	*Then it could:*
Improve cargo launch system reliability or performance:	• *Fund development of technologies in the Advanced Launch System and other programs.*
Improve Space Shuttle system safety, reliability:	• *Fund development of Liquid-fueled Rocket Boosters (LRBs).* • *Fund continued development and improvement of Advanced Solid Rocket Motors (ASRMs) and alternate turbopumps for the Space Shuttle Main Engines.* • *Fund installation of built-in test equipment in the Shuttle and more automated test equipment in launch facilities.*
Maintain a sustainable Shuttle launch rate of 9 to 11 launches per year:	• *Fund the purchase of at least one additional orbiter to be delivered as soon as possible (1996), and direct NASA to reduce the number of Shuttle flights planned per year. NASA could reduce Shuttle flights by:* *a. postponing or cancelling some planned Shuttle launches; or* *b. relying more on cargo-only launch vehicles, such as Titan IVs.*
Reduce risks to successful Space Station assembly:	• *Direct NASA to develop and use Shuttle-C to carry some Space Station elements to orbit. (This would reduce the total number of flights required.)*
Develop the technology base and plan for building new crew-carrying launch systems:	• *Continue to fund planning and technology development and test efforts such as:* *a. the Advanced Manned Launch System studies;* *b. the National Aero-Space Plane program (NASP); or* *c. the Advanced Launch System (ALS) program.*
Provide for emergency crew return from the Space Station:	• *Fund a program to develop a U.S. crew emergency return vehicle.* • *Support joint development with Space Station partners of vehicle for emergency return.*

Far-Term Decisions

If Congress wishes to:	*Then it could:*
Build safer, more reliable crew-carrying launch systems:	• *Fund development of safer, more reliable launch systems to augment or succeed the Shuttle. These might include:* *a. a Personnel Launch System (PLS), or* *b. an Advanced Manned Launch System (AMLS), or* *c. vehicles derived from the National Aero-Space Plane (NASP) program.*
Improve cargo launch system reliability and reduce costs:	• *Fund development of launch vehicles or systems (e.g., ALS engines) that could be manufactured, integrated, and launched by highly automated methods with improved process control.*
Increase operability:	• *Fund development of vehicles designed for quick turnaround, such as those considered for an Advanced Manned Launch System or possible successors to the proposed National Aero-Space Plane test vehicle (X-30).*

Source: *Access to Space: The Future of U.S. Space Transportation Systems*, International Security and Commerce Program, p. ix, April 1990.

Selected Options for Improving the Space Shuttle System

The following options were selected from a wide range of possible improvements to the Space Shuttle System. The effectiveness of each option represents OTA's considered judgement. However, each may be more or less effective depending upon other improvements chosen and the pace at which they are implemented.

Options	Objectives: Improve Shuttle safety and/or reliability	Increase Shuttle system performance (payload per flight)	Maintain capability to sustain Shuttle launch rate of 8-11 per year	Extend the life of the current orbiter fleet	Increase the probability of assembling Space Station on schedule	Provide for emergency crew return from space	Prepare for the development of future launch systems
Major investment							
1. Continue to develop the Advanced Solid Rocket Motors (ASRMs)	**	**			**		
2. Fund development of Liquid Rocket Boosters (LRBs)	***	***		*	*		***
3. Develop Shuttle-C				**	***		*
4. Fund purchase of one or more additional orbiters			***	*	***		
5. Fund development of capsule or glider for Space Station escape						***	*
6. Institute integrated long-term program to improve reliability, safety, and performance of Space Shuttle system	***	***		**	***		*
Supporting improvements							
1. Continue to improve the Redesigned Solid Rocket Motors (RSRMs)	*	*	*		*		
2. Incorporate built-in test equipment in existing launch vehicles and develop additional automated test equipment for launch facilities	*		**	*			***
3. Develop lighter weight External Tank (ET)		**					*
4. Develop lightweight structures for Shuttle orbiter		**					*
5. Modify orbiter for automatic flight capability	*	*				*	*
6. Fund technology development and test efforts	***	*		**	*		***
7. Shift all payloads not requiring crews from Shuttle to expendable launch vehicles to reduce Shuttle flight rate			**	**	**		

KEY: *** = Very effective
** = Moderately effective
* = Somewhat effective

Source: *Round Trip to Orbit: Human Space Flight Alternatives—Special Report*, International Security and Commerce Program, p. xi, August 1989.

Category III: Examples of information that helps orient a reader to a report, (e.g., text that describes the purpose, objectives, or context, etc., of the report)

THE PURPOSE OF THIS STUDY

This report responds to requests from the House Committee on Science and Technology and the Senate Committee on Energy and Natural Resources asking OTA to "assess how nuclear technology could evolve if the option is to be made more attractive to all the parties of concern" and to identify possible technical and institutional approaches for the Congress "that could contribute to the maintenance of this important industry." The report describes the major impediments to nuclear power relative to other types of generating capacity, identifies options that might be considered to remove those impediments in light of the problems and conflicts discussed above, and explores the consequences of not maintaining the nuclear option.

Changes could be made in the technology and in the institutions that manage it. If a reactor were to be developed that physically could not suffer a major accident or pose health and safety risks for the public, it might allay some of the concerns of the regulators, the intervenors, and the public. Such a reactor might not require the ever more stringent standards of quality required for current light water reactors (LWRs), thus reducing the economic risks. Improvements also could be considered in management of the construction, operation, and regulation of reactors. If all reactors were to match the experiences of the best managed plants, there would be much less concern over the future prospects for the nuclear option.

It is the intent of this study to explore these possibilities in the light of the different interests and different concerns discussed above. The report details the various difficulties facing the future of nuclear power and the measures that would be useful and practical in overcoming these difficulties if the Nation wishes nuclear power to once again be a well accepted, viable energy option. The technological options are restricted to converter reactors similar to those now available on the international market. These are the reactors that could be deployed in the United States by the end of the century. Breeder reactors are not included because their development program will not make them commercially available until sometime in the next century. The other elements of the fuel cycle—uranium resources and enrichment, reprocessing and waste disposal—are not included either. Waste has been considered in great detail in a recent OTA report. The other elements need not pose constraints to reactor orders, which is the key issue addressed in this report.

This assessment was carried out with the assistance of a large number of experts from all sides of the nuclear debate—utilities, nuclear critics,

Source: *Nuclear Power in an Age of Uncertainty*, Energy and Materials Program, p. 8, February 1984.

Box 1-A—The OTA Study in Context

The six congressional committees requesting this assessment asked OTA to focus on a very specific question: "Can the United States reduce carbon dioxide emissions in the near term?"

Changing by Degrees does not examine in depth many equally difficult questions such as the science of climate change, the uncertainties and state of atmospheric modeling, or the projected ecological effects of global warming. Rather, most of OTA's resources have been devoted to analyzing technical options to decrease CO_2, although methane, nitrous oxide, and chlorofluorocarbon (CFC) emissions are addressed wherever possible. At the time of their request, the congressional committees were well aware of ongoing international efforts to phase out CFCs and halons; since OTA's study began, successful negotiations have been completed.

To answer the question Congress posed, OTA focuses specifically on potential emissions reductions in the next 25 years. The analysis is structured around six key sectors of the U.S. economy: Buildings, Transportation, Manufacturing, Energy Supply, Forestry, and Food. To the extent possible, the report quantifies the potential for emissions reduction within each sector—areas where gains in efficiency, product substitution, conservation, or other technical options can ameliorate increases in CO_2 and other greenhouse gases. A selection of policy options that appear to offer the most promise for achieving these reductions in the United States is presented. OTA was charged to look abroad as well, so the special needs of Eastern Europe, the U.S.S.R., and developing countries—with respect to both energy and natural resource issues—are also addressed.

In our detailed analysis of potential emissions reductions for the United States, we consider an extensive suite of technical options. For example, we estimate the potential increments of CO_2 reduction from electric utility fuel switching, possible improvements in automobile efficiency, changes in commercial building construction, more efficient manufacturing processes, etc. Most of the options relate to decreasing emissions, although some, such as reforestation, involve recapturing gases already emitted to the atmosphere.

The assessment lays out three paths: a Base case ("business as usual"), a Moderate (essentially "no-cost") case, and a Tough case. Only the last fulfills the congressional request and reduces future CO_2 emissions—to a level in 2015 that is 20 to 35 percent lower than today. Some will argue that our estimates of emissions reductions are both politically unattainable and costly. Others will decry a 20- to 35-percent reduction as not being nearly enough; the Intergovernmental Panel on Climate Change and the U.S. Environmental Protection Agency recently estimated that the world must reduce CO_2 emissions by at least 50 to 80 percent to stabilize the atmosphere. Congress' request that we work within a 25-year timeframe in the study proved to be a two-edged analytic sword. It forced OTA to take a close look at where U.S. CO_2 emissions were heading without policy intervention. But, 25 years also is too short a period to include a scenario in which fossil fuels are supplanted with such nonfossil fuel sources as renewable and improved nuclear energy sources.

Indeed, the United States described 25 years hence in this report does not sound fundamentally different from what we know today. However, an underlying theme in OTA's report is that a strong R&D effort is pivotal to bringing non-CO_2 (i.e., nonfossil fuel) sources to commercialization as quickly as possible, even as all sectors of the economy move to use more efficient equipment and decrease energy consumption. If long-term R&D is geared to that purpose, then new nonfossil supply technologies can start to replace existing powerplants and equipment early in the next century.

Many of the technical options evaluated here are worth pursuing for other reasons in addition to climate change, because they address other important U.S. goals such as energy security, local environmental quality, and economic competitiveness. They can reduce emissions in the short-term, reduce total energy demand, and serve to bridge the U.S. economy from a fossil-fuel age to a nonfossil future.

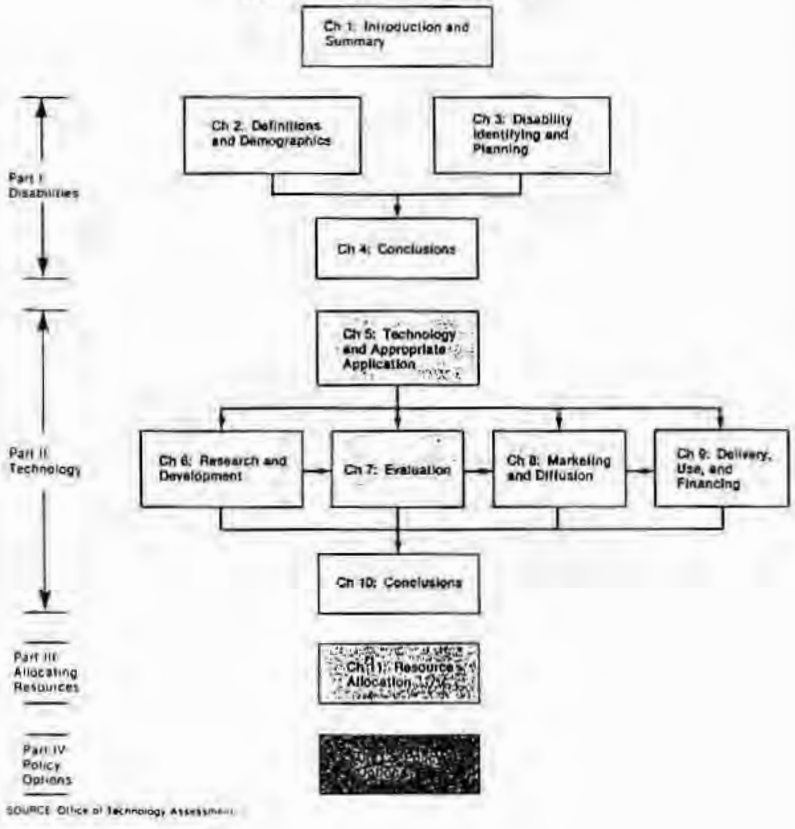
Source: *Changing by Degrees, Steps To Reduce Greenhouse Gases*, Oceans and Environment Program, p. 4, February 1991.

terial on resource allocation, of course, may have to be viewed in the context of a different set of decisionmakers, but the generic issues would remain essentially the same.

ORGANIZATION OF THE REPORT

The rest of this chapter presents a summary of the report and briefly lists the policy options. The body of the report is then organized into four parts. The relationship of the parts and the individual chapters to one another is shown in figure 1.

Figure 1.—Organization of the Report



SOURCE: Office of Technology Assessment

Source: *Technology and Handicapped People*, Health Program, p. 6, May 1982.

Chapter 3
The Status of Low-Resource Agriculture

HIGHLIGHTS

- Low-resource agriculture is practiced by a diverse group of African farmers, herders, and fishers, is based primarily on the use of local resources, but may make modest use of external inputs, including information and technology.
- Low-resource agriculture predominates throughout Sub-Saharan Africa. It produces the majority of the region's food, involves and provides income for the majority of people, helps buffer against famine, and contributes to national economies by producing agricultural products for domestic use and export.
- Low-resource agriculture is no longer able to meet the needs of Africa's growing population. Declines in per capita food production and agricultural income, widespread malnutrition, and natural resource degradation are signs of its decreasing capability and reasons for concern about the future.
- Increasing numbers of Africans will depend on low-resource agriculture for food and livelihood in the coming decades. Thus, it is increasingly important to improve low-resource agricultural systems so they are better able to help meet Africa's food security and agricultural development needs.

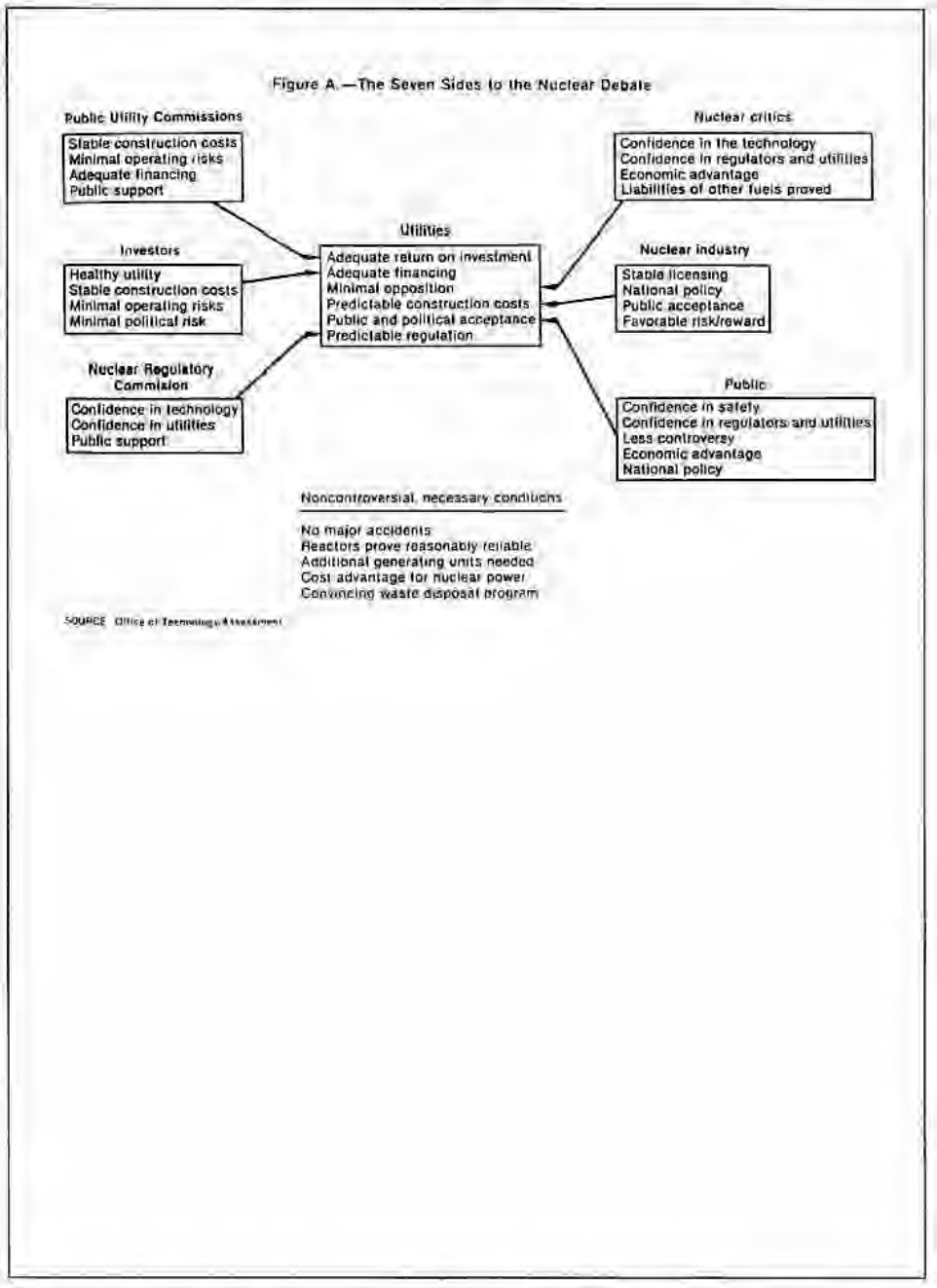
AFRICAN AGRICULTURE: RESOURCEFUL WITH FEW RESOURCES

Africa's hallmark is its diversity. Its vast cultural diversity is manifest in nearly 800 distinct ethnic groups, which account for about one-third of the world's languages (23). The 45 countries of Sub-Saharan Africa show a wide array of political and economic systems, including numerous systems of tribal and modern law. The region also has wide ecological diversity—ranging from desert to savannah to rainforest—and broad soil and climate variations that can change over short distances. This diversity is mirrored in the nature of African agriculture. Having evolved under these differing biophysical and cultural influences, African agriculture encompasses a complex array of crop and livestock production systems.

Clearly, then, it is risky to generalize about African agriculture. There is no such thing as a "typical" African farm. Some common elements, however, can be identified. One consistent aspect of African agriculture is its prominent position in African economies (table 3-1). Agriculture employs about three-quarters of Sub-Saharan Africa's labor force and accounts for about one-third the region's gross domestic product. Also, about one-half of the countries in the region derive at least 40 percent of their export earnings from agricultural products. Further, despite major increases of food imports, particularly grains and dairy products, the region still produces most of its own food—at least 80 percent of its cereals, 95 percent of

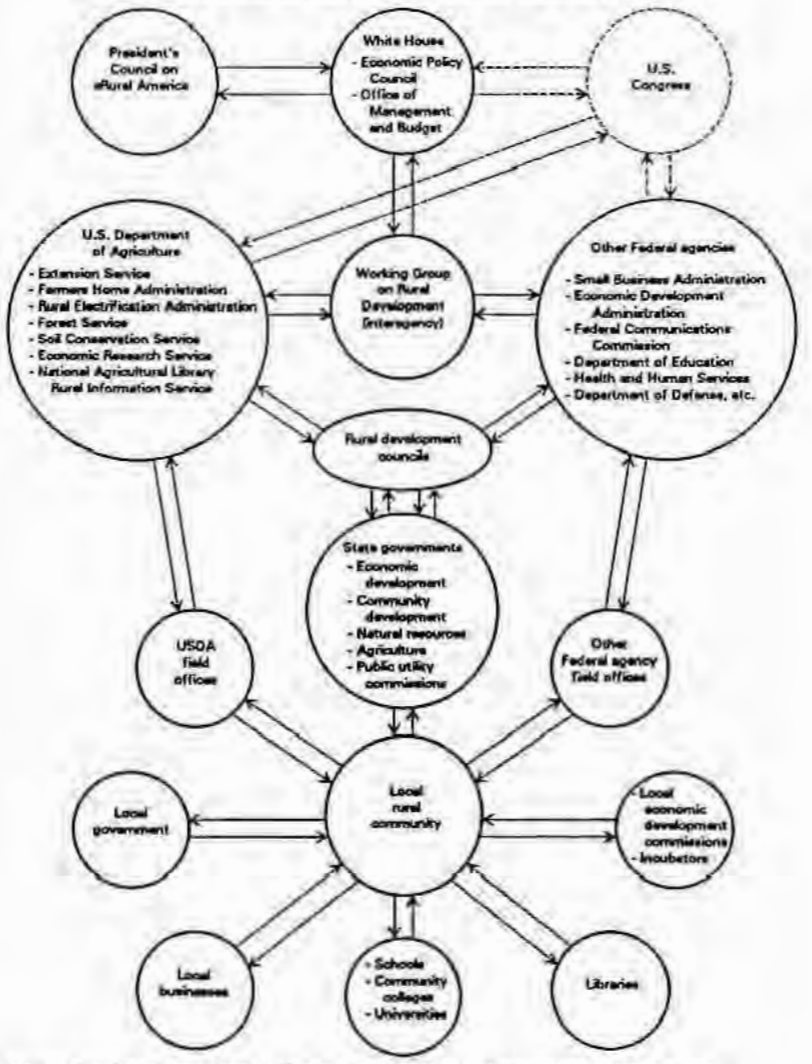
Source: *Enhancing Agriculture in Africa: A Role for U.S. Development Assistance*, Food and Renewable Resources Program, p. 45, September 1988.

Category IV: Examples of methods for summarizing information about the types of questions OTA confronts in many of its assessments, (e.g., stakeholder analysis, international analysis, and legal analysis)



Source: *Nuclear Power in an Age of Uncertainty*, Energy and Materials Program, p. 7, February 1984.

Figure 1-6—Organizational Chart of Agencies Involved With Rural Development



The key players involved in rural development at the Federal, State, and local level, and how they relate to each other.
SOURCE: Office of Technology Assessment, 1991.

Source: *Rural America at the Crossroads: Networking for the Future*, Telecommunication and Computing Technologies Program, p. 22, April 1991.

Box 9-C—U.S. Trade in Renewable and Efficient Energy Technologies

Various programs to help U.S. businesses overcome obstacles in exporting efficient and renewable energy technologies to non-OECD countries have been established by the U.S. Government, independent government agencies, and the private sector.

Agency for International Development (A.I.D.) Programs—A.I.D. promotes energy-related technology development and transfer by supporting prefeasibility funding studies and by leveraging private, multilateral, and other bilateral resources for projects. Some of the leveraging is accomplished through the MDBs, using the Multi-Agency Group on Power Sector Innovation (MAGPI). The agency sponsors reverse trade missions and an energy and environmental training program for host country nationals. A.I.D. has established a Private Enterprise Fund for Eastern Europe to assist the export of U.S. technologies, including energy-related ones. It also is collaborating with India on a 6-year Program for the Acceleration of Commercial Energy Research (PACER) that promotes the commercialization of indigenous energy technologies and improvement of transmission and distribution planning and technologies; PACER has helped establish consortia that link the industrial, commercial, R&D, and government sectors.

Department of Energy and CORECT—The Committee on Renewable Energy Commerce and Trade (CORECT) is a multiagency committee led by the Department of Energy and involving 12 other Federal agencies. Established in 1984, it promotes trade of U.S. renewable energy technologies (and is expanding its efforts to energy efficiency), brings government and business personnel from other countries to the United States for trade conferences and missions, provides technical assistance, and funds the Renewable Energy Design Assistance Center (REDAC) at Sandia National Laboratories to provide technical assessments, prefeasibility and feasibility studies, financing, and other forms of project support.

Export-Import Bank (Eximbank)—Eximbank is an independent U.S. Government agency, chartered under the Export-Import Bank Act of 1945, that helps finance and facilitate the sale of U.S. goods and services to foreign buyers, particularly in developing countries (95,123). Its main programs are direct loans, guarantees, and insurance. The 1990 Foreign Operations Appropriations Act (Public Law 101-167) directed Eximbank to direct not less than 5 percent of its financial assistance in the energy sector to renewable energy projects. In FY 1990, Eximbank provided support for over $6 billion in exports. In the energy sector, it provided final commitments to support $2.1 million, and had pending final commitments for an additional $11.8 million, in renewable energy projects (i.e., hydroelectric, photovoltaics). Assuming pending commitments are finalized, Eximbank's fiscal year 1990 support for renewable energy projects would represent 7.4 percent of its total energy sector support (21).

Overseas Private Investment Corp. (OPIC)—The Overseas Private Investment Corp. (OPIC) is an independent corporation created by Congress. It directly finances projects sponsored by U.S. private investors in over 100 developing countries and provides insurance against political risks for U.S. private investments in those countries. It can provide direct loans of up to $6 million to small- and medium-sized firms and investment guarantees for up to $50 million. In fiscal year 1989, OPIC provided project insurance totaling over $1.5 billion and direct loans and loan guarantees totaling $208 million (59). OPIC is developing a privately owned and managed Environmental Investment Fund for business enterprises in developing countries and Eastern Europe that involve renewable energy, ecotourism, sustainable agriculture, forest management, and pollution prevention (59,60,61). OPIC hopes to capitalize the fund with $60 million of equity raised from U.S. businesses and institutional investors and $40 million in OPIC-guaranteed long-term debt.

Private Export Funding Corporation—The Private Export Funding Corp. (PEFCO) is a government-sponsored commercial corporation that raises funds for export financing in the private market, using unconditional Eximbank guarantees.

U.S. Trade and Development Program—The U.S. Trade and Development Program (TDP), in the U.S. International Development Cooperation Agency, funds feasibility studies, consultancies, training programs, and other planning services for projects involving export markets for U.S. goods and services. Its focus is primarily on large public sector projects (43,93).

continued on next page

Source: *Changing by Degrees: Steps To Reduce Greenhouse Gases*, Oceans and Environment Program, p. 285, February 1991.

Table 1-2.—Federal Activities in Hazardous Materials Transportation

	Regulation of:									
	Hazardous materials[1]	Containers	Vehicles and vessels	Operators	Planning	Recordkeeping	Inspection	Enforcement	Training	Emergency response
DOT:										
RSPA	X	X			X	X	X	X	X	
FHWA		X[a]	X[b]	X	X	X	X	X	X	
FRA		X[a]	X		X	X	X	X	X	
FAA		X[a]	X		X	X	X	X	X	
USCG	X	X[a]	X	X	X	X	X	X	X	X
FEMA					X				X	X
EPA	X				X	X	X	X	X	X[c]
NRC	X	X			X	X	X	X	X	X[d]
DOE	X[e]	X		X	X	X	X	X	X	X[d]
DOD	X[e]			X	X	X	X	X	X	X

KEY: DOT—Department of Transportation; RSPA—Research and Special Programs Administration; FHWA—Federal Highway Administration; FRA—Federal Railroad Administration; FAA—Federal Aviation Administration; USCG—United States Coast Guard; FEMA—Federal Emergency Management Agency; EPA—Environmental Protection Agency; NRC—Nuclear Regulatory Commission; DOE—Department of Energy; DOD—Department of Defense.

[1]This category includes hazardous substances, hazardous wastes and radioactive materials, and the tools for communication of those hazards such as shipping papers, placarding, and marking.
[a]Package/container design.
[b]In addition, National Highway Transportation Safety Administration issues requirements for new vehicles.
[c]EPA responds to accidents involving the release of products regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and oil spills in coastal and ocean water.
[d]Depends on the type of radioactive material, severity of the accident, and the adequacy of State and local response programs.
[e]In cases of national security, DOD and DOE are not required to comply with DOT regulations provided they follow standards affording equal protection.

SOURCE: Office of Technology Assessment.

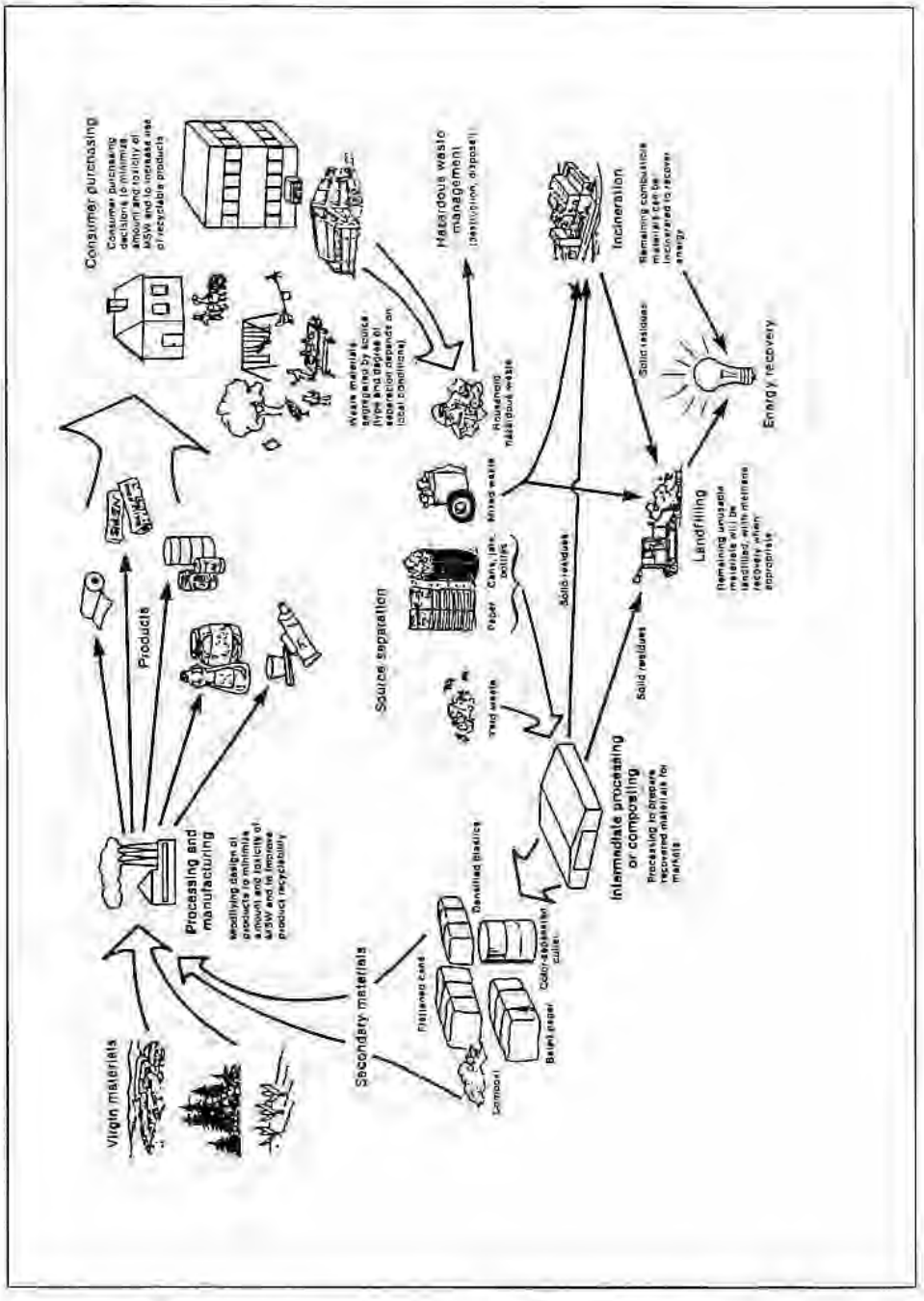
Source: *Transportation of Hazardous Materials*, Science, Education, and Transportation Program, p. 8, July 1986.

Table 1-1.—Comparison of Institutions and Policies Affecting Grain Quality of Major Grain-Exporting Countries

Activity/Policy	United States	Argentina	Brazil	France	Canada	Australia
Seed variety control	No State or Federal control. Release of varieties influenced to some extent by land-grant universities. Largely the market determines adoption of varieties.	Committee of government and industry must approve agronomic properties. Quality factors of minor influence.	Committee with broad representation directs research and approves varieties. Quality is potential criterion but not currently effective.	Formal mechanism exists that regulates release of varieties based on agronomic and quality criteria.	Formal mechanism used to license new varieties. Agronomic and quality criteria given equal weight in testing new varieties.	Formal mechanism followed as a prerequisite for release of varieties. Quality and agronomic criteria are used.
Grain receival standards	None. All types of quality are accepted with appropriate discounts for low-quality grain.	Grain not meeting a specified minimum quality (Condition Camara) is rejected at first point of sale.	Soybeans not meeting a minimum quality are rejected at first point of sale.	Grain not meeting export contract specifications can be rejected by surveying company or receiving elevator.	Developed eight grades for CWRS to differentiate quality. Lowest grade goes to feed market.	Wheat must meet minimum quality standards. If not it is allocated to feed market.
Marketing by variety	No mechanism exists for variety identification.	Variety is not identified in marketing channel.	Variety is not identified in marketing channel.	Very common. Variety often specified in wheat contracts.	Licensed grain must be visually distinguishable.	Very common-use variety control scheme to facilitate segregation by classes.
Price	Loan rate is principal price policy. Includes premiums and discounts for major grains but has not been responsive to market conditions.	Government establishes minimum prices for farmers and exporters. Government also establishes premiums for high-quality grain.	Government establishes a minimum price prior to planting. It is adjusted during the crop year to account for inflation and political pressure.	Key policy is European Community intervention price, which includes premiums and discounts for quality factors. Lower qualities of wheat equated to feed values.	Initial producer price is the principal price policy. Separate prices established for each grade of grain. Lower qualities of wheat equated to feed values.	Guaranteed minimum price (GMP) is key price policy. It is established by class and provides differentials for quality. Lower qualities of wheat equated to feed values.
Farm Storage	Farm policy in past decade has encouraged extensive on-farm storage and inter-year storage.	Government policy through pricing does not encourage on-farm or inter-year storage.	No incentive for farmers to store on farm.	Farm policy through the Common Agricultural Policy (CAP) has not encouraged development of extensive on-farm storage. Also relatively limited inter-year storage due to CAP.	Producer deliveries are regulated to primary elevators via quotas. On-farm storage is substantial.	Use of GMP provides no incentive for delivery in post-harvest period, leading to minimal use of on-farm storage.

SOURCE: Office of Technology Assessment, 1989

Source: *Enhancing the Quality of U.S. Grain for International Trade*, Food and Renewable Resources Program, p. 6, September 1989.



Source: *Facing America's Trash: What Next for Municipal Solid Waste?*, Oceans and Environment Program, p. 8, October 1989.

APPENDIX A

Major Legislation Enacted Since 1975 Affecting U.S. Research and Development

Number and date	Title	Important aspects
Public Law 94-282 May 11, 1976	National Science and Technology Policy and Organization Act	Called for the development of a national science and technology policy, and a national science and technology base. Created the Office of Science and Technology Policy (OSTP) in the Executive Office of the President (EOP) in order to advise the President on science and technology, including budget issues, and to assess the Federal effort in science and technology.
Public Law 95-91 Aug. 4, 1977	Department of Energy Organization Act	Created the Department of Energy, transferring all the duties of the Energy Research and Development Administration to the Department of Energy.
Public Law 95-367 Sept. 17, 1978	National Climate Program Act	Designed to coordinate climate research among the various research agencies, this act called for a heightened effort in climate research and defined the roles of the different agencies who do the research.
Public Law 96-479 Oct. 21, 1980	Materials Policy Research and Development Act of 1980	Required the President to formulate a national materials policy and submit a plan to Congress, addressing coordination in the executive branch and assessment of the economic, industrial, and national security needs regarding materials policy.
Public Law 96-480 Oct. 21, 1980	Stevenson-Wydler Technology Innovation Act of 1979	Created to promote technological innovation, this act established an Office of Industrial Technology in the Department of Commerce, and it mandated technology transfer from the Federal laboratories to the private sector.
Public Law 97-34 Aug. 13, 1981	Economic Recovery Tax Act of 1981	Established various tax breaks for research and development (R&D) expenditures, including a deduction for charitable contributions of R&D equipment to universities.
Public Law 97-219 July 22, 1982	Small Business Innovation Research Act	Aimed at strengthening the role of small firms in the performance of federally funded R&D, this act required all agencies with large extramural R&D budgets to set aside 5 percent of their budget (over 4 years) for the Small Business Innovation Research (SBIR) program.
Public Law 98-373 June 31, 1984	National Materials and Minerals Policy, Research and Development Act	Created the National Critical Materials Council in EOP to coordinate Federal materials R&D programs.
Public Law 98-462 Oct. 11, 1984	National Cooperative Research Act of 1984	In order to stimulate industrial R&D, this act promotes more joint ventures on research projects as it limits the effect of the antitrust laws in such cases. It also reimburses companies for legal costs associated with frivolous antitrust suits brought against them.
Public Law 99-502 Oct. 20, 1986	Federal Technology Transfer Act of 1986	Amended the Stevenson-Wydler Act to allow government-operated Federal laboratories to enter into cooperative R&D agreements, and established the Federal Laboratories Consortium for Technology Transfer.
Public Law 100-418 Aug. 23, 1988	Omnibus Trade and Competitiveness Act	Included the Training Technology Transfer Act and the Technology Competitiveness Act, as well as measures to support semiconductor R&D and to protect intellectual property rights.
Public Law 100-697 Nov. 19, 1988	Superconductivity and Competitiveness Act	Mandated a 5-year National Action Plan on Superconductivity R&D by OSTP, as well as an annual report updating Congress on the implementation of the plan.
Public Law 101-189 Nov. 29, 1989	National Competitiveness Technology Transfer Act of 1989	Part of a Department of Defense authorization bill, this act amended the Stevenson-Wydler Act to allow government-owned, contractor-operated laboratories to enter into cooperative R&D agreements.

-261-

Source: *Federally Funded Research: Decisions for a Decade*, Science, Education, and Transportation Program, p. 261, May 1991.

Category V: Examples of information about the methods used to conduct an OTA assessment

Appendix E

Method of the Study

The purpose of this assessment of Indian health care was to evaluate: 1) the health status of American Indians and Alaska Natives who are provided health care through the Federal Indian Health Service (IHS), 2) the health services provided to them in view of their health needs, and 3) the health delivery systems in which these services are provided. Also identified as a more specific issue to be evaluated was the growing problem of paying for high-cost care that cannot be provided in IHS facilities and that must be purchased from non-IHS providers. (Letters from Congress requesting and supporting the assessment follow this narrative.)

The assessment began on October 1984. Project activities included: selection of an advisory panel; two advisory panel meetings and other extensive reviews; four regional meetings with tribal representatives; site visits to Indian reservations and IHS service units; meetings and consultations with IHS personnel; analysis of Indian social and economic characteristics, health services, and health status; and responding to a special request in addition to the overall assessment.

The advisory panel for this assessment of Indian health care consisted of 19 members from Indian tribal governments and private and tribal health programs for Indians, policy analysts of Indian issues, and representatives of State governments, public health, medical economics, public policy/health care administration, sociology, and law. Rashi Fein, professor of the economics of medicine at Harvard Medical School, chaired the panel.

The first panel meeting was held on January 29-30, 1985. OTA project staff identified the sources of available information and presented a preliminary analysis of these sources to the panel. The panel discussed the overall study plan and provided advice on the focus of the study. Information for this assessment was obtained primarily from unpublished documents (more so than for usual OTA assessments), interviews, regional meetings, and site visits.

OTA project staff was also assisted by several contractors in preparing this assessment. In May-July 1985, four regional meetings were held by OTA in conjunction with the National Indian Health Board (NIHB), an organization that represents the tribes on health issues. The meetings were publicized in NIHB's newsletter, and a common agenda was used at the four meetings, which were held in Portland, Oregon; Phoenix, Arizona; Rapid City, South Dakota; and Tulsa, Oklahoma (the meeting agenda is described below). Several advisory panel members participated in meetings in their localities. The objectives of these meetings were to provide tribes and OTA staff with the opportunity to communicate directly with each other, and to confirm or correct the area-specific health status, socioeconomic, and health services information OTA had sent in advance of these meetings. In conjunction with the regional meetings, OTA project staff visited many reservations to gain a sense of the diversity and special concerns of the tribes.

Projections of the future Indian population were developed under OTA guidance by Henry Cole and S. Ken Yamashita of the Futures Group; computer analysis of data sources on Indian health status was provided by Steven Bjorge of Washington, D.C.; and Paul Alexander of the law firm of Alexander & Karshmer provided a legal analysis of the Federal-Indian relationship. (The method used in the Indian health status data analysis is described below.)

The advisory panel met again on October 28-29, 1985, to review a draft of the final report. Based on that meeting, the summary chapter was rewritten and again submitted to the panel for their review. The draft final report was sent for review to nearly 200 organizations and individuals. The OTA project director also attended the annual meeting of the National Indian Health Board in Albuquerque, New Mexico, in November 11-14, 1985, at which time the draft report was discussed in an open forum, with several advisory panel members participating in the discussion. The final report was submitted to OTA's Technology Assessment Board on January 17, 1986.

During the course of this assessment, the House and Senate Appropriations Subcommittees for the Department of the Interior and related agencies requested that OTA conduct an analysis of the number of beds and whether a surgical suite should be included in the replacement hospital planned for the Rosebud Sioux in South Dakota. The request was made in June 1985 because of a dispute between the Rosebud tribe and the Public Health Service on the size and services of the replacement hospital. The analysis was completed and delivered on August 1, 1985, in the form of an OTA staff memorandum. OTA's conclusions were that, using PHS's own criteria, a 30- to 35-bed instead of a 25-bed hospital was warranted, but that a surgical suite was not.

352

Source: *Indian Health Care*, Health Program, p. 352, April 1986.

Chapter 2

OTA's Assessment Methods[1]

SUMMARY

- OTA undertook this assessment at the request of the House Foreign Affairs Committee and the House Select Committee on Hunger, with specific instructions to examine people's participation in projects funded by the African Development Foundation (ADF) and the projects' results, sustainability, and replicability. The committees also requested an assessment of the Foundation's overall performance and how it could be improved.
- The methods used to assess ADF activities included extensive interviews with development experts in Washington and Africa, including ADF staff; reviews of Foundation documents in Washington, D.C. related to participation, agricultural technology, and renewable resource management in ADF-funded projects; and workshops for OTA staff and contractors.
- Three five-member teams visited East, West, and Southern Africa for 23 days in 1987, observing 12 ADF-funded projects in 6 countries. Each group spoke with project participants, Foundation staff, local and national officials, U.S. ambassadors, AID mission directors, and representatives of other development and research organizations. The teams assessed ADF-funded projects, reviewed the Foundation's programs in each country, and suggested congressional options and ways for ADF to improve its work.

[1]This chapter and app. D provide detailed information for readers with an interest in evaluation methods. In addition, apps. C, E, and F list many of this assessment's participants. The results of the assessment begin in the next chapter.

WHY THIS ASSESSMENT WAS REQUESTED

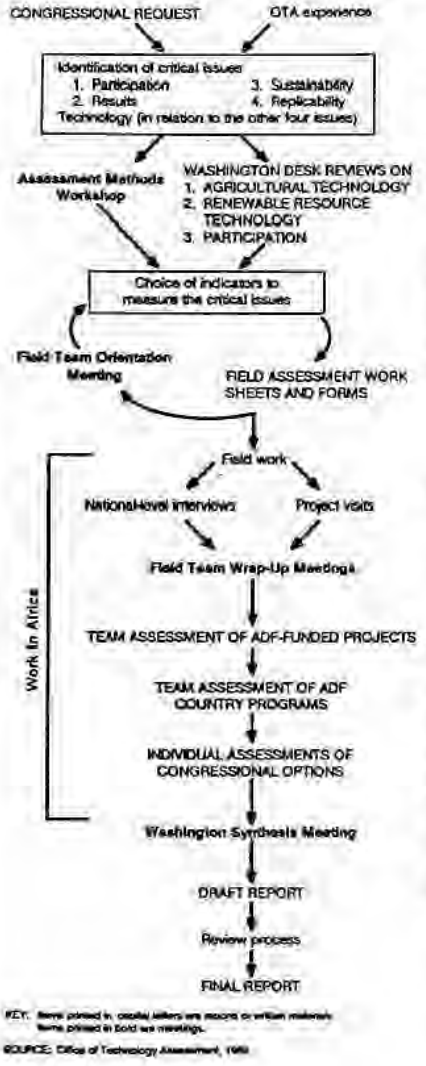
When the African Development Foundation (ADF) was founded, Congress intended that its grassroots approach complement other types of aid already provided to Africa by the United States. Now Congress is evaluating how well U.S. development assistance to Africa is doing and ADF, as one U.S.-funded development program, has come under scrutiny. This is part of Congress' continuing attempt to ensure that the United States provides the most effective assistance possible via the Agency for International Development (AID), the Peace Corps, multilateral institutions, private voluntary organizations, and other groups that receive U.S. funds directly or indirectly. Although the focus here is on ADF's program, this study has broader applicability. For example, the Foundation's enabling legislation stresses the need for Africans to participate in their own development and ADF's experience with participatory development is relevant to the pending reauthorization of the Foreign Assistance Act of 1961.

The House Foreign Affairs Committee and the House Select Committee on Hunger requested this comprehensive assessment of ADF's funding program.[1] Their request noted the context in which U.S. aid to Africa takes place: "Strong humanitarian, political, and economic reasons exist for the U.S. to continue to participate in assisting African countries in their efforts to develop their human and physical resources." As the requesting committees

[1]Representatives Dante Fascell, Chairman of the House Foreign Affairs Committee, and Howard Wolpe, Chairman of its Subcommittee on Africa, and Mickey Leland, Chairman of the House Select Committee on Hunger, requested the study. Senator Paul Simon, Chairman of the Subcommittee on African Affairs of the Senate Foreign Relations Committee, supported their request.

Source: *Grassroots Development: The African Development Foundation*, Food and Renewable Resources Program, p. 23, June 1988.

Figure 2-1.—Flow Chart of OTA's Assessment Methods



KEY: Items printed in capital letters are reports or written materials. Items printed in bold are meetings.

SOURCE: Office of Technology Assessment, 1988

this, OTA tabulated project information, including grant size, duration, maturity, geographic scope, activities, goods or services funded by the ADF grant, and intended outcomes. This analysis provided information on the range of project characteristics and average features so the countries and projects selected for visits would be representative of ADF's portfolio. The survey was limited to the 86 projects funded by ADF through September 31, 1986. Two-thirds of these, or 58, dealt substantively with agriculture or renewable resources and were considered within OTA's scope of work.

This assessment of funded projects must be qualified by the newness of ADF's program. Its first projects are just now nearing completion. Thus, OTA's major focus is on suggesting how ADF's overall funding program can be improved, not on providing a definitive statement judging the results of ADF projects.

Developing Field Team Methods

To develop methods for the field teams' use, OTA held a workshop with two purposes:

1. to review current field evaluation methods, and
2. to develop indicators to address the critical issues identified in Congress' request for this study.

The field research method used is a form of "rapid rural appraisal." In rapid appraisal, teams visit the field for a short time to obtain selected information needed for policymakers. This approach is quicker and more cost effective than some other research methods. It relies on individual and group interviews, observation, and local documentation where available (12,21).

In the methods workshop, OTA staff, team leaders, and three consultants with extensive evaluation experience (app. C) spent 2 days:

- defining the critical issues—participation, results, replicability, and sustainability;
- converting these definitions into concrete indicators that could be observed and measured in the field; and
- designing worksheets on which to collect data for each of these issues.

Source: *Grassroots Development: The African Development Foundation,* Food and Renewable Resources Program, p. 26, June 1988.

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