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9. ABSTRACT

A description of the purpose of AID state-of-the art analyses, how they should be conducted, and the elements they should contain. The state-of-the-art analysis (SOTA) guidelines developed by AID for use by AID grantees and contractors employ a new programming and analytical approach that seeks: (1) to develop guides as to what should and what should not be "delivered" to the targeted farmer in developing countries; (2) provides guidance for testing the application of known principles and practices; and (3) identifies critical knowledge gaps requiring investigation. Obviously, there is more than one way to perform a SOTA review and/or prepare a SOTA statement. The approach will vary with (a) the complexity and nature of the problem or subject; (b) the intended use of the results; (c) the money, time, and expertise available; (d) the availability of appropriate data; and (3) most important, the comprehension, ingenuity, and innovativeness of the people involved. The intent here is to explain the concept and suggest a general approach which is subject to adaptation and modification. In brief, the logic which should be applied to assure a useful SOTA paper involves six steps: (1) Define the problem and its components; (2) For each component, determine state-of-the-science, useful principles, and critical variables; (3) Develop statement of knowledge gap; (4) Specify steps to complete inventory; (5) Evaluate critical variables and recommend practices, training needs, and research priorities; (6) Prepare outputs: publications, seminars, new proposals for R&D. The guidelines include specific steps or details for those six parts of the process.

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**GUIDELINES ON A METHODOLOGY
FOR PREPARING STATE-OF-THE-ART ANALYSES,
DOCUMENTS, AND HANDBOOKS FOR WORLD FOOD PROBLEMS**

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Agency for International Development

HELPING THE SMALL and/or MARGINAL FARMER IN LDCs

State-of-the-Art Analyses

Critical Question

In attacking the world food problem and ameliorating the plight of the rural and urban poor, what current knowledge—used in both high and low technology agriculture—is or can be meaningful for the small, subsistence, family farmer in developing countries?

The AID Approach

Like many other bilateral and multilateral development agencies, the United States Agency for International Development is giving serious attention to the above question and its implications. Recognizing that: (1) an organized knowledge base, focusing on existing practices and their modification into a technological package appropriate to the needs and constraints of the majority of farmers in most developing countries simply does not exist in many, if not most, cases; and (2) the principles and practices developed in temperate climates are not usually applicable to the tropics where most of the poorest developing countries are located and the potential for increased production is greatest—AID has developed a new instrument which it calls state-of-the-art analysis (SOTA). This instrument is the focus of a new programming and analytical approach which seeks: (1) to develop guides as to what should *and* should not be “delivered” to the targeted farmer; (2) provides guidance for testing the application of known principles and practices; and (3) identifies critical knowledge gaps requiring investigation. The guidelines for preparing SOTA analyses and the expected products are attached for your information.

Why Our Approach Should Interest You

While the attached guidelines on an appropriate methodology for SOTA work are designed primarily for use by AID grantees and contractors, (i.e., principally U.S. Land-Grant institutions who are interested in the food problems of developing countries), they require a cooperative relationship among themselves and with scientists from developing countries, other developed countries with tropical

interests and experience, and international and regional agricultural research centers, in a problem-oriented effort of *mutual benefit*. For this reason, the results of SOTA work are intended to be of multi-use, in both developed and developing countries, by governments, institutions, scientists, scholars, extension agents, etc., in improving the quantity and quality of food production in the developing world. They should also be of interest to other bilateral, multilateral and private donor organizations, particularly for pre-investment analysis regarding research projects, production loans, etc.

Some Current Examples

During the calendar year 1975, SOTA work has been initiated on several problems and/or opportunities in the sub-sector of water management. These include: (1) water harvesting methods, (2) irrigation methods, and (3) low energy/low cost pumping plants. Work is also in progress on several important problems in aquaculture including: (1) institutional constraints to small scale fisheries, (2) marketing systems as an impediment to fisheries development, (3) minimum-input aquaculture, and (4) knowledge transfer methodology for small scale fisheries. A major effort is also underway on soil erosion.

During 1976, work is expected to begin on tropical soil liming practices, phosphorus fixation in tropical soils, land use planning, low cost processing of soybeans for food, and others.

Participation and Inquiries Invited

Universities, research institutions, individual scientists and engineers—from both developing and developed countries—as well as potential donors, who are interested in participation in a specific study, the exchange of information, suggesting priority problems for analysis, improving the methodology, assisting in the dissemination of results, or wish additional copies of the guidelines, should write to:

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**GUIDELINES ON A METHODOLOGY
FOR PREPARING STATE-OF-THE-ART ANALYSES,
DOCUMENTS, AND HANDBOOKS ON WORLD FOOD PROBLEMS**

I. Problem

AID and the U.S. Land-Grant institutions have long been engaged in a partnership to assist developing countries in increasing agricultural production. In recent years, the trend has shifted from a concentration on institution-building and the education and training of developing country nationals to a more problem-oriented focus, accelerated by the recent evidence of a "world food crisis" and Congressional mandates.

Increasing concern with the small farmer, the quality of life for the rural and urban poor, and such factors as the energy crisis, ecological balance, and the requirements for a systematic approach to the production, delivery and consumption of food necessitate a new concept of development assistance which is more than just the simple transfer or adaptation of sophisticated agricultural technology so characteristic of the developed world.

Many U.S. land grant universities have a long history of involvement in development assistance and have acquired a great deal of knowledge about developing countries. Unfortunately this knowledge is often confined to a single region or country, is not focused on the problems of small family farmers and the constraints within which they must operate, and is all too often based on broad generalizations from a limited amount of information. An organized knowledge base, focusing on existing knowledge and its modification to a technology for the small LDC farmer, simply does not exist in most cases even though many of the critical problems and limiting factors have already been identified and at least partial solutions are known. The primary issue, then, is: what do we know and what does it all mean?

II. Background

In recognition of this problem, a group of universities involved in AID-supported programs in tropical soils, water management and aquaculture,* met in May, 1975, to discuss a common methodology for fulfilling this need in a state-of-the-art (SOTA) format. This meeting was the result of a growing concern that developed country scientists (particularly in the U.S.) who were experts in their own field simply did not know enough about the problems as they exist in the tropics and, therefore, could not recommend optimal solutions of general applicability. This became increasingly apparent in the comprehensive reviews of 211(d) grants whose major purpose was to strengthen U.S. institutional competence in priority problem areas.

The development of such a knowledge base is now one of the prime elements in all new 211(d) grants and the primary justification for the extension and revision of existing grants. It is also required in many research contracts and should be an essential part of any new programs authorized under Title XII of the FAA of 1961.

Because of the importance now being given to SOTA effort, AID believes it is necessary to develop mutually acceptable guidelines so that desired results are achieved, information is inter-changeable, and the emphasis is on the inventorying and analysis of practices appropriate for the developing countries and not solely or primarily academic or scientific treatises.

Obviously, there is more than "one" way to perform a SOTA review and/or to prepare a SOTA statement. The approach will also vary with: (a) the complexity and nature of the problem or subject; (b) the intended use of the results; (c) the money, time, and expertise available; (d) the availability of appropriate data and information; and (e) most important, the comprehension, ingenuity and innovativeness of the people involved.

The guidelines are *not* intended to be rigid. When a specific approach, methodology or format is "required", this will be negotiated in the appropriate funding agreement. The intent here is to explain the concept and suggest a general approach which is subject to adaptation and modification.

*Consortium for International Development (CID)—Univ. of Arizona, Utah State Univ., Colorado State Univ., Univ. of California-Riverside, and Oregon State Univ., Consortium on Soils of the Tropics (COST) — Cornell Univ., North Carolina State Univ., Prairie View A&M Univ., Univ. of Puerto Rico, and Univ. of Hawaii; and Auburn Univ.

III. Definition and Concept

What is State-of-the-Art?

As used here, "state-of-the-art" is a keenly analytical review of the knowledge accumulated by research and practice on either a narrow or broad subject setting forth the established principles, how and where they can be used, and identifying the gaps in knowledge needing research for establishment of better principles. If there is no practical or economic solution to the problem for a specific area, crop, or other subdivision, alternatives should be suggested. Some conventional "reviews" meet these standards, but most do not. SOTA is not an anthology, a book of abstracts, and should not attempt to cite all of the accumulated literature. Emphasis must be on the principles and how they can be applied. Not a recipe book, it is a *guide on diagnosis and solution of a problem* with the emphasis on simplicity and economy.

Purpose

Preparation of a SOTA paper serves several useful purposes in the application of knowledge, including research. For those involved, its preparation forces them to critically examine the literature, distill out the principles, and crystallize usable and researchable hypotheses. For those not involved in the effort but working in the area, it provides an authoritative background and guidance for further investigations. Far too much work is undertaken without a critical review of the literature before-hand with the result that enormous amounts of effort are wasted, i.e., study of problems already solved or of low priority.

In application of knowledge (extension, education, delivery systems) "state-of-the-art" products are the guide as to what should be and what should not be delivered. This is an important point. Much information, for example, on soil and water management developed in temperate climates with temperate-zone cropping systems cannot be extended to the tropics and to do so is dangerous. "State-of-the-art" *targeted* at developing country problems and to the tropics are particularly important to what can be and should be extended. For guidance of research and development where principles have been established, but their application is being tested, the "state-of-the-art" effort should offer a guide for testing these principles with a minimum of effort, cost, and time.

There are other results expected, not the least of which is the involvement of U.S. agricultural scientists in a *cooperative relationship* with scientists from developing countries and regional research centers in a problem-oriented effort of *mutual benefit*. The very process of doing a SOTA study is expected to strengthen both the domestic (U.S.) and international networks.

When, How, Who?

A "state-of-the-art" effort should be undertaken when there is a definite need and some person, group or institution is available with the ability to conduct it. Since the emphasis is on critical analysis of accumulated knowledge, preparation time might well take one to two years or more of part-time work. The greater the experience and accumulated knowledge of the analysts, theoretically the less time required. From the standpoint of the Technical Assistance Bureau, negotiations for "state-of-the-art" papers can be a part of a grant, cooperative agreement and/or research contract. More expensive modes, where expertise is not otherwise available, are through special contracts with individuals, research centers or consultants. Since the emphasis is on critical analyses and quality, scientists must be carefully screened as to ability and interest. Authorship can be single or multiple, but individual responsibility is clearly needed for analytical thinking. To the extent feasible, participation in selected parts of the effort should include scientists from outside the designated institution, e.g., sister institutions, international research centers, cooperating country institutions, etc.

All manuscripts should be reviewed by peer scientists, including those of developing countries, for adequacy, accuracy and logic of interpretation and within AID for applicability. This may warrant one of more workshops during the course of preparation and final review.

The objective in publication of the final products should be its availability to a wide spectrum of readers at reasonable cost for a period of five to ten years. AID will publish and disseminate SOTA handbooks and bulletins to the development community. Other publication alternatives are review series such as *Advances in Agronomy* or experiment station bulletins, but such alternatives may be more desirable for specific products flowing from the SOTA paper, e.g., bulletins on applicable practices.

The style and language should be simple, commensurate with adequate communication of the subject matter. The audience should be regarded not only as scientists or engineers, but government officials and others having no specialized training in the subject matter.

Utilization

How should "state-of-the-art" papers help food production in developing countries? First, they would supply authoritative sources of information relevant to the tropics to teachers and students at the University level, to scientists and engineers conducting research pertinent to production problems, and to persons preparing education and extension materials for use in the development process.

For example, there is now no authoritative guide on the behavior of phosphorus when applied to tropical soils in terms of its critical role for crop response—yield, quality, etc.

Second, and equally important, such papers would be a valuable text for guidance of developing country scientists in their research and extension programs. Of course they would make adaptations for their specific situations.

Finally, they would be used by national governments, regional and international agricultural research centers, and bilateral and multilateral donors as an important input in determining priorities, training requirements, land-use patterns, improved practices, research and a host of other needs with which administrators are often forced to deal with limited information.

Selection of Problem

Subject matter can range from very narrow to very broad depending upon the selected problem. Obviously, no attempt should be made to cover all problems pertinent to increasing food production in the developing countries. By the time the last SOTAs are written the first one will be outdated. Overlap between subjects should be minimized, but some is essential. Nature and the production problems related to its variations and limitations were not put in neat little boxes. Subject matter, by definition, should not be directed at a single country* but should be written for world-wide or general application to similar soils, climates and constraints. The extent of applicability should be specifically stated insofar as known from the world literature, soil maps, climate data, authoritative literature, and other sources.

In fact, the prevalence of the problem in the developing world and its susceptibility to a joint cooperative approach by the international network of agricultural institutions will be the prime criterion of SOTA selection by AID. Also, the relevance of U.S. competence and experience to the problem and AID's ability to contribute will be another important factor.

In most cases AID, in close cooperation with its field mission and developing country officials, CGIAR, the regional and international agricultural research centers, FAO, USDA, IBRD, and the U.S. land-grant community, will select the problems or subjects it believes have priority and warrant funding, either through grants, contracts or otherwise. However, universities, private organizations and individuals from the U.S. and elsewhere are invited to propose topics, including a proposed plan for carrying out a SOTA effort, the expected results, and most importantly, their impact on the solution of problems impeding development.

*However, a modified SOTA approach can be applicable to site-specific problems.

In negotiations with participants and institutions, AID will solicit their viewpoints on needs and subject matter for subsequent determinations of competence and sufficient enthusiasm to give the SOTA effort high priority.

IV. Preparation of SOTA

Consideration of the Technical Facets

There is no set way to do a comprehensive, state-of-the-art as defined herein. Nevertheless, there is a logic which can and should be applied to assure a useful product, i.e., the SOTA paper itself and its eventual utilization. It includes:

1. Define the problem
 - describe and set in the context of developing countries and focused on the family farmer
 - determine separable components of the problem (include environmental, socio-economic and energy components in addition to breakdown of technical problem)
2. By *each* major component
 - determine state-of-the-science and its application/relevance to the developing world
 - inventory and analyze current and past principles and practices in terms of their usefulness to the developing countries
 - determine critical variables, e.g., demography, climate, rainfall, soil, etc.
3. Develop statement of knowledge gap
 - determine criticality to desired end-result
 - relate to other on-going SOTA work.
 - specify additional knowledge/data required
4. Specify steps to complete inventory
 - more literature review or data exchange
 - inputs from “outside” experts
 - field surveys

5. Evaluate

- determine critical variables, constraints, etc, for each component
- integrate components and analyze interrelationships
- prepare statement on “what it all means,” e.g.,
 - recommend practices
 - training needs
 - knowledge gaps
 - research priorities

6. Prepare outputs

- publications, bulletins, etc.
- seminars, outreach activity
- new proposals for R&D

Planning the Approach

A complete, comprehensive and successful SOTA effort usually starts long before the consideration of technical facets by a designated institution and can continue after the actual work is completed and published by extending the work to another approximation, participating in workshops, or other follow-up and outreach activity. Illustrative milestone events are:

1. Subject and institution selected

- AID determines SOTA effort it wishes to finance according to program priorities
- at AID request, individual, institution or group of universities agrees to take on responsibility
- appropriate agreements negotiated and executed

2. Preliminary work-plan prepared

- SOTA leader selected
- problem components determined
- staff selected or identified
- technical facets considered
- tasks assigned
- work-plan and budget approved

3. SOTA work begins

- literature review, worldwide or regional, as required (the main principle here is scope and completeness)
- consultation, correspondence, workshops
- field visits to obtain current practices and experience
- when necessary, confirming laboratory or field measurements may be required in order to evaluate or understand previous or on-going work.
- evaluation, synthesis and identification of transferable information, gaps, etc.

4. Completion of SOTA and follow-on determined

- final document(s)
- symposium to disseminate SOTA information
- determine need for additional SOTA on problem, a critical component of problem or interrelated problem
- recommend outreach/extension follow-on
- recommend new research, training, etc.

Planning the Work

Detailed workplans should be developed, with AID participation and/or approval, for two year periods. When SOTA is designed for more than two years, summary workplans are acceptable for that period *beyond* the first two years. In order to assure some consistency and completeness, the outline below should be followed whenever a workplan is appropriate for a particular sub-category, i.e., problem component. While these workplans will not be included as part of the grant or contract agreement itself, it will be considered an informal understanding on substantive detail and schedules and be made available at appropriate progress reviews. The institutions will be encouraged to keep such workplans up-to-date and revise them at least once a year when their annual report is submitted to the sponsoring technical office. (*See next page for components.*)

1. *First major component* (of the problem)

- Activity or work to be performed
- Staff to be involved
- Scheduled events/targets
- Expected results and/or end-of-work status indicators
- Estimated cost and man-months of effort
- Summary of work expected for remaining grant or contract term (if applicable)

2. *Second major component* (of the problem)

- Activity or work to be performed
- Staff to be involved
- etc.