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Mid-Term Evaluation of Integrated Planning Technology (IPT)

Implemented by the
International Institute for Environment and Development
through a cooperative agreement with the
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INTRODUCTION

During the early part of 1985, the Office for Forestry, Environment and Natural Resources in the Bureau for Science and Technology began to discuss with the International Institute for Environment and Development (IIED) the need to develop a better program for research planning in the environment and natural resources sectors. Faced with a growing number of proposals and in a time of continually shrinking funding, it seemed urgent to find ways to channel resources more effectively and efficiently in addressing the growing environmental problems faced in developing countries. This was the basic goal of the program: for IIED to assist AID, S&T/FENR in developing an objective research planning tool. The effort, known as the Integrated Planning Technology (IPT), began in October 1985, supported through the A.I.D. cooperative agreement (Environmental Planning and Management Project, 936-5517) with IIED.

In the near future, the planned funding for IPT will be exhausted. Continuation is being considered, which makes this an appropriate time to conduct an evaluation. Progress to date, the product, project continuation and the form and direction of the program were evaluated by a four-member team, including the A.I.D. representative, an IIED representative and two outside consultants. All three non-A.I.D. participants have experience and background in modeling. One team member (Max Langham) has used the Dynamo computer package in his own research. The team addressed three general issues:

1. the ability of the model to assist in establishing research priorities and developing a research agenda for S&T/FENR,

2. the validity of the model,

3. the value of the workshop process to improve interchange between disciplines and develop a more integrated approach among decision- and policy-makers.

The original scope of work for the evaluation is attached as appendix 1. The steps and activities taken by the IPT team of IIED are discussed below, followed by the findings and recommendations of the evaluation.

IPT MIDTERM REVIEW

The IPT team has done an impressive amount of work since October 1985 and it is an appropriate time to evaluate their accomplishments and to offer suggestions on future directions.

The original objectives of the Integrated Planning Technology (IPT) activity were:

1. to assist AID S&T/FENR to develop an integrated, objective research agenda for the environment and natural resources sector and

2. to reinforce the concept that linkages exist between agencies and among divisions within AID.

These original objectives appear to have been broadened to include: fostering a useful and enjoyable workshop process which can sharpen the analytical, decision-making capabilities of planners.

The IPT activity was initially divided into three phases designed to meet the two original objectives. After examining the steps taken by the IPT team, the three phases can more clearly be divided into eight sets of activities as shown in Figure 1. To date, the activities of the IPT team have been confined within phase I -- the assessment of needs. This first phase identified three main steps -- Identification, Subtraction and Prioritization.

Figure 1. Activities within the three initial phases of the IPT Project

Phase I - Assessment of Needs

- Identification of AID's data needs
- Subtraction of topics that are well understood
- Prioritization of remaining topics by impact on AID activities

Phase II - Assessment of Current AID Environmental Research

- Examine AID projects to evaluate inclusion of new priorities
- Review communication of research needs within AID and between other donors
- Assess costs/benefits of research within a development context

Phase III - Professional Review

- Critique of Phase I and II by professionals within and outside AID
- Incorporate suggestions into a final report for action.

Within the identification activity, nine sectors were suggested by the IPT team, in consultation with AID S&T/FENR, to be the most important subjects for consideration within the environmental and natural resources sector. The selected sectors provided a very broad base from which to work as follows.

1. Plant, animal and wildlife ecology
2. Forestry
3. Agriculture
4. Range and Livestock
5. Watershed, Hydrology and Soils
6. Economics and Social Sciences
7. Energy
8. Coastal Resources
9. Population, Environmental Health and Nutrition

The identification activity was conducted -- in a quasi Delphi mode -- in an attempt to identify some specific goals, major issues and variables within each of the nine important environmental and natural resource sectors (e.g. a semi arid tropical forest), and to develop a first approximation (hypothesis) of how the variables in this sector or subsector interact. Fifty-nine representatives from AID and other organizations participated in the workshop held in March 1986. Most of the participants were resident in the Washington, D.C. area. Three-fifths of the participants were either AID or IIED employees; and of the AID employees, 69 percent were from the Central Science and Technology Bureau and the rest were from Washington regional bureaus. The resulting sector groups were a mixture of technical experts, facilitators and those familiar with the needs of AID. The workshop appeared to foster effective interdisciplinary interchange but could have benefited by the participation of a few more technical experts in some of the sector groups and by greater regional bureau or AID field representation.

After a Plenary session, the sector groups separated into subgroups to conduct the following task assignments:

1. develop a wish list for research topics as related to individual duties,
2. identify goals and major issues,
3. create a sub-sector boundary diagram, and
4. identify variables.

At the end of the workshop sector groups reassembled and gave short summaries of their activities to the other participants.

After the workshop, the IPT team compiled a list of the research topics as determined by the frequency of occurrence in linkages and expressions of interest in the workshop. This list was used to provide guidance for the formulation of the FENR section of the Bureau for Science and Technology's 1986 Central Program Strategy Statement (CPSS), later in 1986.

Six of the sector working groups completed the four task assignments in sufficient clarity and detail to allow the completion of the diagramatic model, and for the IPT team to begin the computer coding process. For a variety of reasons, the Energy, Coastal Resources, and Economic and Social Science sectors were not developed adequately during the workshop process. The IPT team re-did the Coastal sector using locally available experts, and this has received positive review.

The outcome of the workshop was a preliminary flow diagram of the linkages in each of the dynamic subsystems. Following the workshop, these diagrams were further developed by the IPT team and sent to the workshop participants for review.

The IPT team should be commended for the diagrammatic models that have been developed from the workshop outputs. The informal reviews have substantiated completeness for meeting the objectives of this phase of the project. The attempts of the IPT team to cover voids in structure that remained after the workshop appear to be good.

The second set of activities requires literature searches for information to provide the basis for quantifying linkages and interactions of variables described in the flow diagrams. This excercise is essential for translation of the flow diagrams into the computerized Dynamo simulation models. The exercise provides insights on data and information gaps and has the side benefit of developing data bases for each of the natural resources sectors.

The third activity within Phase 1 uses the models in an attempt to obtain insights into the operations of the subsystems and then uses these insights to set research priorities for S&T/FENR. Finally, plans call for the participants of the original workshops to reassemble and analyze the computer results for purposes of refining and grouping potential research activities into a priority list.

An illustrative demonstration of how the computer models could be utilized in establishing a forestry research agenda has been presented by the IPT team. To summarize briefly, the model was run over a period of years (30 in the example) for three levels (the expected value $\pm$ 50 percent from the expected value) for each of a selected number of variables. In the example, attention was focused on variables on which available data were quite scarce and/or of unknown quality. The analysis could of course be extended to any specified subset of the variables or to all variables.

The results were evaluated at year 15 in the runs. Cummulative percentage changes were then calculated for the goal variables, total closed forest area (TCFA) and total closed forest volume (TCFV), and over the plus and minus deviation from the expected values of each selected variable. These cummulative percentage changes were then ranked from highest to lowest.

Based on this rank ordering obtained from the model runs, variables could then be grouped and ordered into research problem sets for S&T/FENR's consideration. These "research priorities" and problem sets would be subjected to review and criticism during a second workshop. This meeting has not been held, and a rank ordering of research problems has been conducted only for the forestry sector. This process and the problems are discussed further below.

The logic is not clear on how the proposed model results will facilitate setting research priorities in a constructive and objectively dependable way. The method chosen to rank and order research topics selects a single point in time (year 15) at which comparisons of outcomes are made. This static approach does not take advantage of the dynamic properties of the model to explain systems behavior. The cummulative percentages provide some information about which variables have the greatest impact on the goal variables within the hypothesized model structure. This information, however, could be quite biased by the point in time which is chosen. Also, it does not provide any information on differences in trends which may be far more important.

Sensitivity analysis on any subset of variable whose values in the model are of questionable validity may be quite important from the point of view of model construction and validation. However, such sensitivity is of lesser importance in setting research priorities for S&T/FENR. If a model is of questionable validity because it has been parameterized with data which are based solely on opinion or are otherwise of questionable value, then one must worry whether the model is ready for use to aid in setting research priorities.

Any model should go through an intensive validation process before it can be applied. This has not been done for the forestry model. There is extensive literature on model validation and the process is quite time consuming. This important component of the

modeling process has been ignored and does not appear in the critical path analysis of proposed activities for the first 23 months. There is a 1 1/2-month task of model verification proposed in the two-year plan (task 6) for future work, but the work proposed is only one part of a process of model validation and 1 1/2 months is not believed to be sufficient for a complete process.

Models to be successful need to be problem specific in a rather narrow sense. The general problem of setting research priorities for a program as broad as that of S&T/FENR is asking much too much of a 23 month modeling effort. The procedure under the cooperative agreement attempts to shortcut the time requirement by structuring models on the basis of expert opinion in short workshops and thus essentially ignores the modeling validation process. Even if the model validation process were not included (although it must if one ever hopes to put it to use), the task remains much too large for the proposed time frame.

If a model of the type demonstrated for the forestry subsystem is to be useful in setting research priorities, it should be used to explore the consequences on the subsystem of some well-defined alternative courses of action (e.g., research expenditures) being contemplated by S&T/FENR. One would then examine, using the model, what then would be the relative impact on the subsystem (e.g., forest protection) of each alternative course of action. Some rather well defined "what if" alternatives should come from the decision makers within S&T/FENR. The model could then be used to

explore the consequences of the alternative course of action on the important goal variable within the subsystem. Information from this model exploration could then be fed back to the decision process. The results from these explorations should capture the dynamics of the system and be an important part of the feedback to the S&T/FENR decision processes.

In summary, the major difficulties with the approach as it was conceived and is being carried out, are as follows:

1. There are no plans properly and thoroughly to validate the models of the nine subsystems. The validation activity proposed is insufficient in terms of process and time.

2. The sensitivity analyses being conducted do not provide insights for setting research priorities for F&S/FENR but rather insights into what information (or lack of it) used in model construction should be a cause for concern. It is setting priorities based first on where information is lacking on all variables and then on the importance of the information-poor variables, rather than the other way around.

3. There are no plans to use the model(s) to explore the consequences of alternative uses of research monies on the system of interest.

As a consequence, there is little hope that the IPT effort as currently planned will lead to an efficient cost-effective approach to setting research priorities originally intended in the cooperative agreement.

Data Base

The data base being created has two attractive features. First, the IPT staff has documented the source(s) of each piece of information along with a subjective assessment of the quality and availability in published sources of that information. Secondly, the data have been stored using Lotus 1-2-3 software and are easily retrievable.

In terms of extrapolating from the model to worldwide issues and using the data base, there are a few problems. The data are for a limited number of very specific sites and it is difficult to appraise the extent to which the stored data would be of value in studying similar biomes in other sites around the world. There is a real danger in assuming that data for one environmental site can be used in modeling another.

Also, we cannot offer an assessment of how thorough the search for data was. The modest time and financial resources available to the IPT team have of necessity limited their data collection activity. And data bases are by their very nature never complete. We feel that this activity is an essential part of work on IPT under

the cooperative agreement but should continue to be specific to models being constructed, and be focused on examining specific problems and/or research alternatives.

Other Goals

In addition to the primary goal of helping set research priorities for S&T's Forestry, Environment and Natural Resources program, the development of Integrated Planning Technology has been touted as potentially providing answers for a variety of questions in the broad field of environment and natural resources planning and management. It is variously being promoted as a tool for teaching and demonstration, as a mechanism for reviewing data, as a tool in national environment and conservation research planning, and as a method of project evaluation.

As described in the promotional literature, IPT's suitability for these uses is based on the assertion that it provides:

- a common, effective language for communication between disciplines,

- an unparalleled learning tool for diverse groups,

- a more explicit and quantified understanding of complex systems,

- a specific identification of planning assumptions and data gaps,

- an analysis of alternative project plans, and

- a record and accountability for information and plans.

To date IPT has been used in two contexts outside of the originally proposed goal of setting research priorities -- a workshop to evaluate a large-scale irrigation project in Sri Lanka and a workshop, held in Botswana, to demonstrate IPT's potential in research planning for a National Conservation Strategy.

The first workshop was held in Washington D.C. in April of 1984 (anteceding the current S&T/FENR research agenda project). It brought together a small number of experts in various environment and natural resource management fields to evaluate the Sri Lanka Mahaweli irrigation project using information provided in a number of existing feasibility and EIA (environmental impact assessments) studies. The week-long workshop began with a collective identification and discussion of goals, issues, hypotheses and key questions. It then went on to structure the main components of the project in terms of a series of systems dynamics flow diagrams. Data for about 800 variables were acquired from the feasibility and EIA studies and from informed guesses. The model was then run to assess the impact of a variety of policy interventions primarily concerned with varying levels of forest management. The principal

results of these computer runs demonstrated the importance of forest management in determining eventual rice production and determined that some 30 percent of potential production would be lost if a full forest management policy were not adopted.

It is clear from the write up of this workshop that IPT carried out in this way is a useful tool for bringing different disciplines together to focus on a specific complex problem and for illuminating the dynamics of individual sectors of the problem and a limited set of their cross connections. It helps clarify participants' thinking and produces an interaction of ideas and perceptions that leads to useful insights.

However, in common with many other similar exercises, the participants found themselves confronted with the problem of managing and understanding an increasingly complex model. As the participants strove to include all the apparently important factors, the model became larger and more complex. As they recognized, there is a tradeoff between technical manageability and client satisfaction for which there is no final answer. The model had to be completed after the workshop, and its eventual use was restricted to examining the effects of forest management policy.

The outcome of the model was thus of value, but primarily as a demonstration tool which graphically presented the potentially large effects of forest management on agricultural development. It did not, of course, present a well validated, scientific result but

rather a hypothesis deduced from a selected set of expert inputs. The next stage in a planning or evaluation exercise would be to examine the hypothesis more thoroughly, perhaps through a more detailed modeling exercise.

Overall, the Mahaweli workshop demonstrated the potential power of IPT as a tool for use in planning and evaluation. But clearly, it requires considerably more work before it can be used as anything other than a demonstration and teaching exercise.

The workshop in Botswana was held in October 1986 under the auspices of IUCN and funded primarily by SIDA (Swedish International Development Agency). This occasion was of interest to AID as a possible opportunity to obtain data for the research agenda-setting model and also as an experiment in the general applicability of the workshop technology.

The aim of the IUCN program was to demonstrate the use of an interactive computer display as a tool for the planning and management of living natural resources in developing countries. Specifically, the Botswana workshop was to assist in the preparation of the National Conservation Strategy by providing a tool which could assist decisionmakers with projections of the financial, growth and conservation consequences of policy and program proposals.

Some 60 people attended the workshop, from a variety of government ministeries. One aim was to familiarize participants with computers and a concurrent training session introduced ministry staff to basic computing skills including word-processing, statistical analysis, and systems dynamics. Participants were asked to describe the kind of questions they hoped the model would answer and then were separated into sector groups and went through the process of identifying and defining goals, issues, key questions and variables, culminating in the production of system flow diagrams. This was similar to the process conducted in Washington and described above.

Once again, the workshop clearly proved valuable in bringing together different disciplines and sectoral representatives and in achieving better perceptions of a complex system. However, the complex system was essentially the whole natural resource system of Botswana and it was not possible to produce a working model in the few days available. The proposal, therefore, was to leave the skeleton model in Botswana to be further developed by nationals of the country, probably in the Ministry of Finance and Development Planning.

It is evident from the records of the discussions in the workshop that the participants expressed high expectations of the eventual benefits from building the model, and were encouraged in this. They were interested in long-term predictions, in policy analysis, in cost-benefit analysis, in project evaluation, in the

analysis of spatial variations and so on. The model, it was claimed, once built, could satisfy all these demands. Clearly, given progress to date on the model for the S&T/FENR research agenda activity, this represents a considerable degree of overselling.

While it is true that the process of flow diagramming, model construction and data acquisition could now be transferred to Botswana, a fairly intensive effort would be required over several weeks if not months. How the model is used and what it can be legitimately and reliably used for is not yet known. .Transfer of the modeling techniques at this stage requires an act of faith that it eventually will be useful. As yet, there is little evidence that it can be used in the various ways that the Botswana experts anticipate, and as described in the promotional literature. The Botswana experts should clearly understand that they are embarking on an experiment to see if a useful model can be constructed. Again, this model would require validation. It would be far better if the project were to begin with a specific problem focus where there is confidence of producing a useful result that would demonstrate the model's longer-term potential.

Following the Botswana workshop the team also made a very brief visit to Namibia. Here they met with a group of wildlife experts who were wrestling with the problem of controlling a rabies outbreak. Once again, the power of the workshop technique was demonstrated. Although only a few hours were available, a clarification of thinking about the rabies problem apparently resulted.

Some Recommendations

S&T/FENR is to be congratulated for its interest in exploring new ways to confront decisions regarding the allocation of limited research monies. Also the IPT team is to be congratulated for the impressive amount of work they have done in the brief period since October 1985. Our conclusions and recommendations follow.

1. The idea of using a systems dynamic framework to explore, brainstorm, and free think on a matter of environmental concern is quite creative and should be encouraged for use by A.I.D. and its missions. The workshops provide a mechanism for decision makers to explore their own ideas and to think about the dynamics and complexities of environmental issues of critical concern. The workshops have been well received, and a learning and "recharging of batteries" have occurred via that setting.

2. S&T/FENR and IPT should continue to explore the usefulness of systems dynamic models for setting research priorities. That is, we recommend that S&T/FENR continue the use of some research monies for this type of effort through the cooperative agreement with IIED.

3. The modeling effort should be scaled down to no more than one or two subsectors which are issue-specific and take components from existing sector models as required. This would allow more time to do background research in the construction of the model,

to include a strong model validation component, and to explore some meaningful "what if" issues with the validated model. We further recommend that the subsystem be chosen to utilize the technical training of the IPT team. Model results should be discussed in a workshop environment with those in S&T/FENR and others with a strong interest and program concern within the subsector. Suggested steps in such an effort would be as follows:

a. Select one of the important issues for which S&T/FENR has received requests for research funds. The issue should be one for which some hard choices will need to be made on the direction of research. This should not be a brush fire issue but rather an issue of concern for longer range planning. The environmental system affected by the issue should be initially structured in a workshop framework of the type which has been used by the IPT team.

b. Use mini workshops and/or consultative efforts to assess the most likely and potential effects of each research direction being considered on goal variables within the system. This process would require some assessment of the probability of success of the research and the lag times involved for research results to have an impact on the system.

c. Conduct background research to obtain information to structure the model. This step is a data and information gathering exercise to provide the necessary inputs to structure further and code the model. The work that has been accomplished on the various models by the IPT team will be a valuable resource to draw on in this exercise.

d. Validate the model. The subsystem model could be run as a base representation of the current state of the system, model components checked for internal consistency, and if possible, checked over some period of known history to explore how it tracks a real world subsystem.

e. Run the model to obtain a simulated assessment of each of the alternative research directions being considered and interpret the results. Sensitivity analysis could be useful in this and the preceding step.

f. Meet in a workshop setting with decisionmakers and technical staff of S&T/FENR to review and discuss the model results and their implication for the allocative decision for research monies.

g. Prepare a written report of the assessment for S&T/FENR, and, where appropriate, publish the results to enable more general access to the method and the results of the assessment.

4. The further application of the model to tasks such as national research planning and project evaluation should be postponed for at least a year until there is clear evidence of success in meeting S&T/FENR's research agenda setting needs and of a reliable approach and protocol to development, testing, analysis and use of the model. A choice should then be made between either national research planning or project evaluation as a focus of application and this intensively investigated over at least a couple of years.

5. Workshops on environmental subsystems within a systems dynamic framework should not be utilized to oversell the powers of formal models in solving complex problems. The current research and information bases in most developing countries are not well developed. And formal models are quite demanding of data. Therefore, formal modeling efforts for environmental systems should not be encouraged as a panacea for anyone's decision problems. For the present, further attempts to sell the model by the IPT team in the developing countries incur the risk of loss of credibility.

Concluding Remarks

Attention should be paid to the presentation of the IPT technique, its history, aims, procedures, methods, outcomes and uses. It should be remembered that the primary benefit of systems analysis is that it helps to make thinking clear and logical. If

the presentation is muddled it largely defeats the purpose of the exercise. The points should be made in clear, in logical order, using simple language and illustrated by simple, colored diagrams and overheads. In general, it is better to understate the benefits of IPT rather than overstate them. When presenting model outcomes they should be regarded as hypotheses rather than factual findings and the explanation for the outcomes should be progressively laid bare by simple diagrams.

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