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EVALUATION
AGRICULTURAL PLANNING & STATISTICS

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A. Overall Assessment and Conclusions

The Agricultural Planning and Statistics Project started in 1981, the first technical assistance team arrived in Sudan in 1983, and a second team under a USAID contract with Chemonics arrived in 1988. Long-term and short-term training started slowly, but has moved ahead rapidly in the last two or three years. Procurement of vehicles and other commodities is also an important project component.

Despite a number of problems in project implementation, a good deal has been accomplished. The Production Economics and Marketing Economics sections of PAEA were established and effective data collection and analysis activities institutionalized in their respective areas. Several surveys of production costs and input use in rainfed agriculture have been conducted and analyses of the data published. A system of reporting prices from major market centers by radio is in place and functioning; several surveys of marketing costs and margins have been conducted and the results reported. A monthly publication, "Situation and Outlook," was instituted and now is well known as a source of current information on agriculture in Sudan.

After several years of unsuccessfully trying to obtain needed aerial photography, a workable Area Sample Frame was put in place in 1985/86 using Landsat imagery. Surveys of area and yield for the major crops were conducted in the latest three crop years using the ASF. However, due to the inadequacy of the Landsat images for locating sample segments, the coverage rate has been unacceptably low in the traditional sector. Consequently, the evaluation team recommends an experiment with SPOT imagery; if SPOT proves adequate, a greatly improved ASF can be constructed and more reliable estimates of area and yield generated.

The original objective of the project--to help the GOS improve its agricultural data collection, analysis and planning capacity--is still valid and worthy of support by USAID. The focus on PAEA as the major actor in agricultural policy analysis and planning is valid. Funding for the University of Khartoum and other institutions as supporting actors is well founded and appropriate.

Progress in the area of policy analysis has been disappointing. This is partly due to unrealistic expectations. The Project Paper Amendment of 1987 gives the impression that dramatic improvements in the economy of Sudan would result from a small investment in studies and analyses. This unrealistic expectation for APS project performance is based on three misjudgements of the environment: (1) an assumption that some undefined or vaguely defined "policy changes" will have a dramatic positive effect on Sudan's economic performance; (2) the idea that good data and analysis will lead to immediate policy changes which are then flawlessly implemented; (3) the belief that the APS project would eliminate almost instantaneously any deficiencies in analytical and statistical capabilities. While the APS project has not worked miracles in the policy area, we believe the overall project has produced reasonable benefits from a fairly modest investment by USAID.

A second reason for disappointing performance in the policy analysis area stems from conflicting and shifting concepts of the decision making process. The Project Paper Amendment envisions a process whereby the Ministry of Agriculture and Natural Resources would identify key policy issues and seminal studies and obtain USAID concurrence. If this process had worked as planned, the new Chemonics technical assistance team would have had unambiguous guidance and could have immediately designed and implemented policy analyses. The process, which may have been unworkable from the start, has not worked during the tenure of the Chemonics team. In fact, there appears to have been an "informal" redesign in the several months between approval of the Project Paper Amendment in April 1987 and the issuance of the request for proposals. The Chemonics proposal asserts that a list of policy issues would be developed under the supervision of the Chief of Party; a similar concept appears in the contract. This revised concept also has not worked.

A third reason for disappointment is the general lack of appreciation of the magnitude and quality of human resources and the information infrastructure required to do good policy analysis. In an ideal world, the policy analyst would have ready access to accurate and complete data, would thoroughly understand the issues, and would be in constant contact with a network of the best researchers and analysts in the field. Reality falls far short of the ideal. In Sudan, agricultural data is nowhere near complete and is often of dubious quality, policy analysts are few and usually inexperienced, communication is difficult, and only very limited research is ongoing. Realistically, significant progress can be made through training, technical assistance and procurement of appropriate equipment and materials. Over a period of several years we may well see noticeable improvement in Sudan's policy analysis capability, but it is a slow process even in the best of circumstances.

B. Recommendations

The overarching recommendation for USAID is to stay the course. The APS project is working, it can be made to work better, and the evaluation report includes a variety of suggestions and recommendations for doing so. The following paragraphs briefly outline the major recommendations and their rationale.

1. Recommendations for Immediate Action

The 1989 Work Plan prepared by PAEA and Chemonics has been a contentious subject, generating a lot of paper, considerable heat, and a little light. In the opinion of the evaluation team, the Work Plan is satisfactory in most respects. Most of the 38 tasks described in the Work Plan are practical, implementable and appropriate; they should proceed with the unqualified support of USAID, PAEA and Chemonics. Dissatisfaction with the Work Plan stems mainly from the fact that the planned tasks are not clearly related to a concise list of priority policy issues. As noted above, the process for

identifying the issues is itself unsettled, and we see no prospect for quick resolution of this problem. Nor do we see any reason for USAID to withhold approval of the entire Work Plan. We recommend that USAID approve immediately the 1989 Work Plan, with the understanding that the Statistics tasks will be modified in accordance with the recommendations in the evaluation report and the Policy Analysis tasks reformulated.

The APS budget includes \$800,000 for SERISS. We found a great deal of confusion over how this component, apparently intended for some kind of remote sensing application, fits into the overall effort. After lengthy discussions with USAID, PAEA, Chemonics and others, a plan for using remote sensing was devised. The plan entails procurement of SPOT imagery for selected areas, the conduct of an experiment to test the usefulness of SPOT for constructing an ASF, doing land use stratifications and locating segments, followed by a decision whether to procure SPOT for a much larger area. We recommend moving ahead immediately with this plan, which is detailed in the Agricultural Statistics chapter of the evaluation report.

Aside from but related to the ASF, we found insufficient effort to improve the execution of field surveys, which absorbs more than half the manpower of PAEA and is a central concern of APS. We recommend more training in statistics, better documentation, improved supervision of enumerators, better design of questionnaires, and better application of survey design principles to the various surveys conducted by PAEA. These measures, which were developed in close collaboration with PAEA statisticians and the Chemonics Statistics Advisor, are detailed in the evaluation report. PAEA should also consider institutional innovations, such as a "crop reporting board" which would systematically take into account ASF and other information in developing official production estimates. There is a consensus on the need to improve the statistics activities and a much better understanding of what needs to be done. We trust that USAID will give more attention to and actively support these activities in the future. In the past there seems to have been an unhealthy fixation on "policy" to the neglect of the basic data-oriented activities that are indispensable to the development of improved policy analysis capability.

To improve overall APS project performance, particularly in policy analysis, we recommend a realignment of the Chemonics team. The current contract authorizes five long-term positions: Economic Policy Advisor, Agricultural Trade and Marketing Advisor, Production Economics Advisor, Agricultural Statistics Advisor, and Computer Support Specialist. The contract specifies that one of the long-term advisors be designated Team Leader, or Chief of Party (COP) as he is customarily referred to. The Economic Policy Advisor served as COP until his departure due to illness in early November 1988. The Agricultural Trade and Marketing Advisor was acting COP for more than two months, at which time the Production Economics Advisor assumed the COP duties, also on a temporary basis.

Aside from the disruptions caused by turnover in COP duties, we believe the structure of the team is unsound. We recommend the addition of a COP position to the team, resulting in separate positions (and people) for the Economic Policy Advisor and the COP. It is not humanly possible for one individual to do justice to both functions. Under the revised staffing pattern, the Policy Analysis Advisor would continue to work with the Policy Analysis section of PAEA, while the COP would interact with the Director General and the two departmental directors of PAEA. The COP would coordinate and support the efforts of the other five team members, assist the PAEA directors in shaping the agency's programs, help solve management problems, and represent Chemonics in its relations with USAID and the GOS.

We also recommend an increase in the authorized level of short-term assistance from the present 10 person-months to 30. This change was anticipated in the contract, and given the expected demand for short-term assistance, it would be prudent to authorize the 30 person-months now.

We also suggest a change in emphasis (not necessitating formal changes in the contractual terms of reference) for the Agricultural Trade and Marketing Advisor and the Production Economics Advisor. Both should devote more of their time to more directly policy-related work, price policy analysis for the former, and sector modeling for the latter. There is no clear demarcation

between policy-related and other types of economic analysis conducted by PAEA. The actual allocation of the advisors' time will be dependent on the type of analyses undertaken by PAEA in the next two years and the professional judgement of the advisors. It would be ill-advised to try to impose any rigid time allocation a priori.

PAEA should immediately implement two APS components designed to involve Sudan's universities in agricultural policy analysis and planning: a plan to strengthen the capacity of the Department of Rural Economy of the University of Khartoum; and the provision of local currency research grants to Sudanese professors and graduate students. Neither program has started yet, and we see no reason for further delay. USAID should do whatever it can to assist.

The effectiveness of technical assistance is contingent upon proper logistic support. A recent Chemonics short-term advisor assessed commodity procurement requirements. The evaluation team agrees with the general thrust of his report. In particular, we strongly urge timely procurement of vehicles needed to meet field operation requirements. Shortage of vehicles has hindered data collection in recent years. The evaluation report also contains a number of ideas for improved management of the PAEA fleet.

2. Longer-term Recommendations

The evaluation report includes a number of recommendations that will take more time to implement. The major ones are briefly discussed below.

During our few weeks in Sudan we had many interesting and fruitful exchanges regarding analytical and data collection methodologies. Our attempts to elicit a list of priority policy issues, however, always drew a blank. This experience and similar experiences elsewhere, lead us to recommend abandonment of the attempt to divorce "policy" from "analysis." Identifying issues independently of analytical and data concerns may be a pleasing intellectual exercise, but it doesn't get you anywhere in terms of project implementation.

Instead, we recommend a process focusing on specific analytical concepts and models. Some methodological suggestions are discussed in the evaluation report, including a program of commodity price analysis, the possible construction of a multi-market model, and laying the groundwork for a price-endogenous linear programming model. These are only suggestions; the actual analyses to be undertaken must be specified by the concerned professionals in PAEA, Chemonics and USAID. There is considerable common ground already, and we think an analytical plan for the remaining two years of the project can be agreed on by all parties in about two months. There is no guarantee, however, that the adversarial attitudes and acrimony surrounding the APS project will not sabotage this effort. Good management and recognition of the problems are essential to success.

The purist may still wonder what happens to policy issues in this process. There is a high probability that an agreed upon list of policy issues to be addressed will emerge from the methodological discussions. If it doesn't, don't worry. The important thing is that much better, and relevant, policy analyses will be conducted in the next two years if methodological agreement is reached. A pragmatic approach that gets things done is needed here, not rigid adherence to an impossible ideal.

A related concern is the lack of understanding of the institutional framework for policy analysis and planning in Sudan. The evaluation team talked to many Sudanese officials who were very knowledgeable and articulate on this subject. Furthermore, these individuals shared a common vision of how government works or doesn't work in Sudan. Some expatriates, on the other hand, expressed ignorance. To overcome this problem, we suggest that the concerned individuals read the chapter on organization in the evaluation report, and thereafter make a conscious effort to better understand the environment in which they work.

Another concern is the myopia of many government and donor officials. The pressing concerns of the day often crowd out concern for the longer term. Building capacity for agricultural policy analysis, planning and data

collection, however, is unavoidably a long term process. Proper guidance and support for the process requires a planning horizon of a decade or more. Discussion of the ASP project is often dominated by concerns about the PACD, when the next progress report is due, what's wrong with the latest piece of paper, etc. To better assure the future development of agricultural policy analysis and planning in Sudan, we recommend PAEA develop a "Strategy for the 1990s." The strategy would include a statement of desired capabilities by the turn of the century, the size and training of staff required, and required facilities (office space, vehicles, computers, printing equipment, etc.). It also would include a realistic assessment of funding expected from the Government of Sudan and the amount and type of support needed from other sources. To develop the strategy, it would be appropriate for Chemonics to provide a "facilitator" to organize and lead the strategy development process. We encourage USAID to participate substantively in the process and give due consideration to support beyond the ASP project.

Finally, we recommend that a work plan for the period from January 1, 1990 to the end of the APS project be prepared, reviewed and approved no later than December 1989. It should provide about the same level of detail as the 1989 Work Plan, and should be explicitly justified in the context of a jointly developed methodological plan, as discussed above, and the strategy for the 1990s.

INTRODUCTION

The Agricultural Planning and Statistics (APS) Project was initiated in 1981 to enhance the Government of Sudan's capability in agricultural data collection, policy analysis and planning. The first technical assistance team arrived in 1983 and remained until early 1988, with the exception of several months in 1986.

A second technical assistance contract was negotiated with Chemonics in early 1988 to provide services to 1991, when the project is to terminate. Long-term and short-term training and commodity procurement also are major components of the project.

The only previous evaluation was conducted in 1985. The present evaluation was scheduled for January 1989 in the Project Paper Amendment of 1987, and actually occurred in February and March 1989. The evaluation report is based upon meetings and conversations with Government of Sudan officials, particularly the staff of the Planning and Agricultural Economics Administration (PAEA) of the Ministry of Agriculture and Natural Resources (MANR), USAID staff and others in Sudan, and a review of pertinent documents.

The bulk of this evaluation report consists of four chapters. The first of the four chapters reviews the plans for technical assistance, assesses progress thus far, and comments on prospects for the remainder of the project. This is followed by an assessment of the 1989 Work Plan prepared by Chemonics with PAEA. The third Chapter is an in-depth review of agricultural statistics. The fourth chapter is concerned with organization, management and training issues.

Before plunging into the detailed evaluation, it should be noted that, despite a number of problems in project implementation, a good deal has been accomplished.

The Production Economics and Marketing Economics sections of PAEA were established and effective data collection and analysis activities institutionalized in their respective areas. Several surveys of production costs and input use in rainfed agriculture have been conducted and analyses of the data published. A system of reporting prices from major market centers by radio is in place and functioning; several surveys of marketing costs and margins have been conducted and the results reported. A monthly publication, "Situation and Outlook," was instituted and now is well known as a source of current information on agriculture in Sudan.

After several years of unsuccessfully trying to obtain needed aerial photography, a workable Area Sample Frame was put in place in 1985/86 using Landsat imagery. Surveys of area and yield for the major crops were conducted in the latest three crop years using the ASF. However, due to the inadequacy of the Landsat images for locating sample segments, the coverage rate has been unacceptably low in the traditional sector. Consequently, the evaluation team recommends an experiment with SPOT imagery; if SPOT proves adequate, a greatly improved ASF can be constructed and more reliable estimates of area and yield generated.

The original objective of the project—to help the GOS improve its agricultural data collection, analysis and planning capacity—is still valid and worthy of support by USAID. The focus on PAEA as the major actor in agricultural policy analysis and planning is valid. Funding for the University of Khartoum and other institutions as supporting actors is well founded and appropriate.

The overarching recommendation for USAID is to stay the course. The APS project is working, it can be made to work better, and the evaluation report includes a variety of suggestions and recommendations for doing so. The following chapters include detailed recommendations and their rationale.

TECHNICAL ASSISTANCE : PLANS AND PROGRESS

A. Introduction

This chapter reviews the plans for technical assistance in the second phase of the APS project, and assesses progress thus far and prospects for the remainder of the Project. Technical assistance, along with training and commodity procurement, has been an essential element of the APS project. This assistance has been directed almost entirely to PAEA, which plays the central role in agricultural policy analysis, planning and data collection in Sudan.

PAEA is divided into two directorates, Policy Analysis and Planning, and Economics and Statistics. Technical assistance under the APS project to the first directorate focused on project identification in the first phase and policy analysis; project identification was dropped after the 1985 APS evaluation. The second directorate, Economics and Statistics, has benefited from technical assistance in production economics, marketing economics, statistics and computer science.

B. Technical Assistance Inputs

The Project Paper Amendment approved by the USAID Mission Director in April 1988 called for one year extensions of the advisors in place at that time, followed by competitive award of a new contract. The service of the first contract staff was in fact extended to approximately April 1988. Proposals for Phase II technical assistance were requested as planned; Chemonics was chosen as the new contractor and a contract was negotiated in early 1988.

The implementation schedule called for the new contract team to be in place in March 1988. As usually happens, the actual arrival of the new advisors was somewhat later than planned. The Chief of Party (COP) and

Policy Advisor, the Agricultural Trade and Marketing Advisor, and the Production Economics Advisor arrived in-country on or about June! The Computer support Specialist arrived in August and the Statistician in October. The five person team of long-term advisors was then complete, but not for long. The COP encountered serious health problems and departed for medical treatment abroad in early November.

As of this writing (March 1989), return of the COP to his post is expected in early May. However, the Marketing Advisor plans to depart in early June. Thus, the team is likely to be at less than full strength for much of 1989. Short-term assistance, while authorized under the Chemonics contract, has not been used to fill in during the absence of long-term staff, but may be used extensively in the remaining term of the contract.

C. Perceived Role of the Technical Assistance Team

The Project Paper Amendment provides a rationale for Phase II technical assistance and specifies some important steps to be taken by PAEA and USAID before and after arrival of the contract advisors. Plans and actual accomplishments have diverged in significant ways. Much of the disappointment regarding project performance may be related to this divergence. To explain this problem, we will quote key passages from the project Paper Amendment, followed by our comment.

The first quote appears in the "Progress to date" section of the Project Paper Amendment and suggests some ambivalence on the basic objectives of the project.

Thus far, progress under the project has been largely of the institution building type....only to a limited extent, however, has this knowledge been used to influence policy decision-making within the GOS.

A good part of institution building is learning by doing. To the extent that PAEA produces useful outputs, PAEA as an institution is strengthened.

Thus, it would be a mistake to think of influence on policy decision-making as unrelated to or competitive with institution building. A second concern is the implication that influence on policy decision-making can be meaningfully attributed to donor-assisted projects such as APS.

The second quote appears in the "Rationale" section on page 6 and illustrates the expected impact of the Project.

The adverse trends [in agricultural production and productivity] noted above are in large part the consequences of poor and inappropriate economic policies that have emanated from a weak agricultural policy structure and an inadequate data base. It is those deficiencies which the policy analysis and statistical components of the project aim to eliminate.

This statement overrates (1) the impact of economic policies on Sudan's economic performance; (2) the effect of good analysis and data on policy making; and (3) the prospect that the APS project will eliminate the perceived deficiencies. The result is expectations of dramatic improvements in the economy of Sudan to be obtained from a very small investment. No project can live up to such high expectations. Unreal expectations is an important flaw in project design which should be taken into account in evaluating performance.

The third item refers to the role of policy makers and appears on page 9.

Unless there is effective two-way communication between policy makers and policy analysts, the relevance and usefulness of analysis will be limited as far as its utilization for decision making is concerned. In this regard policy makers themselves have a major responsibility for providing clear indications of priority policy issues.

Communication is indeed critical, but the desired effective two-way communication will take place only if the policy analyst is highly skilled, persistent and, above all, trusted by the policy maker. Even in the best of circumstances, policy makers are not likely to provide clear indications of priority policy issues. And under the present circumstances in Sudan, the

probability is virtually nil. The implication for project management is that a definitive list of priority policy issues will be difficult to construct, and may be impossible.

The fourth point, also on page 9, deals with the capability of a policy analysis staff and its information needs.

The capacity of the policy staff group to quickly bring together available information and to conduct analysis under severe time constraints will be critical to its effectiveness in serving policy makers' needs....it is essential that the staff have at its fingertips relevant, consistent, timely data and economic indicator sets, and be familiar with the issues that arise.

In an ideal world, the policy analyst would have ready access to accurate and complete data, would thoroughly understand the issues, and would be in constant contact with a network of the best researchers and analysts in the field. Unfortunately, reality falls far short of the ideal even in the most highly developed countries, and in Sudan circumstances are much more difficult. Realistically, we can expect only a modest improvement in the situation during the remaining life of the APS project.

The fifth point relates to policy analysis assistance to be provided under APS.

The long-term economic policy advisor will be placed in this unit [Policy Analysis Unit], and short-term technical assistance will be available to meet needs for critical policy studies which the PAEA lacks the time or expertise to undertake. The research grants....will also support the work of this unit, as will the production of timely and reliable agricultural statistics by the statistics division and intermediate analysis by the production and marketing/trade analysts provided under this project.

This sounds good, but actual assistance to the Policy Analysis Unit falls far short of the ideal and needs to be beefed up. The one long-term advisor to

this unit was effectively on the job for only five months and much of his time was absorbed in COP duties. No short-term assistance has been provided. The research grants have not gotten off the ground yet. The time of the other long-term advisors is directed mainly to their counterparts, and rightly so. The timeliness and reliability of agricultural statistics still need a lot of improvement, an objective to which much of the APS Project assistance is rightly directed. In the meantime, the policy and planning side of PAEA needs a good deal more of direct assistance.

The sixth quote, appearing on pages 9 and 10, anticipates a key process in APS project implementation.

The major emphasis of the project will, in future, be focussed on a limited number of priority policy issues and studies of relevance to agricultural policy decision-makers. A process has been initiated within the Ministry of Agriculture to define these critical issues. It is intended that this process will result in the selection of 3-4 key policy issues which must be addressed on a recurrent basis, and 2-3 seminal studies per year which will be selected on an annual basis....To ensure that these studies are relevant to the needs of policy-makers, the Minister of Agriculture will review proposed issues and seminal studies prior to their selection.

Had this process been implemented and issues and seminal studies identified as planned, it would have increased considerably the effectiveness of the new technical assistance team. We see no evidence, however, that the process worked. In fact, the COP spent a good deal of time trying to institutionalize such a process after he arrived in-country. As intimated above, we are doubtful whether the proposed process would have worked, even with the best of intentions. It is particularly doubtful that a Minister of Agriculture would assume such an active role in the identification of issues and seminal studies.

The Project Paper Amendment goes on to discuss in more detail the process, as follows.

These discussions [involving Ministry staff, USAID and the then long-term technical assistance team] will result in the selection of issues by the PAEA to be submitted to the Minister of Agriculture and Natural Resources for approval. The MANR's proposal for the 3 to 4 key recurrent policy issues as well as the additional studies on which the project will focus during the first year of the second phase will then be submitted to USAID for concurrence. USAID will review this submission and come to agreement with MANR on the issues ideally prior to the signing of the grant agreement amendment.

The process is also the subject of a proposed condition precedent. Furthermore, the implementation schedule specifies the selection of "studies" in March of 1988, 1989 and 1990. The intent was for MANR, with the concurrence of USAID, to give unambiguous guidance on priority policy issues to be analyzed and seminal studies to be conducted. The technical assistance team has received no such guidance. In fact, an "informal" redesign occurred between approval of the Project Paper Amendment in April 1987 and the issuance of the requests for proposals. The Chemonics proposal asserts that a list of policy issues would be developed under the supervision of the COP; a similar concept appears in the contract. This revised concept also has not worked.

D. Local Technical Assistance

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In addition to the provision of expatriate technical assistance, the Project Paper Amendment gives considerable emphasis to the involvement of Sudan's universities. We endorse this intent. Despite failed attempts in the first phase of the Project, the Amendment states on page 14 that "the decision has been made that this project should begin to strengthen the capacity of the Department of Rural Economy [of the University of Khartoum] through the upgrading of classrooms and teaching materials... and the provision of research grants for faculty and students." Almost two years later, nothing has happened.

RECOMMENDATION: That PAEA immediately implement the University of Khartoum component of the APS project.

The Project Paper Amendment also envisions a substantial research grants program as outlined on page 14.

A new project component will be the provision of local currency research grants to Sudanese professors and graduate students working on relevant high priority topics identified by the PAEA.... Both USAID and MANR agree that the university community is a source of expertise that should be used in data collection and analysis to assist the PAEA in policy formulation.

Not a single grant has been made. Perhaps one reason for the lack of progress is the inability of PAEA to specify "high priority topics." If so, we suggest that proposals be solicited in the general areas of agricultural policy analysis, planning and statistics, and that proposals judged appropriate be funded as soon as possible.

RECOMMENDATION: That the research grants program be implemented as soon as possible.

D. What If?

The failure of the process for identifying priority policy issues and seminal studies leaves Chemonics and PAEA in a highly uncertain situation. If these issues and studies are agreed upon by MANR and USAID in the near future, Chemonics will be in a position to effectively implement the designated tasks. If not, we recommend an alternate path.

During our few weeks in Sudan we had many interesting and fruitful exchanges regarding analytical and data collection methodologies. Our attempts to elicit a list of priority policy issues, however, always drew a

blank. This experience and similar experiences elsewhere, lead us to recommend abandonment of the attempt to divorce "policy" from "analysis." Identifying issues independently of analytical and data concerns may be a pleasing intellectual exercise, but it doesn't get you anywhere in terms of project implementation.

Instead, we recommend a process focusing on specific analytical concepts and models. Some methodological suggestions are discussed in the evaluation report, including a program of commodity price analysis, the possible construction of a multi-market model, and laying the groundwork for a price-endogenous linear programming model. These are only suggestions; the actual analyses to be undertaken must be specified by the concerned professionals in PAEA, Chemonics and USAID. There is considerable common ground already, and we think an analytical plan for the remaining two years of the project can be agreed on by all parties in about two months. There is no guarantee, however, that the adversarial attitudes, acrimony and overbalancing ignorance surrounding the APS project will not sabotage this effort. Good management and recognition of the problems are essential to success.

The purist may still wonder what happens to policy issues in this process. There is a high probability that an agreed upon list of policy issues to be addressed will emerge from the methodological discussions. If it doesn't, don't worry. The important thing is that much better, and relevant, policy analyses will be conducted in the next two years if methodological agreement is reached. A pragmatic approach that gets things done is needed here, not rigid adherence to an impossible ideal.

RECOMMENDATION: Adoption of a process focusing on specific analytical concepts and models, rather than generalized policy issues.

F. Outputs and EOPS

Expected Project Outputs and End of Project Status appear in pages 16-18 of the Project Paper Amendment. Although more than two years remain to the end of the project, it is possible to make some judgments on the likelihood of achieving the stated objectives. The following is confined to technical assistance; training is treated in another chapter of this evaluation report.

Output: 3-4 Policy analysis documents and
2-3 economic studies per year.

Assessment: Thus far in second phase outputs forthcoming at lower than expected rate, but should pick up in remaining years. May achieve numerical target over the three year period.

Output: A system in operation within the MANR whereby demands for policy analysis are channelled from policy-makers to analysts within the PAEA, these demands are translated into work plans and the results of analysis are provided to policy makers in a timely fashion.

Assessment: One could argue that such a system already exists. It is not readily visible to outsiders, and execution is thought to be weak. APS Project will help improve the system.

Output: 10-12 professionally prepared and/or evaluated projects.

Assessment: Second phase of APS will have little or no impact; this was a main feature of first phase.

Output: An operational computer-based data management system.

Assessment: One could say the system is already in place. Significant advances have already been made in the effectiveness of computer use in PAEA, and much more is expected in the next year or two.

Output: An operational area sample frame covering most of the country.
Assessment: Said frame exists, but it has problems. Specific suggestions for improvement are found elsewhere in the Agricultural Statistics chapter of this evaluation report; noticeable improvement probably will occur before end of Project.

The End of Project Status indicators essentially repeat some of the outputs discussed above, but with an added dimension of sustainability.

EOPS #1: Capability of the Ministry of Agriculture and Natural Resources to manage and sustain a sound policy analysis process, to prioritize problem areas and policy issues, to conduct policy analysis, and to provide information to decision-makers in a timely manner.

Assessment: MANR is likely to have at least a modest capability at the end of the APS project. To maintain or improve that capability, significant training inputs will be required, at least part of which will require donor support.

EOPS #2: Capability of the Ministry of Agriculture and Natural Resources to initiate, manage and sustain the preparation, analysis, monitoring and evaluation of projects to achieve development in the agricultural sector.

Assessment: MANR has that capability now, but it may be diminishing as attention and resources are focused elsewhere in PAEA.

EOPS #3a: A statistically sound area sample frame will be in place at a minimum in the irrigated and mechanized farm areas of Eastern, Central and Western Sudan.

Assessment: Said frame is in place in the irrigated and mechanized areas.

EOPS #3b: Statistical information will have been gathered, tested, and published for six years.

Assessment: This will be achieved.

EOPS #3c: Capability of the Ministry of Agriculture and Natural Resources to operate, maintain and expand an improved system for the collection and reporting of agricultural statistics on a regular basis.

Assessment: MANR will have the technical capability, but the cost of maintaining or even expanding the system will be considerable. To do so, outside assistance will be needed.

THE 1989 WORK PLAN

The APS Project design calls for periodic work plans. Chemonics, in collaboration with PAEA, completed the 1989 Work Plan in December 1988. It has been a contentious subject, generating a lot of paper, considerable heat, and a little light. The Plan consists of 38 "task" plans, a brief introduction, a time phasing chart for the tasks, and a table summarizing the allocation of Chemonics and PAEA staff time among tasks. The tasks are organized in six categories: Policy Analysis, Production Economics, Agricultural Marketing, Agricultural Statistics, Computer Center, and Project Management.

While the Work Plan refers to calendar year 1989, it needs to be evaluated in the context of the remaining life of the Project (to be completed in 1991) and the long-term effects on the PAEA. In addition to assessing the probability of completing the various tasks in 1989, we need to assess the likelihood that lines of activity started this year either will be completed before the Chemonics contract expires or will be sustainable beyond that point. A broader concern is whether the activities as currently envisioned are optimal for achieving project goals, or if some specific redirection of effort would lead to better results.

A. Sectoral Objectives and Policies

A clear, concise statement of priority agricultural policy issues and objectives for the agriculture sector in Sudan would be very helpful both for directing PAEA and orienting the Chemonics input. Considerable effort has been expended since the Chemonics team arrived in May 1988 to establish a process whereby priority issues would be identified and data collection and analytical work directed toward well defined objectives. At the present time, however, priority policy issues and objectives for agriculture are not well defined. (Reasons for this state of affairs are discussed in the previous

chapter.) Consequently, the 1989 Work Plan may appear to the reviewer to lack cohesiveness and a sense of direction.

The Work Plan does specify "two general objectives of the PAEA." These are (1) "to promote policies which lead to an increase in foreign exchange earnings through agricultural production;" and (2) "to seek policies that lead to the improvement of Sudanese terms of trade." These statements seem to imply a sectoral objective of maximizing net foreign exchange earnings. Given Sudan's external debt problems, many observers might agree that foreign exchange maximization is the principal if not the sole objective of the sector.

It is highly doubtful, however, whether policy makers or the general public would rank foreign exchange maximization as the primary objective of agriculture in Sudan. Increasing farm income and employment would certainly be high on the list for rural people and probably also for governmental agencies and political leaders who view them as their main constituency. Food security would also appear to be a major national objective with major implications for agriculture. In general, a thorough analysis would probably identify several high priority objectives which are to some extent in conflict.

On a more narrow analytical note, working with a single, measurable objective such as foreign exchange maximization may make life easier for the policy analyst, but may also make him irrelevant. A more appropriate guide for the analyst may be the maximization of the sum of consumer and producer surplus. This concept will mean little or nothing to policy makers, but is a useful unifying theme for policy analysis. Analytical results obviously must be translated into terms meaningful to policy makers.

The Work Plan does not explicitly identify priority policy issues or instruments, although the proposed analysis of wheat price policy and optimal use of resources in the irrigated sub-sector suggest that these are high priority issues. The following sections deal with the various work plan categories.

B. Computer Center

The Computer Center section of the 1989 Work Plan includes eight task plans, five of which deal with the processing of area sampling frame survey, crop cutting survey and commodity price data. The remaining three tasks are concerned with computer training, procurement of equipment and supplies, and maintenance of microcomputers.

All these tasks are important for the efficient operation of data collection and analysis in PAEA. The task plans are well developed and practical. The main concern for implementation is the retention of the Chemonics Computer Support Specialist and key PAEA computer staff. If, for whatever reason, one or more of these experts depart, implementation of the planned tasks will suffer.

RECOMMENDATION: That Chemonics and PAEA jointly plan for the retention of computer specialists and the training of PAEA staff to further strengthen the Computer Center. Benign neglect could well destroy what is now a very successful endeavor. Explicit support from USAID would be helpful.

RECOMMENDATION: That USAID approve the tasks in the Computer Center section of the 1989 Work Plan.

C. Agricultural Statistics

The seven tasks in this section of the 1989 Work Plan are aimed at improvement of the estimates of area and production of the major crops in Sudan. Briefly, the tasks are (1) publish statistics based on the 1988/89 area sample survey; (2) improve the area sampling frame; (3) revise the area sample, resulting in a sample size of 1,100 to 1,200 segments; (4) improve questionnaires and instruction manuals; (5) improve the coverage rate and timing of area and crop cutting surveys, resulting in 15,000 completed field

questionnaires in 1989/90; (6) reduce the time between the completion of field work and the publication of statistical results; (7) test the feasibility of incorporating remote sensing data in crop area estimation.

The seven tasks, taken as a whole, could result in considerable improvement of area and production estimates, both in terms of accuracy and timeliness. It is a costly undertaking: over half of the staff time (1,890 person weeks out of a total 3,416) in the Work Plan is assigned to Statistics tasks; satellite imagery, photo interpretation and technical assistance must be procured under the SERISS contract; twenty new vehicles are needed.

Many detailed recommendations pertinent to this section of the Work Plan appear in the Agricultural Statistics chapter of this evaluation report. The main thrust of the tasks are appropriate, but need to be modified in light of the evaluation recommendations.

RECOMMENDATION: That USAID approve the Agricultural Statistics section of the 1989 Work Plan with the proviso that the tasks be modified in accordance with the evaluation.

D. Agricultural Marketing

Four tasks appear in the marketing section of the 1989 Work Plan. In brief, these tasks are (1) the collection of price data from key marketing centers, the publication of these data, international price data and related information; (2) preparation of short articles on price and marketing topics for situation and outlook publications of PAEA; (3) collection and analysis of data on marketing costs and margins, and reporting of analytical results; (4) preparation of a report on market structure, conduct and performance.

These tasks are directed mainly at improvement of ongoing activities of the Agricultural Marketing section in PAEA. These are essential functions in that they provide timely market intelligence at least potentially useful to

many private and public sector institutions in Sudan and international organizations, and over time accumulate a substantial data base for more in-depth analysis.

The reviewer might be disappointed by the absence of more sophisticated price and market research in this section of the Work Plan. Price analysis however, is touched upon in the Policy Analysis section of the Work Plan and is discussed below.

The reader should not assume that the time of the Chemonics Marketing Advisor is devoted solely to these four tasks in the Agricultural Marketing section of the Work Plan. In fact, much of his time is allocated to tasks in the Policy Analysis section of the Work Plan, as can be seen in the table preceding the task plans. This time allocation is appropriate, and should not be construed as in any way diminishing the work of the Agricultural Marketing section of PAEA.

RECOMMENDATION: That USAID approve the Agricultural Marketing section of the 1989 Work Plan.

E. Production Economics

The tasks in this section of the Work Plan are directed mainly to improvement of ongoing functions of the Production Economics Section of PAEA. The seven tasks are designed to (1) prepare a report summarizing costs of mechanized sorghum and sesame production in 1987/88; (2) conduct the 1988/89 survey of mechanized sorghum and sesame production costs; (3) collect input-output data for sunflower production, analyze the survey results and prepare a report; (4) prepare a report summarizing 1987/88 traditional rainfed sorghum, sesame, groundnut and millet production costs, and write a brief article for publication in "Situation and Outlook;" (5) conduct the 1988/89 survey of traditional rainfed sorghum, sesame, groundnut and millet production costs, and prepare a report summarizing the results; (6) prepare a report

summarizing 1986/87 irrigated cotton, wheat and sorghum production costs, and write a brief article for publication in "Situation and Outlook;" (7) conduct the 1988/89 survey on input costs, production practices and restraints in the irrigated sub-sector, and prepare a report.

The task plans include notable improvements and extensions of the production Economics section's activities, including better survey sample selection and questionnaire design; faster and more accurate data processing on PAEA computers; reduction of time between data collection and reporting; more in-depth data collection and analysis of the irrigated sub-sector.

There now exists an adequate data base for construction of linear programming models for some typical mechanized and traditional rainfed farms. The data base on irrigated areas is limited, but the Farm Management section plans to expand it so that linear programming models of typical irrigated farms can also be constructed. As well as being useful analytical tools in themselves, these farm models can be used as "building blocks" for a sector model. (See discussion of sector model below.) In general, the specific tasks in the 1989 Work Plan are appropriate and practical, and lay the groundwork for more sophisticated analysis in the future.

As with the Marketing Advisor, the Production Economics Advisor plans to allocate a considerable portion of his time to tasks in the Policy Analysis section of the Work Plan. This allocation is appropriate, and in no way detracts from the appropriateness of the ongoing work of the Production Economics section of PAEA.

RECOMMENDATION: That USAID approve the Production Economics section of the 1989 Work Plan.

F. Policy Analysis

This section of the 1989 Work Plan contains a rather diverse set of nine tasks, and is the most problematic. Several of the tasks are briefly

commented on in the following paragraphs. Other tasks are examined under the headings of "Price Analysis" and "Sector Model" below.

The second task is aimed at analysis of Domestic Resource Cost (DRC), and the third task is intended to provide enterprise budgets for the DRC analysis. These are well defined tasks requiring relatively low levels of effort, which should provide useful information and can be readily implemented. We understand that a computerized DRC model was developed under the previous technical assistance contract, but is apparently not being used in PAEA; rather than developing a new model, we suggest that the previously developed model, if possible, be used instead. The DRC analysis can be conceptually linked to a more elaborate sector model, which, if done, would add a greater sense of integration or cohesiveness to the overall analytical agenda.

The sixth task envisions two series of lectures and seminars on the policy analysis process. Because of the absence of the Policy Analysis Advisor, this task may not be completed as planned. Nevertheless, it is a good idea that should be pursued. The organizers may wish to invite higher level officials such as the PAEA Director General and the First Undersecretary of Agriculture to lecture or lead a seminar.

RECOMMENDATION: That USAID approve the second, third and sixth tasks in the Policy Analysis Section of the 1989 Work Plan.

The seventh task deals with the "Kadugli study." Detailed household and farm data were collected in the Kadugli area of South Kordofan during the previous technical assistance contract. Many problems were encountered in the conduct of the survey and subsequent data processing. The resulting data has been characterized as "junk." The survey and intended analysis, however, represent a significant investment of personnel and other resources and appears to have been a centerpiece of Phase I of the APS project. Thus, there is considerable sentiment to push ahead, clean the data base and carry out the planned analyses. Data checks conducted thus far raise considerable doubt

whether the data will support any meaningful analysis; it is particularly doubtful whether the intended household modeling is possible. Further testing of the data is planned, but it now appears that a decision may have to be taken to terminate further work on the Kadugli study. For possible assistance in making this decision, we suggest that the Chemonics Washington office contact John Strauss, currently at Yale. We understand that Dr. Strauss advised PAEA in the planning and conduct of the survey and is very knowledgeable about this and similar endeavors in other developing countries. If the data set is found to be unusable, the planned task should be eliminated; the time and energy saved could be more usefully applied elsewhere.

RECOMMENDATION: That PAEA, with the assistance of Chemonics, decide as soon as possible whether to proceed with the seventh task in the Policy Analysis section of the 1989 Work Plan, and that USAID concur in a timely fashion if it agrees.

G. Price Analysis

The fourth, fifth and eighth tasks in the policy analysis section of the 1989 Work Plan are entitled Price Policy Analysis, Wheat Production and Consumption, and Food Security Analysis, respectively. These tasks, while relatively vague at the present time, seem to be closely related. Rather than separate tasks, we suggest that they be made a part of a broader program of price analysis.

The suggested approach would start with simple demand and supply analysis of key commodities. Because of their critical importance as staple foods, sorghum, millet and wheat may be given top priority. Secondary priority might be assigned to commodities such as cotton, sesame, groundnuts and gum arabic. Whatever commodity priorities are finally established, the important point is that a planned set of commodity market analyses using a common conceptual framework would be initiated.

Highly refined concepts and tested techniques are available. The basic framework of the suggested approach is clearly and concisely presented in Peter Timmer's recent book, "Getting Prices Right." While the choice of a conceptual framework must be made by PAEA with the assistance of Chemonics, we see a number of advantages to the approach advocated by Timmer. It starts from a simple demand/supply analysis of one market and can then be extended to multiple markets and interactions with the macro economy; useful analytical products can emerge at each stage as the analysis proceeds to more complex levels. It is admirably suited to the analysis of the impact of taxes and subsidies on producers, consumers and government expenditure. Finally, it emphasizes the criterion of maximization of the sum of producer and consumer surplus, a theme which could be carried over to a sector model.

RECOMMENDATION: That PAEA, with the assistance of Chemonics, consider replacing the fourth, fifth and eighth tasks in the Policy Analysis section of the 1989 Work Plan with an integrated program of price analysis, and that USAID concur with said program in a timely fashion if it agrees.

A final suggestion for implementation of price analysis: directly involve PAEA employees currently in long-term training. Any of the proposed analyses would be suitable thesis topics, and high quality technical guidance is available in all the major U. S. agricultural economics graduate programs.

H. Sector Model

The two remaining tasks in the policy analysis section of the 1989 Work Plan are entitled "Agricultural Sector Monitoring Model" and "Irrigated Sector: Long Range Planning." We propose for consideration of PAEA and Chemonics the merging of the resources planned for these two tasks into a single effort to develop an integrated sector model.

The work plan task to develop "an appropriate economic simulation model" strikes us as too vague and tentative. We suggest that PAEA and Chemonics

decide on a specific model structure and move ahead as soon as possible. This effort may fail, but, on the other hand, the potential payoff is high. It is better to have tried and failed than to never have tried.

Similarly, the proposed stand-alone modeling of the irrigation sub-sector, in light of the many past and present analyses focussing on irrigation, could be redirected. Resources now allocated to the irrigation modeling task could be more profitably employed in the development of a single model that could capture some of the interactions between the irrigated and rainfed crop sub-sectors.

A price-endogenous linear programming model may be appropriate. This type of modeling is well developed and tested. The CHAC model developed by Roger Norton and colleagues in Mexico in the early 1970s and its many extensions and refinements are thoroughly documented in the professional literature. And similar models have been developed and used in many other developing countries. The task is made easier now by the fact that a model for Sudan can be developed and run on the microcomputers already in place in FAEA.

A price-endogenous linear programming model would be conceptually compatible and complementary to the price analysis proposed above. The sector model would incorporate many of the same demand parameters used in the price analysis, but would utilize a much more articulated structure on the supply side, which would make good use of the data base being developed by the Production Economics section of FAEA. On the other hand, the price analysis could incorporate many of the more subtle features on the demand side and in market structure. The sector model would readily handle a number of important linkages among the agriculture sub-sectors, such as labor flows and wage rates.

Price-endogenous linear programming models are solved by explicitly maximizing the sum of producer and consumer surplus across all the interacting markets. This feature is conceptually identical to the price analysis approach outlined earlier. Both the sector model and price models can be used

to simulate competitive equilibrium for different settings of the exogenous variables. Thus, in that sense, they are simulation models.

We note that a fully developed price-endogenous linear programming model will probably require several years to complete, and thus is not likely to be in place at the conclusion of the APS project. We believe, however, that it may be appropriate to start working toward that long-term goal now. An alternative is a "multi-market model" utilizing matrices of elasticities on both the demand and supply side. We suggest that Brian D'Silva of USAID, who has experience with both types of models, along with other experts be involved in deliberations regarding an agricultural sector model.

RECOMMENDATION: That PAEA, with the assistance of Chemonics, USAID and others, consider merging the sector modeling tasks into a single effort to develop an integrated model.

Finally, a note of caution: a sector model can be a very useful analytical tool, but it is no panacea; policy analysts, even if they have the world's best sector model, must still draw their information and inspiration from a multitude of other sources.

The earlier suggestion to involve PAEA staff currently enrolled in graduate programs also applies to the sector model. Several good dissertations could be written on the development of a basic sector model and possible extensions, such as the incorporation of risk parameters.

I. Summary & Conclusions

The 1989 Work Plan tasks are directed toward strengthening ongoing functions of the PAEA for the most part. Most of the tasks can be completed in 1989, although one would expect similar types of work to appear in future work plans. There are no obvious questions of sustainability because no major new lines of activity are initiated in the Work Plan, although the possible

sector modeling raises a number of questions about sustainability which must be tackled as model design emerges.

We propose a frontal attack on the sustainability issue. A major problem is the myopia of many government and donor officials. The pressing concerns of the day often crowd out concern for the longer term. Building capacity for agricultural policy analysis, planning and data collection, however, is unavoidably a long term process. Proper guidance and support for the process requires a planning horizon of a decade or more. Discussion of the APS project is often dominated by concerns about the PACD, when the next progress report is due, what's wrong with the latest piece of paper, etc. To better assure the future development of agricultural policy analysis and planning in Sudan, we recommend PAEA develop a "Strategy for the 1990s." The strategy would include a statement of desired capabilities by the turn of the century, the size and training of staff required, and required facilities (office space, vehicles, computers, printing equipment, etc.). It also would include a realistic assessment of funding expected from the Government of Sudan and the amount and type of support needed from other sources.

RECOMMENDATION: That PAEA develop a "Strategy for the 1990s" to more effectively guide long term development of PAEA and related institutions.

To develop the strategy, it would be appropriate for Chemonics to provide a "facilitator" to organize and lead the strategy development process. We encourage USAID to participate substantively in the process and give due consideration to support beyond the APS project.

The overall 1989 Work Plan should be approved formally by USAID with the stipulations enumerated above. There should be no formal revision. Instead, plans should be worked out in a collegial manner with all parties cooperating and contributing.

RECOMMENDATION: That USAID formally approve the 1989 Work Plan.

The next formal work plan exercise should take place later in 1989. We recommend that a work plan for the period from January 1, 1990 to the end of the APS project be prepared, reviewed and approved no later than December 1989. It should provide about the same level of detail as the 1989 Work Plan, and should be explicitly justified in the context of a jointly developed methodological plan, as discussed earlier, and the strategy for the 1990s.

RECOMMENDATION: That a Work Plan for the period from January 1, 1990 to end of project be prepared, reviewed and approved no later than December 1989.

AGRICULTURAL STATISTICS

A. Summary

The statistics component of the APS project has not progressed as well as one could reasonably expect. The major contribution to this limited performance is the lack of photographic material to construct a sample frame, select the sample and carry out data collection. As a result, little progress on objective procedures was made during the first five years of the project. The SERISS project provided a sampling frame for the 1986/87 crop year by using Landsat imagery. The area sample frame was hastily constructed on a 1:250,000 photographic product. The Sudan Survey Department failed to provide low level aerial photography for sample selection and data collection purposes. This resulted in many of the original sample segments being lost in the traditional stratum and prevented increasing the sample to an operational level. PAEA repeated the 1986/87 data collection effort for two additional years with little or no change.

Substantial effort will be required if the PAEA is to be left with a viable objective data collection program. The frame exists and can be used, however, its efficacy would be improved by further enhancement or completely redoing it. Improved photographic products are required for enhancing the frame, for sample selection, sample location in the field and data collection. The pending SERISS extension set forth in Section D, SERISS Extension, and the design suggested in Section E, Design Improvements, are designed to determine if SPOT can meet these requirements. Section E defines procedures to carry out a field test of SPOT and other technical improvements. Once the 1989/90 survey results are available, a definitive answer as to further direction of the AFS component can be provided.

The ASF can be made operational and provide results with acceptable levels of precision if SPOT can provide adequate photographic products. Time remaining in the APS project becomes a critical element. The time required to determine the feasibility of SPOT and carry out the additional work would not allow a

full operational sample until the 1990/91 crop year. Additional time will be required to fully exploit the investment in SPOT imagery. On the other hand, should SPOT prove to be inadequate, the ASF should be discontinued in the traditional stratum until such time that proper mapping material can be found. TM photographic products are to be evaluated in terms of their usefulness in segment location should SPOT be decided against.

In the meantime, field manuals need to be developed and utilized during data collection, data handling procedures need to be developed and followed, and additional short-term training is required. These efforts are needed to reduce the nonsampling errors that currently exist. Sufficient vehicles are required for logistical support and as such, their use needs management and planning. The best mapping materials available and unlimited vehicles will do little good unless the nonsampling errors are controlled. Conducting the ASF is a massive undertaking and a substantial management effort is required. There are a number of technical recommendations in Section E, Specific Issues, that specifically address the nonsampling error problem. AID will need to actively support the training program outlined in Appendix E to assist the project.

Finally, there are some institutional problems. Most units within the Economics and Statistics Department are engaged in survey activity. The technical expertise to carry out and conduct surveys is limited and thus more collaboration within the Economics and Statistics Department is needed. Eventually, one may want to consider moving towards a more functional organization.

B. General review

The Area Sampling Frame (ASF) accounts for a considerable part of the APS project effort. Establishing an ASF is a large undertaking and requires a rather healthy portion of the available resources, at least during the early stage of its development. It is, however, a necessary first step in establishing an objective statistical data collection system for agriculture. We wish to thank members of PAEA, the Chemonics Team and Dr. Falconer from the Nairobi Center of Remote Sensing. Their generous contribution of time is deeply appreciated.

This section will open with brief discussions on the land use in Sudan, the historical data collection system, how the frame was constructed and sampled. The main problems encountered by the ASF are discussed. During the review process it became apparent that the Sudan Emergency and Recovery Information and Surveillance System (SERISS) had a large impact on the project. There was confusion over the relationship between SERISS and its objective versus ASF and its objectives. This confusion has been detrimental to both projects and is discussed in Appendix B. A SERISS extension was being formulated as part of the APS project so extra effort was required to ensure adequate coordination. A list of tasks for the SERISS extension are outlined and then some design improvements are discussed. The design improvements section may be carrying this evaluation somewhat further than intended; however, it might be helpful. Specific issues addressed by the scope of work are then covered in Section E. Some of the discussions are a little lengthy but this was felt necessary as statistics and ASF are fairly technical topics.

Survey documentation is seriously lacking. It is difficult, if not impossible, to find such basic items as survey results. It was only after considerable effort that the evaluation team found the survey results and even that required additional calculations. Survey results are presented in Appendix C. Documentation describing the methodology of the frame construction procedures, sampling plans, sample design etc. apparently does not exist.

1. Land use

Approximately 90% of land in Sudan is government owned. Irrigation projects along the Nile have been developed by the government and are controlled by government irrigation corporations. The land is leased to tenants for long periods of time. The crops planted, some inputs such as insecticides and fertilizer and marketing of the crop are rather tightly controlled by the corporations. The irrigated sector accounts for approximately 20% of the total cropland.

The government also owns the bulk of land in the dryland areas. The cultivated dryland area can generally be broken into the mechanized portion and the traditional portion.

Mechanized dry land farming is defined as the land where the soil is prepared for seeding by mechanical means. A portion of the harvesting is done by mechanical means and the balance by manual means. The land around the villages is largely left undisturbed as the land is developed into large fields. The farmers may farm the land around the village as they wish. The mechanized rainfed sector accounts for approximately 30% of the total cropland.

Mechanized rainfed agriculture can be further divided into demarcated and undemarcated areas. The demarcated area consists of large fields of either 1,000 or 1,500 fedans. A holding generally consists of a 2x3 kilometer piece of land. The government creates these holdings thru their developmental program. The holding is leased to tenants who can operate the land about as they wish, however, the government strongly encourages certain crop rotation patterns.

Holdings can range from 1,000 to 6,000 fedans in the undemarcated areas. Fields may or may not be regular in shape and may contain non-cultivated areas such as patches of trees that have not been cleared.

The balance of the cropping activity falls in the traditional area. This portion is characterized by small holdings where the farming activities are generally accomplished by hand. Farmers grow a food crop for consumption and a cash crop to generate some income. Fields are small, irregularly shaped and scattered. Much of the land is tribally administered and farmers may move their operations around as land is not a limiting factor.

2. Historical data collection and estimation program

The statistics section of PAEA had to rely on a subjective approach prior to the establishment of the area sampling frame. They obtained reports from the Mechanized Farm Corporation, which provided subjective information, and information from the local agricultural offices. The local offices obtained their information by traveling around their respective areas making eye estimates and talking to informed persons in the area. Some crop cutting was carried on by the Statistics Division using a list frame from the 1964 population census. The quality of the information supplied by the local agricultural offices has deteriorated in recent years.

The preceding system was highly subjective and could not produce the type of information required. It is still used to provide forecasts of acreage, yield, and production. The ASF is the only vehicle available to provide an objective estimate with a stated measure of error.

3. Frame construction

The frame covers 9 provinces in the central part of the country. Southern portions of the country are excluded due to the war and the northern part was excluded due to lack of agricultural activity.

Four strata were defined: irrigated; mechanized demarcated; mechanized undemarcated and traditional. Personnel associated with remote sensing created blocks of land on approximately 35 Landsat scenes corresponding to the 4 strata definitions. During this process large areas of land were classified as non cropland (rangeland, forests, and wasteland) and dropped from the frame. The remaining land that was classified as cropland into one of the 4 strata was then measured by using grids. Each grid contained 25 square kilometers. It was desirable to have each primary sampling unit (PSU) equal one grid, however, in practice, it was necessary to make the PSUs larger due to insufficient boundaries observable on the satellite coverage. PSU size generally ranged from 1 to 6 grids. A sample of the PSU's were provided to the Statistics Division.

4. Sample selection and data collection procedures

Many of the sample PSU's were much larger than the desired 1 grid (25 square kilometers) due mainly to the inadequacy of boundary information observable on the satellite coverage. The Sudan Survey Department was to provide low level photography of each selected PSU. They, however, were never able to provide complete coverage. Much of the anticipated sample was never provided for the traditional area. As mentioned earlier, PSU's were often too large and as such they were subsampled to yield a final PSU with an average size of approximately one grid unit. An entire grid was selected for enumeration in the mechanized demarcated and undemarcated strata. The grids had to be further subdivided in the traditional stratum. Each grid was subdivided into 24 segments in the field. Two of the 24 segments were then selected for data collection. The scale of the 1960's low level photography obtained from the Sudan Survey Department was 1 to 30,000. The low level photography was generally judged to be of sufficient detail to subdivide the PSU, however, the little material that we observed was seriously lacking for data collection purposes. The matter will be discussed in greater detail under specific issues.

A data collection team of the supervisor, one or more enumerators and a photo interpreter went to the area containing the PSU. They split the PSU (in the traditional stratum) and after locating the specific area for enumeration they have one or more persons familiar with the area to help them list the operators having land inside the segment. They then return to the village and normally the chief asks the farm operators to come to a central point where the interviews take place. Recent low level photography is necessary to carry out sub-sampling, segment location and data collection. As a consequence, the unavailability of adequate photography continues to hamper efforts to establish and carry out a data collection program. Recently, "SPOT" has been investigated as an alternate and will be discussed later in this report.

C. Problem Areas

1. Introduction

The APS is now eight years into a ten year project. Very little was accomplished during the first five years of the project towards developing a statistical component based on objective procedures. As a result of the SERISS project, an area frame was hastily developed, a sample selected and data collected. Remarkable progress was made in a very short time. National estimates with reasonable coefficients of variation were produced. The same survey was conducted for two additional years with no enhancement of the frame, sampling materials or data collection procedures. A data collection capability has been demonstrated by PAEA. Much improvement remains to be done and the availability of adequate mapping materials continues to be a major problem. PAEA has the sole responsibility of providing official crop statistics and they have no alternative method other than ASF. Continued progress is largely dependent on obtaining adequate photographic materials to improve the efficiency of the frame, to enable subsampling PSUs, locate the segments for enumeration in the field and facilitate accurate data

collection. A viable estimation program can be mounted providing adequate photographic materials can be obtained.

Much time has been wasted and the remaining time in the APS Project is probably too short to complete the development to ensure PAEA is left with a viable program of data collection and estimation which will withstand the test of time.

2. The frame

An ASF is a listing of identifiable land areas which when taken together comprise a sampling frame just as a list of names provides a sampling frame. A probability sample can be selected from the frame and an estimate can be developed with a stated measure of sampling error. If the resulting estimates have an error that is too large to be useful, one has the choice of reducing the error largely by one of two ways: improving the frame to make it more efficient or by increasing sample size. The decision of which method to use in reducing the error is dependent on a number of factors. The most important of these factors are the time and resources available over an extended period (improvement to the frame costs may be amortized over a long period of time vs. the increased sample size being a recurring cost), prior information available for use in improving the frame, cost of resampling the frame, and the total resources available to carry out data collection and estimation procedures.

The ability to construct an efficient ASF is largely dependent upon the type of photographic material that is available, land-use patterns, and the existence of recognizable identifiable boundaries. As is true with most sampling distributions, the more scattered the distribution of the item being estimated, the more difficult it is to estimate.

The ASF was constructed by using 1:250,000 Landsat imagery. It was decided to use land use stratification to improve the efficiency of the frame. Such stratification will normally improve the efficiency

substantially. Consequently, the four basic land use strata used were: irrigated, mechanized demarcated, mechanized undemarcated and traditional. These types of land use are easily recognizable on the Landsat scenes, but provide little gain in precision over a purely geographic stratification that is inherent in an area frame. The traditional agricultural sector would be expected to be the most variable in terms of the occurrence and density of agricultural activity. The four western provinces are almost entirely composed of traditional agriculture. In summary, the land use stratification largely achieved the same effect as geographic stratification and as such was ineffective in reducing sampling error.

3. Mapping Material

An ASF requires mapping material for three distinct phases: frame construction; sample selection; and field data collection. Aerial photography is the preferred material as it shows land features and use. Topographic maps of good quality have been successfully used in other countries for all three phases.

The ASF component of the APS Project has been hampered from the very beginning by the absence of photography. We understand that low level aerial photography of 1960s vintage is available. Land use changes come about rather quickly and this material was judged as not being acceptable for ASF construction. The SERIES Project obtained Landsat which was used for this purpose. Landsat is useful for stratification as it shows current land use but the scale is such that physical boundaries are difficult to determine. This is particularly true in a country like Sudan where physical boundaries such as roads etc. are limited. As a result, the PSUs constructed on Landsat tend to be quite large. This in turn requires two, and sometimes three, stages of sampling to arrive at the selected sample segment. The scale of the photography used for sample selection must be larger so that physical boundaries used to define segment boundaries are more visible. Photography of about 6 to 8 inches to the kilometer is desirable to use for data collection. This allows the enumerator to draw tract and field boundaries on the photograph.

Original plans called for the Sudan Survey Department to fly the selected PSUs and provide low level photography. This effort was not successful. The available satellite material becomes fuzzy and unclear when it is enlarged. It was not adequate to split PSUs into segments or to provide sufficient detail to allow locating the segment in the field. The absence of low level photography has also impacted on the mechanized strata. An entire PSU was used as the segment. This resulted in segments that are probably much larger than is necessary and as such adds to data collection costs and perhaps nonsampling error.

CONCLUSION: The absence of adequate mapping material has been the single most important factor in limiting the effectiveness of the ASF in Sudan.

4. Precision of estimates

a. Area

A brief analysis was completed to determine the approximate increase of sample size required to reduce the variance to prescribed levels. A full analysis for a recommended final sample size is presented in section F-1, ASF Sample Size, of this report. The Statistics Division established desired precision requirements of 10 percent at the province level for major crops. The results of the analysis using this criterion are presented in Appendix A. This analysis indicated that nearly 3200 segments would be needed for sorghum. Alternatively, nearly 1,150 segments would be required to provide the 10 percent error level for millet. A compromise allocation would provide for a 10 percent error at the province level and 6.0 percent nationally for millet, and 10 percent for sorghum in major provinces, approximately 20 percent in less important provinces and 5.4 percent nationally. This could be

accomplished with an overall sample size of approximately 700 PSUs and 1,150 segments. This analysis clearly shows that either additional land use stratification within the traditional sector, relaxation of the precision requirements or both will be required.

CONCLUSION: Some gain can be achieved by additional stratification. This gain will not be sufficient to provide a 10 percent level of precision for all crops at the provincial level with a manageable sample size. There must be some relaxation of precision requirements at the provincial level.

b. Sorghum production

During the course of the evaluation a question was raised about the production of sorghum in Darfur. Apparently, the Jebel Mara project had greater production than the estimate for the area. First of all, most of the sample in the traditional area was not surveyed because of missing low level photography. The remaining segments will not estimate for the entire area. In fact an estimate of the area should not have been made. A crop cutting sample can only be laid out in a segment enumerated for area. In addition, one cannot be sure which stratum the project was placed in without locating it on the frame and the estimates provided by the Jebel Mara project are suspect. As mentioned before, the error was in publishing the estimate, however, we understand the desire to publish the data with the pressure for information during that time period and the absence of any alternative. This example should not be construed to indicate the methodology does not work.

5. Nonsampling errors

The total error in an estimate is composed of sampling error and nonsampling error. The sampling error can be measured by the variance calculation and consequently is reflected in the c. v. On the other hand, nonsampling errors cannot normally be measured. They can only be controlled by following all the proper procedures from the frame construction process to

preparing the final estimate. Institution of a quality control program helps control nonsampling error and point out areas of concern. Nonsampling errors are additive, generally are in one direction and as such seldom cancel the effect of each other. The first source of nonsampling error is dropping a portion of the land, classified by the photo interpreters as nonagricultural, from the frame. Dropping the irrigated stratum from the survey and excluding irrigated land not in the irrigation schemes from the survey is also a nonsampling error. Other sources of nonsampling error were detected during this review and have been discussed in sections F-3, Enumerator Quality, and F-4, Yield Data. Needless to say, procedures have been somewhat loose. It is only through continued attention to detail, strict adherence to procedures, proper training and finally the institution of a good quality control program that one can control nonsampling error. What appears to be a high quality estimate can be made useless or even detrimental unless a conscious effort is made to control nonsampling error.

CONCLUSION: Little attention has been paid to the nonsampling error problem. Detailed procedures need to be developed for each phase of the survey. Once developed, these procedures need to be closely followed.

6. Surveys Other Than Area Frame

There are specific functions in survey development that are technical and require expertise. Questionnaire design, survey procedures, sample selection, etc. are such functions. PAEA Staff with these skills are limited in number. Additional staff can and are being trained, however, they are insufficient in number and expertise.

CONCLUSION: There needs to be more collaboration on all parts of the survey process within Economics and Statistics. Eventually, one may want to consider moving towards a more functional organization.

7. Institutionalization

As mentioned previously, the SERISS constructed the ASF and provided a sample of PSUs to PAEA. A photo interpreter from the Soil Survey Department traveled with the enumerator team to each segment. He was responsible for locating and splitting the PSU into segments in the traditional sector. PAEA then collected and summarized the data. Thus, as far as PAEA is concerned, only the data collection activity has been institutionalized; the frame construction and sample selection activities have not been institutionalized.

It is desirable, if not imperative, to have the statistical agency that is responsible for making official estimates in control of the technology and resources needed to develop those estimates. Only in this way can the statistical agency be held accountable. Admittedly, it is more efficient to have the frame construction completed by remote sensing personnel in the current situation. However, if at all possible, a limited number of the Statistics Division staff should work on the frame along with the photo interpreters. The proposed SERISS extension discussed later envisions full participation and direction from PAEA.

RECOMMENDATION:

Future training and development of the ASF should consider building a strong technical base in the Statistics Division consistent with time constraints.

D. SERISS Extension

The area frame currently used by APS was provided by SERISS. Since that project ended after one year, further improvements in the frame were not possible. Also, the frame was never completed in the sense that the land classified as nonagricultural cannot be dropped from the frame. The SERISS extension currently under development clearly places RCSSMRS in the role of supporting the ASF and thus the APS project.

1. Preliminary Task Listing

Discussions between Dr. Falconer, the Chemonics Statistical Advisor, and others led to the preliminary listing of tasks that follow:

<u>TASK</u>	<u>RESPONSIBLE PARTY</u>
1. Feasibility study of SPOT & Landsat Thematic Mapper (TM) on sample in Darfur.	Technical Committee, RCSSMRS
2. Decision to use land use stratification within PSUs. Implies use of SPOT if decision is affirmative.	Technical Committee

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| 3. Review stratification in Darfur and recommend final stratification guidelines for traditional sector. | Technical Committee,
Consultant |
| 4. Complete stratification on TM for traditional sector and assign intensity of visible agricultural index of 6 or less classes. | Soil Survey Dept., Consultant,
NRSC |
| 5. Select PSU sample and provide mapping materials. The sample PSUs should be digitized if possible. | PAEA |
| 6. Land use stratification within PSU. | Soil Survey Dept., PAEA |
| 7. Select segments within PSU | PAEA |
| 8. Provide some type of enlargement for enumerator purposes. | NRSC, RCSSMRS
Soil Survey Dept., PAEA |
| 9. Support data collection | Soil Survey Dept., PAEA |
| 10. Support input of data into classification and G.I.S. Pilot. | RCSSMRS |

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|---|---------------------|
| 11. Prepare specifications
for G.I.S. Pilot out-
put. | Technical Committee |
| 12. Training | RCSSMRS, PAEA |
| 13. Archive and Maintenance
function | PAEA |

RECOMMENDATION: The preceding list of tasks for the SERISS extension is recommended.

2. Discussion of Tasks

Task 1, Feasibility Study: The failure of the Sudan Survey Department to provide low level photography has seriously hampered the AFS project. Low level photography is necessary to split PSUs into segments and to locate the segment in the field. In addition, low level photography could be used to further stratify the PSU by intensity of agricultural activity to enhance the efficiency of the ASF (see discussion in section E-1). This task is designed to determine if SPOT or TM can be used for this purpose. Observation of TM enlargements for 6 or 7 PSUs indicates that it is not sufficient for landuse stratification within selected PSUs. The study is to determine the following:

- 1) Is the clarity of SPOT sufficient to allow land use stratification within PSU?
- 2) Is the clarity of SPOT sufficient to split PSUs in the office?
- 3) Is the clarity of SPOT sufficient to locate the segment in the field?
- 4) Is the clarity of TM sufficient for the purposes stated in 1, 2, and 3 above?

Task 2, Decision to use land use stratification: It is possible that SPOT will allow land use stratification within PSUs. It will take approximately 250 SPOT scenes to cover the entire traditional sector. Each scene costs about \$2,000 and as such SPOT will have a total cost of \$500,000. The preliminary PSU sampling plan is provided in section E-2-a of this report.

Since the cost of SPOT is quite large the full sample set forth in E-2-a is not recommended for this year. A smaller sample of replicates will be selected in Darfur for the first year. This is probably the extent of the work that can be accomplished prior to the 1989/90 survey. Taking two years to implement the full sample would provide information to allow for an improved sample design and make other possible improvements based on the experience learned in the first year. The balance of the scenes would be needed the following year.

There is a great deal of work to be completed if the decision to buy SPOT is made. The balance of the tasks in the SERISS extension would be completed. It is doubtful that all of the work could be accomplished in the remainder of the time left in the APS project and still be effective in ensuring that PAEA is left with a viable system that they can operate. Due to the cost of SPOT it would seem reasonable to entertain the idea that an extension of the APS project may be needed.

If SPOT is not satisfactory for land use stratification it is doubtful that the expense would be worth the gain if its only use would be to split PSUs into segments and locate the segment in the field. If this were the situation one would hope that TM would be satisfactory to locate the PSU in the field. In fact, the cost of SPOT may be such that one would decide to forego land use stratification within PSUs, particularly if the study showed TM enlargements (costing \$75 each) would allow locating the PSU in the field.

If the decision is that neither SPOT nor TM can be used, then one should also decide to discontinue ASF data collection in S. Kordofan, N. Darfur, and S. Darfur until adequate mapping material can be found. In the meantime, the subjective procedures used for early season forecasts would be continued.

RECOMMENDATION: Discontinue ASF data collection in N. Kordofan, N. Darfur, and S. Darfur unless adequate segmentation and location can be obtained for all selected PSUs.

RECOMMENDATION: Tasks 3-9: These tasks should be dropped if data collection is discontinued in N. Kordofan, N. Darfur, and S. Darfur.

RECOMMENDATION: Tasks 10-13: If data collection in N. Kordofan, N. Darfur, and S. Darfur is discontinued, a decision on whether to continue these efforts in the mechanized strata is worthwhile. If the decision is to continue with tasks 10-13, then ASF data collection should be resumed in the irrigated stratum.

E. Design Improvements

1. Land use stratification

As discussed under C-4, Precision of Estimates, the land use stratification was not effective in producing efficient samples at the provincial level as it duplicated the natural geographic stratification inherent in the ASF. The major problem is the 4 provinces that make up the bulk of the traditional agriculture sector. It was also stated that the precision of the resulting estimates could be improved by enhancing the frame or by increasing sample size. Measures of precision are extremely high at the provincial level and as such it does not appear reasonable to gain the added desired precision by merely increasing sample size. Thus, additional land use stratification is desirable.

It is conceptually possible to carry out additional land use stratification within a replicated sample of PSUs. Then a stratified sample

of segments could be selected within each replicate. Such a procedure would serve to reduce the overall measure of sampling error. The degree of sampling error reduction is dependent on the effectiveness of the prior PSU stratification. The goal is to stabilize the replication estimate which will then improve the precision of the resulting overall estimate averaged over replication. This second stage of stratification is dependent upon adequate photography of sufficient scale and the existence of physical boundaries. An examination of old low level photography provided by the Sudan Survey Department indicates that new aerial photographs could be used for this purpose if it were available. The evaluation team examined TM coverage, at a scale of 1:50,000, of some actual PSUs in the traditional sector, and based on this examination, judged that land use stratification within PSUs is not possible with TM due primarily to the lack of recognizable boundaries. Even 1:24,000 SPOT coverage, which has more clarity, may not be satisfactory. A feasibility study to determine if SPOT coverage is satisfactory is a task for the SERISS extension discussed previously.

The following sample design is proposed should the decision of Task 2 of the SERISS extension be to use land use stratification within a sample of PSUs.

a. Land Use Stratification Within PSU

This design entails stratification of the PSUs at two levels. After the reclassification of land area into agricultural and nonagricultural as called for in the SERISS extension, the resulting smaller PSUs will be broken into two groups or strata based on intensity of visible field activity. The PSUs will have already been categorized into 6 groups; 75 percent or more, 50-75 percent, 25-50 percent, 10-25 to percent, less than 10 percent but greater than zero, and non-agricultural. An analysis of the number of PSUs in each group would help determine the strata break that would finally be used. In the absence of that information, we would recommend less than 10 percent and 10 percent or more. It may be decided to change this once accurate counts are obtained.

At this point a replicated sample of PSUs would be selected and land use stratification carried out in each PSU. The stratification variable would again be intensity of visible agricultural activity. Three land use strata are proposed for this phase as follows: 50 percent or more, 10 to 50 percent, and less than 10 percent. The stratum that has been originally classified as non-agricultural would also be sampled lightly. The replicated sample size for the preceding frame construction work is as follows:

DOMAIN A: Land originally classified as nonagricultural and dropped from the frame: Select a 2 x 10 replicated sample (2 samples of size 10 each) if frame is completed, otherwise select 20 point samples at random to represent the entire traditional sector.

DOMAIN B: PSU's classified as having 10 percent or more agriculture. In this substratum the following PSU sample is recommended by province:

<u>PROVINCE</u>	<u>ESTIMATED NO. PSUs</u>	<u>SAMPLE SIZE</u>
S. Kordofan	185	4 x 5 = 20
N. Kordofan	2,000	10 x 12 = 120
S. Darfur	685	10 x 12 = 120
N. Darfur	630	10 x 10 = 100
Central Region	740	6 x 10 = 60

DOMAIN C: PSU's classified as having less than 10 percent agriculture. Select a 6 x 10 replicated sample across the entire traditional sector.

Upon completion of the land use stratification a stratified sample of segments would be allocated to land use strata and systematically selected across PSUs. An estimate for each replicate would be obtained by expanding each segment by the reciprocal of its probability of selection and summing

across all PSUs within each replicate. Each replicate when expanded provides an estimate of the item of interest. The final estimate is obtained by averaging replicate estimates, and the variance of the estimate is obtained by calculating the variance between replicates.

Selecting the sample of segments systematically across PSUs within a replication will not allow a valid variance estimate between PSUs within replicate. Thus, in this design study it would be desirable in one of the 3 replicates in N. Darfur to sample independently within each PSU allocating one segment to each land use strata. The variance can be calculated using the ultimate cluster approach.

Accurate cost data should be recorded to adequately reflect within and between PSU costs. It is generally recognized that the between PSU costs will be large and as such favor a heavier within PSU sampling rate. On the other hand, large PSU sampling theory indicates that heavier sampling within PSU does not serve to significantly reduce the overall variance.

The resulting design would be as follows:

S. Darfur: 2 x 12 with 16 segments selected
across PSU. (i.e. 32 segments)

N. Darfur: 2 x 10 with 14 segments selected across
PSU (i. e. 28 segments)
1 x 10 with one segment per land use
stratum within PSU (10 x 3 or 30
segments)

If it appears that SPOT facilitates land use stratification one may want to consider redoing the entire frame. Analysis of the 89/90 data in Darfur will provide guidance in reaching a decision. This is a substantial amount of work and one would need to consider the amount of the additional

effort and time required versus the expected gain over the design specified in this section.

RECOMMENDATION: The feasibility study should be conducted in 2 replicates (2 x 12) in S. Darfur and 3 replicates (3 x 10) in N. Darfur.

b. Use of TM Enlargements

The following sample design is proposed in the event the decision of the technical committee is to use TM enlargements for locating PSUs, thereby foregoing land use stratification within PSUs. Actually this sample design is the same as that recommended under land use stratification, with the exception that larger sample sizes are suggested in Domains A and B. The recommended sample sizes are as follows:

DOMAIN A: Select a 2 x 10 replicated sample.

DOMAIN B: The following PSU sample is recommended by provinces with 2 segments selected within each PSU.

<u>PROVINCE</u>	<u>SAMPLE SIZE</u>
S. Kordofan	4 x 5 = 20
N. Kordofan	8 x 14 = 112
S. Darfur	11 x 16 = 176
N. Darfur	8 x 14 = 176
Central Region	6 x 10 = 60

DOMAIN C: Select a 8 x 10 replicated sample across the entire traditional sector.

c. Agricultural Versus Nonagricultural Stratification

The SERISS extension calls for restratification of the traditional sector. The statistics section says this has already been done in North and South Darfur. The original stratification was apparently done in a hurry and resulting PSU's were very large. The agricultural stratum was redrawn and much smaller PSU's were constructed. Little if any gain in precision can be expected from reducing the PSU size. The restratification called for in the SERISS extension is to cover North and South Kordofan in a similar fashion. Post-stratification of the earlier frame in Darfur indicated that a substantial portion of the agricultural strata was in fact non-agricultural. The area that was post-stratified had 12 PSUs in the ongoing survey. Three of the 12 segments had no agricultural activity and all fell in the non-agricultural post strata. This sample size, however, is too small to draw any firm conclusions. It has been the practice to drop the land classified as non-agricultural from the frame. A serious bias could come about if the restratification involved classifying more land as non-agricultural and dropping it from the frame. Task 3 in the SERISS extension is designed to review this stratification and develop guidelines to be used in the entire traditional sector.

RECOMMENDATION: Review the restratification of North and South Darfur. If the review indicates an overall improvement then the same restratification should be carried out in North and South Kordofan. The SERISS extension could be set up to collaborate on the review and if the results are positive provision made to carry out the work in Kordofan.

2. Other Sample Design Considerations

The general sample design is a two stage cluster sample selected with replicated systematic procedures. Systematic sampling is discussed in section

F-2, Simple Random versus Systematic Sampling, of this evaluation. Continuation of the replicated systematic selection procedure is recommended. Also in Section F-1, AFS Sample Size, the sampling fraction at the second stage is discussed. This section on sample design is concerned with the methodology used in selecting the second stage sample in the traditional sector, the size of the segment in the mechanized strata, and the exclusion of land classified as non-agricultural from the area frame.

a. Traditional sector

The size of the PSU in the traditional sector is quite large and is approximated in number of grid units graduated to the nearest 1/4 grid. Each grid is 25 square kilometers. The PSU is subdivided into one grid unit with a specific grid selected randomly. The selected grid is then further subdivided into 24 segments from which 2 segments for enumeration are to be selected at random.

As mentioned previously, TM coverage does not allow identification of physical boundaries needed for segmentation of the PSU. The majority of the segmentation has to be done in the field and as such the control of the sampling procedure is minimal. This problem was raised by Statistics Division staff and the resident advisor. All were aware of the biases that normally arise from an uncontrolled sampling procedure. It appears that point sampling, or some variation, is called for within the PSU if TM coverage is used for locating the PSU. Point sampling needs to be tightly controlled and can lead to biases when there is a relationship between boundaries and land use. A better procedure in this situation would have the sampling section staff construct segments in the PSU using imaginary boundaries when necessary or alternatively select a random point and construct a segment about the point using imaginary boundaries. This work would be done in the office prior to going to the field. The photo interpreter and enumerator would then go to the field, attempt to locate the segment and carry out data collection. In doing the data collection, the tract boundaries would be drawn on the enlarged

segment overlay as nearly to scale as possible. This process would continue until an area approximately the size of the segment had been enumerated. During this process, the imaginary boundaries would be generally adhered to but could be violated where necessary. The resulting segment would then be measured and its expansion factor calculated by dividing the area in the segment by the area in the PSU. This implies that the area of the PSU is accurately determined by planimetry or digitizing and that the enlarged overlay of the segment to scale is available.

Selection of the final segment in the field needs to be well documented in a step by step procedure and field crews trained to ensure this sampling procedure is adequately carried out. It will probably be necessary for members of the sampling section to develop and test the step by step procedure to be used in the field.

RECOMMENDATION: Develop and field test a step by step procedure to select segments within PSU in the field.

b. Mechanized sector

The sample results in the mechanized sector have been reasonably good. The entire PSU has been enumerated. The PSUs are quite large and may have one or more villages within the PSU. This creates a situation where the enumeration load per PSU is quite large and proxy respondents are being used for many of the small fields around the village. For example, there are instances where the chief was reporting for the entire small village. Clearly these segments needed to be reduced in size. Segmentation should be easier in this stratum due to the greater incidence of boundaries. Most of the segmentation could be accomplished prior to going to the field. Reasonable reductions in the size of the resulting segment should have little impact on the expected variance. Perhaps, an analysis of data already collected would provide a guide as to a more optimum segment size. It would appear that the

PSU could be split into 2 or 4 parts and one selected at random for enumeration.

RECOMMENDATION: The PSUs in the mechanized strata should be subsampled for data collection purposes.

c. **Non-agricultural land**

Large areas of land were classified as non-agricultural and dropped from the frame during the original development of the frame. This was accomplished by interpreting Landsat at a scale of 1:250,000. The assumption that such land does not contain agriculture needs to be checked. This could be accomplished by taking a small point sample. This sample would help justify exclusion of these large land areas.

RECOMMENDATION: Select a small point sample in the non-agricultural stratum for inclusion in subsequent surveys.

3. Survey Materials

Inherent in the area frame closed segment approach is the use of an enlarged photograph during the interview. This serves to properly orient the respondent so that accurate data can be obtained. The tracts and fields are to be drawn on the photograph and then the information obtained on a step by step basis. One can then visually check the data reported for accuracy by comparing the reported tract and field area that is shown on the enlargement. Only in this fashion can one obtain high quality data.

Better field materials should be provided for field use. Enlarged segment photographs for data collection would be extremely useful. The feasibility study will experiment with 1 to 10,000 SPOT enlargements. However, if these are not adequate it is proposed to provide a segment outline on clear acetate for use in the field. This outline can be developed by reducing topographic

maps to 1:25,000 on clear acetate overlays. The segment boundaries are then traced onto the clear topo acetate including major field boundaries, etc. inside the segment. Other physical boundaries not shown on the topo could be added in the area adjacent to the segment. This overlay could then be enlarged and used for field enumeration. The enumerators could then sketch fields on the overlay and approximate the area of the field in the segment review. The Remote Sensing office in Khartoum can help provide these materials. Perhaps the SERISS extension can address the issue of providing enlarged scaled segment enlargements using cartographic procedures that would be an enhancement to that suggested above.

RECOMMENDATION: Actively seek out and develop procedure to provide a scaled segment sketch to the enumerator of sufficient size to facilitate drawing tract and field boundaries during the interview.

RECOMMENDATION: Check the availability of low level photography of 1960 vintage. It may be helpful in locating segments and for enumeration purposes.

F. Specific Issues

1. AFS Sample Size

"The number of samples for AFS; what is the optimal number of sample units taking into consideration national needs, regional needs and costs involved at different levels of precision?"

This is a difficult, if not impossible answer to provide given the data that is available to work with. As discussed earlier, low level photography for a large portion of the sample in the traditional sector was not provided. Data were collected from only the PSUs for which low level photography was received. These PSUs do not represent the total area and as a result, no

faith can be placed in the level of the estimate. Secondly, the data were collected from so few segments in the traditional area that the resulting variance calculations are quite high and are likely to be unstable. It is difficult to obtain information due to almost a total absence of documentation. Much of the survey results reported in this evaluation had to be developed from various sources and as such obtaining information on costs are completely out of the question. Also as discussed later in section F-7, Regional vs. National Data, the entire orientation of the program has been pointed toward regional estimates.

The PAEA Statistics Section requested a 10 percent level of error at the provincial level for each of the crops. Required sample sizes were then calculated for this level of precision (see Appendix D). Analysis of variance by components was provided by the Chemonics Advisor. This analysis indicated that the variation between PSUs accounted for nearly all the variation in resulting estimates (see Appendix D). We recognize that the between PSU cost is quite large compared to the within PSU cost. However, the logistical support for data collection is a limiting factor so it was decided to do 2 segments per PSU in the traditional sector.

The analysis of sample sizes required to achieve a 10 percent level of precision for each crop at the provincial level would require a 12 to 14 fold increase over the current level (see Appendix D). This clearly is beyond the capability of PAEA.

Some gains in efficiency (improved precision without increasing sample size) can be achieved by improving the stratification, particularly if SPOT is obtained. This gain will not allow achievement of the 10 percent provincial goal. In addition, a benefit-cost analysis (if one were possible) would not support this level of precision. Thus, it is apparent that the level of desired precision of resulting estimates may not be obtainable.

The sample size problem was then approached with an altered precision requirement. The requirement asked the following question "What sample size

would be required to achieve a 10 percent measure of error in the more important provinces for specific crops and a solid overall national level of precision?" The following table indicates that this general approach would require a sample of 725 PSU's containing 1170 segments.

Table E: Sample size required by crop & province with an overall recommendation

Province	Number of PSU				Recommended	
	Sorghum	Millet	Sesame	Groundnuts	PSU	Segments
Kasala	70		210		70	70
B. Nile	194		67		190	190
S. Kordofan	79	21	454	1,350	20	20
	26	14	151	450	20	40
N. Kordofan	337	63	113	332	115	230
S. Darfur	582	224	310	191	190	380
N. Darfur	443	120	1,100		120	240
Total	1,731	435	2,405	2,323	725	1,170

Table F: Expected c.v. of major crops using recommended sample size

Province	Sorghum	Millet	Sesame	Ground Nut
Kasala	7.2		17.3	
B. Nile	10.0		5.9	
S. Kordofan	16.2	7.0	38.9	67.1
N. Kordofan	17.1	7.4	9.9	17.0
S. Darfur	17.5	2.7	12.8	10.0
N. Darfur	19.2	10.0	30.3	
Total	5.1	4.5	8.5	12.8

The preceding table of expected c.v.'s indicates that the 1170 segments would provide for reasonable levels of precision (i.e. around 5 percent for sorghum and millet and 9-12 percent for sesame and groundnuts at the national level).

The recommended level of enumeration in table E does not account for possible efficiencies that may come about from improvements in the frame, increased stratification and reduction of segment size in the mechanized stratum recommended elsewhere in this report. Gains from these actions cannot be estimated with available information, however, they will serve to reduce sample size. Thus, it would appear reasonable to approach the required sample size in steps and using the additional information gained on effect of improvements.

The recommended sample size in table E can be scaled to any level desired. For example a 50 percent reduction in the recommended sample size would achieve a 7 percent c.v. for sorghum, 6 percent c.v. for millet, 12 percent c.v. for sesame, and a 18 percent c.v. for groundnuts at the national level.

2. Simple Random vs Systematic Sampling

"The evaluation of the AFS activities carried out in July recommended a switch to random sampling from systematic; the consultant should furnish guidance on this issue."

The evaluation recommended switching to simple random sampling within fine geographical substrata. This was to be done when a new sample would be selected after the frame was restratified. One must conclude from their report that the primary objective of the revised stratification was to create smaller and more homogenous PSUs. It is doubtful that creating smaller PSUs will have much effect on the resulting variances. While it is true that the PSUs are very large, they were subsampled into subunits of approximately 1 grid area as the first stage of a 3 stage sample. The frame materials and boundaries are such that the resulting PSU will still be somewhat larger than one grid. There does not appear to be anything in the restratification process which addresses land use.

One of the primary advantages of systematic sampling is that it provides a good geographic distribution of the resulting sample. The proposal would also provide for geographic dispersion as they suggested simple random sampling within fine geographic substrata. Sudan is a vast country and any reasonable geographic substratification would still not ensure dispersion with anticipated sample sizes.

The chief concern with systematic sampling is lack of a consistent variance estimator. In sampling areas of land where there are little periodicities in the listing of land areas, the variance of systematic samples is often somewhat smaller than those of alternative designs. Normally, one draws a single systematic sample and calculates the variance as a simple random sample. The resulting variance estimate normally overstates the actual variance, however, it is better to overstate the variance and have a more accurate estimate than it is to change the sample design to improve the variance estimate of a less accurate estimate.

The preceding discussion is based upon a systematic sample with a single random start (one sample). A consistent estimator of the variance is available if one were to choose more than one random start. If one wanted to select a sample of size 100 systematically with multiple random starts one is effectively selecting r samples of n segments at a time such that $rn=100$. Any value can be chosen for r . For example, if one chose r equal to 5, then we would say that there were 5 samples of 20 each. Each of the 5 samples (replicates) provides an independent estimate of the population and the variance calculated between the estimates is a consistent estimate of the variance. This type of sampling is often called "replicated" sampling.

Replicated sampling has several advantages in addition to providing a consistent estimate of variance while using systematic sampling. It makes it possible to achieve rotation by merely rotating replications. One can achieve a 20 percent rotation by merely dropping a replication or adding another in our example of 5 replications of 20 each. Also, one can adjust sample size

quite easily by including or excluding entire replications for a given survey. A final advantage of replicated sampling is it allows splitting the sample by subject matter areas in a single survey. In our example, we might ask cost of production data on 2 replications and farm income data on the remaining 3 replications.

RECOMMENDATION: Continue selecting replicated systematic samples.

3. Enumerator quality

"The quality of enumerators should be evaluated and any additional training needed to make the statistics teams more efficient should be suggested."

Determining the overall quality of the enumerators is a rather difficult task under the conditions that exist here and time constraints. Ideally, one should set through their training school, observe the field collection and review the completed survey schedules. Data collection was in progress but it was determined that such a trip would require 3 full days and it would be of questionable value as all interviewing is conducted in Arabic. The completed questionnaires are also in Arabic so a review of the reported data was not feasible.

As mentioned earlier, data collection in the field uses a team approach. Each team is composed of a photo interpreter, a driver, one or more enumerators, and a supervisor. The photo interpreter is responsible for locating the segment boundaries on the ground and identifying landmarks. The absence of physical boundaries, good maps, and the nature of the terrain can make this a difficult task. Once the segment is located, The team is to

drive/walk around the segment and observe as much as they can. They then enlist the help of an informed person and obtain a list of the operators having land inside the segment. They generally have the respondents come to a central point to obtain the questionnaires. The supervisor reviews all questionnaires after the enumeration is completed but before the team leaves the segment area.

A training school is held for the enumerators prior to going to the field. The team manual is the main instrument used during the training session. Generally, the training session has little structure and is a problem oriented discussion. The team manual has not been updated to cover situations that arise from actual experience.

The team manual is inadequate and bears little relationship to how the work is being carried out. For example, the manual describes a process of marking each tract on the segment photo in blue pencil etc. However, the photographic material used in the field is not of sufficient scale that the procedure can be used. Another example of how the manual and actual procedures differ is the unit upon which data is recorded. The manual defines a field as "one continuous area of land devoted to one use including one crop. For the purpose of this survey every field for major crops must be considered as a separate field." Yet, in the actual survey, all fields of a specific crop are combined and listed in the questionnaire as one field. For example, one segment in the mechanized strata contained between 500 and 600 operators from 3 or 4 villages. The farms operators were grouped by village and the chief of the village reported for 100 or more farmers. For example, all the sorghum was reported as one field for the 100 or more farmers. It is very possible that the land tenure situation would dictate that the data should be collected in this fashion. However, if this is correct, it should be documented in the manual. In all probability, the segment should be reduced in size. The team manual needs to be rewritten and translated to Arabic so that it is realistic and useable and then field personnel should be required to follow the procedures. It is imperative that all enumerators follow the same procedures.

The closed segment approach is used for data collection and estimation purposes. The closed segment approach involves accounting only for the land physically located within the segment boundaries. One of the strengths of the closed segment approach is the ability to add up all the reported acreage and compare it to the known amount of land in the segment. This provides an excellent check on the completeness of reported data and serves to reduce nonsampling error. The manual does not instruct the field personnel to make such a check and it is not carried out consistently. Actually, a form should be developed and included in the segment kit for use in the field and forwarded to the central office.

The object of good questionnaire design is to have the questions stated clearly and concisely and then to have all enumerators ask the questions as they are written. Also, to the extent possible, instructions and definitions should be included in the questionnaire. All too often, a fairly complex set of instructions and definitions are covered in the field manual but are never brought to bear on the questionnaire (the general case - not in Sudan as the manual really does not exist).

It was obvious that the questionnaire does not fit the manner in which data are collected. As such, each enumerator develops his own technique with no general criteria. This can cause a great deal of variation between enumerators in the quality of data collected. The questionnaire has screening questions to determine that the correct respondent is being used and a question to determine the total area in the tract. The questionnaire then provides a transition statement, "Now I would like to ask about each field inside this blue tract boundary and its use this year." They are to record the total area in the field, type of crop being grown, area not planted, area planted, area harvested, and production for each field. In the actual enumeration the enumerator may say "How much sorghum do you grow?". In a few cases, the total land use in a segment changes substantially from one year to the next. This could be caused by either the enumerator not being able to determine the segment boundaries accurately or by an "ad hoc" questioning

process which allows the respondent to report on land that actually falls outside the segment. Also, remember that separate fields are being combined and recorded as one field. This has implications on crop cutting and will be discussed later.

The questionnaire attempts to arrive at a net area planted. A similar procedure is not used on the area harvested. A series of questions should be developed for this purpose. For example, one could form a question that asks "of the _____ area planted, is there any area that will not be harvested" etc.

This discussion has dealt more with questionnaire design and field materials rather than addressing the quality of the enumerators. Clearly, the enumerators are following ad hoc procedures that lead to a host of non-sampling errors. It is a lack of direction and proper material that are responsible. We were impressed with the dedication, knowledge, and sharpness of those enumerators interviewed. Their training, field manual, questionnaires and documentation need to be improved. The enumerators are capable of carrying out the work if provided with the proper tools.

Other field procedures are handled in a sloppy fashion. For example, controls are loose enough that there have been examples of data collected from segments that were to be excluded from the survey. Also, the method of handling the data once it reaches the office needs to be improved and materials stored in such a way that they can be retrieved easily. A more comprehensive computer data edit with less emphasis on manual editing would be beneficial. The creation of a master record of the frame and sample to be used for summarization purposes and controls would be beneficial. Much of the computerization is being revised and developed.

The Resident Statistics Advisor recommended an overall program of training which is attached as Appendix E. The recommended program is well rounded and

solid. Courses 1, 2, and 3 are largely concerned with non-sampling error and Course 4 deals with sampling error. Care should be taken to show how these two concepts are related. There may be some shifting of proposed subject matter and time as the program is finalized. It is, perhaps, overly ambitious from the time point of view and may have to be spread over a greater time period or reduced somewhat in scope;

RECOMMENDATION: The training program as described in Appendix E should be carried out with the entire staff of Statistics Division in so far as it is possible to do so.

RECOMMENDATION: The field manual should be rewritten taking into account the experience that has been gained. The revision should lay out the procedures that are to be followed and solutions to unusual problems that may arise. Steps should be taken to insure that proper field and enumeration procedures are followed.

RECOMMENDATION: The enumerator training school that is conducted prior to each survey should be more structured.

RECOMMENDATION: Provide a check sheet for each segment and have it sent to the Central office with the completed questionnaires. The purpose of the check sheet is to list all tracts in the segment, obtain the total area of all tracts and compare it to a measured area obtainable from the survey material. The enumerator should recheck some interviews if the land area measured and reported differ by more than a given level (for example 5 percent).

RECOMMENDATION: Continue development of data processing with more emphasis on computer edits and master records, and develop procedures to handle individual segment expansion factors.

4. Yield Data

"The methods by which yield data is obtained should be reviewed. Information on yields is often obtained by farmer interview. Should cutting of samples be systematically carried out?"

Review of the yield data was hampered by the lack of documentation. The information from the crop cutting program does not become available until March and thus the Statistics Division must rely on subjective methods for earlier production estimates. This involves obtaining information from large government land corporations and the Regional Agricultural Officers. The data provided, for example, by the Mechanized Farm Corporation was subjective in nature. The Agricultural Officer traveled around the local area and provided estimates of area and yield by observation and talking to locally informed people. Some crop cutting was carried out for sorghum mainly in the mechanized area using a list frame provided by the 1964 Population Census. Attempts at updating the list frame were done on a sample of villages. In the judgment of the Statistics Division, the quality of the subjective data deteriorated over the years. Of course, the main disadvantage of estimates based on subjective data is that a measure of reliability can not be developed. One can not judge how good a subjective estimate is in the absence of good reliable check data on marketings, farm consumption, etc. Early crop cutting programs were hampered by the absence of adequate sampling frames.

There is still a need to rely on subjective methods to provide early season estimates of yield and production as the information from the ASF is not available until March. Regional office staff visit local officials and obtain subjective information and forward it to the Statistics Division where it is fed into a forecast. The ASF questionnaire also obtains some subjective information. For each segment the enumerator contacts local officials and observes the area. He then records the general crop condition (poor, fair, good, excellent) on each of the 4 major crops, planting dates, adequacy of

inputs (short, adequate, surplus), pest infestation (less than normal, normal, above normal) and provides general comments on rainfall, progress of field activity, yield prospects and general crop quality. In addition, the production of each field inside the segment is obtained from the farm respondents. The subjective information obtained from the survey is being fused into the subjective estimates as an attempt to improve early season forecasts.

Subjective estimates of yield are generally regarded as unreliable. Crop reporters tend to exaggerate a trend, i.e., tend to overestimate in good years and underestimate in poor years. Thus, there is an inherent bias in the estimate even if there is good information available to weight the yield estimates from local areas to a regional or national basis. This bias may be partially adjusted out of the estimate if solid end of the year estimates are available from independent sources such as marketing data or crop cutting surveys. For example, it is possible to attach numerical scores to the crop condition ratings, weight the condition reports to a regional or national level and attempt to adjust the bias out of the estimate by relating the average crop condition to the final yield established by check data or objective means. This procedure requires a rather long time series of comparable data and assumes the bias in the subjective estimate is fairly consistent. This latter assumption seldom holds and good quality check data are seldom available for most crops.

Probability samples of farmer reported yields have been tried in several countries. The results of these efforts have generally been judged as superior to those based on local condition or informed sources but are still judged as inadequate. The farmer reported yield or production is generally judged as inadequate for several reasons. Individual farmers have a tendency to round yields or production, may deliberately over or under report production for a whole host of personal reasons, may report only that portion of the crop that is sold and exclude the portion that is used on the farm,

etc. As a result, probability surveys for farmer reported crop yields are generally inadequate. They can, however, be useful in developing small area production estimates when a higher order estimate has been developed by objective means. In other words, farmer reported yields from a probability sample can be used to distribute production at the national level to regional levels given that the national estimate has been based on objective procedures. The preceding rationale then leads one to the conclusion that crop cutting surveys should be systematically carried out given that there is an adequate sampling frame, such as the ASF, to properly weight individual crop cutting plot yields to a regional or national basis.

At this point, it is important to discuss specifically how a crop cutting survey should ideally be conducted. Normally, the area sample is enumerated early in the growing season. From this information a sampling frame for the crop cutting sample is constructed by expanding each field of a specific crop by the segment expansion factor. The specific fields in which a crop cutting sample will be taken are selected by a systematic sample of fields from the expanded field totals. Large fields may receive multiple crop cutting samples (normally a upper limit of 3 or 4 samples is set for extremely large fields). When selected in this manner each field has the correct probability of being included in the sample and the individual crop cutting samples are self weighting.

Experience in Sudan is that the ASF data collection period has always been too late in the season to allow summarizing the field data, selecting the crop cutting sample, and returning to the field to conduct the crop cutting survey. The goal of the Statistics Division is to conduct two surveys, one early in the growing season to obtain acreage and the second to conduct the crop cutting survey. In the event that Statistics Division is able to conduct two surveys, another question needs to be examined. Ideally, the objective plot should not be harvested more than 1 week prior to farmer harvest. The logistics involved in the process would be difficult at best. Perhaps, a

local person could be hired and trained to observe the field and harvest the plot at the proper time. To this point the ASF data collection and the crop cutting survey has been conducted during the same time period. In fact, many crop cutting samples are lost as the farmer has already harvested the field.

In the current crop cutting survey the enumerator is instructed to lay out the crop cutting sample after the segment ASF data has been collected. His instructions are to lay out crop cutting samples in all fields in the segment, however, if there are more than 6 fields he is to select 6 fields randomly from all fields in the segment. Each field in the segment has an equal probability of selection regardless of its size. As a result the crop cutting sample is overweighted to small fields and will be biased to the extent yields differ by size of field (which can be normally expected). Also, there is a question as to what constitutes a field. Interviews with some enumerators showed that two or more fields were being combined and listed as a single field in the questionnaire. In these situations, it is an open question as to how the enumerator selects the final field in which to lay out the plot.

Once the field is selected, the enumerator is required to measure the sides of the field, for example, the length and width of the field. He then selects two random numbers, the first is the distance along the edge of the field and the second the distance into the field. The enumerator then lays out two plots of 5 meters square each, for each crop cutting sample. The second plot is located at a specified distance from the first plot. The grain is harvested and the number of heads counted. The heads are then placed in a sack so that they can air dry. The grain is threshed and weighed after about a week of drying. No adjustments are made for moisture content.

It is hard to judge how well procedures are carried out in the field. Following is information on the crop cutting survey results for 1986/87 sorghum crop.

	Ave. Kilos Per Fed	C.V. Percent	95% Conf. Interval
Gedaref	306	6	269 - 348
Damazine	340	4	314 - 365
Habila	191	10	154 - 228

With these levels of precision, a C.V. of approximately one percent for average yield would be achieved at the national level. This is a respectable level of precision. The major contribution to the measure of precision of production arises from the acreage component.

It would be possible to develop an early season forecast of production if the Statistics Division were able to conduct the acreage survey early in the growing season. A forecast of yield could be made by multiplying the number of heads by the weight per head. The number of heads could be determined by laying out sample plots and counting them during the early season survey. The average head weight could be determined from data collected during crop cutting surveys conducted in earlier years.

RECOMMENDATION: The crop cutting survey is providing valuable information with reasonable levels of precision. It should be continued.

RECOMMENDATION: The crop cutting sample fields should be selected on the expanded basis which requires separate acreage and crop cutting surveys implying going to the field twice.

RECOMMENDATION: Select the desired number of crop cutting samples with probability proportional to size if acreage and crop cutting surveys are conducted at the same time thereby eliminating potential bias of small fields.

RECOMMENDATION: Develop an enumerator manual showing all the procedures to be used in locating and laying out the crop cutting plots. Cover the procedures carefully in the survey training school. This would help in holding non-sampling errors to a minimum.

RECOMMENDATION: A small study should be conducted to determine the stability of moisture content of the grain. It is possible that one would want to utilize forced heat drying equipment so that the weight could be adjusted to a standard moisture content.

5. Precision of Estimates

"The ASF effort experienced high coefficients of variation, what can be done to reduce these?"

The results of the ASF have been larger at the national level than is desirable. As mentioned elsewhere, the absence of mapping material limited the sample size in the traditional sector to more or less a pilot or experimental level. Even given this difficulty the 1986/87 survey produced a 12 percent c.v. for sorghum, 14 percent c.v. for millet, a 19 percent c.v. for sesame and a 26 percent c.v. for groundnuts (see Appendix C, Survey Results). According to the sample estimates the traditional sector accounts for a large portion of these four crops in the area covered by the 1986/87 survey. The traditional sector accounted for 35 percent of sorghum acreage, all of the millet acreage, 91 percent of the sesame acreage, and all of the groundnut acreage.

Perhaps, the entire orientation on provincial versus national results has not benefited the ASF. This aspect is discussed in detail under Section F-7,

Regional vs National Data, and as such will only be touched on lightly at this point. It is far more complimentary to say that the ASF achieved a 12 percent c.v. for the mechanized and traditional sector sorghum planted area than it is to say that it had a c.v. of 70 percent in S. Darfur, etc.

The precision of the ASF estimate can only be reduced significantly by improving the efficiency of the sampling frame, increasing the sample size, or some combination thereof. The availability of adequate mapping material is such that the gain that can be achieved from frame improvement is questionable. There is a limit on how much the sample size can be increased both from the manpower point of view and availability of adequate mapping material in the traditional sector. Remote sensing techniques may provide some assistance if we are able to locate the fields precisely in the coordinate system. This is a difficult task and remote sensing estimation has not been tested in this project.

As discussed throughout this report, certain things can be done to improve and enhance the ASF. In the final analysis, the sum total of these recommendations will still not provide estimates at the provincial level with a 10 percent measure of error. We then have to face the issue of providing a less precise estimate at the provincial level and accept reasonable levels of precision at the national level. This is the basis of the recommended sample size provided in F-1, ASF Sample Size. This level of effort will provide useful results for the foreseeable future. In the meantime it is hoped that the SERISS extension can provide the mapping material and other technology that would allow major improvements.

6. Integration of other data sources

"How can other sources of data (i.e. projects, schemes, etc) be integrated into a national scheme based on Area Frame Sampling?"

Constructing an ASF requires substantial resources. Once the frame is properly constructed, it will serve for relatively long periods of time. The

longevity of a frame is related to how quickly land use changes. As land use changes (such as grassland being converted to cropland) the area frame becomes less efficient. The sample size will need to be increased to maintain given levels of precision in resulting estimates. A point will eventually be reached where it is more efficient to build another area frame given that adequate frame materials (more recent photographic coverage, etc.) are available. It is difficult to say but, as a normal rule, one can expect an ASF to last for 10 to 15 years.

It is not a minor task to properly change an ASF after it has been constructed and a sample has been selected without drawing a new sample. It is therefore preferable to remove irrigation schemes etc during the frame construction process. Of course, before making this decision, one should determine that the other sources of data are adequate. For example, from a limited amount of information, we judge that the acreage information from the government irrigation corporations is acceptable while that from the Mechanized Farming Corporation is not. In the case of farm projects, the decision to exclude it from the frame would be based on the expected longevity and the quality of its data.

Given that the data are of sufficient quality and that the project or scheme is large enough in area to make the effort worthwhile, then one can consider integrating alternative sources of data into a national scheme based on Area Frame Sampling. There are two basic procedures that may be used to bring the integration about. The first procedure is to remove the irrigation schemes for which you have alternate sources of data and draw a new sample in the balance of the land use stratum. This is the safest procedure and yields the same results as if it were removed prior to frame construction. The second procedure is to use the current sample but enter a zero for each sample segment that falls within the boundaries of the irrigation scheme. This procedure requires somewhat more care during the data collection and processing stage to ensure that all information is handled correctly.

The Statistics Division did not sample the irrigated stratum in the 1987/88 or 1988/89 surveys. It should be noted, however, that large irrigation schemes account for approximately 90 percent of all irrigated land. The Statistics Division dropped the entire irrigated stratum from the survey, and as such, the remaining 10 percent of the irrigated land is not accounted for in the current survey. Some of this irrigated land is located in provinces not included in the survey. The amount of irrigated land in the frame and not in the large schemes should be determined. If it is significant, it should be sampled and included in subsequent surveys.

RECOMMENDATION: Determine the amount of land in the ASF that does not belong to an irrigation scheme managed by a corporation. Additional samples should be selected and included in subsequent surveys.

RECOMMENDATION: Contact the irrigation schemes and document the quality of the area data and the cotton and wheat production data.

RECOMMENDATION: Determine how the irrigation schemes estimate yield of sorghum and groundnuts and evaluate their procedures. Perhaps the Statistics Division can work with the schemes to standardize their procedures and assure itself of obtaining reliable consistent yield data. Otherwise, one should continue crop cutting in the irrigation schemes for these two crops.

7. Regional vs National

"How can regional and national data needs be reconciled and work by the PAEA made complimentary to regional data collection?"

As discussed elsewhere, the ASF is not capable of providing estimates at the provincial level with a 10 percent measure of error for each of the 4 major crops. The ASF, however, can be most instrumental in providing a useful program of estimates, both at the national and provincial level.

It will be useful to discuss the general orientation of an estimating program prior to returning to the question of regional versus national data needs. The strength of any survey estimate is at the higher level, i.e. the estimate is strongest at the national level in terms of sampling error. Therefore, one should determine the national estimate first and then set regional estimates. Most people look at the problem in the reverse or from the regional point of view. They assume one must make accurate estimates for each region and then obtain the national estimates by summing the individual regions. Their point of reference being that one cannot have a strong national estimate without adding strong regional estimates. Survey results are used at their weakest point if this logic and procedure are followed. It is evident that most staff associated with this project are approaching the estimation problem from the regional basis. For example, publications present only regional data. Discussions with Statistics Division staff indicated this was the manner that they approached the problem.

As mentioned previously, a statistical survey is strongest at the national level. Therefore one should consider all the available information and determine what the official national estimate will be. In most instances, this will be the survey result or at least within one standard error of the survey result. They would then proceed to set the regional estimates again using all available information at each regional level. The regional estimates are determined such that they add to the national total when

summed. There may be more than two stages involved in this process, i.e., first set the national level, second set the strata level, and finally set the provincial level.

By approaching the estimating problem from the national perspective one can easily incorporate other sources of information at the regional level. A prime source of other information would be that provided by remote sensing techniques. The more reliable subjective techniques could also be utilized under this procedure.

RECOMMENDATION: Thought should be given to developing an estimation procedure from the national perspective. The essential elements of such a procedure should be developed and then followed.

8. Survey Content VS Data Needs

"Is the data that is currently targeted concordant with the needs of intended users?"

The Statistics Division has the official responsibility to provide all crop statistics. There was a time, a few years ago, when several different groups were in the estimation business. The Mechanized Farm Corporation, the Ministry of Finance, and several other groups were making subjective estimates as well as PAEA. There were times when contention over what the correct level should be when the estimates varied. Most of these groups have now dropped their activity and rely on PAEA. The monthly Agricultural Situation and Outlook carries a great deal of statistical output. The Early Warning Program needs additional data at the regional level. We found no other evidence that there was a great concern about any lack of regional data. It is in this light that the data users are fairly well satisfied.

ORGANIZATIONAL, MANAGEMENT AND TRAINING ISSUES

Perceptions of the PAEA vary somewhat among Sudanese, USAID and Chemonics personnel. These variances, however, are mainly in details as seen from different perspectives. The overall picture seems clear enough with respect to the PAEA's mission, its role in relationship with others, its general capabilities and its shortcomings.

In the general scheme of the GOS government, an organization such as the PAEA should exist within the Ministry of Agriculture and Natural Resources (MANR) and should be performing the mission currently assigned to that agency. This is particularly true with respect to the role of the PAEA in relationship to that of associated units within the Ministry of Finance and Economic Planning (MFEP).

The APS project is located properly within the PAEA, the appropriate focal point for agriculture sector policy analysis and planning. Institutional development support to the PAEA is justified notwithstanding possible questions with respect to the effectiveness of other project activities such as the Area Sample Frame, the reporting of agricultural data and the impact of that reporting on national policy decisions.

The ultimate effectiveness of the project will be dependant to a great extent upon the institutional development of the PAEA. Potential is strong. That potential will be realized, however, only to the extent to which the PAEA's institutional capability is developed and exploited. Perhaps it would be a bit much to say that management and organizational considerations should take precedence over technical inputs. It is not an exaggeration, however, to state that the effectiveness of the technical inputs (as well as the overall effectiveness of the APS project) is dependent upon assertive attention to management and organizational considerations.

A. Policy Linkages

The PAEA contributes to GOS policy dialogue within the framework of the Ministerial Economic Committee, headed by the Prime Minister. The Ministry of Finance and Economic Planning (MFEP) serves as the Rapporteur. Other ministries involved include: Agriculture, Irrigation, Animal Resources, Foreign Trade, Internal Trade, and Transport. Specific actions are brokered through Technical Committees comprised of interested ministries and other cognizant entities such as the commodity corporations dealing with such items as wheat, oil seeds, cotton, gum arabic, etc. On occasion, in order to avoid conflicts and duplication of effort, broad policy issues, such as those dealing with food security and irrigated agriculture, have been dealt with by means of special steering committees equipped with a secretariat to handle the work flow.

CONCLUSION: There appears to be doubt in some quarters as to the actual effectiveness of this national committee system, nevertheless, in theory the idea is sound, and the Ministry of Agriculture and Natural Resources (MANR) should be encouraged through the PAEA and the APS project to participate as assertively as possible to instill maximum effectiveness in the system.

Working within the national framework, the PAEA is making a constructive impact. Through the project steering committee, the PAEA is incorporating ideas from the MFEP. The latter is approaching certain issues through the MANR. In that regard, that ministry wants the MANR to focus on certain topics. For example, the MFEP is studying in cooperation with the MANR the matter of national self-sufficiency in wheat.

The MFEP considers planning and policy formulation being at two levels, i.e., macro and micro. Although the MFEP formulates plans for all sectors at the macro level, it looks to action ministries concerned within the task force

system to take the lead at the micro level. The MFEP uses the inputs of the MANR, much the same way as it does the expertise of the Bank of Sudan, for example, in cases where competencies lie beyond the MFEP. Definitely, the MANR should formulate agricultural policy. The MFEP, in turn, interprets agricultural policy at the macro level to arrive at multisectorial national policy.

The MFEP does not recognize any competition or duplication of effort with the MANR in the collection of data or the determination of policy. As previously indicated, there is, of necessity, a distinction between macro and micro approaches to any given field of interest. Action ministries are responsible at the micro level for their individual areas of responsibility. The MFEP collates these contributions to arrive at national policy at the macro level. Individual action ministries, such as the MANR, influence national policy through the force of persuasion of their submissions made at the sectorial level.

The MFEP undertakes its own field visits and studies primarily with a view to testing its position at the macro level by cross-checking its own information and that received from other sources; also it does not want to lose its own field capability. The MFEP does not consider such initiatives to be duplicative to the efforts of others. To the contrary, the MFEP consciously makes use of inputs from others, while sharing responsibilities and providing that supervision necessary to assure coordination within the context of objectives at the macro level.

The effectiveness of the steering committee (or task force) system is not weakened so much by interministerial competition as by lingering tendencies to retain procedures ingrained through time. For example, the commodity corporations, if left to their own devices, have had a proclivity for independent action, susceptible to arbitrary decisions, if not actually influenced by narrow interests, oblique political concerns, or just plain

unscientific methodology. The PAEA has an important role to play in this arena. The PAEA has already made a significant contribution with respect to wheat and cotton price structuring.

The PAEA generates its own issues thought to be of current interest, but also responds to requests from the Minister. The PAEA also supports directly the needs of the various agricultural services within the ministry, e.g., Extension, Horticulture, Plant Protection, etc.

PAEA data collection and policy analysis takes into account and recognizes the importance of the major subsectors within the agricultural sector, i.e., traditional rainfed, mechanized rainfed, irrigated, and livestock. Food crops and cash crops are treated equally, as are crops both for external trade and internal consumption. Only fruits and truck garden vegetables are left aside due to their low magnitude of impact on the national economy.

Duplication of effort in the collection of agricultural data is not seen as a problem. Aside from the internal coverage of the individual crop corporations and subsector schemes, the PAEA is the only collector of crop statistics. The MFEP bows to MANR in such matters. MANR collects and distributes data requested by MFEP. PAEA supports the Ministry of Animal Resources with appropriate livestock data beyond the latter's internal collection capability.

The MANR is the principal repository of agricultural statistics. The MFEP relies heavily on PAEA in this regard. Projects funded by the Kuwaiti Fund are a good example here. PAEA works closely with the MFEP, providing required agricultural statistics to support that project. Statistical units from both ministries work well together and engage in joint training sessions. There is close coordination to avoid duplication. In this regard, it is noted that the Director of Plan's statistical unit is an active constructive member of the APS project's Steering Committee.

PAEA sections are reportedly coordinated to participate jointly in various research tasks. However, there is some question as to the extent to which such coordination, in fact, takes place. In any case, PAEA espouses the idea of a multidisciplinary approach to problem-solving. PAEA is represented on subsectorial task forces together with representatives from MFEP, the University of Khartoum and the various commodity corporations, as appropriate. The PAEA coordinates with various other entities, as required, e.g., the national demographics office for matters concerning consumption and migration; the Ministry of Irrigation on matters of irrigated crop production, etc.

In those cases where a broad reach of interdisciplinary data is required from various sources - e.g., crops from MANR, credit from MFEP, livestock from Ministry of Animal Resources, current statistics and census data from the National Department of Statistics, - special steering committees may be formed similar to those created for policy considerations. A good example of the success of this modus operandi was seen with formation of the special steering committee to broker the development assistance recently proffered by the Arab Fund.

The various crop corporations and irrigation schemes have, over time, developed their own managerial mechanisms for the collection and analysis of data. There is nothing wrong per se with individual entities maintaining that in-house capability. However, the information generated must be available to others. Sound planning procedures require broad dissemination of data gathered from individual crops and schemes for the development of sectorial plans and policies which, in turn, lead to the national plan and policies.

The heads of agencies reporting directly to the Minister have been reluctant, to varying degree, to ^{the} involvement of other units in their individual domains. This reticence is diminishing with the realization that loss of control is not in question. This situation will gradually correct itself as the PAEA, for example, becomes more deeply involved with the individual crop and subsectorial agencies, and the latter come to participate more effectively within the task force system of data collection and analysis.

A good case in point here is the situation involving the Rahad and Gezira irrigation schemes. USAID assistance in data collection and analysis is being provided to the Rahad and the Gezira irrigation schemes through the Policy Analysis and Implementation Program under agreement with MFEP in response to a request for assistance from that ministry. The activity is directly under the direction of the Under-Secretary of MFEP. Advisory assistance is being given directly to the management of the two irrigation corporations with respect to development of data collection materials and analysis of data eventually collected.

There has been some consternation among PAEA staff concerning the duality of USAID assistance to the irrigation subsector. Apparently, it has not been clear to all parties why, and under what conditions, USAID has been providing advisory assistance directly to the individual irrigation schemes at Rahad and Gezira. In actuality, there does not appear to be any problem with respect to the exchange of information between PAEA and management of the schemes concerned. PAEA entities and management from the individual schemes appear to cooperate freely in the exchange of information.

RECOMMENDATION: Due to the obvious overlapping interests in the collection of data concerning irrigated agriculture, PAEA and USAID should assure coordination of the two USAID activities implemented through the two different ministries.

The coordination of efforts and compatibility of inputs with respect to data collection and analysis within the irrigated subsector involves yet another actor on the scene, i.e., the Advisory Unit for Agricultural Corporations (AUAC) financed by the World Bank. Although not a planning unit, AUAC processes a vast amount of information concerning production inputs, costs and pricing for a variety of irrigated crops such as cotton, dura and groundnuts.

The irrigated subsector is an important factor in the economic fabric of Sudan. An overall view of that subsector is crucial to agricultural sectorial planning. The PAEA would appear to be the logical entity for developing and nourishing the appropriate perspective.

RECOMMENDATION: The PAEA should endeavor through APS project support to achieve a broad and thorough analytical coverage of the entire irrigated subsector.

RECOMMENDATION: The PAEA should, with APS project input, conduct liaison with all appropriate crop corporations, as necessary, to cover with its sectorial analysis umbrella the entire scope of traditional agriculture, mechanized agriculture and livestock enterprise at the comprehensive national level.

The PAEA sees the need for the creation of a special mechanism for dealing with all matters (e.g. policy guidelines, resource allocations, etc.) impacting upon major national agricultural planning concerns, such as cropping patterns, water resources, etc., where a variety of interests are involved and a broad base of intellectual input is desirable. To meet this need, PAEA proposed to the former Minister of Agriculture the creation of a forum, a sort of brain trust, combining contributions from an Agricultural Planning Council (formed by the ministries of Agriculture, Irrigation and Animal Resources) with those from the MFEP, the University, as well as other knowledgeable individuals from both the public and private sectors. This proposal was not acted upon during the tenure of the former minister. PAEA is still awaiting the reaction of the present minister to said proposal.

RECOMMENDATION: The APS project and its technical assistance inputs should assist the PAEA explore the need for, and the feasibility of, establishing appropriate mechanisms for fostering agricultural policy analysis and determination.

In general, the PAEA has good outside contacts and coordination with various other agencies.

The University of Khartoum is a particular contact with whom the PAEA should enjoy a mutually beneficial relationship. The University provides degree-training for students sponsored by the APS project. It is the source of valuable insights. On the other hand, the university connection appears neglected. Substantive dialogue is not taking place between the PAEA and the university with respect to student programs or research requirements for university execution. It seems that project steering committee meetings have taken place without invitation having reached the university representative. Good ideas initially conceived have suffered from lack of follow-up.

Likewise, financial support to the university for their part in the joint enterprise languishes in limbo. Receipt of a minivan bus and three IEM

microcomputers, supposedly promised, has yet to take place. Support to the agricultural department library and expansion of office/study room facilities is reportedly still an open question. No follow-through has resulted from project steering committee deliberations concerning local currency use for the foregoing. No research requests have been received for university execution under paid contract arrangements.

RECOMMENDATION: PAEA should implement, as soon as possible, cooperative activities with respect to student affairs, research requirements, joint training activities, etc.

The Project Paper Amendment called for the establishment of a research grant program drawing upon the expertise of university faculty and graduate students, alike, the idea being to stimulate the production of scholarly literature covering Sudan's agricultural sector, thereby strengthening the PAEA's analysis and planning capability. To date, no action has been taken concerning this important project component.

RECOMMENDATION: The competition and award of research grants should be addressed in the context of the university's relationship with PAEA. Consideration should be given to tying the research grant program to the PAEA publication initiative suggested later in this paper.

The PAEA's relationship with the university is discussed further under the section "The Training Program" presented later in this paper.

Both FAO and IERD are well aware of the APS project and its role within the PAEA. Both of these agencies esteem the reports and the data published by

the PAEA and consider it useful. They use the various outputs produced by PAEA. Particular recognition is given to the "Outlook and Situation" reports. More timely publication of data collected and broader coverage of information would improve PAEA's output. The role of PAEA is not disputed; to the contrary, it is accepted as making an important contribution to agricultural development in Sudan.

For example, FAO believes that PAEA should take the leading role in the coordination of agricultural sector information and format for the benefit of policy-makers. PAEA should also be responsible for the initial analysis of all agricultural data. Coordination with crop corporations and the various activities funded by IBRD and/or FAO is not seen as a problem. Closer contact and cooperation with these entities would be welcomed. PAEA could benefit from contact with broader sources of information.

FAO will be providing a pricing policy expert to work in PAEA for a TDY of 60 to 90 days. This expert should be arriving any day. Within the coming weeks, FAO will be assigning a food security advisor to provide technical assistance to PAEA for one year. The assignment of these two technicians will help strengthen PAEA. Their inputs should be coordinated with the overall APS project effort. FAO is considering the possibility of recommending to the GOS how best to disseminate PAEA outputs more broadly to agricultural and planning entities. Such a recommendation might address the matter in some organizational manner and/or the possible assignment of an advisor to that end.

RECOMMENDATION: While PAEA enjoys a good reputation with IBRD and FAO, utilizing the Chemonics technical assistance team, as appropriate, PAEA should take pains to foster its relationship with these entities.

The country's nine regions are each headed by a Governor usually supported by three regional ministries, one for agriculture and economic development as well as one each for social affairs (e.g., health and

education) and administration. Administratively, these ministries report to their respective governor. For overall technical guidance, the regional ministries for agriculture and economic development report to the First Under-Secretary of Agriculture. Although the regional ministries of agriculture work independent of guidance from the national ministry with respect to various aspects of local traditional agriculture and small project support, there are important linkages to the national scene beyond looking to the capital for logistical support.

The PAEA sees the regions playing an increasingly more important role in data collection. For example, radios have been placed in the regions so that daily price data can be reported from sources in the interior. The PAEA sees a need for beefing up regional initiatives not only within the framework of the regional ministries themselves, but also through the strengthening of its own regional units. In Gedaref, for example, assertive data collection is underway utilizing local staff and by sending headquarters staff there on TDY to work with the local staff. The regional ministries also are considered an important source for the identification of new projects appropriate for implementation in the interior. PAEA studies have benefitted the regional ministries, albeit in a somewhat indirect manner, such as by enhancing regional planning through dissemination of reports covering such topics, among others, as sorghum production and price policy.

The PAEA performs in the mainstream of national policy determination. Inputs from the PAEA impact directly on the GOS economic development effort. Although still fragile, the linkages for the PAEA's participation in that effort are in place and are operative. Indications are that said linkages should, with time, strengthen upward to the cabinet level as well as laterally and downward to service units. The PAEA Director General fears that the end of the APS project at its current PACD will jeopardize the ability of the PAEA to perform effectively in Sudan's development arena by seriously compromising the PAEA's professional integrity for meaningful contribution.

B. PAEA Internal Organization

The PAEA normally reports directly to the First Under-Secretary of Agriculture. Working within the framework of the MANR, the PAEA has an important role to play in the task of sectorial planning. The development of strong collection and analysis capabilities within the PAEA will facilitate this task.

The second phase of the APS project has seen the creation of a steering committee at the project level which has greatly improved the situation prevailing during the first phase of the project. This has proven to be a useful tool in project implementation. Project implementation is monitored by means of this steering committee headed by the First Under-Secretary of Agriculture. Other members include the Ministry of Finance and Planning in the person of the Under-Secretary, as well as the chief of that ministry's statistical unit, and the University of Khartoum. This membership is active and keen to participate and contributes constructively to APS project implementation. It meets at least monthly. In January 1989, it met three times. This committee is similar in nature to those steering committees formed to address policy issues. The PAEA has suggested that USAID be invited to participate in steering committee sessions, but the MFEP reportedly continues to shelve the idea.

RECOMMENDATION: USAID project management should be represented, at least, at specified sessions of the project steering committee, not only to put forth in full quorum USAID views, but to assess GOS implementation intentions. Therefore, USAID should make the appropriate demarche to assure said participation.

The assignment of a PAEA staff member as APS Project Director has improved project implementation, particularly with respect to facilitating actions in concert with other agencies, such as the MFEP, and effecting

administrative procedures dealing with such things as procurement and outlay of budgetary resources. Funding release under the APS project now works more smoothly than previously, though snags in the process are still reported. The APS project steering Committee approves the APS work plan and the budget contained therein. The eventual end of Local Currency availability under the APS project will adversely affect PAEA operations and that agency's level and quality of project activity.

The PAEA's Agricultural Economics and Statistics Department, so far, has benefitted the most from APS project inputs. Nevertheless, this does not mean that policy considerations per se have been neglected. It is generally recognized that all areas of PAEA interest and activity contribute to that analysis which leads to sectorial planning and policy determination.

The work of the marketing and production economics sections, each with a staffing pattern of approximately twelve professionals with university training, is well integrated into the policy analysis effort. Individual tasks are coordinated from the beginning to assure compatibility of inputs and quality of output.

Attention is directed to the analysis of the commodity marketing system and its possible influence on policy; this effort includes price gathering, marketing information, and all possible links with policy factors. Production cost data is considered a priority. Much use is made of secondary sources for inputs. The PAEA has the expertise necessary for collating such information.

Although there is an outstanding issue concerning the effectiveness of coordination among all the sections of the PAEA, the marketing and production economics sections seem to have a clear view of an appropriate sequence of events for implementing the work program. In that scenario, one section or the other should take the lead, as appropriate, on the various items coming under study. The prevailing management opinion is that the study approach should be through subsectors, then down to individual commodities, analyzed for costs, prices and markets, etc.

The PAEA regional radio network has particularly facilitated data collection by the Marketing Economics Section and the statistical reporting effort of the PAEA in general. The APS project is considered to be responsible for the present capability and output capacity of the marketing and production economics sections.

The Food Security Section is another unit within the Agricultural Economics side of the PAEA house. This unit has not been involved with the APS project, however, as mentioned earlier, it is scheduled to receive technical assistance from the FAO. It is anticipated that the FAO advisor will be alert to coordination requirements within PAEA, as appropriate.

The Agricultural Statistics Section is the largest unit within the PAEA. It has some ninety professional and technical employees deployed in three subunits, i.e., Printing, Sampling, and the Computer Center.

RECOMMENDATION: The Computer Center does and should provide services broadly to the PAEA as whole. It should be located organizationally within PAEA accordingly.

Relatively speaking, the Policy Analysis Section within the Planning and Policy Analysis Department has had limited exposure to APS project inputs, primarily due to the extensive absence of the Chemonics policy advisor, his preoccupation with COP duties when in Khartoum, and the dichotomy of functional organization existing within the PAEA.

This section with a staffing pattern of twelve professional positions, against which nine individuals are currently on duty, offers the potential for substantial policy analysis within PAEA. Three employees are on leave-of-absence studying in Egypt, two at the Master level, one at the Bachelor level. Of the nine individuals on duty, three hold a Master degree, six a Bachelor degree.

RECOMMENDATION: That Chemonics give greater attention to in-depth technical assistance and guidance to enhance the functioning of the Policy Analysis Section, with special attention being given to its QJT requirements and the integration of its work into the activity of other units within the PAEA.

The Monitoring and Evaluation Section has a staff of twelve, all with Bachelor degrees. The section is responsible for the coordination of all proposals from the MANR submitted to the MFEP for approval. It monitors implementation of all projects under MANR authority. It is the principal point of contact within MANR for the donor community, both for the multilaterals as well as the bilaterals. In this capacity it is responsible for facilitating project procurement and transportation problems. It is responsible for liaison with visiting donor teams. It maintains files and information on all projects, approximately 65 in number and conducts evaluations at national, regional and project levels.

The Monitoring and Evaluation Section is isolated from the APS project. Its requests for travel funds to execute the monitoring responsibilities of the section are ignored. It is not involved in the exchange of inputs or outputs with the rest of PAEA. According to the section, technical assistance advise is required and wanted.

The section is a logical source of information with respect to baseline data utilized in the design and evaluation of project activity, as well as that deriving from implementation experience.

The section has the potential, presently not tapped, for the coordination of all donor assistance in the agricultural sector with a view towards maximizing sectorial objectives and eliminating duplication, contradictions and dispersion of efforts.

It is unfortunate that this section falls outside the APS project and that its resources are not strengthened and utilized in the pursuit of APS project objectives.

RECOMMENDATION: The Monitoring and Evaluation Section should be strengthened and exploited for the dissemination of information deriving from the project implementation experience. This data would represent valuable input to the policy dialogue.

The Project Preparation and Planning Section with a staffing pattern of twelve positions is involved in the design of projects financed by the donor community, as well as projects financed directly by the GOS in conjunction with the National Development Plan. The section currently has six individuals on duty, two of whom have a Master degree, the other four, a Bachelor degree; six other individuals are on leave-of-absence.

Project preparation and planning was a priority element in the original APS project, but this function has been downgraded subsequent to the elimination of the technical advisor position contained in Phase I. The matter of the eliminated position aside, the de facto disengagement of the section from other project activity is now seen as a mistake weakening the overall APS effort and PAEA involvement in agricultural policy development. On the upside, other donor resources are being utilized, at least to some extent, to meet the continuing technical assistance requirement. A FAO advisor, for example, is currently on a three-month assignment providing guidance and training, including the development of workshops to strengthen the section's capabilities.

The Project Preparation and Planning Section has been in the forefront of the contention of interests between the ministries of agriculture and finance. Previously, the MFEP was wont to drop projects, fully designed and

vetted, onto the MANR with no technical inputs from the latter. This practice evidenced a serious lack of field inputs and coordination in implementation. The PAEA has subsequently managed to exert its presence into the design process through the Steering Committee process. Examples of jointly vetted projects currently underway include the South Kassala Project with the IERD; and the Agricultural Research Corporation and the South Kordofan Project with the IERD and AFDB. In the pipeline are the Blue Nile Integrated Rural Development Project and the El Nahod Small Farmers Credit Project financed by IFAD.

In addition, the project preparation section was the action agency for the collection of base-line reference data for agricultural development in the Darfur region, an activity undertaken in 1984. There is a need for the collection of similar data concerning the other eight regions. The section also plays a role in the elaboration of the National Development Plan.

In summary, the project preparation section is involved with the donor community and other GOS agencies in the collection and analysis of data at the project design level, data that derives from, and contributes to, the empirical experience, an attribute of considerable value in the development of agricultural policy in a country such as Sudan.

As a part of his duties, the director of PAEA's Project Preparation and Planning Section was recently called to Gedaref to conduct a two-week project implementation course under an IERD agricultural infrastructure development project.

A number of interesting points concerning project implementation and its relationship to policy analysis (as well as the overall objectives of the APS project in that regard) were covered during the training session. Points covered included the need for paying attention to the planning of other ministries when addressing agricultural development objectives; and the

importance of listening to the opinion of local services, particularly in those areas where local knowledge can clarify questions concerning recurrent costs, capability of implementation agents, likelihood of strong self-help inputs, etc. The value of heeding the experiences of the various donors was also cited, along with the need for collecting data on, and evaluating, a wide range of project implementation experiences in order to reach sectorial objectives. It is obvious that the director of PAEA's Project Preparation and Planning Section is knowledgeably engaged in training activity which is related to the achievement of APS project objectives, i.e., data collection, policy analysis, coordination of the work of various entities related thereto, and the need for outreach to regional areas with respect to those objectives.

The Project Preparation and Planning Section is not actively engaged in the APS project; in fact, in practical terms, it is alienated from the project, along with the Monitoring and Evaluation Section. The members of these two sections are routinely precluded from participation in meetings and activities involving the APS project and, in this respect, are generally not involved in the pursuit of overall PAEA objectives. This is unfortunate as these two sections have a valuable contribution to make to the fulfillment of PAEA's APS objectives.

Both USAID and the PAEA agree that the basic concept of the APS project, as indicated in project documentation, does not preclude the integration of these sections into the project. In practice, however, this has not happened.

RECOMMENDATION: The planning and monitoring sections should be integrated into the APS project with their work coordinated within the PAEA to contribute to the common cause. Appropriate technical assistance and OJT should be afforded to the personnel of these two sections.

At present, the PAEA maintains field offices in two regions. Plans are that additional offices will be opened in the near future in four other

regions (those outside of the war zone) with more than one area office in some regions. A total of approximately ten regional/area offices are planned.

The regional offices provide a wide variety of local support services to the PAEA headquarters, including collection of data on such items as yield, prices, production and marketing. The regional offices receive instructions and requests for information and assistance from various sections at PAEA headquarters. The regional offices could also work in coordination with other sections, such as those involved with project preparation and monitoring/evaluation; however, these latter units are not being adequately utilized within the PAEA, or by the APS, for the furnishing of information applicable to policy analysis, particularly where feedback from project implementation experiences are concerned. In turn, the regional office would benefit from better coordination among the various sections at headquarters.

The Gedaref office has received only limited visits from members of the APS project technical assistance team. Those visits were geared primarily to the collection of information, not to the expansion of local staff skills. More frequent visits by members of the present Chemonics team to the various regions could provide two-way benefits. First, OJT to local staff would strengthen the capability of the regional office; secondly, the technical assistance advisors would have the opportunity to broaden their familiarity with conditions in the interior.

The Gedaref office had two of its professional staff on TDY at the Rahad irrigation scheme collecting data for a study on marketing costs. The management of the Rahad scheme cooperate well with the PAEA regional office. The Rahad scheme and the PAEA Gedaref office frequently exchange information; the statistical office of the former provides all information requested. The Gedaref office is satisfied with the cooperative attitude of Rahad. It does not maintain a permanent liaison with Rahad, but only collects information when so requested by PAEA headquarters. Gedaref was not aware of data advisory assistance from USAID to Rahad with respect to the development of data collection methodology and analysis.

A member of the PAEA marketing economics section was on a six-week TDY in Gedaref engaged in a study covering transportation, storage and handling factors of commodity movement between Port Sudan and Khartoum. The study will look into crop prices, including price comparison among the seasons as well as at three trading levels, i.e., field assembler, wholesale and retail. Crops included in the study are sorghum, gum arabic and sesame, both seed and oil.

The PAEA regional office in Gedaref maintains contact and exchanges information with a wide number of other agencies in the region. There is good coordination among the various local units of the national Ministry of Agriculture. There is no regional supervisor; the heads of the various units merely work together as peers.

The PAEA unit works with the local office of the Ministry of Animal Resources primarily with respect to livestock pricing. PAEA also shares information with the regional Ministry of Agriculture much the same way as it does with respect to the mechanized subsector.

RECOMMENDATION: The PAEA with APS project support should take appropriate action for strengthening its field apparatus. Training and logistical requirements should be included in that effort.

The PAEA forms internal working groups to address policy issues, such as pricing and external trade matters. This brings PAEA staff together for the treatment of such issues. There is, however, opinion that notwithstanding the concept of internal working groups, the efforts of the PAEA are too compartmentalized and a greater interaction among its various sections is needed.

Fault should not be found in the concept, but more attention needs to be placed on extracting maximum effectiveness out of that concept. Better coordination is required with respect to a number of PAEA's internal procedures.

Task assignments among sections is a good example. It is not uncommon for one section to embark upon an assignment without appropriate cognizance on the part of the other sections. Even worse, more than one section may initiate work on different aspects of the same enterprise unaware of the inputs each might provide to the common effort.

RECOMMENDATION: More coordination is needed among the various sections, which function independently from, and frequently oblivious to, the work of each other. PAEA efforts need to be brought under control through internal planning and progress reports. There should be better coordination of work assignments assuring common knowledge of base data and modus operandi.

RECOMMENDATION: There is a need for in-house editorial review of publications. To assure uniformity of content and format and to avoid errors, oversight and duplication of effort, all substantive PAEA documents in preparation should be identified to all sections at the outset of research and subjected to an internal review and clearance procedure prior to publication and dissemination.

The PAEA seems to have established well-defined parameters for collecting data and undertaking studies with appropriate inputs from the APS project technical assistance team. The topics selected for analytical study equate with national requirements as identified by the PAEA with advice from the technical assistance team.

Once the PAEA and its advisory team have collaborated on the research of these study topics, however, it is essential that the Minister and other high ranking officials are enlightened sufficiently to make decisions consistent with the results of the studies undertaken.

It has been suggested that particular studies should be subjected to review and constructive criticism through the seminar process. In this manner, a particular study would be presented and subjected to the scrutiny of technicians and decision-makers, alike. This would provide an effective mechanism for assuring a sound decision process based on the findings and recommendations of the study at hand. A seminar would present, for example, the opportunity to analyze and debate different scenarios influential in pricing determinations. Said seminars would be similar to the meetings of technical committees functioning under the chairmanship of an Under-Secretary, hopefully on occasion even, the Minister, with the objective of presenting recommendations for ratification by the Ministerial Economic Committee.

In a similar fashion, meetings among statistical reporters and data-users would be helpful for feed-back purposes, as well as to propagandize PAEA efforts and achievements.

RECOMMENDATION: The Chemonics team should be prepared to assist the PAEA organize and hold seminars for the purpose of disseminating the findings of studies undertaken by the PAEA.

PAEA publications have spread that organization's reputation as a good source of information on the agricultural scene in Sudan. Said publications enjoy a wide distribution among other government services, international agencies, the private sector and commercial interests. The creation of a PAEA documentation center has been suggested as a vehicle for expanding PAEA's publishing role. As indicated above, the organization of discussion seminars attracting a broad-based participation has been suggested as an effective manner for stimulating interest in, and increased utilization of, data published by PAEA.

Without a doubt, PAEA publications are a significant output of the APS project. Although fairly limited in number at present, documents published by

PAEA are highly regarded and are in demand throughout the community. Approximately six annuals, one periodical (8 issues annually), three or four monographs, as well as various training manuals and survey questionnaires are published annually. Potential exists for greater publication production and increased dissemination. Printing problems, however, present a serious bottleneck even for the present load. The need for an increased printing capability has been addressed in the Chemonics procurement study.

Clearly, there is a need and an enthusiastic market for increased publication of informative documentation covering Sudan's agricultural sector. The PAEA is the logical publisher of such information. Said publications, both statistical and narrative in nature, would stimulate dialogue with respect to national agricultural policy and sectorial planning. Publication of such documentation would consolidate PAEA's position in that arena.

Authorship need not be limited to the PAEA alone, but might involve collaborative efforts with the university and/or other knowledgeable agencies. One interesting possibility would be to publish under the PAEA banner the studies emanating from the would-be competitive research grant program.

RECOMMENDATION: The PAEA with APS project support should make a determined effort to develop an expanded program of publication and dissemination of documentation covering the national agricultural sector, including that emanating from competitive research grants. In conjunction with this recommendation, the idea of officially creating a Documentation Center within PAEA should be explored. High priority should be given to the use of APS project resources to these ends.

C. The Training Program

Off-shore degree training, APS (Phase II). Quantitatively speaking, this training element seems, for the most part, to be on track. Most of the slots for off-shore degree training through PACD have been filled. Nine Master candidates are currently studying in the United States; a tenth is on alert for departure NLT April 1989. Three PhD candidates are currently studying in the United States; a fourth slot was cancelled due to lack of time remaining prior to PACD subsequent to prior candidate rejection. Seven Master candidates are currently studying in Alexandria, Egypt; an eighth is on alert for departure NLT July 1989. One Master candidate is currently accepted for training in India; subsequent to an earlier rejection of prior candidates, three additional slots must be filled NLT July 1989. PAEA training officials are confident that the three vacant slots for India will be filled by appropriate participants within the remaining time limit.

Except for Statistics, which has been slighted, off-shore degree training has generally equated with PAEA needs as identified in the Training Plan. Training in the United States focussed on Agricultural Economics. Training in Egypt covered marketing, production and rural economy subjects. Relatively speaking, there seems to be an overabundance of degree candidates in general Agricultural Economics.

Except for a limited number of courses inserted into some of the U.S. Agricultural Economics programs, degree training in Statistics has been limited to India. Only one student has been selected for India so far. Even if the additional three slots for India are filled as expected with appropriate participants, the total of four trained statisticians seems inadequate. There is wide spread feeling that degree training in Statistics will be inadequate to the needs. There is also concern that the training in Statistics has been, for the most part, limited to India. There is the feeling that that training will result in strong theoretical abilities, but will be short on practical application techniques.

Previous U.S. degree training under APS (Phase I) resulted in one PhD and five Masters, two of whom completed training in 1988. All six have returned to Sudan and are reportedly employed in the MANR. Specific follow-up action should be taken to ascertain to what extent their training has been put to effective use.

It is difficult to judge objectively, at this time, the extent to which the increased degree level of education, particularly through the substantially augmented effort in Phase II, will benefit the future operations of the PAEA. Subjectively, one must assume that more formal education is more useful than less education. All in all, the long-term training under the APS project upgrades somewhat an already relatively well-educated civil service cadre.

It is widely held that, due primarily to TOEFL requirements, and despite a joint USAID/PAEA selection process, the best participants (in terms of inherent abilities and job assignment potential upon return from training) were not selected for training in the United States. It has been remarked that with a relatively modest increase in investment tied to a more flexible position on English language training (ELT), better results could have eventually accrued from the U.S. degree training program.

TABLE 1 - Long-Term Degree Training

	PHASE I		PHASE II			Total I/II
	Completed	On-going	Selected	Open Slot	Total	
<u>United States</u>						
Ag Economics, PhD	1	3	-	-	3	4
Ag Economics, MS	3	9	1	-	10	13
Econ., Gen., MS	1	-	-	-	-	1
Stat., Econ., MS	1	-	-	-	-	1
<u>Egypt</u>						
Ag/Rural Dvl, MS	-	7	1	-	8	8
<u>India</u>						
Statistics, MS	-	-	1	3	4	4
<u>Total, Off-Shore</u>	6	19	3	3	25	31
<u>Khartoum</u>						
Ag Economics, MS	-	12	-	7	19	19
<u>Total, Overall</u>	6	31	3	10	44	50

TABLE 2 - Short-term Training Completed in the United States

	<u>PHASE I (1982-87)</u>	<u>PHASE II (1988)</u>	<u>Total</u>
Agriculture, General	7	2	9
Agricultural Economics	4	-	4
Agricultural Development	5	4	9
Economics, General	1	-	1
Economic Planning	3	-	3
Statistics	3	-	3
Computer Science	3	1	4
Data Processing	-	3	3
Remote Sensing	1	-	1
Total	27	10	37

RECOMMENDATION: With respect to Statistics (as well as any other priority fields of study, such as Policy Analysis, Sector Modeling, etc., within PAEA requirements), project management should consider recourse to special non-degree programs of one or two semesters in the United States through which appropriate personnel could take courses concentrated in accordance with the specific needs of the participant in question. USAID and/or Chemonics should contact likely universities directly, as necessary, to make arrangements for the enrollment of participants in appropriate study programs. Note that the courses need not be at the graduate level.

Although time has run out for embarking on new additional degree programs, sufficient time remains to develop and implement concentrated non-degree programs.

English language requirements for special non-degree students will not be so rigid as for the degree-seekers, thus there will be a broader, and better, pool of candidates from which to select participants.

RECOMMENDATION: Where necessary to accommodate otherwise highly desirable candidates, there should be liberal recourse to English language training (ELT) in conjunction with the special technical studies.

There are currently twelve students studying for the Master degree at the University of Khartoum. The participants studying at the University of Khartoum are concentrating on Agricultural Economics and development studies in association with the Development Research Studies Center. Six or seven more students will be selected for 1989. The programs in Khartoum compare relatively weakly with those at American universities. The quality of local study, however, could be greatly improved by simply procuring from the United States and distributing to the students a collection of texts and other helpful training materials.

RECOMMENDATION: Working together, the PAFA and the university utilizing the advisory services of the Chemonics technical assistance team should compile a list of textbooks and other appropriate training materials for urgent procurement under the APS project. These materials to be held in such a manner as to provide maximum utilization to long-term and short-term students alike, whether registered at the university or engaged in informal study under the project.

The University of Khartoum is a source of valuable insights and knowledge beneficial to the PAEA. In the other direction, students use the PAEA computer center as a resource base for their research; they take advantage, as well, of other data available from the PAEA. The Chemonics team has provided training, particularly on data processing, to various departments of the university.

Notwithstanding the advantages to the PAEA and APS project to be gained from the relationship, the university connection appears neglected. Approximately ten students are accepted each year for study at the university, but cooperative interest seems to stop there. PAEA has not identified special training needs for the individual students, nor has it attempted to influence the direction of their research topics.

RECOMMENDATION: A renewed and continuing dialogue is needed to improve the training benefits to be derived from that relationship. Action should be taken, as soon as possible, to address outstanding matters, such as student guidance, joint training activities, and improvement of university facilities to meet training needs, etc.

None of the degree-seeking students have any commitments to, or have received guidance from, the PAEA with respect to research and special study activity.

RECOMMENDATION: Particularly with respect to those at the University of Khartoum, the students should be obliged to maintain close contact with the PAEA and should choose research and study topics from lists of priority items identified to them by the PAEA. Correspondence should be maintained with faculty advisors of the off-shore participants with a view towards providing similar guidance to, and receiving commitments from, those students. The Chemonics advisors should play an important role in providing direction to that effort.

Short-term off-shore training under APS (Phase I) was not intensive. Over a period of six years, only 27 participants undertook short-term non-degree training in the United States. For twelve of those participants, the training period was approximately one year in duration; for the rest, training lasted from two weeks to several months.

Subsequent to the completion of Phase I training, five of the 27 participants are no longer with the MANR. Four have left Sudan, one of which is on official leave-without-pay while accompanying her husband on assignment elsewhere. This particular participant had undertaken a one-year training program, the others attended short training sessions of a few weeks apiece. With the inclusion of one participant from 1988, the drop-out rate from the MANR among participants returning from short-term training stands at six out of 37, or sixteen percent. It is not known whether these absentees will be permanent, or only temporary.

Quantitatively speaking, short-term off-shore training under Phase II has been quite active so far. Ten participants, one of whom not presently in Sudan, undertook short-term training in the United States in 1988.

One participant is presently being processed for training in 1989.

On the other hand, the relevancy of the curriculum content of some of the short-term off-shore technical training undertaken has been questioned when evaluated in light of specific PAEA job requirements. There does not appear to be a conscious effort to seek out specific short courses, or to devise in concert with selected training institutions, specialized courses in response to specific PAEA requirements.

Beyond that provided in the form of short workshops on the part of Chemonics staff, local short-term training has been limited to one course in statistics conducted by USDA in July 1988.

As indicated earlier in the discussion on longer term programs, training in the field of Statistics is a special concern. Statistics is a highly specialized technical subject requiring training specifically directed to that field. The PAEA organization is extremely thin in its cadre of trained statisticians. Additional staff must be trained. The Chemonics statistics advisor has already outlined a tentative training proposal to address this matter. Training manuals on methodology for statistical operations appropriate to Sudan need to be devised.

The marketing and production economics sections need increased training opportunities covering specialized topics peculiar to their technical concerns, e.g., credit, pricing, cost analysis, margins, etc. The idea being that specific individuals within those sections might become highly specialized in such topics so as to be able to take the lead in those analyses demanding such expertise.

RECOMMENDATION: An active program of short courses is needed covering the entire breadth of topics involved in sectorial policy analysis and planning. Such programs should be developed for implementation through local workshops as well as more in-depth training off-shore. Off-shore short courses should address specific needs; even especially arranged, if necessary. The University of Khartoum should be involved in the conduct of local short courses to the extent possible.

PAEA training officials understand that planning should take place with respect to the development of the short course program, but they are not sure how, or when, this should be done. The principal problem is that the PAEA is not well informed concerning training institutions available to conduct in-country training sessions. Neither are they aware of the varied training opportunities available, nor are they familiar with the institutions with whom specialized programs might be developed for Sudanese participation. Their access to such information is limited to a USDA catalog periodically received from USAID augmented by infrequent mailings of course announcements directly to the MANR from a limited number of institutions. They are basically uninformed concerning the numerous training announcements available through normal A.I.D. channels. Likewise, they have virtually no knowledge with respect to possible linkages with American institutions of higher learning. They are confident that the PAEA could assimilate more training, if training opportunities were better known and/or developed.

RECOMMENDATION: USAID and Chemonics should take appropriate action to supply and discuss with the PAEA training announcements routinely available through A.I.D. and American educational channels. They should also endeavor to develop institutional linkages with
appropriate

institutions, particularly those known through past professional association or already associated with A.I.D. through centrally-funded projects. The intent of such linkages would be to develop and provide specific in-country or on-campus short-term training tailored to APS project needs.

During Phase I, a series of in-country short courses were conducted involving topics in marketing, production, policy, project preparation, statistics, etc. The PAEA is enthusiastic about expanding upon such past activity. Appropriate inputs are needed from USAID and the Chemonics team concerning identification of, and arrangement for, training facilitators.

Although special in-country workshops need to be conducted, as well as more intensive short courses in the United States for a smaller more talented group, OJT is seen as the most effective manner to achieve skills development and transfer so as to prepare PAEA staff to replace TA advisors. On the bright side, the individual members of the Chemonics team have each on his own undertaken a modest, yet quite effective, training initiative through OJT and the organization of short workshops. Unfortunately, the Chemonics team is not bound to a formal training responsibility. Neither is there any dialogue on the part of PAEA training officials with Chemonics staff. In short, the Chemonics team is not part of a comprehensive formalized dialogue with training as its subject.

In fact there is no such dialogue. Beyond the periodic submission of generalized training plans on the part of the individual PAEA departments, there is no sustained guidance, nor dialogue within PAEA, nor outside with USAID or Chemonics concerning implementation of the ongoing training program.

The functions of the USAID training officer is limited to the administrative processing of participants for off-shore training. He is not involved in the development of training activities. Nor is he involved with local training activities, whether degree programs at the University of Khartoum or short-courses organized with expatriate or local technical assistance.

In short, there is no comprehensive effort to plan, develop and implement a structured short-term technical training program. One senses that the long-term off-shore degree program moved forward smartly primarily because specific slots were readily identifiable, and trips were available for the taking. One does not mean to denigrate long-term degree education, but one can not overlook the importance of short-term technical training and the relatively more difficult task of breathing life into a comprehensive and continuing program of OJT, workshops, seminars, in-country short courses and off-shore specialized technical training which remains essentially unprogrammed and without direction.

The situation calls for USAID and PAEA leadership in approaching this matter by providing guidance with respect to identification of appropriate training and trainees as well as for making arrangements for the undertaking of the training required.

RECOMMENDATION: USAID and PAEA should provide the management leadership and guidance necessary to assure the implementation of a comprehensive short-term technical training program meeting the professional needs of the PAEA staff, which emphasizes inputs from the Chemonics technical assistance team, the University of Khartoum and institutional relationships with American schools.

D. Project Administration and Logistics

The assignment of a PAEA staff member as APS Project Director has improved project implementation in the project's second phase from that experienced during the first phase, particularly with respect to the establishment of procurement procedures, administrative oversight and the release of budgetary resources controlled by the MFEP.

Funding release under the APS project now works more smoothly than previously, though snags in the process are still reported. The APS project steering Committee approves the APS work plan and the budget contained therein. The PAEA draws down, accordingly, from the MFEP and maintains a project account in the Bank of Sudan. The account is replenished every six months. An expenditures report is submitted every three months.

The eventual end of Local Currency availability under the APS project will severely curtail PAEA field work. There is little hope at this time that resources from the national budget will be adequate to maintain the present level and quality of project activity.

Against this scenario, there is considerable question concerning the local currency account, including drawdown procedures, the current budgeting situation, and the longevity of its availability. Drawdown has been relatively slow, even when specific uses have supposedly been identified. One senses the possibility that expenditures have been intentionally curbed with the intention of husbanding the funds for use subsequent to PACD and the consequent end of appropriated funding availability.

RECOMMENDATION: A complete review of the local currency situation should be undertaken and appropriate decisions made with respect to its utilization and longevity of availability. The results of this review should be disseminated to, and understood by, all parties concerned.

There is some concern within PAEA with respect to the degree to which USAID might further involve PAEA management in the planning of activities funded from the project dollar account, specifically with respect to commodity assistance to the University of Khartoum and off-shore training, activities which might be more adequately coordinated with PAEA.

RECOMMENDATION: USAID should conduct an internal review of dollar account expenditures, commitments and availabilities, as well as the extent to which commitments have been specified and established through Project Implementation Letters and share resulting information, as appropriate, with PAEA management.

The APS Project Director coordinates the work among the various PAEA sections supported by the Chemonics team. He establishes budgets. He is responsible for planning the use of project resources based on the overall PAEA work plan derived from the submissions of the individual sections.

RECOMMENDATION: The APS Project Administrator's actual responsibilities and authorities for independent administrative action within the framework of the PAEA command structure and organization require further clarification and unequivocal specification, particularly with respect to his position in relation to that of the Director General of the PAEA.

Continuation of the APS project at an optimal operational level will require a considerable amount of commodity procurement. Chemonics recently provided a TDY consultant, Bill Slocum, to assess the situation and make recommendations concerning requirements in that regard. The following commentary reflects inter alia a review of the Slocum report, entitled "Procurement Recommendations for the Agricultural Planning and Statistics Project". Except where noted in the following discussion, agreement is expressed with respect to the findings and recommendations of that report.

1. Vehicles.

To the extent that project management eventually decides to continue and/or expand field activities, including data collection operations, additional vehicles would definitively be required.

It is noted that vehicle requirements are currently identified in terms of the current situation wherein PAEA field operations are, for the most part, mounted from Khartoum. The PAEA reportedly plans to expand its field representation from two regional offices, at present, to a total of approximately ten. At that time, the PAEA expects to transfer a considerable portion of its field operations, along with an appropriate number of its vehicle fleet, to those regional offices. This transfer of vehicles will affect the maintenance and repair issue. This matter should be taken into consideration when making a final decision with respect to the procurement of the vehicles, themselves, as well as to the adoption of an appropriate solution to the maintenance and repair issue.

The overall needs of the regions are not known, however, it should be pointed out that the Gedaref office with a professional staff of eight has only two vehicles (pick-up trucks), both in deteriorating condition and in continuing need of repair, one a Ford, the other a Toyota. The operations of that office are limited accordingly. The requirements of the regional offices, as well as those of Khartoum need to be taken into consideration.

The APS project is essentially an agricultural infrastructure development and specialized information collection and analysis project. Transportation aspects are only incidental to the organization and mission of the PAEA. In any case, extensive motor pool operations are difficult under ideal circumstances. Operations of that nature in an organization not oriented to, or traditionally involved in, such activity is risky and fraught with problems that can bog down other more appropriate elements of a project. The recurrent cost aspects of a major vehicle maintenance activity such as proposed would be staggering. Under the present circumstances of the APS project and the prognosis with respect to the PAEA's budgetary health subsequent to project end, one should be wary of dumping such a burden on the PAEA.

It has been noted that public transportation in Khartoum, as well as that into the interior, is available at relatively moderate prices. Slocum did not explore the possibility of fleet leasing of chauffeured or non-chauffeured vehicles on an intermittent or regular periodic basis. Given the socioeconomic and cultural mores operating in Sudan, the feasibility of "making a deal" with a local transport entrepreneur(s) to meet the transportation needs for PAEA field operations could be problematic. The matter, however, should be thoroughly explored with imagination by suitable local personnel.

The Slocum report is correct in its observations concerning the garage requirements, as well as the technical assistance and training needed to assure a successful motor pool operation of the magnitude contemplated. All attempts possible should be made to preclude the project from getting involved in such an operation. If at all feasible, the operation should be contracted to the private sector to the fullest extent possible.

To the extent possible without hindering PAEA field operations, procurement of vehicles should be undertaken only after exploring the possibility of an advantageous servicing contract of one sort or another, running the whole range of possibilities from full servicing in the dealer's garage to the dealer providing supervision, labor and/or training for certain repair and maintenance operations at the PAEA facility. If such an arrangement can not be made with the dealer, the same possibility should be explored with an independent garage operator with the capacity to perform such services.

In any case, the technical assistance required, as identified in the Slocum report, should be locally procured, and if possible on a concessionary basis. One possibility might be to negotiate arrangements with a vocational trade school, exchanging the availability of tools, parts, facilities and vehicles in need of maintenance and repair against labor, supervision and management.

If necessary, the PAEA motor pool might operate with its internal resources at the first and second echelon of maintenance. Any repair operations beyond that would, of preference, be handled at an outside facility.

Particular attention should be given to the servicing capability and spare parts inventory of the dealer selling the vehicles. As an alternative to the purchase and storage of project-owned spare parts, the possibility of negotiating alternative arrangements with the dealer should be explored. If for financial, or other reasons, the dealer can not on his own maintain an adequate stock of spare parts, perhaps a mutual assistance program could be negotiated assuring spare parts availability against a financial contribution to maintain the general inventory, or some such arrangement.

Time-sharing of the vehicles against guaranteed maintenance might also be explored.

Renovation of the old Fords is dependent upon spare parts delivery and additional procurement. Ways and means to handle these vehicles should be explored in light of the foregoing comments, including the possibility of making a deal to dispose of some vehicles against repair and maintenance of others.

Agreement is expressed with respect to the make and model for procurement suggested in the Slocum report. Procurement of American vehicles would be out of the question. The history of previous project vehicle procurement under this project is a sad one. The original purchase of American vehicles was a mistake and has greatly aggravated the maintenance problem due to inadequate local servicing facilities and spare parts availability. AMC procurement has been a particularly sorry experience. As for Ford procurement, one lot of 15 Ford vehicles remained in the port unreleased for more than one year due to administrative neglect for reasons unknown. The deterioration of these vehicles left unattended for so long made the experience with that procurement even worse.

Taking into consideration the foregoing commentary, USAID might wish to explore the feasibility of alternatives to the recommendations of the Slocum report with respect to the maintenance and repair issue. Subject to satisfactory resolution that issue, one way or another, agreement is expressed with the proposal to procure additional vehicles necessary to meet field operation needs.

RECOMMENDATION: Subject to resolution of the maintenance and repair issue, including exploration, as appropriate, of the alternatives discussed above, vehicles should be procured to the extent needed to meet project field operation requirements.

2. Motorcycles.

The remarks above with respect to the four-wheel vehicles apply somewhat to the motorcycles and should be taken into consideration, as appropriate. Agreement is expressed with the general rationale for motorcycle procurement.

3. Radios.

It has been recommended earlier in this report that PAEA strengthen its regional offices and resident operations. Improved communications are essential for the effective function of those units. Therefore, agreement is expressed with respect to procurement of radio equipment, including make and model specified, as proposed. The sales agreement should adequately address assurances with respect to servicing and parts availability.

4. Computers and Related Equipment.

An increased flow of data processing and analysis justifies procurement of this equipment. Agreement is expressed with respect to the procurement

proposed, specifically with the idea of placing the order with the local dealer for the reasons stated. The sales agreement should adequately address assurances with respect to servicing and parts availability.

5. Office Equipment and Furnishings.

Agreement is expressed with respect to the need for the procurement proposed. Improvement of the physical work facilities of the PAEA will foster more effective operations and work efficiency.

6. Printing Equipment and Materials.

Earlier in this report, recommendation was made to expand considerably the PAEA's production of publications, including the possibility of creating a documentation center. While agreement is expressed in general with the procurement proposed in the Slocum report, it is suggested that the ultimate requirement for an expanded PAEA publication load, as recommended herein, might increase somewhat the needs described in the Slocum report.

RECOMMENDATION: Procurement of printing equipment and materials proposed in the Slocum report should take place without delay. However, the needs described in the Slocum report should be reassessed for possible additional needs in the light of any expansion of PAEA's publication program contemplated in the aftermath of the recommendation to that effect made elsewhere in this report.

In general, the PAEA is pleased with the contributions made by the Chemonics advisory team who apply their efforts in strict accordance with the PAEA agenda and priorities. Their advice is sought and appreciated. The advisors have proven themselves particularly valuable with respect to OJT, the organization and conduct of workshops, and informal training techniques in general.

The primary shortcoming of the Chemonics effort has been the prolonged absence of the COP/Policy Advisor, whose presence and contributions were highly esteemed and appreciated. Interest in policy research was spurred as a result of that individual's efforts prior to his inopportune departure.

The prolonged absence has had a profound negative effect from two standpoints. First, the policy analysis effort has come to a virtual halt. Perhaps more devastating, however, to overall project effectiveness has been the almost complete lack of a cohesive multidisciplinary effort among the remaining Chemonics team members and the PAEA project staff with respect to overall project management requirements. To their credit, the remaining Chemonics team members have been able to make progress with their respective counterparts in their individual fields.

There is common agreement with respect to the urgent need for a policy advisor, particularly one not burdened with COP and/or administrative duties. The immediate assignment of a policy analysis advisor to the Chemonics team is sorely needed. This advisor should be limited in duties to policy analysis, without being encumbered with COP responsibilities or general project management duties.

Short-term assignment of a policy analysis advisor would not be appropriate in view of the continuity needed in the attainment of adequate knowledge concerning the factors involved in the development of Sudan's evolutionary agricultural policy. The PAEA is not ready to accept that solution to the problem of missing and/or inadequate advisory services addressing policy analysis requirements. Short-term TA is considered acceptable for more well defined, limited tasks such as developing a specific model or presenting a training course.

Chemonics (Slocum) has proposed the establishment of an additional position to relieve the COP/Policy Advisor of certain administrative duties.

This proposal for a Chemonics Project Director is a well written document containing a detailed job description and an extensive list of tasks to be performed. Nevertheless, it has its shortcomings.

It still retains a certain duality in the position of the combined COP and the policy advisor. The policy advisor job alone is a full-time one. The Sudanese certainly expect it to be, and the success of the project demands a full-time maximum effort on the part of a policy advisor. It is questionable whether the proposed Chemonics Project Director can liberate the COP to such an extent that he can, in effect, function as a full-time policy advisor.

RECOMMENDATION: Instead of establishing a Chemonics Project Director position, a separate COP position should be established. See Appendix A for the evaluation team's staffing suggestions.

Communication and coordination among USAID, the Chemonics team and the PAEA is lacking. The USAID project committee makes decisions beyond the Chemonics advisors' knowledge and input. In the perception of the latter, inadequate dialogue exists with USAID, and the effectiveness of the team is weakened by reason of isolation and lack of cohesive effort. Notwithstanding good will and sound professional efforts in their individual bailiwicks, Chemonics technicians are not cognizant of the full essence of PAEA's institutional being. Chemonics and the PAEA are not a fully integrated team pulling steadily in one direction.

CONCLUSION: In summary, the PAEA is a viable, yet ailing organization with an important mission to perform. It can profitably absorb the assistance available from the APS project. The latter, despite problems along the way, is poised to realize its potential, at least, to considerable degree. The primary shortcoming of the project is the lack of a concerted will,

common to all parties, to put all the pieces together into a cohesive effort. There is a lack of interaction and coordination among the various elements of the PAEA, other GOS agencies, USAID and the Chemonics team. Communications are ineffective. There is no sense of a common overriding purpose and direction. It is essential that appropriate technical assistance inputs from Chemonics and/or elsewhere be put into place as soon as possible to assure required project management guidance and technical advisory services to all elements of the project.

APPENDIX A: STAFFING SUGGESTIONS

A number of changes in the Chemonics staff is anticipated over the next few months. At the same time, a clearer picture of the work load during the remaining life of the contract is emerging. Given our understanding of the likely direction of work and the available resources, we offer our suggestions for Chemonics staffing.

To improve overall APS project performance, particularly in policy analysis, we recommend a realignment of the Chemonics team. The current contract authorizes five long-term positions: Economic Policy Advisor, Agricultural Trade and Marketing Advisor, Production Economics Advisor, Agricultural Statistics Advisor, and Computer Support Specialist. The contract specifies that one of the long-term advisors be designated Team Leader, or Chief of Party (COP) as he is customarily referred to. The Economic Policy Advisor served as COP until his departure due to illness in early November 1988. The Agricultural Trade and Marketing Advisor was acting COP for more than two months, at which time the Production Economics Advisor assumed the COP duties, also on a temporary basis.

Aside from the disruptions caused by turnover in COP duties, we believe the structure of the team is unsound. We recommend the addition of a COP position to the team, resulting in separate positions (and people) for the Economic Policy Advisor and the COP. It is not humanly possible for one individual to do justice to both functions. Under the revised staffing pattern, the Policy Analysis Advisor would continue to work with the Policy Analysis section of PAEA, while the COP would interact with the Director General and the two departmental directors of PAEA. The COP would coordinate and support the efforts of the other five team members, assist the PAEA directors in shaping the agency's programs, help solve management problems, and represent Chemonics in its relations with USAID and the GOC.

We also recommend an increase in the authorized level of short-term assistance from the present 10 person-months to 30. This change was anticipated in the contract, and given the expected demand for short-term assistance, it would be prudent to authorize the 30 person-months now.

We also suggest a change in emphasis (not necessitating formal changes in the contractual terms of reference) for the Agricultural Trade and Marketing Advisor and the Production Economics Advisor. Both should devote more of their time to more directly policy-related work, price policy analysis for the former, and sector modeling for the latter. There is no clear demarcation between policy-related and other types of economic analysis conducted by PAEA. The actual allocation of the advisors' time will be dependent on the type of analyses undertaken by PAEA in the next two years and the professional judgment of the advisors. It would be ill-advised to try to impose any rigid time allocation a priori.

The new Agricultural Marketing Advisor hopefully would arrive in Sudan before the departure of Dr. Karuse in June to assure continuity in that position. In addition to advising the Agricultural Marketing section of the PAEA, the Advisor would take the lead in the program of price policy analysis. This individual should have practical experience and training in demand and price analysis, as well as the ongoing functions of the Agricultural Marketing section, e.g., collection and interpretation of price and margin data and market structure analysis.

After the new Agricultural Marketing Advisor has settled in, a short-term specialist will be needed to develop a detailed scope of work for the program of price policy analysis. The scope should specify the priority commodities to be studied, the general types of models, data sources, and staff time required, both PAEA and Chemonics. PAEA staff in long-term training should be encouraged to design their thesis research to fit into the program of price policy analysis.

Following are suggested terms of reference for COP, formally called "Team Leader/Senior Project Advisor," and the Economic Policy Advisor. The latter is modified slightly from that in the current contract to account for the overall realignment of duties among team members.

Team Leader/Senior Project Adviser

The Team Leader/Senior Project Adviser will be designated by the contractor, subject to USAID/Sudan and GOS Project Director approval. In performing duties as Team Leader, the advisor is responsible to the Director-General of the PAEA and the USAID/Sudan project officer.

As Team Leader he will:

(1) work with the GOS Project Director to coordinate all project activities;

(2) ensure that annual workplans are prepared by each member of the technical assistance team;

(3) synthesize the individual workplans into one workplan for the project;

(4) prepare reports as required in C.2(d)(1);

(5) coordinate an annual, internal self-review of progress and problems;
and

(6) be responsible for all contractor administrative matters, including the hiring and training of local staff.

In his capacity as Senior Project Adviser he will be adviser to the Director of PAEA and in this capacity will assist the PAEA as follows:

(1) in collaboration with MANR colleagues and policy makers, identify major policy issues, data needs and analytical studies to be undertaken; draw up short- and long-term work plans to design, conduct, and report on such policy studies; and devise mechanisms for effectively channelling information to policy-makers;

(2) on the basis of economic analysis and policy studies, assist the PAEA to advise policy makers on development opportunities, investment alternatives and priorities, and policy trade-offs for the agricultural planning process;

(3) maintain close working relationships with MANR and GOS policy makers in order to predict and respond ex ante to economic policy needs; and

(4) assist the PAEA director and the APS director in analyzing and resolving institutional management problems both organizational and logistical which inhibit the realization of project impact.

Economic Policy Advisor

The Economic Policy Advisor will be an employee of the contractor who will assist the GOS through the MANR in strengthening its capacity to carry out priority agricultural policy analysis and formulation. This advisor will serve as a direct counterpart to the senior policy analyst in the policy analysis unit of the PAEA. The level of effort for this position is three years.

The Advisor will assist in the organization and operation of the policy analysis unit and in determining data gaps which need to be filled by other project staff. He/she will work with the Director General of the PAEA and his/her counterpart to develop a process for identifying key policy issues on which the staff of the analytical unit should focus their work both on recurrent policy decisions requiring analysis, and special one-time studies to

assist in formulating new policies or plans in response to immediate needs of decision makers and for conveying the results of such analyses to policy makers. His/her work will focus on the recurrent decision of the GOS dealing with demand and supply of crops and livestock products, prices of agricultural products and inputs, and policy issues arising from government interventions in agricultural markets and trade.

Specifically, the Economic Policy Advisor will:

(1) provide on-the-job training to the MANR and other staff in the design and implementation of economic policy studies responsive to the needs of policy decision-makers;

(2) undertake analytical studies on the direct effects and distributional impacts of current and alternative agricultural prices and subsidies;

(3) in collaboration with Sudanese counterparts, maintain systematic indicators on the performance of the agricultural sector and its major subsectors;

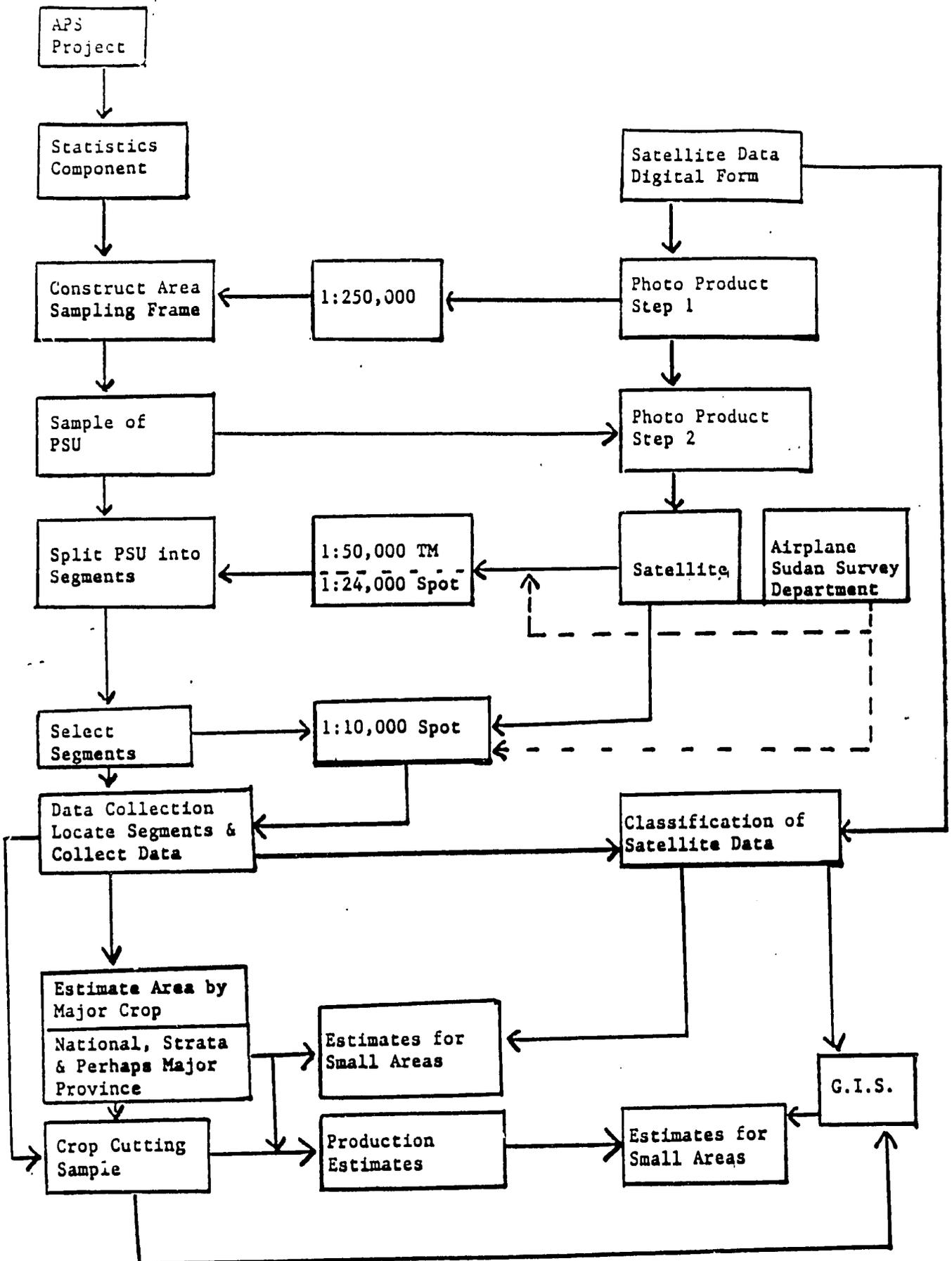
(4) in collaboration with the senior policy analyst, identify needs, prepare scopes of work for, and schedule short-term technical assistance for the policy analysis unit, and develop and implement a training plan for policy analysis unit staff.

APPENDIX B: RELATIONSHIP OF ASF AND SERISS

In my discussions with AID and MOA, I developed the impression that the APS Project was being somewhat hampered by confusion over the relationship between SERISS and its objective versus ASF and its objectives. To a large extent this can be explained by the history of the APS project. The ASF was very slow in being developed because of the lack of basic photographic material. When the SERISS project came into being, the ASF was developed as an integral part of the SERISS project with the purpose of providing ground truth data. In the meantime the Agricultural Planning and Statistics Project (APS) used the frame to select a sample of area segments to provide crop estimates which as a by product could provide ground truth to the Remote Sensing Project. The final report of SERISS, published in December 1987, provided results of the area segment enumeration (area sample) only as the SERISS project never progressed to the point of making estimates.

The scope of work in the pending proposal to continue the SERISS project called for the Regional Center for Services in Surveying, Mapping and Remote Sensing, (RCSSMRS), "to improve estimates of major crops by refining the ASF which will be recommended in the proposed SERISS evaluation. This may include re-stratification increased number and re-allocation of the PSU's in various agricultural sectors, particularly the traditional sector in Kordofan and Darfur." In other words, the crop estimation under the ASF and Remote Sensing Project were thought of as a single project rather than as two independent efforts that compliment each other by SERISS providing photographic materials and a frame to ASF and AFS in turn providing survey enumeration information material to SERISS for ground truth. The requirements of an area sampling frame differ if used to provide independent estimates of crop areas as opposed to providing ground truth to remote sensing for use in correcting satellite data prior to generating estimates. If used to provide ground truth only, one does not have to be as concerned about the efficiency of the ASF as opposed to providing an independent estimate with reasonable measures of precision.

Conceptual Flow of ASF and its Relation to Remote Sensing



APPENDIX C: SURVEY RESULTS

The 1986/87 survey placed considerable effort in the irrigated stratum. The Statistics Division felt that data from the government corporation was well known and as such it would be a good check to determine the effectiveness of the ASF methodology. Survey results were, for all practical purposes, identical to the government corporation data and as such the Statistics Division accepted the ASF methodology even though they had been skeptical of its usefulness. The survey results are presented in Table A along with a comparison of the government estimates based on subjective procedures.

Table A: Sorghum acreage planted 1986/87 and 1987/88, Government estimates (subjective procedures) and ASF results (objective procedures)

<u>Strata</u>	Gov. Est. <u>(000) fed</u>	ASF Est. <u>(000) fed</u>	ASF C.V. <u>(Percent)</u>
1986/87			
Irrigated	705	704	6.0
Mechanized	3025	2444	7.8
Traditional	1243	638	29.0
Total	4973	3668	7.3
Mechanized and Traditional	4268	3082	8.6

<u>Strata</u>	Gov. Est. <u>(000) fed</u>	ASF Est. <u>(000) fed</u>	ASF C.V. <u>(Percent)</u>
1987/88			
Irrigated	711	(Not Sampled)	
Mechanized	5315	4272	12.3
Traditional	918	1538	32.1
Total	6944		
Mechanized and Traditional	6233	5810	12.4

Source: 1986/87, December 1987 SERISS Publication
1987/88, Government Estimate, Agricultural Situation and Outlook
Report
1987/88, Resident Statistical Advisor pulled from various printouts

The traditional subsector accounted for 20 to 26 percent of the estimate and nearly 50 percent of the variance. It should be recognized that the final sample size in the traditional area was substantially less than planned due to the absence of adequate photo coverage. The 1987/88 survey results were similar to those achieved in 1986/87. Some changes were made in the sample size. Changes were limited due to the availability of low level photography.

The Chemonics Statistical Advisor and I were able to summarize data on the four major crop areas planted by Province for the 1987/88 survey as follows:

Table B: Sorghum and Millet planted area, 1987/88 crop year by Province.

<u>Province</u>	<u>Sorghum</u>		<u>Millet</u>	
	<u>Area</u> <u>(000) fed</u>	<u>C.V.</u> <u>Percent</u>	<u>Area</u> <u>(000) fed</u>	<u>C.V.</u> <u>Percent</u>
Kassala	1853.7	9.2	-	-
B. Nile	1912.8	25.4	-	-
S. Kordofan	606.8	19.4	220.5	8.4
N. Kordofan	463.5	38.3	2631.6	16.6
S. Darfur	451.1	69.7	950.9	43.2
N. Darfur	522.1	63.5	1486.3	33.0
Total	5810.0	12.4	5294.3	14.6

Table C. Sesame and Ground Nuts planted area, 1987/88 crop year by Province.

<u>Province</u>	<u>Sesame</u>		<u>Ground Nuts</u>	
	<u>Area</u> <u>(000) fed</u>	<u>C.V.</u> <u>Percent</u>	<u>Area</u> <u>(000) fed</u>	<u>C.V.</u> <u>Percent</u>
Kassala	137.6	20.9	-	-
B. Nile	132.6	14.9	-	-
S. Kordofan	126.5	46.5	169.8	80.2
N. Kordofan	2548.3	22.2	744.3	38.0
S. Darfur	75.2	50.8	467.1	39.9
N. Darfur	16.6	100.0	-	-
Total	3036.8	18.8	1381.2	26.4

The last four provinces listed in the preceding tables essentially make up the traditional agricultural sector. Tables B and C clearly point out the large c.v.'s for provincial estimates.

It should be noted that many of the estimates are based on very small sample sizes. One also has to use the results with extreme caution since many sample segments were lost because of failure to obtain low level photography. These small samples do not represent the population from which they were drawn and the c.v.'s are not stable.

Table D provides the population and samples sizes by province. The overall sampling rate is approximately one-tenth of a percent.

Table D: Number of sampling units in the population and sample by province.

<u>Province</u>	<u>Population</u>		<u>Sample</u>	
	<u>No. PSU's</u>	<u>No. Segments</u>	<u>No. PSU's</u>	<u>No. Segments</u>
Kassala	754	754	48	48
B. Nile	1169	1169	30	30
S. Kordofan	1043	11496	28	47
N. Kordofan	2260	54252	23	88
S. Darfur	1284	30816	12	32
N. Darfur	1230	29250	11	32
Total	7740	128007	152	277

APPENDIX D: SAMPLE SIZE REQUIRED TO PROVIDE AN ESTIMATE OF 10 PERCENT SAMPLING ERROR AT THE PROVINCIAL LEVEL, SORGHUM AND MILLET PLANTED AREA

Province	ASF (000) fed	C.V. %		PSU Sample Size	Segment Sample Size	Sample Size Required		
		Ac- tual	Expec- ted			Current PSU Segments	Adjusted ¹	
<u>Sorghum Planted Area:</u>								
Kassala	1853.7	9.2	8.0	48	48	70	70	70
B. Nile	1912.8	25.4	10.0	30	30	194	194	194
S. Kordofan	606.8	19.4	10.0	21	21	79	79	79
				7	26	26	104	52
N. Kordofan	463.5	38.3	10.0	23	88	337	1348	674
S. Darfur	451.1	69.7	10.0	12	32	582	1746	1164
N. Darfur	522.1	63.5	10.0	11	32	443	1330	886
Total	5810.0	12.4	4.5	152	277	1731	4871	3119
<u>Millet Planted Area:</u>								
S. Kordofan	220.5	8.4	8.4	21	21	21	21	21
				7	26	14	28	28
N. Kordofan	2631.6	16.6	10.0	23	88	63	252	126
S. Darfur	950.9	43.2	10.0	12	32	224	672	448
N. Darfur	1486.3	33.0	10.0	11	32	120	260	240
Total	5294.3	14.6	6.0	74	199	442	1333	863 ²

^{1/} see the explanation that follows.

^{2/} total for 6 provinces is 863 + 70 + 194 = 1127

The adjusted column was developed after looking at the contribution to sampling error from the 2 stages of sampling used in the traditional sector. Under the current procedure the second stage sample (segments within P.S.U's) was increased to 4 in South and North Kordofan and 3 in N. and S. Darfur in an attempt to reduce sampling error. The following analysis of the contribution to the total sampling error came almost exclusively from the between P.S.U contribution. This implies that very little gain can be achieved by increasing the second stage sampling fraction.

<u>Province</u>	<u>Var (y)</u>	<u>Between Variance Component</u>	<u>Within Variance Component</u>
S. Kordofan	23.6	23.2	.4
N. Kordofan	10.69	10.66	.03
S. Darfur	104.2	103.9	.3
N. Darfur	126.0	124.9	1.1

Based upon the preceding information, the adjusted sample size assumed limiting the second stage sample to 2 segments per P.S.U. In all probability selecting only one segment per P.S.U. would be more nearly optimum with the current frame. However, the between P.S.U. cost is quite large and requires substantially more vehicles as compared to the within P.S.U. cost. These components of cost data are not available. Also, the number of vehicles available for data collection is a limiting factor. I, therefore, decided to use a second stage sampling fraction of 2 of 24 segments.

Alternatively, millet is the major crop in the traditional sector. One could argue, reasonably, that we would obtain millet at the 10 percent level and let sorghum fluctuate. This then provides the following results for sorghum planted area:

Province	ASF	C.V.	Sample size	
	(000) Fed		PSU	Segments
Kassala	1853.7	8.0	70	70
B. Nile	1912.8	10.0	194	194
S. Kordofan	606.8	19.4	28	56
N. Kordofan	463.5	23.1	63	126
S. Darfur	451.1	16.1	224	448
N. Darfur	522.1	19.2	120	240
Total	5810.0	5.4	699	1134

The following table sets forth the sample sizes needed to achieve a 10 percent level of precision at the provincial level for sesame and groundnuts.

Province	ASF (000) fed	C.V.		Sample Size		Sample Size Required		
		Percent Act.	Exp.	PSU	Segment	Current PSU	Adjusted Segments	Adjusted
<u>Sesame Planted Area</u>								
Kassala	137.6	20.9	10.0	48	48	210	210	210
B. Nile	132.6	14.9	10.0	30	30	67	67	67
S. Kordofan	126.5	46.5	10.0	21	21	454	454	454
				7	6	151	605	302
N. Kordofan	2,548.3	22.2	10.0	23	88	113	452	226
S. Darfur	75.2	50.8	10.0	12	32	310	930	610
W. Darfur	16.6	100.0	10.0	11	32	1,100	4,400	2,200
Total	3,036.8	18.8	8.4	152	277	2,405	7,118	4,136

Groundnuts Planted Area

S. Kordofan	169.8	80.2	10.0	21	21	1,350	1,350	1,350
				7	26	450	1,800	900
N. Kordofan	744.3	38.0	10.0	23	88	332	1,328	664
S. Darfur	467.1	39.9	10.0	12	32	191	764	382
Total	1,381.2	26.4	6.5	63	167	2,323	5,242	3,296

APPENDIX E: TRAINING PROPOSAL DEVELOPED BY THE RESIDENT STATISTICS ADVISOR,
CHEMONICS.

1. ORGANIZATION

The Department of Agricultural Economics and Statistics of the PAEA is responsible for compilation and publication of all agricultural statistics and for carrying out various agricultural surveys. The Agricultural Statistics Division (ASD) is one of the several units of this Department and it is in charge of conducting part of the crop statistics produced by the Department of Agricultural Economics and Statistics.

The data collection systems applied by the ASD vary considerably between crops and also public organized and private sectors and it could be divided in three main methods:

- a. State Corporation: Objective crop acreage comes from their records. Reporting yields is usually subjective, except for cotton that is objective information from the records too.
- b. Agricultural Inspectors: Their main duties are the regulation of land use, but they are also responsible for reporting crop area yield for private sector within their jurisdiction. In this information they use purely subjective observations, judgment and reporting forms, lacking any kind of formal training and/or instructions.
- c. Crop Surveys: For the important crops based in the ASF methodology. The 1988/89 crop area survey is being conducted for the mechanized and traditional sectors. Then a subsample is selected to carry out the crop cutting to estimate objectively the yields.

To accomplish the above activities the ASD has 91 working personnel with 4 of them classified as High Staff, 26 Inspectors, 17 Agricultural Technicians, and 44 Enumerators, organized in four sections as follows:

- i. Sampling Section: Take care of the sampling design, selection and estimation, field data collection and supervision, data analysis. It has 71 persons (the head of the section, 9 inspectors, 17 agricultural technicians and 44 enumerators).
- ii. Sampling Frame Section: Their activities are the ASF construction, survey design, research material preparation (questionnaires, manuals, etc.), editing and coding, data imputation, analysis. There are 8 persons (the head of the section and 7 inspectors).
- iii. Printing and Documentation Section: Preparation and distribution of the ASD publications (yearbook of Agricultural Statistics, Current Agricultural Statistics, Agricultural Situation and Outlook). There are 9 employees (the head of the section and 8 inspectors).
- iv. Computer Center: Provide computer processing service with 2 persons.

The chief of the ASD manages and coordinates the technical and administrative work of the entire Division.

Besides there are 11 persons (10 women and 1 man) hired like enumerators but doing clerk activities for all the Department of Agricultural Economics and Statistics.

2. PERSONNEL

The following table shows the education level of the ASD Staff:

TABLE 1

ASD PERSONNEL BY EDUCATION LEVEL

EDUCATION LEVEL	NO.	%
1. Post Graduate with Diploma or MSc	9	9.9
2. BSc in Agricultural Sciences	21	23.0
3. Agricultural Secondary School Graduates	17	18.7
4. Secondary School Graduates	22	24.2
5. Intermediate School	22	24.2
Total	91	100.0

The first group (9.9%) includes university graduates with high studies in statistics. Most of the group are graduates from ISPC (5 persons) and 2 of them hold MSc in Social and Economic Statistics and only one person holds a diploma in computer science. The other MSc and diploma holders are from different countries (4 persons) like London, Cairo, Ghana and Romania. The second group (23.0%) are graduated from faculties of agriculture mainly from Khartoum and Cairo universities. Most of this group had attended domestic courses in statistics arranged by the PAEA or other agencies such as USAID.

No regular statistics courses have been arranged for the remaining groups (3, 4, 5), except those ones conducted each year in the APS prior to the agricultural survey start. There are many persons with long experience in data collection in the field and most of them lack adequate english language knowledge.

3. TRAINING PROPOSAL

It is possible and necessary to provide a short training program during the remaining life of the APS project. The table 2 shows the training courses proposed for the ASD of the PAEA.

TABLE 2

SHORT TRAINING PROGRAM IN STATISTICS FOR THE ASD

	NO. OF PERSONS	DURATION (WEEKS)	PLACE
1. Survey Design and Research Material Preparation	20	2	Khartoum
2. Data Collection	20	2	Khartoum
3. Editing, Coding and Data Analysis	20	2	Khartoum
4. ASF	20	4	Khartoum
5. Training Abroad	8	4.3	USA
6. Sampling Methods	2	8.6	USA
7. Photo Interpretation	4	12	Kenya
8. ISPC One Year Training	2	104	USA
9. Study and Orientation Courses	4	17.2	USA & other countries

- a. Survey Design and Research Material Preparation: This course will deal with the planning of survey like objective and scope formulation, variable definitions, methodologies, budgetting, activity programming, questionnaires and auxilliary form design, instruction manuals, etc.
- b. Data Collection: It will provide the tools for training the field staff (enumerators, supervisors, etc.), field organization, data collection procedures, supervision and quality control systems.
- c. Editing, Coding and Data Analysis: The preparation of the data for computer processing and the analysis of the intermediate and final results.
- d. ASF: This course will teach on basic area sampling theory like, sample size, stratification, sample size, sample allocation and selection. PSU construction and Segment Division, estimation procedures.
- e. Photo-interpretation: It will deal with the use of cartographic, aerial photography and satellite imagery for in the ASF system.

The first four courses will be held in Khartoum, Sudan starting during the dead season (March-July) of 1989. There are US institutions that conduct this kind of training or it would be more feasible and easier to hire a consulting firm and/or consultants with good know-how in the specific field of agricultural statistics, specially in ASF, with Sudanese experience. The photo-interpretation course could be held in the Regional Center for Services in Surveying, Mapping and Remote Services in Nairobi.

Two persons will be selected from each of the first four courses to travel to the USA to get on-the-job training in the current agricultural statistics activities, specially at the USDA national and state facilities.

Two additional persons from the ASF course will be sent to the University of Michigan Summer course (2 months: July-August) to take sampling methods program at a higher academic level.

The High Staff will have the needs of orientation visiting USA institutions dealing with ASF, remote sensing and objective measurement techniques. It would be very useful to combine these visits to some developing country working in this approach.

APPENDIX F: PERSONS CONTACTED

USAID/Khartoum

Frederick Gilbert, Acting Director
Sidney Chernenkoff, Acting Deputy Director
Gary Bayer, Supervisory Agriculture Development Officer
John Mullenax, APS Project Officer
Brian D'Silva, Program Economist
Raouf Youssef, Chief, Project Operations
George Ghobrial, Agronomist
Tahir Quadri, Forester
Mohamed Abdul Rahman, Agriculture Economist
A/Moneim El Obeid, Agriculture Program Analyst
Tony Pryor, Project Officer

Ministry of Agriculture and Natural Resources

Dr. Musa Mohamed Musa, First Undersecretary

PAEA

Dr. A.M. El Sheikh, Director General
Dr. Abdel Raziq El Bashir, Planning and Policy Analysis Director
Abdelrahman Suliman, APS Project Director
Dr. Omar El Farouk, Marketing Economist
Hassan E. Elbashir, Chief, Statistics Division
Hassab El Rasoul Hag Elsaed, Chief, Marketing Economics Section
A/Latif Ijaimi, Chief, Production Economics Section
A. M. El-Tohami, Chief, Project Preparation and Planning Section
Md. Mohamed, Computer Center
Mukhtar Ibrahim, Senior Statistician
Zaidan, Agricultural Statistics

Ministry of Finance and Economic Planning

Lila Bashir, Deputy Director for Agricultural Planning

Gezira Corporation

Abubakar Ismail Karrar, Deputy Director, Planning, Socio-Economic Research Unit
Hafiz Hussein Mohamed, Planning and Development Officer

University of Khartoum

Dr. Kamil Hassan, Department of Rural Economy

Chemonics

Stanley Krause, Agricultural Marketing Advisor
Ronald Krenz, Production Economics Advisor
Guillermo Otanez, Agricultural Statistics Advisor
Bogale Demissie, Computer Support Specialist
Bill Slocum
JoAnn Bowman

World Bank

Aftab Raza

Food and Agriculture Organization of the U.N.

Magdy Ghieth, Programme Officer

Regional Centre for Services in Surveying, Mapping and Remote Sensing

Allen Falconer

APPENDIX G: SUMMARY OF RECOMMENDATIONS

Chapter III - Technical Assistance: Plans and Progress

D. Local Technical Assistance

RECOMMENDATION: That PAEA immediately implement the University of Khartoum component of the APS project. (p. 17)

RECOMMENDATION: That the research grants program be implemented as soon as possible. (p. 17)

E. What If?

RECOMMENDATION: Adoption of a process focusing on specific analytical concepts and models, rather than generalized policy issues. (p. 18)

Chapter IV - The 1989 Work Plan

B. Computer Center

RECOMMENDATION: That Chemonics and PAEA jointly plan for the retention of computer specialists and the training of PAEA staff to further strengthen the Computer Center. Benign neglect could well destroy what is now a very successful endeavor. Explicit support from USAID would be helpful. (p. 24)

RECOMMENDATION: That USAID approve the tasks in the Computer Center section of the 1989 Work Plan. (p. 24)

C. Agricultural Statistics

RECOMMENDATION: That USAID approve the Agricultural Statistics section of the 1989 Work Plan with the proviso that the tasks be modified in accordance with the evaluation. (p. 25)

D. Agricultural Marketing

RECOMMENDATION: That USAID approve the Agricultural Marketing section of the 1989 Work Plan. (p. 26)

E. Production Economics

RECOMMENDATION: That USAID approve the Production Economics section of the 1989 Work Plan. (p. 27)

F. Policy Analysis

RECOMMENDATION: That USAID approve the second, third and sixth tasks in the Policy Analysis Section of the 1989 Work Plan. (p. 28)

RECOMMENDATION: That PAEA, with the assistance of Chemonics, decide as soon as possible whether to proceed with the seventh task in the Policy Analysis section of the 1989 Work Plan, and that USAID concur in a timely fashion if it agrees. (p. 29)

G. Price Analysis

RECOMMENDATION: That PAEA, with the assistance of Chemonics, consider replacing the fourth, fifth and eighth tasks in the Policy Analysis section of the 1989 Work Plan with an integrated program of price analysis, and that USAID concur with said program in a timely fashion if it agrees. (p. 30)

H. Sector Model

RECOMMENDATION: That PAEA, with the assistance of Chemonics, USAID and others, consider merging the sector modeling tasks into a single effort to develop an integrated model. (p. 32)

I. Summary and Conclusions

RECOMMENDATION: That PAEA develop a "Strategy for the 1990s" to more effectively guide long term development of PAEA and related institutions. (p. 33)

RECOMMENDATION: That USAID formally approve the 1989 Work Plan. (p. 34)

RECOMMENDATION: That a Work Plan for the period from January 1, 1990 to end of project be prepared, reviewed and approved no later than December 1989. (p. 34)

Chapter V. - Agricultural Statistics

C. Problem Areas

RECOMMENDATION: Future training and development of the ASF should consider building a strong technical base in the Statistics Division consistent with time constraints. (p. 47)

D. SERISS Extension

RECOMMENDATION: The preceding list of tasks for the SERISS extension is recommended. (p. 50)

RECOMMENDATION: Discontinue ASF data collection in N. Kordofan, N. Darfur, and S. Darfur unless adequate segmentation and location can be obtained for all selected PSUs. (p. 52)

RECOMMENDATION: Tasks 8-9: These tasks should be dropped if data collection is discontinued in N. Kordofan, N. Darfur, and S. Darfur. (p. 52)

RECOMMENDATION: Tasks 10-13: If data collection in N. Kordofan, N. Darfur, and S. Darfur is discontinued, a decision on whether to continue these efforts in the mechanized strata is worthwhile. If the decision is to continue with tasks 10-13, then ASF data collection should be resumed in the irrigated stratum. (p. 52)

E. Design Improvements

- RECOMMENDATION: The feasibility study should be conducted in 2 replicates (2 x 12) in S. Darfur and 3 replicates (3 x 10) in N. Darfur. (p. 56)
- RECOMMENDATION: Review the restratification of North and South Darfur. If the review indicates an overall improvement then the same restratification should be carried out in North and South Kordofan. The SERISS extension could be set up to collaborate on the review and if the results are positive provision made to carry out the work in Kordofan. (p. 57)
- RECOMMENDATION: Develop and field test a step by step procedure to select segments within PSU in the field. (p. 59)
- RECOMMENDATION: The PSUs in the mechanized strata should be subsampled for data collection purposes. (p. 60)
- RECOMMENDATION: Select a small point sample in the non-agricultural stratum for inclusion in subsequent surveys. (p. 60)
- RECOMMENDATION: Actively seek out and develop procedure to provide a scaled segment sketch to the enumerator of sufficient size to facilitate drawing tract and field boundaries during the interview. (p. 61)
- RECOMMENDATION: Check the availability of low level photography of 1960 vintage. It may be helpful in locating segments and for enumeration purposes. (p. 61)

F. Specific Issues

- RECOMMENDATION: Continue selecting replicated systematic samples. (p. 66)
- RECOMMENDATION: The training program as described in Appendix E should be carried out with the entire staff of Statistics Division in so far as it is possible to do so. (p. 70)
- RECOMMENDATION: The field manual should be rewritten taking into account the experience that has been gained. The revision should lay out the procedures that are to be followed and solutions to unusual problems that may arise. Steps should be taken to insure that proper field and enumeration procedures are followed. (p. 70)
- RECOMMENDATION: The enumerator training school that is conducted prior to each survey should be more structured. (p. 70)
- RECOMMENDATION: Provide a check sheet for each segment and have it sent to the Central office with the completed questionnaires. The purpose of the check sheet is to list all tracts in the segment, obtain the total area of all tracts and compare it to a measured area obtainable from the survey material. The enumerator should recheck some interviews if the land area measured and reported differ by more than a given level (for example 5 percent). (p. 70)
- RECOMMENDATION: Continue development of data processing with more emphasis on computer edits and master records, and develop procedures to handle individual segment expansion factors. (p. 70)

- RECOMMENDATION: The crop cutting survey is providing valuable information with reasonable levels of precision. It should be continued. (p. 75)
- RECOMMENDATION: The crop cutting sample fields should be selected on the expanded basis which requires separate acreage and crop cutting surveys implying going to the field twice. (p. 75)
- RECOMMENDATION: Select the desired number of crop cutting samples with probability proportional to size if acreage and crop cutting surveys are conducted at the same time thereby eliminating potential bias of small fields. (p. 76)
- RECOMMENDATION: Develop an enumerator manual showing all the procedures to be used in locating and laying out the crop cutting plots. Cover the procedures carefully in the survey training school. This would help in holding non-sampling errors to a minimum. (p. 76)
- RECOMMENDATION: A small study should be conducted to determine the stability of moisture content of the grain. It is possible that one would want to utilize forced heat drying equipment so that the weight could be adjusted to a standard moisture content. (p. 76)
- RECOMMENDATION: Determine the amount of land in the ASF that does not belong to an irrigation scheme managed by a corporation. Additional samples should be selected and included in subsequent surveys. (p. 79)

RECOMMENDATION: Contact the irrigation schemes and document the quality of the area data and the cotton and wheat production data. (p. 79)

RECOMMENDATION: Determine how the irrigation schemes estimate yield of sorghum and groundnuts and evaluate their procedures. Perhaps the Statistics Division can work with the schemes to standardize their procedures and assure itself of obtaining reliable consistent yield data. Otherwise, one should continue crop cutting in the irrigation schemes for these two crops. (p. 79)

RECOMMENDATION: Thought should be given to developing an estimation procedure from the national perspective. The essential elements of such a procedure should be developed and then followed. (p. 81)

Chapter VI - Organizational, Management and Training Issues

A. Policy Linkages

RECOMMENDATION: Due to the obvious overlapping interests in the collection of data concerning irrigated agriculture, FAEA and USAID should assure coordination of the two USAID activities implemented through the two different ministries. (p. 88)

RECOMMENDATION: The FAEA should endeavor through APS project support to achieve a broad and thorough analytical coverage of the entire irrigated subsector. (p. 88)

- RECOMMENDATION:** The PAEA should, with APS project input, conduct liaison with all appropriate crop corporations, as necessary, to cover with its sectorial analysis umbrella the entire scope of traditional agriculture, mechanized agriculture and livestock enterprise at the comprehensive national level. (p. 38)
- RECOMMENDATION:** The APS project and its technical assistance inputs should assist the PAEA explore the need for, and the feasibility of, establishing appropriate mechanisms for fostering agricultural policy analysis and determination. (p. 89)
- RECOMMENDATION:** PAEA should implement, as soon as possible, cooperative activities with respect to student affairs, research requirements, joint training activities, etc. (p. 90)
- RECOMMENDATION:** The competition and award of research grants should be addressed in the context of the university's relationship with PAEA. Consideration should be given to tying the research grant program to the PAEA publication initiative suggested later in this paper. (p. 90)
- RECOMMENDATION:** While PAEA enjoys a good reputation with IERD and FAO, utilizing the Chemonics technical assistance team, as appropriate, PAEA should take pains to foster its relationship with these entities. (p. 91)

B. PAEA Internal Organization

- RECOMMENDATION: USAID project management should be represented, at least, at specified sessions of the project steering committee, not only to put forth in full quorum USAID views, but to assess GOS implementation intentions. Therefore, USAID should make the appropriate demarche to assure said participation. (p. 93)
- RECOMMENDATION: The Computer Center does and should provide services broadly to the PAEA as whole. It should be located organizationally within PAEA accordingly. (p. 95)
- RECOMMENDATION: That Chemonics give greater attention to in-depth technical assistance and guidance to enhance the functioning of the Policy Analysis Section, with special attention being given to its OJT requirements and the integration of its work into the activity of other units within the PAEA. (p. 96)
- RECOMMENDATION: The Monitoring and Evaluation Section should be strengthened and exploited for the dissemination of information deriving from the project implementation experience. This data would represent valuable input to the policy dialogue. (p. 97)
- RECOMMENDATION: The planning and monitoring sections should be integrated into the APS project with their work coordinated within the PAEA to contribute to the common cause. Appropriate technical assistance and OJT should be afforded to the personnel of these two sections. (p. 99)

- RECOMMENDATION:** The PAEA with APS project support should take appropriate action for strengthening its field apparatus. Training and logistical requirements should be included in that effort. (p. 101)
- RECOMMENDATION:** More coordination is needed among the various sections, which function independently from, and frequently oblivious to, the work of each other. PAEA efforts need to be brought under control through internal planning and progress reports. There should be better coordination of work assignments assuring common knowledge of base data and modus operandi. (p. 102)
- RECOMMENDATION:** There is a need for in-house editorial review of publications. To assure uniformity of content and format and to avoid errors, oversight and duplication of effort, all substantive PAEA documents in preparation should be identified to all sections at the outset of research and subjected to an internal review and clearance procedure prior to publication and dissemination. (p. 102)
- RECOMMENDATION:** The Chronics team should be prepared to assist the PAEA organize and hold seminars for the purpose of disseminating the findings of studies undertaken by the PAEA. (p. 103)
- RECOMMENDATION:** The PAEA with APS project support should make a determined effort to develop an expanded program of publication and dissemination of documentation covering the national agricultural sector, including that emanating from competitive research grants. In conjunction with this recommendation, the idea of

officially creating a Documentation Center within PAEA should be explored. High priority should be given to the use of APS project resources to these ends. (p. 104)

C. The Training Program

RECOMMENDATION: With respect to Statistics (as well as any other priority fields of study, such as Policy Analysis, Sector Modeling, etc., within PAEA requirements), project management should consider recourse to special non-degree programs of one or two semesters in the United States through which appropriate personnel could take courses concentrated in accordance with the specific needs of the participant in question. USAID and/or Chemonics should contact likely universities directly, as necessary, to make arrangements for the enrollment of participants in appropriate study programs. Note that the courses need not be at the graduate level. (p. 108)

RECOMMENDATION: Where necessary to accommodate otherwise highly desirable candidates, there should be liberal recourse to English language training (ELT) in conjunction with the special technical studies. (p. 108)

RECOMMENDATION: Working together, the PAEA and the university utilizing the advisory services of the Chemonics technical assistance team should compile a list of textbooks and other appropriate training materials for urgent procurement under the APS project. These materials to be held in such a manner as to provide maximum utilization

to long-term and short-term students alike, whether registered at the university or engaged in informal study under the project. (p. 109)

RECOMMENDATION: A renewed and continuing dialogue is needed to improve the training benefits to be derived from that relationship. Action should be taken, as soon as possible, to address outstanding matters, such as student guidance, joint training activities, and improvement of university facilities to meet training needs, etc. (p. 109)

RECOMMENDATION: Particularly with respect to those at the University of Khartoum, the students should be obliged to maintain close contact with the PAEA and should choose research and study topics from lists of priority items identified to them by the PAEA. Correspondence should be maintained with faculty advisors of the off-shore participants with a view towards providing similar guidance to, and receiving commitments from, those students. The Chemonics advisors should play an important role in providing direction to that effort. (p. 110)

RECOMMENDATION: An active program of short courses is needed covering the entire breadth of topics involved in sectorial policy analysis and planning. Such programs should be developed for implementation through local workshops as well as more in-depth training off-shore. Off-shore short courses should address specific needs; even especially arranged, if necessary. The University of Khartoum should be involved in the conduct of local short courses to the extent possible. (p. 112)

RECOMMENDATION: USAID and Chemonics should take appropriate action to supply and discuss with the PAEA training announcements routinely available through A.I.D. and American educational channels. They should also endeavor to develop institutional linkages with appropriate institutions, particularly those known through past professional association or already associated with A.I.D. through centrally-funded projects. The intent of such linkages would be to develop and provide specific in-country or on-campus short-term training tailored to APS project needs. (p. 112)

RECOMMENDATION: USAID and PAEA should provide the management leadership and guidance necessary to assure the implementation of a comprehensive short-term technical training program meeting the professional needs of the PAEA staff, which emphasizes inputs from the Chemonics technical assistance team, the University of Khartoum and institutional relationships with American schools. (p. 114)

D. Project Administration and Logistics

RECOMMENDATION: A complete review of the local currency situation should be undertaken and appropriate decisions made with respect to its utilization and longevity of availability. The results of this review should be disseminated to, and understood by, all parties concerned. (p. 115)

RECOMMENDATION: USAID should conduct an internal review of dollar account expenditures, commitments and availabilities, as well as the extent to which commitments have been specified and established through Project Implementation Letters and share resulting information, as appropriate, with PAEA management. (p. 116)

RECOMMENDATION: The APS Project Administrator's actual responsibilities and authorities for independent administrative action within the framework of the PAEA command structure and organization require further clarification and unequivocal specification, particularly with respect to his position in relation to that of the Director General of the PAEA. (p. 116)

RECOMMENDATION: Subject to resolution of the maintenance and repair issue, including exploration, as appropriate, of the alternatives discussed above, vehicles should be procured to the extent needed to meet project field operation requirements. (p. 120)

RECOMMENDATION: Procurement of printing equipment and materials proposed in the Slocum report should take place without delay. However, the needs described in the Slocum report should be reassessed for possible additional needs in the light of any expansion of PAEA's publication program contemplated in the aftermath of the recommendation to that effect made elsewhere in this report. (p. 121)

RECOMMENDATION: Instead of establishing a Chemonics Project Director position, a separate COP position should be established. See Appendix A for the evaluation team's staffing suggestions. (p. 123)