PDBAF-082

SO.DE.VA.
AUDIO-VISUAL SECTION
DAKAR

REVIEW OF THE AUDIO-VISUAL CAPACITY IN SO.DE.VA.

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I

INTRODUCTION : OBSERVATIONS

This report is a direct response to the request of the Director General of SODEVA to delineate the state of affairs of the Audio-Visual/Training component of the extension services of SODEVA.

The purpose of this paper is to suggest a series of possible interventions by the technical assistance of the USAID/Aurora contract team audio-visual specialist and to suggest a series of concrete proposals which could assist the organization and planning of the training division and especially the audio-visual section through the transition period of Phase I to Phase II of the Senegal Cereals Production Project.

The goal of this report is to establish a point of departure for a collaborative effort between SODEVA and USAID technical assistance. It is in no way intended to be a unilateral exercise in futile development rhetoric or criticism. It is hoped that the report could serve to establish a bilateral plan of action to develop a stronger and more effective use of audio-visual materials within the training division.

OVERVIEW

Until the present, the objectives of SODEVA's extension services were to deliver a series of technical themes to the farmer in order to increase agricultural production. In the letter of mission to SODEVA by the Senegalese Government for I981/82 - I983/84, SODEVA extension service must take on an expanded role to assure an integrated rural development plan to incorporate literacy, cooperative education, integration of women in the development process and rural artisinal into the contract plan.

The aims of the Senegal Cereals Production Project Phase II are to :

I) upgrade and refine SODEVA's recommendations and, concurrently, its field personnel,

2) develop the extension training program at Pout with the main aim to upgrade and form agents consistent with SODEVA's needs in Phase II and also to serve the in-training extension need for the respective departments,

3) develop an audio-visual production center at Pout and to coordinate the Center's production program and training program with SODEVA's extension needs ensuring that SODEVA's extension recommendations can be transposed into effective communication forms.

In order to meet those objectives and aims, it is necessary to acknowledge that change is necessary to meet the evolving need of the present day Senegalese farmer. Information and messages that were formerly extended to the targeted audience are no longer viable or appropriate technologically. The audio-visual materials and equipment used to diffuse those messages have become non-functional or obsolete and need transformation and renovation.

This dynamic of change must evolve into an updated series of extension recommendations. This dynamic exists where there is a constant flow of information and/or requests coming into SODEVA. One flow is from the rural community, the other from agricultural research. It is this liaison that is essential in order that an

effective communications program can be developed and new extension recommendations be transformed into appropriate communicative forms.

It is in this transition stage of Phase I to Phase II that SODEVA's extension program must determine through analysis, planning and evaluation a definitive approach to its extension needs and usage of audio-visual support services. Audio-visuals are only part of a complex system in a development plan.

STUCTURE (see organigram copy)

Within the organigram of SODEVA, the audio-visual section is a seperate section of the training division. The training division is under the Direction of Operations and Techniques. In order to meet the expanded needs of the Training division and to increase the capacities of its extension services, SODEVA should consider reviewing the relative importanoe and position of training within the SODEVA structure. The duties and responsibilities of the training division are far outweighed by the lack of importance given the training division under the present structure.

The change in structure could enhance the performance of the training division by grouping together all units of the training division under one director who is structurally on the same level as the other four directions. As it is, in the transition phase, the separate units are dispersed in different areas and locals. It seems necessary to gather these ressources together to collaborate effectively for a cohesive extension program and to establish a direct liaison link between the other directions of SODEVA.

It is especially necessary to more closely link the audio-visual section to the training division. This will happen as a matter of course once the audio-visual personnel and equipment are moved to Pout with the completion of the Production Center. It is vital that the above proposed structural change allow the audio-visual section to be more fully integrated into a structural entity through the redefinition and planning of the Phase II program.

It is not within the scope of the Audio-Visual Specialist to delineate the priorities and substance of the needed structural changes. It is, however, relevant to the intended performance of the audio-visual section within the structure that such a proposal

is made.

The proposed USAID short term consultant requested to address the major issues of the entire training division could also be required to analyse this area of concern.

The audio-visual section can no longer exist as an isolated entity but must become an integrated support service in determining the expanded role of SODEVA's rural development mission.

ORGANIZATION - PERSONNEL

SODEVA should immediately address the issue of the present audio-visual staff and how best to use their services and expertise. They are underutilized. Their morale is very low and their incentive to perform even on an everyday work level is best described as minimal.There is a lack of direction and purpose and they are frustrated by the apparent lack of interest in their relation to the overall development program of SODEVA. The selection of a dynamic, committed individual to organize and plan the audio-visual activities for the training division is imperative to create a coordinated and collaborative program. The best guarantee of success for the audio-visual program is the placing of full reponsibility for its operation upon a qualified leader who will work on a coordinate basis with other training personnel. Some of the major duties and responsibilities of the Audio-Visual leader would be :

I- counsel SODEVA in the wise selection of audio-visual materials,

2- work within the SODEVA structure to improve production of audio-visual materials and their utilization in the training extension programs,

3- compile monthly orders for audio-visual materials and forward them to the technical staff,

4- train SODEVA personnel in the use of audio-visuals materials,

5- organize the sheduling and use of audio-visual materials in SODEVA,

6- be responsible for the care and maintenance of audio-visual equipment,

7- serve on the liaison committees ;

a. attend monthly meetings of the delegations and SODEVA departments,

b. help make decisions for the expenditure of yearly budget for new materials and supplies,

c. help select materials and equipment that will be purchased,

d. evaluate the functioning of the audio-visual program in SODEVA.

8- maintain an effective liaison between regional training programs and the production center for effioient operation of the audio-visual program :

a. inform regional trainers of available materials,

b. promote participation by regional trainers in the preparation and preview of materials,

c. prepare materials for pick-up and return to the production center.

9- work closely and advise SODEVA officials on all phases of the program,

IO- demonstrate and interprete audio-visual materials and equipment to SODEVA personnel and visitors to the center.

Another major priority in the transition stage of Phase II should be given to staff development of the present audio-visual staff of technicians. Immediate attention should be given to the organization, labor division, programming and upgrading of technical skills. This could be accomplished once a definitive chief of the audio-visual services has been designated. The audio-visual specialist could work directly with this individual on a counterpart basis. To date there is a lack of definition in this area, which has lead to the confusion of exactly where the audio-visual specialist could intervene and assist effectively and directly.

During the transition phase and until the Production Center is built in Pout, the present staff should be expected to be retrained technically and given appropriate management skills to assure that concepts, materials, and equipment used in the production of the audio-visual materials can be incorporated into the

expanded role of this unit. Work-shop sessions should be immediately established, dealing with the full gamut of materials and equipment needed. These work-shops should be non-theoritical, with a practical, hands-on nature. These work-shops (i.e. flannelgraph design) could produce prototype materials which could be tested in the field for their usefulness and acceptability.

The regional training agents should also be included in these work-shops as they have expressed an urgent need for technical training in all areas of audio-visual usage.

Formal training at other training institutes for the audio-visual agents should be encouraged. This should be limited to West African development program institutes that have successful audio-visual training/extension programs. Training visits to such centers could be made possible through USAID project training funds.

The present audio-visual staff is a cohesive group of willing individuals who already have sufficient technical skills to produce acceptable materials. It is imperative that their professional skills be used to the optimum and a directed plan of organization managed by a qualified dynamic chief be employed.

ORGANIZATION - EQUIPMENT

All too often in development projects, technological equipment for technical services such as audio-visual is ordered without regard to its adaptability or function over long term evolving needs of such development agencies. Little concern is given to the conceptual and pedagogical approach of such tools. Even less attention is given to the proper handling, use, maintenance, repair and storage of such equipment. Equipment is usually ordered with the idea that since this is useful in modern education and training programs of the industrialized world, it can be "perhaps" effective if similarly used in developing nations. The result of such thinking is a shopping list of the newest technological innovations in equipment. More attention is given to the quantity of the equipment than to the quality and appropriateness within the context of the particular projects needs.

The above case is not particular to SODEVA but seemingly

endemic to the developing world. The audio-visual equipment that was supplied to SODEVA from the Iran-Senegal project to the present date was given little forethought to a long range development program. The usage of SODEVA's equipment, although functional in its limited scope and time, has not evolved with the needs of SODEVA and has fallen into disrepair and disuse for seemingly many reasons.

SODEVA must address the issue of the usage of appropriate technology in its training efforts. Ordering of such technology cannot be left up to technical assistance counselors but from practical, hands-on experience in the field. Equipment should be tried and tested and evaluated for its appropriateness. If it is not useful, it should be discarded or sold.

Equipment that is ordered should be rationally used as tools of communication rather than entities in themselves. An audio-visual program is not a closet full of audio-visual equipment. Equipment should be used as an integrated functional part of an entire training system. It is useless to have a I6mm projector without any film or film program. It is useless to have form but no content.

SODEVA's equipment, be it 35mm photo, I6mm film, film strip, overhead projectors, slide projectors, transformers, loudspeakers, microphones, amplification systems, screens, tape recorders, is now stored away in dust-filled closets and storerooms of the audio-visual section, CETAD, and the four regional offices. It is inoperative and non-functional in its present state. A detailed inventory has been taken of this equipment but regardless of the numbers of each type of equipment the fact remains that it is not functional.

SODEVA must address the issue of rational usage of the audio-visual equipment. The inventory is a point of departure to determine how much equipment there is already available but the real question is <u>how</u> this equipment that already exists and with the addition of the FAO consultant's equipment list, Paul Moity, for the USAID project are going to be rationally used in Phase II and integrated into a functional audio-visual training program.

The specialist recommends that rather than decentralize the equipment as was done with the Iran-Senegal project, the existing audio-visual equipment should in its entirety be transferred

and properly stored and maintained in the storerooms of CETAD. It is also recommended that once a program is established for the Phase II of the project, that the selected equipment be used in the field but maintained by the Center at Pout on a loan basis to the regional offices. The equipment that is no longer functional and appropriate to the needs of the training division should be sold or dispensed with.

The final equipment list for the Production Center at Pout has been cleared through USAID/Dakar. The order will take six months in shipment. All equipment projected for the Production Center should be at SODEVA by July 1982.

ORGANIZATION - FACILITIES AND LOGISTICAL SUPPORT

The present facilities and logistical support for a functional, ongoing audio-visual program are highly inadequate. The audio-visual section now at Rue Joffre is again being transferred to a more distant suburb from Dakar. For the remainder of the transition period until the Production Center at Pout is completed, the audio-visual section will be at Amitie III. It is therefore imperative that SODEVA expedite the approved construction program of the Production Center at Pout in order to establish a permanent location for the audio-visual section. This will alleviate the problem of isolation from the main offices of SODEVA headquarters and finally fully integrate the audio-visual section into the training division.

In an attempt to minimize this isolation due to locale, SODEVA should consider establishing a liaison office in SODEVA headquarters for the training division purposes. This liaison could eventually become the training director's office within the SODEVA headquarters. At present there is no office or space for such a liaison.

The logistical support given the audio-visual section during the transition period can best be described as minimal. Requests to do documentation or field visits were systematically rejected during the six month penury period after the specialist arrived. No funds were available to purchase even the most inexpensive supplies or maintenance materials.

SODEVA must address the issue of budgeting operating expenses to support the expanded role that the training division must assume and provide adequate funds to maintain such a program. One of the USAID financed vehicles designated initially for the technical assistance of the USAID project should be assigned directly to the training division for its priority use. The training division and more directly the audio-visual section cannot continue in such isolation.

ORGANIZATION - PROGRAM

The CETAD training program of which the audio-visual section is a part is being revised to take into account the evolving role of SODEVA agents in the field. The Center will continue to provide training of SODEVA staff in technical knowledge and diffusion of themes and will also take into account an expanded role of training trainers in production of audio-visual training materials for groups. The use of audio-visuals will play an important part in Phase II AID program as it will in all SODEVA's activities in the future and the development and use of audio-visual constitutes a major theme of AID assistance.

SODEVA must address the issue of how to use audio-visuals as support to their total development program. What was relevant in the diffusion of technical themes during Phase I is no longer appropriate in Phase II. The movement away from mass communication systems (film, radio, mobile units) exclusively to audio-visual supports to address groups is essential (teaching aids). The specialist recommends that SODEVA consider incorporating the mass communication tools into a more comprehensive audio-visual program where the full gamut of audio-visuals be employed together appropriately in conjunction with one another. (Example : Radio programs prepared by SODEVA should be packaged on cassette tapes and distributed to interested field trainers along the same slide and printed materials.) The audio-visual program should be coordinated and organized in such way that all parts become the whole rather than dispersing technical information in a shotgun method with separate audio-visual non-integrated supports.

SODEVA should plan its training program in such a fashion that logistical problems be considered as the major issue and that follow-up and evaluation be paramount.

A thorough program planning should be developed in conjunction with the audio-visual section. Part of this program development strategy is to hire a training consultant to assist in developing such a plan. SODEVA has accepted this proposal and should agree to collaborate fully to see a revised training program for Phase II.

The audio-visual chief and the audio-visual specialist jointly should collaborate in developing a program for the audio-visual Production Center to meet the needs of such a program and the transition period of Phase II.

AUDIO-VISUAL SUPPORTS

The following is a list of the mass communication systems and audio-visual supports which are presently available at SODEVA. It includes the audio-visual specialist's recommendations for their continued and revised usage, or discontinuation.

I- Rural Radio (RER- Radio Educative Rurale)

Radio is the best mass communications medium available to SODEVA to disseminate its messages directly to the farmers. SODEVA has failed to utilize the full potential of this medium and to insure an integrated extension programming message development, materials production and feedback process. SODEVA must recognize the importance of this medium by giving its full logistical support to program development, production and personnel. Rural radio could become the core of the extension program by its ability to reach the largest number of farmers at one time and by provoking discussions through follow-up using other audio-visual supports. SODEVA must commit itself to the development of practical, culturally acceptable messages geared to the needs and interests of its targeted rural audience. Immediate attention should be given to the integration of radio programming in the overall extension programming. Radio programs should be recorded (cassettes) and a permanent archival collection of all SODEVA broadcasts be established. SODEVA

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should collaborate fully with the RER programming staff in its revitalization of the former Radio DISSO program. Radio clubs should be reinstated only if such programming becomes a vital dynamic process.

2- Film -

a) I6mm

SODEVA's I6mm film program should be suspended for the time being. Most I6mm projectors are inoperational and need repair. The I6mm films that were produced are outdated and overutilized and no longer appropriate technically. SODEVA should explore other available sources within Senegal and West Africa for training films and make plans to obtain such films either on loan or purchase. The I6mm film program should be limited for the present time to staff development.

b) Super 8mm

SODEVA's S-8 film program should be revitalized. S-8 films should be explored as a practical extension tool. The S-8 films that were locally produced under Phase I should be reorganized to comply with technical needs of the present training division. The former films seem to be cumbersomely long, lack point of view and visual interest. SODEVA should explore the possibility of developing simple short (silent) film messages on divergent technical and development themes that provoke discussions and action rather than simple transfer of technical information.

c) Slides

Like the S-8 film program, SODEVA's slide program should be renovated and revitalized. Slides should be reclassified and readapted to SODEVA's present needs. Slides should be considered as an excellent "image pool" from which many other forms of audio-visual supports could be produced. Unlike I6mm and S-8 films, slides can be developed in Dakar in 24 hours. Slide duplication process should be renovated and work-shop training for the regional trainers should be considered as an immediate priority.

d) Mobile units

Although USAID has projected additional mobile units to replace ailing units of the Iran project, no definitive plan has been established for their rational use. The mobile unit is an extremely expensive extension communication tool. It should be used only in conjunction with all the other audio-visual supports and

not simply as a rural projection and amplification system. The mobile units could be integrated in the extension service by considering a more multidimensional expanded role with I) a full range of materials collection (ex : radio, cassette, photo, slide, video, film), 2) distribution of didactic and agricultural campaign materials (ex : brochures, tracts, leaflets to extension agents), 3) amplification of development messages at village/town gatherings through demonstration and pre-packaged cassette programs, night projections of films and slides followed by discussions, 4) and even as mini rural CETAD training center for extension agents training. If such a plan is established, the specialist recommends that these units be restricted for extension training usage only and that such units be centralized under the auspices of the training center at Pout.

The present study of the rational use and impact of the mobile units in the Louga region should be continued but a more multidimensional approach be explored in conjunction with this study. The remaining units in the regions should be suspended until a more definitive plan is established.

e) Offset production

SODEVA's usage of printed materials in conjunction with its extension program is highly inadequate and underutilized in considering the potential of the printed image and word. SODEVA should reevaluate the potential of this tool and explore other usages besides the "tract" program of the past. The specialist recommends that the offset production be used for the functional literacy program exclusively for the immediate future and that prototypes of booklets, leaflets, brochures and other didactic materials for the literacy program be produced and tested.

f) Video

The ½" black and white portable video unit at the audio-visual section should be used for training audio-visual staff in the transition period (January-June I982). The 3/4" color video equipment for the audio-visual center at Pout should arrive by July I982. Prototype materials (½" 30 minute productions) should be produced. These productions can be used to explain the capabilities

of this technology to SODEVA.

The three SODEVA agents who received training in France and the United States should be assigned directly to this unit and should collaborate in organizing a plan of work and production schedule. The audio-visual specialist could intervene directly in this area.

g) Other supports

SODEVA should begin immediately to produce prototype models of the following to be tested in the field for village level extension aids including BIT consultant, Mlle DERRIEN 1979 report recommendations :

1- flannelgraphs
2- models
3- flash cards
4- posters
5- manuals and handouts
6- flip books
7- strip cartoons
etc...

h) CETAD

SODEVA should view the training center at Pout as three important tools of in-service training and develop a plan and budget to enlarge it further so that the full usefulness in these three aspects of training and production be realized. These three tools are : I) a center for training SODEVA agents involved in agricultural development along the lines of technical knowledge and methods of diffusion ; 2) an audio-visual center ; 3) a. a center involved in the production and use of audio-visuals, b. a center for training other trainers. The specialist recommends that CETAD assume its function in this projected expanded role and that the proposed AID consultant assist in developing a coherent comprehensive plan to put this into effect.

SODEVA should also consider this center as being a service to development organizations other than itself.

The specialist suggests that SODEVA also consider an expanded

role of the audio-visual center as a regional center for audio-visual research and development. This expanded role could take the form of an archival collection of audio-visual materials produced throughout Francophone West Africa which could serve as models to be evaluated for their effectiveness and explored and adapted to different regional and development uses. All too often, effective uses of audio-visual materials remain within the context of the particular development project or country. There is a need to collect and define appropriate audio-visual support materials experience in West Africa rather than duplicate the same inappropriate mistakes. During the proposed training visits to other development areas already suggested, such a collect could be purposeful.

i) Pout Audio-Visual Center - Construction

The construction of the Audio-Visual center has begun. The audio-visual specialist has submitted to SODEVA revised and modified construction plans. These modifications are to both reduce costs and to provide more functional building.

The construction of the audio-visual center should be followed closely by audio-visual head and warranted modifications be considered important in the long range usage of the audio-visual center. There should be more flexibility in this area.

TRANSITION PHASE - PLAN OF WORK - AUDIO-VISUAL SPECIALIST

January I982 :

- Assist in Agricultural Fair preparations
- Assist in reorganization of audio-visual section at Amitie III.
- Assist in briefing returning SODEVA agent from U.S. training

February-May 82 :

- Assist and collaborate with Aurora short term consultant for SODEVA training division to develop long range training program for SODEVA
- Assist in training SODEVA personnel in reorganized plan and use of audio-visual materials and equipment
- Assist in establishing liaison between research and development of training materials
- Assist in training of field agents in proper use of audio-visual materials and equipment
- Assist in audio-visual workshops for training division
- Assist in follow-up of USAID financed audio-visual equipment and construction plans for Pout center
- Assist in redynamization of Radio Disso and associated programs
- Assist in coordination between CETAD and audio-visual seotion for transfer to Pout

June-September 82 :

- Equipment (USAID) for Pout Center arrives
- Assist in audio-visual documentation during SODEVA I982 agricultural campaign with new equipment
- Assist in continued field training of SODEVA personnel

September I982 :

- Transfer and installation of equipment and personnel at Pout

September-December 82 :

- Preparation of audio-visual materials production.

November 8, 1979

CEREALS PRODUCTION PHASE II
(685-0235)

Farm Budgets

In order to more clearly demonstrate the microeconomic impact of the project, budgets contrasting typical farm units with and without adopting recommended project inputs have been prepared. A typical farm unit is determined to consist of 10 hectares of cultivated land, supporting an extended family unit of 15 people. One-half the cultivated area is attributed to peanuts, and the other half to millet.

Certain farming operations can necessarily be considered as a common denominator to any farming operation, and their labor cost in this analysis has been taken as the consumption of millet considered necessary to maintain the family members for one year i.e. 150 kg millet/year/person. The extra labor involved in performing the project recommended practices has been priced at an opportunity cost of 800 CFA/day/laborer.

The present project recommended inputs* can be summarized as follows:

1) Fertilizer for millet: 150kg 10-21-21/ha and 100kg urea/ha.
2) Early thinning of millet.
3) Conscientious weeding.
4) Use of the millet variety Souna III.
5) Cattle fattening using farm by-products.
6) Planting of cowpeas for improved nutrition of farm family.

(*) Note: The project is not specifically concerned with recommendations for peanuts, however, a farmer cooperating with SODEVA will also be exposed to its recommendations for this crop.

Typical Yearly Farm Unit Budget Without Recommended Inputs

I. Costs	
a. Fertilizer	
Millet : 5 ha X 50 kg/ha X 25 CFA/kg	6,250
Peanuts: 5 ha X 50 kg/ha X 25 CFA/kg	6.250
b. Machinery	
Total cost of 50,000 CFA amortized over 5 years	10,000
c. Seed	
Millet : 5 ha X 5 kg seed/ha X 40 CFA	1,000
Peanuts: 5 ha X 120 kg seed/ha X 51.9	31,140
d. Labor (Costed as millet consumed by family)	
150 kg X 15 persons X 40 CFA	90,000
e. Miscellaneous Costs	
10 ha X 1,000 CFA/ha	10,000
f. Draft Animals (Amortized over ten years)	
Horse : 100,000 CFA	
Donkey: 30,000 CFA	13,000
Total Farm Costs	167,640 CFA
II. Receipts	
a. Yield	
Millet : 5 ha X 400 kg.ha X 40 CFA	80,000
Peanuts: 5 ha X 850 kg/ha X 45.5	193,375
Total Farm Costs	273,375 CFA
NET RECEIPTS	105,735 CFA

Typical Yearly Farm Unit Budget With Recommended Inputs

I. Costs

a. Fertilizer

Millet : 5 ha X 150 kg 10-21-21/ha X 25 CFA/kg + 5 ha X 100 kg urea/ha X 25 CFA/ha	31,250
Peanuts: 5 ha X 150 kg/ha X 25 CFA/kg	18,750

b. Cattle Fattening (two animals)

2 animals X 52,900 CFA	105,800

c. Machinery

Total investment 115,000 CFA amortized over 5 yrs	23,000

d. Seed

Peanuts: 5 ha X 120 kg/ a X 51.9 CFA/kg	31,140
Millet : 5 ha X 5 kg/ha X 40 CFA/kg	1,000
Cowpeas (interplant) 5 ha X 10 kg/ha X 50 CFA/kg	2,500

e. Labor

1. Normal (costed as millet consumed by family)

150 kg X 15 persons X 40 CFA/kg	90,000

2. Additional labor for extra weeding, thinning and spreading fertilizer

Weed: 1 person X 2 days X 10 ha	=	20 PD
Thin: 1 person X 2 days X 10 ha	=	20 PD
Fertilize: 1 person X 1 day X 10 ha	=	10 PD
Total		50 PD

50 PD X 800 CFA/day	40.000

e. Miscellaneous Costs

10 ha X 1,000 CFA/ha	10,000

g. Draft Animals (amortized over ten years)

Horse : 100,000 CFA	
Donkey: 30,000 CFA	13,000
Total Farm Costs	366,440 CFA

II. Receipts

a. Yield

Millet : 5 ha X 1,200 kg/ha X 40 CFA/kg	240,000
Peanuts: 5 ha X 1,400 kg/ha X 45.5 CFA/kg	318,500

b. Sale of Fattened Cattle

2 head X 69,500 CFA/head	139,000
Total Farm Receipts	697,500 CFA
NET RECEIPTS	331,060 CFA

If a 50% increase in the price of fertilizer is factored into the farm budget, the following impact results:

Previous farm costs	366,440
50% X 50,000 CFA (increase in cost of fertilizer)	25,000
Total farm costs	391,440
Gross receipts	697,500
Net receipts	306,060 CFA

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210 CFA = $1.00 US

November 9, 1979

CEREALS PRODUCTION PHASE II
(685-0235)

Franzel Comment

An interim evaluation presented by S. Franzel in May 1979 under a Michigan State/AID contract concludes that the SO.DE.VA. project is not economically viable. However, the Franzel analysis vastly underestimates the benefit stream of the project by incorrectly diminishing the importance of the returns to the project area of the less intensified TL and TB farm categories. Franzel assumes that the total returns to the project of the TL and TB intensification levels equal that of the TBFF category. The results of the project belie these assumptions. Analyses carried out by the USAID/Senegal Economist D. Brown demonstrate aggregate returns to TL and TB levels of intensification to be nearly ten times that for the TBFF category, and total benefits of the project more than double those calculated by Franzel with consequent positive economic rates of return.

OPTIONAL FORM NO. 10
JULY 1973 EDITION
GSA FPMR (41 CFR) 101-11.

UNITED STATES GOVERNMENT

Memorandum

: Mr. Norman Schoonover, Mission Director DATE: September 11, 1979

: D. Brown, Ag. Economist

: Steve Franzel Evaluations of Bakel Small Perimeter Irrigation and Senegal Cereal Production Projects

Attached Annex I and II are detailed analyses of Franzel's evaluation of the Bakel and the Cereal Production I projects. These analyses show that Franzel has made a number of errors particularly on the estimates of the benefit streams of the two projects. The results of these errors is to grossly undervalue the economic worth of the projects.

Efforts by a graduate student such as Franzel can be important. That may or may not have some worth to the AID mission policies and programs, but in any case are usually no major consequence to the overall operation of the mission. However, the specific circumstance of his analysis and the importance of the issue he attempts to evaluate requires a more detailed review of his efforts than would be normally called for.

Franzel's work was done under the auspices of Michigan State University's contract with AID (AID/AFR-C-1260) to do analysis of the development process in Africa. As such, his work receives wide distribution within the Africa Bureau.

Franzel's subject was to look at the economics of rainfed and irrigated agriculture in Senegal. This subject is of major importance to both AID and the GOS in determining their development policies over the next 20 years.

The principal conclusion of Franzel's paper is that both the Bakel and the Cereal Production projects are not economically viable having negative economic rates of return. Unfortunately his analyses provide no additional information on the economic trade-offs between rainfed and irrigated agriculture (more on this later).

The strongly negative results of Franzel's paper and its wide distribution within the Africa Bureau should be a major concern to the mission principally because it does not correspond with our own evaluations of the projects or those of other evaluations. It should be noted that economic analysis is more an art than a science. Results depend on the assumption made by the economist doing the analysis on the projects cost and benefit streams. To see where the difference lies between Franzel's work and that of others, including the

original project papers, I made a step-by-step analysis of the assumptions in his paper. The results of the major errors I found in these assumptions are in the attached annexes. A resume of these results are as follows:

(1) Bakel Small Irrigated Perimeter Project:
Franzel used an exceptionally low border (world) price as the bases to calculate the benefits of the project — the increase output of rice and maize. He chose world market prices for 1977; a period of exceptionally large world supplies and corresponding low market prices. A more reasonable price would be the average price for the 1973-78 period which represents the new world commodities price trend after the major price increases in the 1973-1974.

Additionally, Franzel included as project cost continual construction of central infrastructure and field trial stations after the project funding ends. This, of course, is not the case. Correcting only these two errors results in a rate of return of the project of over 8%.

Additional questions can also be raised on Franzel's assumptions on pumping costs and labor requirements. Modifying these assumptions further raises the rate of return of the project to almost 17%.

(2) Senegal Cereals Production Project:
Unfortunately the economic analysis of the SODEVA project is not as clear as Bakel. It is more difficult to analyze concretely the results of this project. What is clear however, is that Franzel's analysis vastly underestimated the benefit stream of the project by diminishing the importance of the returns to the project area of the TL and TB categories of farm intensification. Franzel assumes that the total returns to the project of the TL and TB intensification levels equal that of the TBFF category. Franzel in fact recognizes only the TBFF levels as the "intensification" system of the project.

The results of the project belie these assumptions. The major intensification systems adopted by farmers during the project period were in the TL and TB categories. Returns to these categories are substantial although the exact level is still not certain. What is evident is that aggregate returns (benefits) of the TL and TB categories (called semi-intensified by Franzel) is much greater than for the TBFF category alone. In my review of this project I attempt to estimate the total return of each category. While such an estimate is based on skimpy data and necessity of using several hypotheses on the relationship between farms types and hectares involved in each intensification category, the results show that the aggregate returns the TL and TB categories to be as much as ten times that for the TBFF category and total benefits of the project more than double those calculated by Franzel. Recalculating the rate of return of the project with this modified benefit stream gives a result of over 17%.

As can be seen from the above discussion, the evidence of Franzel's analysis is clearly wrong for the Bakel project and strongly so for the Cereals Production Project.

This exercise raises a number of general questions. As I noted earlier, no new information on the basic question of the economic trade offs between irrigated

and rainfed agriculture is provided by the Franzel report. The general error in the analysis makes comparison between the projects irrelevent. In the last section of his paper, Franzel touches on various issues but his analysis does not support them in any consistant way. Some of the issues are extremely important, i.e. suitability of the technical packages and the risk factor involved in their application to the peasant farmer.

The Franzel report also suffers from a basic error similar to several other university based reports I have seen. It generalizes from a specific point in a projects's development to the entire project activity. Franzel repeatedly points out failures to reach project objectives particularly in the 1977/78 crop year as indications of the lack of acceptance of general project activities. He does this without duely noting that this was a period of extreme drought and disastrous crops. Further, he takes these particular shortfalls and generatizes them over the entire 15 year period of his analysis.

There are important issues on which Senegal needs to have serious analyses — but it is not getting it. I am not against AID making contracts with universities to provide funding for U.S. graduate students to do work in the third world. It is a laudable idea, but only if the universities provide adequate guidance and support of the program so that work undertaken is worthwhile to AID.

For example, the mission did not have a chance to comment on the full contents of Franzel's report until now—after the report has been published. We received a resume of the final result and nothing more. Since a real evaluation of the report has to be based on examination of how the results were obtained such a summary is worthless for any realistic response. It should be the universities responsibility to get this response from us.

What this adds up to is a lot of wasted time. Time wasted on working with the graduate student. Time wasted on responses to misinformation the report generates. Yet this effort would not be a waste of time if results useful to Senegal and AID's programs and policies were being obtained. To date at least, both the MSU and Purdue experience seems to indicate that the usefulness of university contracts, at least for Senegal, should be seriously reevaluated.

Annex I

Bakel Small Irrigated Perimeter Project

In calculating net economic benefits for the Bakel project, Franzel used two methods to determine the shadow (economic) price of farm output: 1) an adjusted border price method where the border price is adjusted upward 15% to take account of the overvalued CFA franc; and 2) a Governement policy price method where the border price is not only adjusted for the overvalued currency but also adjusted to reflect the government's goal of self-sufficiency as seen in the official price higher than the border price. Both of these methods are of course based on a given border price. For the border price Franzel used those found in Table XXII of Volume V Annex 9 (Economic Analysis) of the Project Paper of the Casamance Regional Development Project. This table gives a CIF Dakar price of maize of 28.64 CFA/kg and of 32.44 CFA/kg for paddy. These are based respectively on a world market price of 20.64 CFA/kg for US No.2 maize (fob gulf) and 59.45 CFA/kg for broken rice (fob Bangkok). These prices can be converted to $ metric ton (using a conversion factor of 230 CFA = 1$) to $90/MT for maize and $258/MT for broken rice.

It should be noted that prices of commodity goods fluctuate differently from other goods (such as manufactured ones). They react more sharply to the forces of supply and demand and short term price trends often move independently of general price movement of the economy. It is usually recommended to use current prices of goods in a benefit/cost analysis on the assumption that cost and returns will move simultaneously over time, this canceling the effects of inflation. However current prices have to be taken with a great deal of caution with commodities. Long termpprice trends of commodities provide a more accurate analysis of project benefits and cost over time. Failure to do this can result in grossly underestimating (or over-estimating) the value of a project as we will see in Franzel's analysis of Bakel where an exceptionally low world price was used as the bases to evaluate the economic worth of the project.

World market prices of US No.2 yellow maize (fob gulf) were relatively stable between 1952-1972 (1). They varied between a low of $43/MT in 1961 to a high of $59/MT in 1966. Beginning in 1973 and accelerating in 1974, world prices of maize, as well as most other commodities, rose dramatically. Maize, for example, more than doubled to $134/MT. The jump in world commody prices in 1973/74 was of a "rachet" nature establishing a new higher price trend.

For maize this new price trend has averaged about $112/MT in the 1973-78 period. An exceptional drop in prices occured in 1977 when the prices was $95/MT. The price rebounded to $130/MT in early 1978. It was this exceptional low price level of 1977 that Franzel used to evaluate the Bakel project.

The situation is similar with rice. The average world market price of 5% broken, milled, Thai rice (fob Bangkok) in the 6 year period 1973-1978 was $361/MT. Franzel used $258/MT in his analysis.

Recalculating Franzel's adjusted border price for rice and maize using the average price in the 1973-78 period, i.e. $361/MT for rice, $112/MT for maize, gives the following results.

(1) all prices are from Commodity trade and price trends (1978 ed) - World Bank and Commodity Review and Outlook 1977-78 - FAO

Rice (CFA/kg)

5% broken millet		
fob bangkok		
$ 361/MT =	83,03	(2)
CIF	12,00	
Fob Dakar	95,03	
Milling % (0.65)	61,77	
Milling cost	-12,00	
Transport	- 2,00	
Border price	47,77	
15% overvaluation	7,17	
Economic price	54,93	

Maize (CFA/kg)

US No.2 (fob gulf port)		
$ 113/MT =	25,99	(2)
CIF	8,00	
fob Dakar	33,99	
(border price)		
15 CFA		
Overvaluation	5,10	
	39,09	

(2) conversion at 230 CFA = 1$

In addition to the erronously low shadow price used to calculate project benefits, there are some errors in the project costs as set forth in Franzel's report. Under "Central Infrastructure" he has a cost of 10.856.000 CFA ($ 47,200) for construction of extension buildings and other non-farm infrastructure from year 5 to 15 of the analyses. In fact this construction will end in year 4 of the project. Under "Miscellaneous" cost he has 12.440.000 CFA ($ 54,300) for years 5-15. This should be reduced to 10.580.000 CFA. The rest of this amount covered costs for the Field Trial Station i.e. its construction and equipment which will no longer be project expense once they are built or purchased. The remaining miscellaneous costs cover GOS expenses for personnel, workers and agricultural inputs. These two changes reduce the recurrent cost in the analysis in years 5-15 from 53.431.000 CFA to 38.749.000 CFA.

Taking these two changes in project cost into account and using the modified economic prices of rice and maize. The IRR of the Franzel calculation is 9.42% (see Table V). However, another modification should be made. Franzel uses in his calculation of benefits the area, planned for project development plus the 65 ha already being cultivated before the project began. It is unappropriate to allocate benefits to the project from activities started before the project began. Thus, a second calculation was undertaken using the previously corrected figures with the reduced area of actual project development to calculate the benefit stream. This additional modification reduced the IRR to 8.66% (See Annex V).

By correcting these basic errors in Franzel's analysis the report shows a substantial return on its investment. Nevertheless, it would still have a benefit/cost ratio of less than if discounted at rather high rates of 15-18%. It should be added that the above calculations were made without questioning Franzel assumption on farm level cost; there are questions here as well, particularly on pumping and labor costs.

Pumping costs were taken from actual figures for the 1977/78 season of a pump in a perimeter near the one used in the study. While Franzel states that these figures are higher that could be considered normal, he still uses them. The 1977/78 season is an unfortunate period to base long term calculations.

It was an unusual year agriculturally with one of the worst droughts in recent history. Due to lack of rain the peanut crop, for example, was the lowest since 1942. Pumping requirements would indeed be higher than normal that year due to low level of soil moisture and lower level of the river requiring the pump to lift water higher and during longer periods of time than a more normal year. The operational aspect of the pumping operation is also important to fuel costs. This is one area where improvement should be expected due to the activities of the project. This is not taken into account in Franzel's calculations. Mr. Khoi Lee, AID representative at the Bakel site, indicates the usual figure on fuel use for the pumps in the Bakel area is 150 lt of fuel per ha and 9 lt of oil. This compares to Franzel's figures of 350 lt of fuel and 15 lt of oil per ha.

Labor cost is another area of contention. Franzel assumes 322 days of labor for rice and 141 days for maize. He puts the cost of labor at 100 CFA/day. The Project Paper assumed 239 days of labor for rice and 47 days for maize. The cost of labor is estimated at 75 CFA/day labor and 25 CFA/day for birdwatching done by children.

Franzel's figure for the amount of labor comes from interview with "several Bakel extension workers and farmers". The Project Paper estimated was made by the CIDR team in Bakel which had spent five years previously in the area developing the initial technique used by the project. Their figure appears to have greater validity. Even assuming the higher labor cost of 100 CFA/day the cost of labor, using the CIDR estimates, results in labor costs of 23,900 CFA/ha for single cropping and 28,600 CFA/ha for double cropping. This compares to 32,200 CFA and 46,300 CFA/ha in Franzel's report.

If we again recalculate the economic analysis using the above mentioned modification in pumping cost and labor cost we get an IRR of 16,93% and a B/C ratio at a 15% discount rate of 1.089 (Table VI).

Table I Calculations of Net Return Land/Labor per ha - Rice & Maize (units CFA/ha)

	Rice		Maize	
	Year 1-5	Year 6-15	Year 1-5	Year 6-15
1. Value of output/ha	164790	219720	78180	97725
2. Variable costs				
Fertilizers	21968	21968	25070	25070
Seed	4400	4400	1233	1233
Pumping cost	40509	40504	26978	26978
3. Maize margin	97913	152843	24899	44444
4. Tools, Rquipment depr,	22369	22369	13292	13292
5. Net Return Land/Labor/ha	75544	130474	11607	31152

Table II - Net Return Land/Labor per ha - Single and Double cropping

Single cropping	Year 1-5	Year 6-15
Rice	64,592	119,522
Double cropping		
Rice	75,544	130.474
Maize	11,607	31,152
Total	87,151	161,626

Table III - Net Return per ha on Irrigated Land (CFA/ha/year)

	Year 1-5		Year 6-15	
	Double crop	Single crop	D uble crop	Single cro
Net Return Land/Labor	87,151	64,592	161,626	119,522
Labor cost	46,300	32,200	46,300	32,200
Net Return Land	40,851	32,392	115,326	87,322

Assuming 1/2 of land is double cropped, Net Return per ha is:

Year 1-5

$$\frac{40,851 + 32,392}{2} = 36,622$$

Year 6-15

$$\frac{115,326 + 87,322}{2} = 101,324$$

Table IV - Project Benefit/year

Year	Net Return per ha	Franzel est. of project area (ha)	'000 CFA Annual Benefits	Project paper est.of project area (ha)	'000 CI Annua Benef
1	36,62	190	69,01	151	54,85
2	36,62	487	17,689	398	14,456
3	36,62	921	33,453	850	30,874
4	36,622	1456	52,885	1391	50,524
5	36,622	1961	71,227	1896	68,867
6	101,324	1961	198,696	1896	192,110
7	101,324	1961	198,696	1896	192,110
8	101,324	1961	198,696	1896	192,110
9	101,324	1961	198,696	1896	192,110
10	101,324	1961	198,696	1896	192,110
11	101,324	1961	198,696	1896	192,110
12	101,324	1961	198,696	1896	192,110
13	101,324	1961	198,696	1896	192,110
14	101,324	1961	198,696	1896	192,110
15	101.324	1961	198,696	1896	192.110

Table V - Economic Analysis ('000 CFA)

Year	Cost (1)	Benefits (2)		Cash Flow	
		1	2	1	2
1	425,925	69,01	54,85	-419,024	-420,440
2	139,331	17,689	14,456	-122,242	-125,475
3	184,345	33,453	30,874	-150,892	-153,471
4	143,325	52,885	50,524	- 90,440	- 92,801
5	38,749	71,227	68,867	32,478	30,118
6	38,749	198,696	192,110	159,947	153,361
7	38,749	198,696	192,110	159,947	153,361
8	38,749	198,696	192,110	159,947	153,361
9	38,749	198,696	192,110	159,947	153,361
10	38,749	198,696	192,110	159,947	153,361
11	38,749	198,696	192,110	159,947	153,361
12	38,749	198,696	192,110	159,947	153,361
13	38,749	198,696	192,110	159,947	153,361
14	38,749	198,696	192,110	159,947	153,361
15	38,749	198,696	192,110	159,947	153,361
B/C	15% 0.758		0.727		
	18% 0.658		0.631		
IRR		9.418	8.661		

(1) Revised Cost

(2) Benefits stream 1 = Franzel's estimate of project area, 2 = PP estimate of project area.

Table VI - Modification of the Benefit stream using corrected labor and pumping cost - Bakel Small Irrigated Perimeter Project.

1 - Pumping Cost

. 150 lt of fuel at 75 CFA/lt	11250	
9 lt of oil at 350 CFA/lt	3150	
	14400	
. 15% for overvalue CFA	2160	
	16560	
Maintenance/repairs	5000	
	21560	
		14373
	Rice (60%)	Maize (40%)

2 - Net Return Land/Labor (CFA/ha)

Rice		Maize	
Year 1-5	Year 6-15	Year 1-5	Year 6-15
94,493	149,423	25,212	43,757

Single cropping

Rice	83,541	138,471

Double cropping

Rice	94,493	149,423
Maize	25,212	43,757
	119,705	193,180

3 - Net Return Labor (CFA/ha)

	Year 1-5		Year 6-15	
	Double	Single	Double	Single
Net Return Land/Labor	119,705	83,541	193,180	138,471
Labor cost	28,600	23,900	28,600	23,900
Net Return Land	91,105	59,641	164,580	114,571

4 - Average Benefit stream by year (CFA/ha)

Year 1-5

$\frac{91,105 + 59,641}{2} = 75,373$

Year 6-15

$\frac{164,580 + 114,571}{2} = 139,576$

5 - Economic Analysis

Year	Cost	Hectares	Benefit	Cash Flow
1	425,925	151	11,381	-414,544
2	139,931	398	29,998	-109,933
3	184,345	850	64,667	-119,678
4	38,749	1391	104,844	- 38,481
5	38749	1896	142,907	104,150
6 - 15	38,749	1896	264,636	225,887

15% B/C 1.0894

IRR 16.9276

ANNEX II: Senegal Cereal Production Project

Evaluation of the Senegal Cereal Project is much more difficult than Bakel for all the reasons Franzel lays out in this report. It is equally difficult to get a handle on his evaluation. The major problem of his analysis is that he undervalues the benefits accured to the project. Franzel takes as the principal benefit, the returns on "intensified" farms. The number of hectares of these "intensified" farms are those classified under the TBFF level of farm intensification in SODEVA reports. He also accounts for "semi-intensified" farms (TL, TB) as having benefits equal to the intensified farms. This unfortunatly misrepresents the actual course of the project. As noted in the Tableau evaluation and in SODEVA's annual report of the project, the major increase in farming technology have been at the TB and TL level and not TBFF (see table I). While Franzel, as per the Bingen letter, seems to discount the TL-TB-TBFF categorization since it is no longer used by SODEVA, This system was used in preparation of the project paper and in the reports prepared by SODEVA on its AID funded activities and is proper criterian to evaluate phase I of the Cereal Production Project.
To evaluate Franzel's report and the project itself, some figures need to be obtained on the benefits of the project which includes not only the "intensified" farms of the TBFF category but also those of the TL and TB class. The problem in doing so lies in the lack of complete data on the number of hectares under each category. As table I shows the number of farms by category has been estimated by SODEVA. This however provides little infromation on the number of hectares since only part of each farm is under the intensified production system.

Nevertheless, by assuming a certain constant ratio between farms of various categories and the hectarage of intensification of each, an interpolation of the data can be made to estimate actual hectares of each category. This assumtion which is based on a constant percentage of intensified hectarage of aggrogate farms is a tentative one but can be used for a rough estimates to provide some guidelines on how to evaluate Franzel's work. The result of these calculations are seen in table II. Once we gave an estimate of hectarage we need an estimate of net return per hectare to calculate the benefits stream of the project. Franzel uses as net return per hectare on his "intensified" farm (TBFF) a figure of 10,826 FCFA/ha not counting return on exen and 12,980 FCFA/ha ~~not~~ counting return on the oxen used. The project paper uses

a multiple value depending on level of intensification category and region (Thiès, Bambey, Diourbel). If we take an average of the three regions, we obtain 6,682 FCFA/ha net return on TL cultivation, 9,877 FCFA/ha for TB and 9,847 CFA/ha for TBFF. These figures are lower than Franzels and represents a conservative estimate of project benefits.

Using project costs estimated by Franzel, which appear more accurate than those purposed in the Project Paper, and using Franzel's assumption of a 10% a year increase in benefits after the end of the project funding as a result of project activites a rate of return of 17.72% is obtained.
A compasion of benefit streams between Franzel's analysis and the one set forth here shows the major difference on assumtion of benefits (Table III). The difference is striking. The "semi-intensified", benefits are 10 times those of the "intensified", not equal to them. While the alternate analysis may have undervalued the return on TBFF farms the results indicate that there was substantially greater returns to the TL-TB farming categories because there was such greater acceptance of them. This is consistant with data on the number of farm for each category.

TABLE I: Number of farms by intensified category

	74	75	76	77
1. TL	6000	9118	12213	11200
2. TB	454	999	1340	2437
3. TBFF	247	264	432	615
4. TB&TL	6454	10117	13553	13637

Source: 1975/76, 1976/77, 1977/78, SODEVA Reports.

TABLE II: Hectares intensified by category (estimates in prenthsis)

	74	75	76	77
5. TL	(11997)	(19144)	(25646)	(25806)
6. TB	(7013)	(11193)	14994	(15086)
7. TBFF	940	1590	2880	2744
8. TB&TL	19.010	30.337	(40640)	(40892)

(1) Ratio used for estimates:

$\frac{\text{row 4}}{\text{row 8}} = \frac{10117}{30337} = .333487 \qquad \frac{6454}{19010} = .33950$ (used lesser ratio)

(Ratio 1 x row 4 for 75 & 74 hectarage of TB & TL)

substract 40640 - 14994 = 25646 to fine TL in 76

Ratio of $\frac{14994}{40640}$ = .36845 x row 8 (TB & TL) = row 6 (TB)

Row 8 (TB & TL) - row 6 (TB) = row 5 (TL)

TABLE III: Composant of Benefit stream between Franzel analysis and alternate choice (1000 CFA)

	Franzel's Analysis			Alternative analysis		
YEAR	Intensified TBFF	Semi-intensified (TL-TB)	Total	TBFF	TL-TB	Total
1	0	0	0	0	0	0
2	9556	9566	19132	640	89042	95443
3	17873	17873	35747	19103	170031	189134
4	32826	32826	65653	17764	179009	189073
5	40248	40248	80496	19540	189210	208750
6	43199	43199	86397	21444	208131	224625
7	47514	47514	95037	23644	228944	252588
8	52271	52271	104541	26008	251839	277841
9	57498	57498	114995	28609	277022	305631
10	63247	63247	126194	31470	304724	336194
12	76529	76524	153058	38079	368716	406795
13	84182	84182	168384	41887	405588	447475
14	92600	92600	185200	46075	446147	492222
15	101860	101860	204720	50683	490762	541445

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UNITED STATES GOVERNMENT

Memorandum

TO : Norman Schoonover, Director

DATE: June 19, 1979

FROM : Don Brown, Agricultural Economist

SUBJECT: Effects of the Development Efforts on Agricultural Production in Senegal, 1965-1976.

While preparing the analysis section of the CDSS, I was struck by the extensive efforts made by the GOS and donors such as USAID in developing the agricultural sector and the seemingly lack of significant results of this effort. For example, peanut and millet production in the 1965-1976 period increased by less than one percent a year while population was going up at better than 2.5% annually.

I was curious to see what effect, if any, this development effort has had on agricultural production. To do so I knew that I would have to separate out the effect of climate on production. The lack of rainfall is the principal reason given for the meager results of the development efforts to date (rainfall during this period was more than 20% less than normal). Other major variables related to agricultural production would also have to be separated out. Not until recently have I been able to gear up my micro-computer at home in the evenings to do the necessary analysis. A report of this effort is attached.

Summary of the Analysis

The working hypothesis I examined was that there has been a significant increase in agricultural production (peanuts and millet) as the result of the development effort of the GOS and foreign donors.

The predictive model employed in this analysis for agricultural production had the following variables: 1) weather - since Senegal's agriculture is principally rainfed in nature, 2) area - to take into account the effect of increases in land cultivated, 3) prices - to measure the supply response to changes in farm gate prices of the crops and their close substitutes, and 4) a development factor.

"Time" was used as a proxy for the development factor on the premise that if the effects of other variables such as weather and prices are factored out, the amount of increased production resulting to time would reflect the residual effect of the development related factors. These factors are both

put into place and return benefits from within a time stream and as such "time" can serve as a proxy for them.

The methodology use to develop coefficients for this model was multiple linear regression. This statistical technique allows the user to simultaneously determine the effects of several independent or causal variables on a dependent or response variable. Thus the individual effects can be separated out from each other and analysed.

The analysis was done in two parts. First a regression was done on millet production and then a regression on peanut production. A joint millet-peanut regression was also untaken but because of the difference between the result of the millet and peanut regression it was not included in this analysis as it provided little useful additional information.
In all cases, the "best" regression equation was sought that contained the minimum number of significant variables of the model.

Conclusion

The analysis shows that there has been a significant and substantial effect resulting from the development effort to increase millet production. According to the regression equation calculated, over 42,000 tons of additional millet production can be attributed to each additional year of development efforts during the period of the analysis.

Peanut production, on the other hand, has shown no significant effect from the same development effort. While the analysis does not indicate why this is so, several hypotheses were put forth to explain these differences (see full report).

The analysis also indicated other variables that play a major role in the production of peanuts and millet. The significant variables affecting peanut production were weather and peanut farm-gate price. The regression coefficients indicate that for every one point change in the rainfall index, a change of over 6,500 tons of peanut production occured. Additionally, for every increase in the farm-gate price of peanuts of one CFAF/kg resulted in an increase of peanut production of almost 23,000 tons.

Besides the response to the development effort (time), millet production was also significantly responsive to weather and the farm-gate prices of both peanuts and millet. The regression coefficients for millet production indicated that for every one point change in the rainfall index, production of millet changed by almost 4,000 tons. A one CFAF/kg increase in the price of peanuts reduced millet production by over 30,000 tons while a one CFAF/kg in the price of millet increased millet production by almost 41,000 tons.

Area was not a significant factor in production of peanuts and millet. During the period analysed there was not a significant increase in the area planted in either crop.

It must be underlined that given the questionable nature of the data used, these specific coefficients must be taken with a certain grain of salt. Nevertheless, the general results of the analysis can be taken with some confidence. The analysis shows that there has been positive results from the development efforts of the GOS and donors such as USAID to increase the production of millet.

Effect of the development efforts on agricultural production in Senegal 1965-1976

The problem

In the twelve year period (1965-1976) the production of peanuts and millet in Senegal increased by less than one percent a year (0.7%). These two crops account for about 90% of the agricultural production in Senegal. Peanuts is Senegal's main export crop, while millet is the basic staple food of the Senegalese diet. During the same period the growth of Senegal's population was at least 2.5%. Continual divergence of the growth rates fo food production and population will lead to a Malthusian disaster.

This twelve year period also saw a major effort on the part of the GOS and foreign donors to develop the agricultural sector. Major increases in the extension system, farm inputs, and research activities were undertaken. But, low levels of rainfall during this period resulted in meager increases in output. Average rainfall in this period was over 20% less than the previous 30 year average.

The specific question in this analysis is what effect, if any, has the development effort in Senegal had in spite of poor rainfall. The working hypothesis to be examined is that there has been a significant (at the 5% level) increase in agricultural production (peanuts and millet) as the result of this effort.

The Model

The predictive model employed in this analysis for agricultural production had several variables. These are the following: 1) weather-since Senegal's agriculture is principally rainfed in nature, 2) area - to take into account the effect of increases in land cultivated, 3) prices - to measure the supply

response to changes in farm gate prices of the crops and their close substitutes, and 4) a development factor. This last factor is needed to take into account increases in quality and quantity of farm inputs and a higher level of farming technology and additional agricultural supporting infrastructures. This is the variable that interest us in testing out hypotheses. A proxy for this variable of development is "time". The reason for using time as such a proxy is as follows: -Specific development inputs are hard to quantify. Data on quality and quantity of farm inputs such as new seeds, fertilizers and farming techniques are not available or not quantifiable. Additionally, the effect on increased agricultural production due to improved social and physical infrastuctures often only occur after a long gestation period.

Nevertheless, time can be used as a proxy for these developmental efforts when it is considered that these efforts take place over time and are directly related to it. If we remove the effects of the other variables on production the residuals effect resulting to time can be considered the result of development.

From the above reasoning, the following model in algebraic form can be stated.

$$Y=\beta_1+\beta_2 W_t+\beta_3 T_t+\beta_4 A_t+\beta_5 P^{p}_{t-1}+\beta_6 P^{m}_{t-1}$$

where:

Y = dependent variable of production in '000 tons

W = weather (rainfall index)

T = time in years

A = area planted in '000 hectares

P = official farm-gate price of peanut in CFAF/kg

P = official farm-gate price of millet in CFAF/kg

t = current year

β_i = regression coefficients

Methodology

The methodology use to develop coefficients for this model was multipl linear regression. This statistical technique allows the user to simultaneously determine the effects of several independent or causal variables on a dependent or response variable. Thus the individual effects can be separated out from each other and analysed. The calculations were made on a micro-computer.

The analysis not only looked at the significants and effect of time on production but tried to develop the "best" equation to identify the minimum number of significant independent variables that have effect on the dependent variable of production. To arrive at this "best" equation, a procedure of backward elimination was used. In this procedure a regression equation using all variables of the model was calculated and the t-value for each coefficient is examined. The variable with the lowest t-value below 1.78 is dropped and the equation is recalculated. This process is continued until all coefficients have a t-value over 1.78 (5% significant level, n = 12).

Data

Data from third world countries are always suspect. Senegal is no exception to this rule. The data used in this analysis are from official sources published in governmental documents. Cross checking of as many as three sources was used to validate the data (see annex 1).

While the accuracy of the data must of necessity qualify the results of the analysis, a couple of salient points provide justification for its use in this analysis. First, the greater the aggregation of the data the less significant the effect of individual errors. In this analysis data are for 12 years for the entire country. This aggregation provides greater confidence in its use.

Secondly, Senegal has had an active program of data collection for a number of years. The quality of its data collection service is higher than in many other LDCs. Thus, while it can be assumed that the accuracy of the data in not ideal some confidence can be had that it is not wholly unrealistic.

A closer look at the data used for each of the variables will highlight the assumptions made concerning it, its use and its possible shortcomings.

1. Production

Production figures for peanuts were taken from official reports of the Banque Centrale des Etats de l'Afrique de l'Ouest (BCEAO). These figures were in turn collected from ONCAD, the peanut marketing board. Since ONCAD controls the vast majority of the peanut crop, the production figures for peanuts can be viewed with some confidence as being reliable. Millet figures, however, are less reliable. They were collected by agents of the Minsitry of Rural Development or SODEVA the major extension agency in the peanut/millet baisn. The actural data used in the analysis for millet were also taken from BCEAO's reports.

2. Weather

The proxy used for the weather variable is an index of rainfall calculated from data of 8 weather stations located throughout the major production regions of

the country. The index is based (=100) on the average rainfall at the 8 stations in the 30 year period, 1930-1960.

Some criticism can be raised on how well this index represents the climatic effect on production. It is argued that the global amount of rainfall is not as important as its duration and timing. Thus, for example, a heavy rainfall at the beginning of the season that did not continue through out the season could have a high rainfall index but result in low production.

In answer to this criticism, it can be pointed out that, at the moment, there is no reliable and handy index that takes into account the effect of timing and duration of rainfall on eventual yield. Additionally, to further look at this question, an examination was made of the relationship between changes in the rainfall index and production of peanuts and millets. It was assumed that the two should vary directly and cases where they did not were examined to see if the timing problem could have caused the differences. Figure 1 below shows the relationship for the period of the analysis.

Figure 1. Relationship between rainfall index and production

Year	66	67	68	69	70	71	72	73	74	75	76
Rainfall index	-	*	-	+	-	+	-	+	+	*	-
Peanut production	-	+	-	-	-	+	-	+	+	*	-
Millet production	-	+	-	+	-	+	-	+	+	-	-

-less than previous year

+more than previous year

* unchanged

As can be seen, there are two years when production did not directly relate to rainfall (1969 and 1975). The drop in peanut production in 1969

in spite of an increase in rainfall could be explained by the "peasant malaise" that was at its peak in that year. This "malaise" was due to the rising cost of agricultural input (fertilizer went from 12 to 16 CFAF/kg) coupled with stagnant farm-gate prices for peanuts that resulted in farmers shifting out of peanut production into other crops, principally millet.

The drop in millet production in 1975 after a period of increasing rainfall could be explained by the drop in area planted in millet that began in 1974. Hectarage dropped from a high of 1,154,000 hectares planted in 1973 to 943,000 in 1975.

Thus it can be seen in both years some mitigating event may have been the cause of the inverse relationship between the rainfall index and production. Given this general situation, it can be assumed that the rainfall index can be used as a reasonable proxy for the climatic variable.

3. Time

As previously noted, time is used as the proxy for the development effort. The numbers used for time is simply the current year of production.

4. Area

Figures on area are given in thousands of hectares. This data comes from the Ministry of Rural Development. The data were collected at the local level by agents of the Ministry or of development agencies such as SODEVA. This information is aggregated up to the national level. Because of greater involement of the state in peanut production, it can be assumed that statistics concerning that crop are more reliable than for millet. Most of the millet production is consumed on the farm and is outside the official market channels.

5. Prices

Prices used for both millet and peanuts are the official farm gate prices set by the GOS. For peanut this can be considered the actual market price in effect for the farmer, as the farmer sells almost all of his production to the government marketing agent, ONCAD. On the other hand, this is not the case for millet. The millet price can only be considered a "reference" price. As already indicated, most millet is consumed on farm, and during this period an insignificant amount was handled by the government. The free market price varied around this official price.

In the analysis prices were lagged one year. This was done on the assumption that farmers make planting and input decisions on the expectation of prices from the previous season.

The Analysis

The analysis was done in two parts. First a regression was done on millet production and then a regression on peanut production. A joint millet-peanut regression was also untaken but because of the difference between the result of the millet and peanut regression it was not included in this analysis as it provided little useful additional information.
In all cases, the "best" regression equation was sought that contained the minimum number of significant variables of the model.

Millet Production

The basic model for millet production contained the variables of weather, time, area and prices both for millet and peanuts. Both product prices were included to examine any possible substitution relationship between the two crops as a response to price.

The regression equation containing all the variables is the following:

$$Y = 2.86\ W_t + 34.62\ T_t - 0.39\ A_t - 33.48\ P^{p}_{t-1} + 46.33\ P^{m}_{t-1}$$

(1.71) (2.41) (1.12) (3.66) (3.40)

$R^2 = 0.75$

(t-values in parenthesis)

As can be seen the variable of area is not significant, while weather is only slightly significant.

Removing area as variable and recalculating the regression gave the following results:

Variable	Coefficient	Standard Error	t-value
Constant	-197.1296	146.982	-1.3412
Weather	3.9592	1.3859	2.8569
Time	42.1703	12.8947	3.2704
Peanut price	-30.1238	8.7974	-3.4242
Millet price	40.8215	12.9212	3.1593

$R^2 = 0.738$

This is the "best" regression equation for millet production. The fact that area was not significant is consistance with the data. The area variable tests for the effect of expansion of the area put into millet production. During the period analysed there was not a significant increase in the area planted in millet.

The other variables were highly significant. Time and prices were significant at a level of $\alpha > 0.005$. Weather was only slightly less significant at $\alpha > 0.01$.

Peanut Production

The basic model for peanut production contained the same variables as that for millet with data related to the peanut crop. Calculation of the all-variable regression for peanuts resulted in the following:

$$Y = 3.32\ W_t - 30.76\ T_t + 0.57\ A_t + 22.63\ P^{p}_{t-1} + 7.68\ P^{m}_{t-1}$$

(0.95) (0.99) (0.92) (1.08) (0.24)

$R^2 = 0.60$

Removing millet prices as a variable resulted in a R^2 of 0.61. The t-values of both area and time were below 1.78 in this new equation (area = , time =). Recalculating the regression without the area variable raised the R^2 to 0.64. The time variable still has a t-value considerably below 1.78 (0.76). Removing the time value from our previous regression gave us the "best" equation explaining peanut production. The result of this equation is the following:

Variable	Coefficient	Standard Error	t-value
Constant	-175.7428	260.732	-0.6740
Weather	6.6020	2.3651	2.7915
Peanut price	27.9995	5.5138	4.1713

$R^2 = 0.65$

Conclusion

The analysis shows that there has been a significant and substantial effect resulting from the development effort to increase millet production. According to the regression equation calculated, over 42,000 tons of additional millet production can be attributed to each additional year of development efforts during the period of the analysis.

Peanut production, on the other hand, has shown no significant effect from the same development effort. While the analysis does not indicate why this is so, several hypotheses can be put forth to explain these differences. 1) The research and extension efforts on peanuts have been pursued in

Senegal since the 1920's. By 1965 the general techniques of modern peanut production was well understood at the farm level. Thus the marginal increase in production of additional extension efforts is small. 2) Research on new peanut varieties and production method has principally been directed towards greater yield stability (drought and pest resistance) and higher oil content not towards increased yields. Therefore only small increased in production would be the results of this activity. 3) Peanuts like other legumes are not highly responsive to fertilizer (particularly nitrogen) applications. Since fertilizer was the major additional farm input during this period, the low response rate may have resulted in insignificant production increases. 4) Much of the early part of the period under analysis was characterized by the "peasant malaise" This social-political event was the result of a combination of increasing prices of inputs and a lack of their availability coupled with stagnate farm-gate prices for peanuts. This lead to a large scale shifting of farmers out of peanut production into millet and other crops.

Millet production did not have these constraints. Until 1965, with the start of "Operation SATEC", no major extension effort had been undertaken to increase millet yields. Given this low base, major increases in production could be expected from an increased developmental effort. Research in new millet varieties was also more orientated towards higher yielding varieties. These efforts represented by the "Souna" varieties has been successful.

The analysis also indicated other variables that play a major role in the production of peanuts and millet. The significant variables affecting peanut production were weather and peanut farm-gate price. The regression

coefficients indicate that for every one point change in the rainfall index, a change of over 6,500 tons of peanut production occured. Additionally, for every increase in the farm-gate price of peanuts of one CFAF/kg resulted in an increase of peanut production of almost 23,000 tons.

Besides the response to the development effort (time), millet production was also significantly responsive to weather and the farm-gate prices of both peanuts and millet. The regression coefficients for millet production indicated that for every one point change in the rainfall index production of millet changed by almost 4,000 tons. A one CFAF/kg increase in the price of peanuts reduced millet production by over 30,000 tons while a one CFAF/kg increase in the price of millet increased millet production by almost 41,000 tons.

It must be underlined that given the questionable nature of the data used, these specific coefficients must be taken with a certain grain of salt. Nevertheless, the general results of the analysis can be taken with some confidence. The analysis shows that there has been positive results from the development efforts of the GOS and donors such as USAID to increase the production of millet.

ANNEX 1. Data on the production of millet and peanuts

Year	Production			Area		Prices	
	Peanuts	Millet	Weather	Peanuts	Millet	Peanuts	Millet
	'000 tons			'000 ha		CFAF/kg	
1965	1122	554	112	1114	967	19	19
1966	923	423	100	1164	1155	19	20
1967	1005	654	100	1191	1054	19	19
1968	830	450	55	953	1054	19	20
1969	784	633	108	1049	960	19	17
1970	583	402	70	1060	975	19.4	17
1971	988	583	86	1071	936	23.4	17
1972	570	323	50	1026	1094	23.1	23
1973	675	571	55	1152	1154	25.5	23
1974	944	769	75	1302	963	41.5	32
1975	1424	621	75	1318	943	41.5	30
1976	1043	511	60	1079	912	41.5	35

source:

Production

Peanuts - in '000 tons, BCEAO, verified with figures from Ministry of Rural Development

Millet - in '000 tons, BCEAO, verified with figures from Ministry of Rural Development

Weather

Rainfall index for eight stations bases on average 1930-1960, Ministry of Plan

Area

Peanuts - in '000 hectares, Ministry of Rural Development

Millet - in '000 hectares, Ministry of Rural Development

Prices

Peanuts in CFAF/kg, BCEAO

Millet in CFAF/kg, BCEAO

EVALUATION OF THE SENEGAL CEREALS PROJECT

S U M M A R Y

After review of the documents, prepared by the contract evaluation team in March-April 1977 and review of SODEVA and CNRA reports on project implementation and ADO project files, the following conclusions can be drawn:

1. SODEVA as the principal GOS implementing agency has done an excellent job in project management and implementation. Inputs have been judiciously and effectively utilized. Well prepared comprehensive reports providing ADO with details of project implementation have been submitted on a timely basis.

2. The development of physical facilities is essentially completed. Commodities have been procured and put to use.

3. The strength of the extension service in the project area has been more than doubled.

4. The rate of extension of use of the technology packages overall has been satisfactory. Use of inputs have shown a steady upward trend. The level of use of the higher level of technology has not reached original projections which were perhaps optimistic. There are a number of reasons why the higher levels of technology have not expanded as rapidly as projected: (1) the relatively small percentage of farming units with adequate land resources, able to make the larger investments or capable of affording the higher risks involved; (2) inadequate supplies of the heavier farm implements required; (3) conflict between heavy fall plowing and harvest for use of labor and (4) the as yet incomplete demonstration of the economic superiority of the higher levels of technology over the less intensive technology.

5. SODEVA and the Liaison Unit of the CNRA are aware of these problems and have taken steps to develop a better understanding of the factors involved. In-house analysis and evaluation of the results of 3 year's operation of the AID and the IBRD supported production intensification projects is currently underway. The results from these will be reflected in some reorientation of the extension programs.

6. The Liaison Unit of the CNRA has undertaken a series of very useful studies on the socio-economic impact of the technology packages. Given the nature of this work and the short period since the project has been under way few definitive conclusions can be reached. The role of the Liaison Unit in providing objective data on which to measure the impact of extension is essential for designing dynamic programs attuned to changing conditions and improvements in technology.

7. During the short period (essentially only two years, since report of results from the 1977-78 crop year was not yet available) it is not possible to measure the impact of the project on production or on the productivity of the farm unit. A measure of such impact, however, can be obtained from comparison of changes in use of inputs being recommended by the extension service and in the number of farms and area of adoption of production intensification practices. The number of farmers adopting some level of intensification increased by 55% and 35% respectively from 1974-75 to 1975-76 and 1975-76 to 1976-77. Corresponding increases in area under intensification were 50% and 38%, and those for use of fertilizers were 45% and 44%.

8. Extension of the project for one year is recommended. The balance of obligated funds remaining plus the unobligated balance of approved funds appear to be sufficient to continue the project at approximately the same level as that for the 1977-78 crop year.

9. Certain recommendations are made for consideration in developing a second phase project.

EVALUATION OF THE SENEGAL CEREALS PROJECT

A. BACKGROUND

The program is based on a project paper which was developed in 1974 and approved in November 1974 as a medium term AID project to counteract the effects of the serious Sahelian drought (1969-73). A Project Agreement with the GOS was signed in February 1975. Implementation began with the 1975-76 crop cycle.

The project is implemented through two entities of the GOS - SODEVA, a semi autonomous agricultural development and extensive organization which is charged by the GOS with the major role for agriculture development in the dry land areas of the Groundnut Basin and CNRA, the National Center for Agriculture Research. By far the bulk of the actions fall under the management of SODEVA. This involves principally the extension and training function. However, an element of data collection for evaluative purposes is also a significant part of the SODEVA role.

The CNRA role is one of carrying out applied research trials at the village level to prove the utility of and/or demonstrate packages of technology, to explore and develop systems for production diversification and to do farm economics studies. This is carried out by a "Liaison Unit" created for this purpose within the CNRA.

AID financing was made available for infrastructure, equipment, operational costs, and technical assistance by two expatriate specialists. A full-time AID project manager was assigned to the program. The ADO role consisted primarily of monitoring the project through reports regularly submitted by the GOS implementing agencies, visits to the project area by the project manager, review and approval of annual budgets, financial review and verification, assistance to GOS in solution of administrative problems and participation in annual evaluations prescribed in the Project Agreement.

A mid-term evaluation by an AID evaluation team was prescribed in the Project Agreement. This was undertaken by a contract team of three individuals in March-April 1977. The report on this evaluation has not been completed, however, a complete draft was available.

B. METHODOLOGY

This evaluation is based upon review and analysis of the draft documents prepared by the contract team; of quarterly and annual reports of SODEVA and CNRA Liaison Unit; ADO files; reports on the IBRD-CCCE supported SODEVA program in the Sine-Saloum area; certain other miscellaneous reports, and consultation with AID and GOS personnel.

The point of departure for the evaluation is the Project Paper and Project Agreement taken together.

The first section relates to the several instruments or actions involved in the project implementation which were projected as necessary steps for achieving project objectives. This is essentially a recording of factual accomplishments without reference to contribution to project purpose or goal.

The second section attempts to relate observable results to the achievement of project objectives as set forth in the ProAg, and to the project goal, purpose and outputs as defined in the Project Paper.

C. PROJECT INSTRUMENTS AND ACTIONS

1. Personnel

(a) SODEVA Component:

The ProAg projected the increase of field extension personnel from 112 to 253 by the end of the project. The numbers actually reported were 196, 234 and 243 for years 1975-76, 1976-77, and 1977-78 as of July 1977. At that time recruitment was in progress for 9 positions.

The total personnel, including that in the field, district headquarters, and special demonstration units, were 249, 289 and 295; of which AID financed 120, 163 and 169 respectively for 1975-76, 1976-77 and 1977-78. The figures for 1977-78 reflect the status as of July 1977.

Two expatriate advisor positions were financed during the entire period as projected in the ProAg.

Performance insofar as increasing the personnel in the project area as essentially consistent with projections.

(b) CNRA Component:

One position, that of the Chief of the Liaison Unit was projected to be financed by AID. During the first 15 months this position was occupied by an expatriate pending the return from training of the GOS nominee for the position. The Senegalese technician returned as scheduled, assumed the directorship of the Liaison Unit and is performing well.

2. Training

(a) In-Service Training

The principal focus of the training element of the project was on basic training for new recruits, in-service training for all field personnel, and farmer training/contacts.

A total of 26,560 person-days of training, of which half was to be done during the first year, were projected in the ProAg. Farmer training/contacts amounting to 83,393 farmer person-days and involving 881 meetings were also projected.

During the first year (1975-76) basic training of approxiamtely 30 days duration were provided for 59 new recruits. This was somewhat less than anticipated due to the late arrival of the expatriate training advisor. In-service training included programs, covering 30 themes, which ranged in duration from 1/2 day to 20 days. The cumulative attendance of field personnel at all programs was 3,188 individuals. Farmer attendance in similar programs totaled 27,404.

During the second year (1976-77) 3,238 days of training were offered to field staff. The per man average was 14 days. Special short courses training for farmers were not undertaken. This was replaced by visits to training centers (ZER) and demonstrations. During 1976-77, 834 meetings with a total attendance of 8,170 farmers and 285 demonstrations involving 7,025 farmers were reported.

Other training/extension activities included the preparation and distribution to extension agents of leaflets and bulletins on 32 topics.

Numerous audio-visual materials including slides and movie films were prepared. During 1976, 146 projections reaching 1,248 villages were effected by mobile units. Estimates of attendance for Department of Thies alone were 300 persons, of which 150 were adults, for each projection.

The level of training activity for the first two years while somewhat below projections appear, nevertheless, to have been satisfactory and well managed.

The in-service training program for SODEVA personnel has been concentrated in the two lower categories of personnel - those most directly in contact with the farmers. More recently the trend has been to recruit from a higher level of educational achievement and the lowest category of agents is being gradually eliminated. One consequence of this will be the gradually replacement of the older agents who are more experienced in the practical side of farming, but less able to keep records, with younger individuals who for the most part have limited practical experience but greater potential for growth.

(b) Participant Training

Participant training was provided for two individuals. One high level SODEVA employee completed a 3-month program including a 2 months course in Agriculture Development and Planning at University of Florida, and observation travel in the U.S. An excellent report was prepared by the participant. This participant is now the SODEVA delegue for the Department of Thies, a position which effectively uses his training.

A second participant completed the course "Organization Development Skills for Agriculture Managers" in May 1976. The participant is now serving as Coordinator between "Promotion Humaine" (Human Resources Development) and SODEVA in the Department of Thies.

(c) Training Facilities

Two levels of training facilities support the training program. The "Centre d'Entrainement aux Techniques Agricoles et de Developpement" (CETAD) provides up-grading training for SODEVA staff on a continuing basis. The new facilities which had been developed in part through assistance from other sources and in part from AID resources greatly facilitated the training of project personnel.

Another level of training is provided at four ZER (Zone d'Entrainement de Reference) centers. These are equipped with the tools and implements which are being extended and serve as demonstration centers for farmer training and for training the two lowest categories of agents.

AID inputs in construction and equipping the ZERs have been adequate and have been effectively used.

3. The CNRA Liaison Unit is a unique innovation of the project. This unit is designed to assure closer and more effective collaboration between research and extension. The Liaison Unit is undertaking a number of trial/demonstrations to prove effectiveness of packages of technology under typical village conditions. AID inputs in support of this Unit has been relatively limited. The salary of the Unit Chief (originally this was filled by an expatriate and subsequently by a well qualified Senegalese agriculture economist who had just completed training in Europe), offices for the Unit at Bambey (main CNRA research station) equipment and 10% of the local and operations costs have been provided by AID. An allocation of AID funding was also made for development of a center at NDiemane for research and development on Deck soils (a heavy soil type of considerable area in and outside of the project area).

4. Infrastructure and Equipment

The project construction of infrastructure has been essentially completed. Some delays in completing certain units, due to a variety of reasons, did not particularly retard the other aspects of project implementation. Total construction costs exceeded the original budget due to three principal causes: (a) inflation (b) the need to conform to Department of Urbanism building codes for certain of the structures (this had not been anticipated in the original design) and(c) the need for supplementary items of construction not initially planned - fencing, garages, etc. Cost increases were approved on a case by case basis within overall budget allocations.

The equipment and supplies programmed have been procured, delivered and put in use. Given the magnitude of the project the allocation for this equipment appears to be very modest.

5. Revolving Funds

Two revolving funds were projected: (a) one to permit SODEVA to procure and distribute production inputs where ONCAD was not satisfactorily rendering this service. These supplies would be placed on credit and recoveries credited back to the fund and (b) one to finance on the farm storage where ONCAD was not adequately purchasing the surpluses.

Neither of these funds were operational during the first two years. SODEVA had nevertheless, to some degree, taken steps to fill the gaps. By agreement with ONCAD, ONCAD reimbursed transportation inputs transported by SODEVA or others. Some construction of on-farm and village storage has been made, however, the Carrera type storage has not been entirely satisfactory. It has been noted that with increasing grain production during the 2-3 years of good rainfal prior to 1977, farmers are improving their traditional storage structures to hold grain for consumption as well as the surpluses destined for the market.

A small fund was established to finance procurement of equipment under a rent-sale program. It is too early to judge this operation as yet in view of its limited operations.

6. Reporting

The Project Agreement required SODEVA and CNRA to report quarterly on operations with an annual report for each year operations. Both organizations have done an excellent job of reporting. The SODEVA reports are especially comprehensive, reporting on the completed year's work and projecting plans for the coming year in their annual reports.

Financial reporting and submission of vouchers for reimbursement have been adequate although there seems to be particularly long time lag betwen making expenditures and submitting vouchers.

7. Evaluation

The Project Agreement required annual joint evaluation of project implementation and accomplishment. One such evaluation was made in early May 1976. This consisted of a meeting with the key personnel of the GOS implementing agencies and ADO. The record of this evaluation showed that a wide range of subjects, issues and problems were openly and frankly discussed. Actions were recommended to resolve issues. The file records that action was taken in most cases.

8. The management of AID inputs by the cooperating agencies has been highly satisfactory. The time lag in implementation actions and in draw down of AID funding appear to be well within the usual AID experience in launching projects of this nature. It is also apparent that the GOS has manager the funds put at its disposition very prudently with the result that considerable savings over original expenditure projections have been achieved.

D. EVALUATION OF RESULTS

1. The Production Intensification Program

The GOS program of increasing agriculture production, farmers income and to promote improvement in the rural sector is based on the expansion of use of increasingly higher levels of technology through the use of more appropriate and greater amounts of production inputs. Three levels are defined. However, there is probably no very clear line of separation between these in actual practice. A large number of practices are included which may be used in a wide range of combinations and intensities.

The lowest level of technology (TL), after the traditional, involves a series of improved cultural practices which require few inputs; better seeds, use of light - horse or donkey - implements and low levels of fertilizers. The intermediate package (TB) includes the same cultural practices, improved seed and use of fertilizers but also involve heavier implements (oxen drawn). The highest level (TBFF) involves all the TL and TB practices, use of heavier implements, more thorough soil preparation and heavier doses of fertilizers including the basic rock phosphate application (phosphatage de redressement).

The SODEVA effort is geared to extend improved technology to the largest number of farmers and to induce a progressive shift from the lower to higher levels. A number of problems have been encountered which impact negatively on this effort, especially which respect to the highest levels: (a) hesitancy on the part of the farmers to clear land and make remedial phosphate applications because of insecure use tenure, (b) the conflict for use of labor between heavy fall plowing and harvest, (c) limited availability of implements and fertilizers.

More success has been achieved with the TL levels. This is to be expected since the incremental increase in yield with the introduction of the first increment of improved practices is usually greater than that obtained with higher increments. This is particularly true with respect to fertilizers. Moreover, the higher the level of technology the more important it becomes to adhere to all the elements and the greater are the risks of negative economic impact from poor rainfall. The farmer is therefore behaving rationally by embracing the lower levels in preference to the higher levels. This, however, does not lead to maximization of production on a national sacle. While the yield effects of the different levels of technology have been demonstrated in experimental trials, it is not clear at this time to what degree this is being achieved in farmers' fields. SODEVA collects numerous data on yields under different levels of intensification.. The collation and analysis of this data is being done as part of an in-house (SODEVA) evaluation of both the AID supported and the IBRD supported project. The results of these evaluations will be available in late March 1978 and should be extremely interesting.

An important element in the applied research being undertaken by the Liaison Unit of CNRA is to determine under present farm conditions the relative value of the different technology packages in terms of profitability to the farmer and in terms of applicability with respect to labor utilization and land areas of the typical farm unit. Pending a clear demonstration of the superiority of the higher levels in the hands of representative farm units it would seem that the extension effort should be geared more to the lighter input technologies. It is understood that some reorientation of the SODEVA program will emerge as a result of in-house evaluations.

2. Measurement of the Effectiveness of the Extension Effort

Some appreciation of the impact of the extension program can be obtained by observing change over time in application of recommended practices. The following tables 1-4 provide data indicative of the progress made.

TABLE 1
Progression of Extension of the Levels of Intensification

Intensification Level Numbers of Farmers	1974	1975		1976	
	Realized	Projected	Realized	Projected	Realized
Highest TBFF	247	-	264	847	432
% realized	-	-	-	-	51%
% increase over prior year	-	-	7%	-	64%
Semi intensive-TB	454	-	999	2,094	1,340
% realized	-	-	-	-	-64%
% increase over prior year	-	-	120%	-	34%
Less intensive-TL	6,000	-	9,118	5,707	12,213
% realized	-	-	-	-	214%
% increase over prior year	-	-	52%	-	35%
Intensification Level Number of hectares					
Highest (TBFF) - millet	310	-	585	1,682	925
% increase from prior year	-	-	89%	-	57%
Highest (TBFF) - groundnut	630	-	827	1,070	1,026
% increase from prior year	-	-	31%	-	24%
Combined semi and least intensive TB + TL	19,010	-	30,337	-	-
% increase from prior year	-	-	60%	-	-
TB only	-	-	-	-	14,994
Total hectares	261,505	-	271,400	-	-

TABLE 2

Use of Fertilizers*

Fertilizer Tons	1974	1975		1976	
		Projected	Realized	Projected	Realized
Groundnut fertilizer MT.	2,013	3,705	3,495	-	5,432
% increase over prior year			74%		55%
Millet fertilizer MT.	4,150	5,610	5,470	-	5,404
% increase over prior year			32%		-1%
Rock phosphate MT.	210	2,869	482	-	443
% increase over prior year			129%		-8%

(*) Deliveries of fertilizers as of July 1977 for the 1977 crop was 30% less than the figures for use on the 1976 crop. The biggest reduction was in millet fertilizers. This is believed to be due to a 25% increase in fertilizer price to the farmer.

TABLE 3

Use of Other Inputs

Input	1974	1975		1976	
		Projected	Realized	Projected	Realized
Seeders	1,056	2,490	2,354	4,508	2,944
Single plow	2,118	3,953	3,885	5,714	4,145
Groundnut lifter	807	1,757	1,134	3,412	444
Basic plow	357	719	630	1,162	599
Heavy plows	15	34	33	13	4
Horse cart	870	2,889	0	3,836	566
Oxen cart	71	172	0	324	0
Oxen trained (pairs)	432	-	1,028	-	1,176
Groundnut seed MT.	15,545	-	14,176	-	15,300
Millet seed MT.	-	-	16	-	38
Niebe seed MT.	-	-	9	-	15

TABLE 4

Integration of Livestock With Crop Production

	1974	1975		1976	
		Projected	Realized	Projected	Realized
Number of farmers	650		1,194	2,015	1,151
Cattle (numbers)	1,525		3,652	3,994	1,634
Sheep (numbers)	250		1,773	4,230	6,000*
Forage crops (farmers	80		109	178	160
Forage crops (has)	20		33	95	61

(*) Data available for only two of the three Departments in project area.

Several points appear to be significant: (a) the rate of expansion of the heaviest input package (TBFF) has been lower than expected, while the less intensive package (TL) have expanded at a much more rapid rate. The intermediate level (TB) also failed to expand as rapidly as projected; (b) the level of use of fertilizers continued to increase with respect to use for groundnuts and millet, but less so for millet. The increase in the use of fertilizer on millet was greater between the crop years 1974 and 1975 than between the 1975 and 1976 crop years. Data for 1977 (as of July 1977) showed a considerable drop in fertilizer for millet; (c) the delivery of light agriculture implements showed a general increasing trend throughout the period while that for the heavier oxen drawn equipment remained very low; (d) the delivery of improved groundnut seeds remained at a fairly constant level while that for millet and cowpea increased substantially; and (e) the data from table 4 suggest an increasing tendency towards integration of livestock production in the farming enterprise.

A number of factors, external to the project are confounded in these data. Particularly significant was the serious shortage in heavy (oxen drawn) implements. It is difficult to determine whether this reflect lack of interest by the farmer or procurement and delivery problems by ONCAD.

The limited expansion of the heaviest input package was undoubtedly due in part to shortage of equipment although the numbers of farmers and hectares using TBFF is still low, the rate of year to year increase has been reasonably good, about 50% increase in 1976-77 from 1975-76. The number of oxen in use, however, exceeds the amounts of heavy equipment available. In 1976-77 for instance, the average pair of oxen plowed only .75 ha. Oxen are being used with light equipment with less effective results.

The increased cost of fertilizers with no increase in commodity prices has undoubtedly been the most important factor conditioning the tapering off and even reduction of use. The differential in fertilizer use or groundnuts and millet, as prices increased, suggest that the cash return from groundnuts are more conductive to procurement of fertilizer. Moreover, after two reasonably good crops of millet since the drought (1975 and 1976) the incentive to the farmer to increase millet production has probably decreased because of uncertain marketing opportunities. Severe drought during the 1977-78 crop year seriously upset the upward production trend for both millet and groundnuts.

The trend towards increasing diversification is of much interest, since this offers alternatives to the millet-groundnut rotation. Greater and more rapid extension of this trend appears to be dependent upon development of and demonstration of the value of alternatives. This is an important element of both the CNRA Liaison Unit's applied research program and of the SODEVA extension effort.

It is clear that the extension effort is producing change. It appears that greater intensification is being retarded by factors external to the project - supply distribution, marketing of output, pricing of inputs and outputs, etc. -.

3. Measurement of Impact on Production and Farmer Income

Year to year production in any given area is dependent on factors besides the use of technology. Variations in rainfall in one of the biggest variables. The relative economic outlook (perceived economic outlook, which under some circumstances could place a higher value on subsistance than or cash income) of different crops can also cause important year to year shifts in production. Consequently the impact of a production promotion effort is measurable only over a long period of time and in terms of a trend line rather than actual amounts.

The impact on farmer incomes of use of different levels of technology is also subject to some of the same variables. Limited data show a trend towards higher yields as the levels of technology increases. Farm management data to show the economic value, however, was not available from the documents reviewed. Research on this is being undertaken by the CNRA Liaison Unit.

That elements of the technology are profitable is reflected in the increasing application of them by farmers. It is estimated for example that about 70% of farmers are now using some fertilizer and a like percentage some form of animal traction. Tables 1-4 provide figures to show the progression of use of inputs and intensification practices.

The development of approaches for measuring the impact of production promotion programs on the individual farmer, on the area as a whole and on a national scale is an issue which is attracting increased attention. The IBRD and SODEVA have undertaken studies to attempt to arrive at a satisfactory approach for use by the SODEVA evaluation unit for the Sine-Saloum project. Collaborative efforts in this area should be encouraged.

4. The Liaison Unit of CNRA

The Liaison Unit established within the CNRA is a unique innovation of the project. This Unit is designed to fill the gap which has traditionally separated research from extension. The Project Paper defines the role of the Liaison Unit as follows: "the preparation of documents and brochures in a form consistent with research results and useable by the extension service. The Liaison Unit will also be charged with the conduct of applied research trials throughout the project area and for socio-economic surveys to measure the effects realized by the project at the farm level.

A proposed staffing consisted of a chief of the Unit, two agronomists at the ingenieur agronome level, 5-6 technical assistants and two expatriate advisors provided by IRAT. The actual professional staffing in February 1978 was as follows: a director, a livestock technician at the engineer level, 6 data collectors (enqueteurs) and one data analyst. The Unit receives technical support from CNRA research staff as well as the SODEVA field personnel in the three sample villages.

The activities of Unit are carried out at three points in the project area (1) headquarters at Bambey, (2) three villages, one in each of the three districts - to be increased to 5 in 1978 -, selected as typical villages for collecting socio-economic data and for experimental trials and demonstrations and (3) a station at NDiemane for experimental trials on Deck soils, these are heavier than those typically found in the project area butare of interest because of the substantial area involved.

The activities include:

(1) A sample survey of three villages including demography, land areas by farm units and by use, equipment and livestock inventory, etc. From this general survey a sample of units are selected for in-depth socio-economic study at the farm unit level.

(2) Establishment of practical trials in each of the villages to study results of technology packages in actual practical application and to identify constraints to more general application.

(3) Carry out certain specialized studies such as (a) the socio-economic impact of mechanized threshing and decortication of millet. Impact on use of labor on grain marketing, on storage, on farm revenues, etc., (b) study of improved grain storage structures and (c) study and demonstration of production diversification with respect to crops as well as livestock, including production of feed for livestock.

(4) Experimental study of production on the heavy soils (Deck) at NDiemane and design of a production system applicable to these. The area of Deck soils is understood to be very sparsely populated.

To date, as is to be expected given the experimental nature of much of the Unit's activities, only limited data have been collated, analyzed and reported in a fashion useable for purposes of evaluation.

A complete analysis of data collected by the Liaison Unit is being developed as part of a broader in-house evaluation ofthe project involving SODEVA as well as the Liaison Unit. It is to be noted that concurrently an evaluation is being made of the Sine-Saloum project with the IBRD. These evaluations will be completed later in the spring of 1978. It is expected that a number of important conclusions will emerge which could result in certain changes in orientation and approach of the activities of the Liaison Unit as well as of SODEVA.

The Liaison Unit is seen as playing a significant role in providing on a continuing basis results from practical trials and socio-economic information needed to guide the larger action programs.

4. Externalities which Impinge on Project Results

Several elements external to the project as currently constituted have an important influence on the achievement of project objectives. Among these the more important ones are: (a) input supplies and related credit, (b) marketing and storage and (c) input and commodity prices.

(a) The responsibility for procuring and distributing of inputs rest with ONCAD (Office National pour la Cooperation et l'Assistance au Developpement). Estimations of requirements are made through the cooperatives in consultation with SODEVA agents and global requirements are provided to ONCAD. ONCAD procures and distributes, administering the allocation and collection of credit by the BNDS. One of the assumptions for project implementation was the satisfactory discharge of the supply and credit functions by ONCAD. The record show that this has been deficient in terms of quantities delivered, timeliness of delivery, and adequate coverage of the area.

SODEVA has taken some initiative to reduce the adverse impact of their deficiencies: (a) negotiated with ONCAD for reimbursement of transportation costs for delivery made by others where ONCAD would not make delivery, (b) suggested placement of inputs on consignment to cooperative under control of SODEVA at the time of sale of their groundnut crop and (c) direct procurement from the source by cooperatives. It is understood the items (a) and (b) will be made operational during the 1978-79 crop year.

(b) The marketing of surplus products from the farmer is handled by ONCAD. ONCAD is the only entity legally entitled to buy and sell commodities such as groundnuts and grain. Traditionally ONCAD interest has been concentrated on buying the groundnut crop. This coupled with limited storage facilities for grain either on the farm or the village or cooperatives creates a problem at harvest time in handling marketable surpluses of grain. It is understood that ONCAD has created a section to handle procurement and marketing of locally produced grain. This action could help resolve this problem. However, ONCAD will be unable to purchase millet this year as a direct result of the poor 1977-78 harvest.

Some efforts have been directed by SODEVA/CNRA towards introduction of improved storage facilities on the farm and at the village. The problem, however, is more complex that the simple provision of facilities. The program being introduced requires that the grain be threshed before storage for subsequent sale. Threshing millet is very labor intensive. Since the harvesting and threshing is compressed in point of time the use of mechanized threshers is being demonstrated. The demonstration of mechanized thresher has apparently had a considerable impact in the rural population. The possible impact on use of labor, timely marketing, farm revenues, etc.of mechanized threshing on family economics however is not clear, but this is being studied by the Liaison Unit.

Some farmer initiative, in improving the traditional storage facilities in which the millet is stored unthreshed as chopped heads firmly packed, has been noted. It would be well to carefully weigh the advantages and disadvantages of "improved" traditional methods as compared to more modern methods of storage of threshed grain.

(c) The importance of commodity and input prices on reaction of farmers to intensification programs hardly need be mentioned. With both commodity and input prices fixed by the Government, careful attention to maintaining a balance which provide some economic incentive is essential. The impact of increasing the price of fertilizers in 1976 on demand for 1977 was noted in table 2. Since the drought there has been little pressure of supply of grain in the market, because surpluses over consumption needs have been divided between sales for immediate cash and reconstitution of

farmer held reserves. The favorable prices for millet since the drought - the GOS raised official prices by about 40% while the parallel market has offered even higher prices - has undoubtedly contributed to the expansion of production in the past few years. When significant surpluses develop, however, the guarantee of a reasonable price to the farmer can become important to his decision to produce.

E. RELATION TO PROJECT OBJECTIVES, PURPOSE AND GOAL

The Project Paper established the following as objectives of the project:

(1) To encourage production of cereals in rotation with existing cash crops to provide farmers with their basic food needs.

(2) Gradually increase farmers incomes by introduction of more rational production methods which will improve productivity and lead to commercialization of the increased millet crop.

(3) Assist in expansion and strengthening of the Senegalese Agriculture Extension Service (SODEVA).

(4) Expand the current program of applied research to village farm cooperatives and intensified farms to serve as models for more generalized agriculture development throughout the groundnut basin.

(5) Develop the necessary rural infrastructure to assure continued overall agricultural development in the area.

The ProAg established essentially the same objectives though in somewhat greater detail, and included some quantification of some of the objectives. A set of inputs were prescribed which were to lead to specific outputs which were to contribute to achievement of a purpose and goal.

The project inputs have been realized as projected except for some time lag in implementation of projected levels (see section C). The use and management of inputs by the implementing agents has been on a high order of effectiveness.

The outputs have also been realized to a substantial degree. The output relating to numbers of farmers adopting intensification practices was approximately reached in terms of total numbers. However, the number practicing the higher levels of intensification, although increasing by 75% fell short of projections (see sections D.1 and D.2).

A dual purpose was defined in the Project Paper: (a) to assist the GOS to achieve a higher and self-sustaining level of productivity in the agricultural sector and (b) to support the effort of the Senegalese implementing agency,SODEVA, to diversify and intensify productivity in the West Central region of Senegal's groundnut basin.

The objective measurement of progress toward achievement of the (a) purpose is not feasible at this point, nor is it realistic to have anticipated that such would be available in the short time since the project was began. This is discussed more fully in section D.3.

The project has made a substantial contribution to the (b) purpose through additions to infrastructure and equipment, additions to personnel strength, training, and the creation of the CNRA Liaison Unit. The adoption of production intensification practices and the production diversification initiatives also contribute to achievement of this purpose.

The program goal was defined: to contribute to economic development of agricultural productivity, particularly in cereals, in an important area of the country's groundnut basin.

The objective measurement of progress toward achievement of the project goal is likewise not feasible at this point see D.3.

The project objectives have been reached to the extent that measurement is feasible. Objectives 1, 3, 4 and 5 have certainly been reached.

F. CONCLUSIONS AND DIRECTIVE FOR A PHASE II PROJECT

1. No provisions were explicitely made for continuation of the project after cessation of AID support after March 31, 1978. The Project Paper suggested that any funds remaining at that date due to lag in expenditures or unused contingencies be allocated to extending AID support beyond the terminal date or for similar actions in other areas.

The Project Paper made the assumption that the GOS would finance continuation of the SODEVA production promotion program beyond the terminal date of AID support, and suggested this would probably be at a somewhat reduced level. Moreover the possibility of obtaining additional external assistance was admitted.

The probabilities of the GOS supporting the project at present levels, even after assuming that infrastructure expenditures in the future will be limited, seems remote, given that payment of salaries alone accounted for about 50% of all AID financial supports for SODEVA. If salaries, training and demonstration and operating expenses are taken into account, AID support becomes almost 70% of the total. The additional annual cost to the GOS for continuing the project at the current level of effort is thus seen to be on the order of twice the total GOS input in the project for the year 1976-77, an amount not likely to be forthcoming, particularly in view of the 1977 drought. Assuming a 25% or even a 50% reduction in the level of effort will require increases of 82% and 22% in GOS expenditures over those for 1976-77.

It is clear therefore that continuing even an acceptable level of effort will require external support.

It is understood that funds still remaining in the project are approximately sufficient to fund one additional year's operation (thru March 31, 1979) at either the full level or at a somewhat reduced level.

It would seem that the remaining funds should be used to finance continuation of the project rather than in planning for expansion to other areas. To do otherwise would place in jeopardy the extension structure which was fielded during the past 3 years.

A second phase of the project was anticipated. It seems that as far as SODEVA is concerned extension into a second phase is a foregone conclusion.

A second phase could consider three alternatives: 1) termination of AID support in the current project areas with the 1978-79 crop year and transferring AID assistance to a new areas; 2) continuation

of support in the present area but with gradual annual reductions in level of support such that after some period (2-4 years) GOS will be bearing the entire cost; and 3) funding item (2) and expansion into other areas as the contribution to (2) is reduced.

The foregoing alternatives assume continuation of support for a project structured essentially as that currently being implemented. A discussion of elements of restructuring is given in section F. below.

Alternative (1) would seem to be unacceptable unless the GOS is able with its own funds to meet the project cost as at present with some gradual reduction in the level of effort over the next two to four years, an unlikely condition.

The choice between alternative (2) and (3) will depend upon the level of AID funding which could be allocated to this type of action. Priority in allocation of funds should go to alternative (2) in order to assure an orderly transition from substantial AID support to the total GOS support.

The best estimate of funds remaining unliquidated as of 12/31/77 for the project excluding the Promotion Humaine element is $1,518,000. Possible GOS committments not considered in arriving at this balance should be relatively small since most of the construction and equipment procurement is already accounted for. This leaves principally the current costs for personnel and operations. Based upon 1977-78 cost of approximately $87,000 per month approximately $1,305,000 will be required to operate the project through March 31, 1979. This leaves a surplus balance of $213,000. If the approved but unobligated amount of $457,000 is added to this balance $670,000 will be available to cover possible committments not reflected in arriving at the unliquidated balance, increases in costs and contingencies, an amount which should be ample. Consequently, it may be concluded that the balance from the currently approved funding level of $4,000,000 for the SODEVA and CNRA components is sufficient to extend the project completion date to March 31, 1979.

Intimately related to the foregoing discussion is that of an eventual level and quality of effort of the extension services. A basic assumption of extension is that innovations or technologies perceived to be good by the farmer will expand on its own once introduced and demonstrated to a sufficient sample of the population. A corollary to this is that innovations or technologies which do not expand through farmer initiative must be perceived as not useful. It follows from this that once a major effort is made in extending certain packages of technology, it should be possible to reduce the level of effort. This is only partly true since in a well managed agricultural

support system improvements in technology are developed on a continuing basis. As technology becomes more complex, and as farmers become better attuned to accepting useful technologies, the needs of extension is more for better trained agents and less for the massive grassroot effort (encadrement lourd). This evolution of extension services should be factored in the planning of training, personnel levels and budgetary requirements.

An additional element which bears emphasizing is that individual farming units vary considerably as to circumstances and adaptability of any set of measures. The blanketing of a total population with a single set of measures must give way to providing sets of alternatives. Real development will occur when each individual will have chosen those good. elements which are adapted to his own circumstances and to his perception of /

2. The draft evaluation paper by the AID contract team and the SODEVA and CNRA reports indicate a preference by the farmers for the semi-intensive levels of technology. In fact the higher levels (TBFF) of technology, as presently practiced in farmers fields appears to offer little productivity advantage over the less intensive levels. This is in part due to the less than complete application of the package by many TBFF farmers. Admittedly the data to support this conclusion is weak, nevertheless a total review of this issue should be made in design of a second phase whether in the present project area or in other areas. It would be well to compare observations in the IBRD-CCCE supported Sine-Saloum area to those emerging from the SODEVA/AID project. The date being developed by the Liaison Unit of CNRA and the two in-house evaluations, SODEVA/AID and SODEVA/IBRD which should be completed in March 1978 should help to clarify this point.

3. Throughout the AID contract team's draft report and also in the SODEVA reports reference is made of the impact of certain elements, external to the project, on achievement of project objectives. There are discussed in section D.5 of this report. The design of a second phase project should carefully consider means of reducing or eliminating the adverse impact of these factors.

4. The limitation in the availability of objective data seriously limits measurements of project accomplishments towards achievement of project purpose and program goal. This problem is common to most projects of this nature. It is understood that SODEVA/CNRA collect considerable amounts of data in the project area. This data should be collated and analyzed as far as possible to determine its adequacy, as well as to serve as a basis for designing more adequate data collection methods and content. Particular attention should be given to study and measurement of social impact. A second phase design should focus special attention on this issue. Comparative experience with other projects, especially the Sine-Saloum project should contribute to some

degree of resolution of this problem. The on-going evaluation of both the AID supported and the IBRD supported projects will probably provide the analysis required.

5. While, the role of the Liaison Unit of CNRA is well conceived, it seems that the scope of its activities exceeds the capacity of the existing staffing and perhaps also of facilities. After three years of functioning, a review of the role of this unit and the adequacy of its resources should be in order.

6. The current project was designed to increase cereals (millet principally) production in a given area in the groundnut basin. Increasing grain production was seen as a means of achieving more rational crop rotation and as a means of increasing farmers incomes through sale of surplus grain.

This objective was consistent with AID as well as GOS strategies at the time of project design, and reflected priorities after several years of serious drought. As implementation proceeded, however, it became apparent that this narrow focus was too limiting. In practice, the SODEVA program has affected not only grain but also groundnuts production. Some other production diversification elements have been introduced as well.

The design of a second phase project should embrace a broader strategy; a strategy which would seek to maximize returns to the farming unit, consistent with preservation of production potential, and optimize comparative advantage at the regional and national levels.

7. SODEVA as the GOS agent charged with agriculture program in much of the dry land areas has initiated actions which go beyond the original concept of the Senegal Cereals Project, e.g. initiatives to integrate livestock production in the farming system, initiatives to expand the crop production base, initiatives in the area of forestry, etc. Such initiatives should be encouraged and supported in so far as a sound basis for these actions can be discerned. Soil conservation and fertility improvement undertakings would seem to be especially appropriate. The application of basic rock phosphate to the phosphate impoverished soils in the groundnut basin (phosphatage de redressement) appears to merit special attention. Since the results are not immediate but accrue over a longer period of time there is a hesitation on the part of the farmer to make the investment in this practice. Although currently partly subsidized, a more substantial or even complete subsidy to achieve more general application of this practice might be considered The support of such a practice would represent more of a direct investment in soil fertility and hence production potential than a production input of short duration.

8. The project has provided very limited participant training. Only two short term participants received training during the first three years. The requirements for higher level personnel in SODEVA as well as in the Liaison Cell should be carefully analyzed by a second phase design group so that the longer term needs can be anticipated and provided for in replacement of expatriates in keeping with GOS policies and for general upgrading of extension staff.

9. Careful consideration should be given to 1) the need to continue the expatriate technical assistance element and 2) the most effective way to use this technical assistance. It is understood that SODEVA plans to discontinue this assistance. It is not clear whether this reflects a careful analysis of need or relationship problems between the expatriate individuals and GOS personnel. It was not possible to undertake an analysis of this issue. The draft contract evaluation report deals with this issue in some detail. This is appended to this report under section F.1.

10. The project as originally structured essentially provided for a transfer ofAID resources for project implementation. Certain elements of the resources transfer could be consider as investment in the development of the capabilities of the GOS to manage and operate agricultural development programs, e.g. physical facilities and certain capital equipment, investment in training and some portion of the investment in personnel. At the same time an important percentage of the resource transfer was essentially a subsidy to current personnel and operational budgets. Much of this type of expenditure is likely to have more limited lasting impact. Although within the context of the Sahel Development Program recognition was made of the need to support local operations costs, it would seem that the question of balance between investments in improvements of a lasting nature and current operations financing should merit serious attention.

11. To the extent feasible the design of a second phase project should be undertaken jointly by GOS (SODEVA and CNRA) and ADO personnel with only such outside consultants as may be necessary to accomplish the task in a reasonable time frame.

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